RADIAN
CORPORATION

Reference 1

224-035-15

ENVIRONMENTAL EVALUATION

PACIFIC COAST PIPE LINES FACILITY

FILLMORE, CALIFORNIA

Final Report

Prepared for:

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2.0 EXECUTIVE SUMMARY

The initial task of the Fillmore Pump Station Environmental Evaluation was a review of existing data. Information was collected from Texaco files at the site and at the Wilmington Refinery, from public agencies, and from available texts. The collected data were reviewed to provide a working knowledge of the site history, conditions, and environmental setting.

Radian then prepared a detailed work plan, which was presented to the California Department of Health both in printed form and as a slide slow summary. The work plan received DHS approval without significant modification.

The site investigation was initiated by a Radian visual inspection. The inspection served to familiarize the crew with the site, to locate special features, and select the sites of future activities.

An undisturbed emission survey was completed for the purpose of assessing atmospheric impacts by volatile compounds under present site conditions. The emission survey showed low emissions of SO_2, total hydrocarbons, and benzene. Under present site condition, no significant atmospheric impact exists.

Five coreholes were then drilled through the waste and into the soils below the waste. These coreholes allowed sampling of the waste and soils, examination of waste and soil stratification and physical properties, and provided a means for monitoring volatile emissions with depth.

Wastes were found to be only 5-6 feet deep over the 50,000 ft^2 pit area, for a total of approximately 11,100 cubic yards of wastes in the main pit. Wastes were generally soft semi-fluid, hard, or soil/waste mixtures. The waste had a pH below 2.0, contained varying levels of trace metals, including high concentrations of lead in some samples, and a very high percentage of organic material.

Soils below the wastes are predominantly alluvial gravels mixed with sand and silt. The soils rapidly buffer acidic waste leachate. Trace metals were found in varying concentrations and no apparent trend existed with depth. The soils have been impacted by low levels of hydrocarbons originating in the waste pit.

Three monitoring wells were installed; one upgradient and two downgradient of the waste area. Ground water existed at approximately 85 feet below the pit surface elevation at the time of installation but is expected to fluctuate substantially with long-term climatic conditions.

Ground water in the vicinity of the main waste pit has been impacted by volatile hydrocarbons (benzene primarily) which presumably originated from the main waste pit. Trace metals, except iron and manganese (probably naturally occurring) were found to be low.

Eight suspected waste disposal areas were investigated by hand-driven coring methods. Wastes were confirmed to exist at six of the areas. The remaining two areas could not be drilled due to surface obstructions. Waste volumes are believed to be very small at three of the suspected areas. Substantial waste volumes (small by comparison to the main waste pit) were found in three areas, and substantial waste volumes may exist at one area not drilled. Wastes in the suspected areas were found to be highly organic wastes, similar to the main pit wastes, or waste/soil mixtures. Impact analysis was not completed for each suspected area, but environmental impacts, if any, are believed to be small.

Other activities accomplished as part of the site investigation included constant meteorological monitoring at two stations, monitoring for emissions from waste disturbance activities at the property boundary between the waste pit and the nearby residences, surveying of corehole and monitor well elevations and location, and an extensive safety program.

The wastes at the PCPL facility, while currently causing minor environmental impact, are not threatening human health at this time. The only potential human hazards currently existing are direct contact with the waste by site personnel or facility trespassers and ingestion of contaminated ground water, which is unlikely since all nearby residences receive a city water supply.

The Fillmore water supply wells are located approximately one mile northwest of the waste pit and derive water predominantly from deeper zones. It is therefore believed that the Fillmore water supply will not be impacted by site contaminants.

Water for the Fillmore Pump Station is supplied by an on-site production well located southeast of the main waste pit. Department of Water Resources Records indicate that the well derives water from three zones; 483-499 ft. below land surface (BLS), 634-655 ft. BLS, and 727-752 BLS. The records also indicate that over 250 ft. of clays exist between the area of the water table aquifer and the shallow-most zone which contributes water to the production well. This fact, combined with evidence that the zones contributing to the production well are strongly artesian, indicates that these deeper zones are hydraulically isolated from the shallow ground water and are not endangered by any contaminants in the water table aquifer. For this reason, the on-site production well was not sampled as part of this study.

It is anticipated that no serious environmental or health impacts would occur during any of the possible remedial action alternatives. If any potential impacts do arise, they can be controlled by existing technologies.

3.0 BACKGROUND

As stated in the previous section, the Pacific Coast Pipe Lines facility at Fillmore, California (Figure 3-1) was the site of a Texas Company (Texaco) refinery from 1920 to 1950. This small refinery disposed of miscellaneous wastes on-site in a large pit located on the western side of the property. In addition, it was believed that wastes were also disposed of in various smaller pits and sumps on the property. Following the closure of the refinery in 1950, the majority of the refinery was dismantled. Only the old garage building and several tanks were left on-site.

The facility was taken over by Pacific Coast Pipe Lines (PCPL), a department of Texaco, Inc., in 1953 and has operated to the present as a crude oil pumping station. It is believed that the waste disposal areas on-site have not been active since 1950.

3.1 General Setting

The facility is located adjacent to the eastern boundary of the City of Fillmore (Figure 3-2). To the east and north of the facility are steep hills which are part of the Topa Topa Mountains of the transverse ranges. South of the PCPL pump station is the Santa Clara River which flows intermittently to the west and southwest, down the Santa Clara synclinal axis. The Santa Clara syncline is bounded on the north and south by major thrust faults. The northern fault, the San Cayetano Thrust, is believed to deviate from its general east-west strike and, in the area of Fillmore, strikes almost north-south. The fault passes just east of Fillmore but the exact location is not known. It is possible that the contact of the flat areas of the PCPL site with the hills to the east and north represent the approximate location of the fault. The San Cayetano fault dips generally to the north at approximately 30-40 degrees.

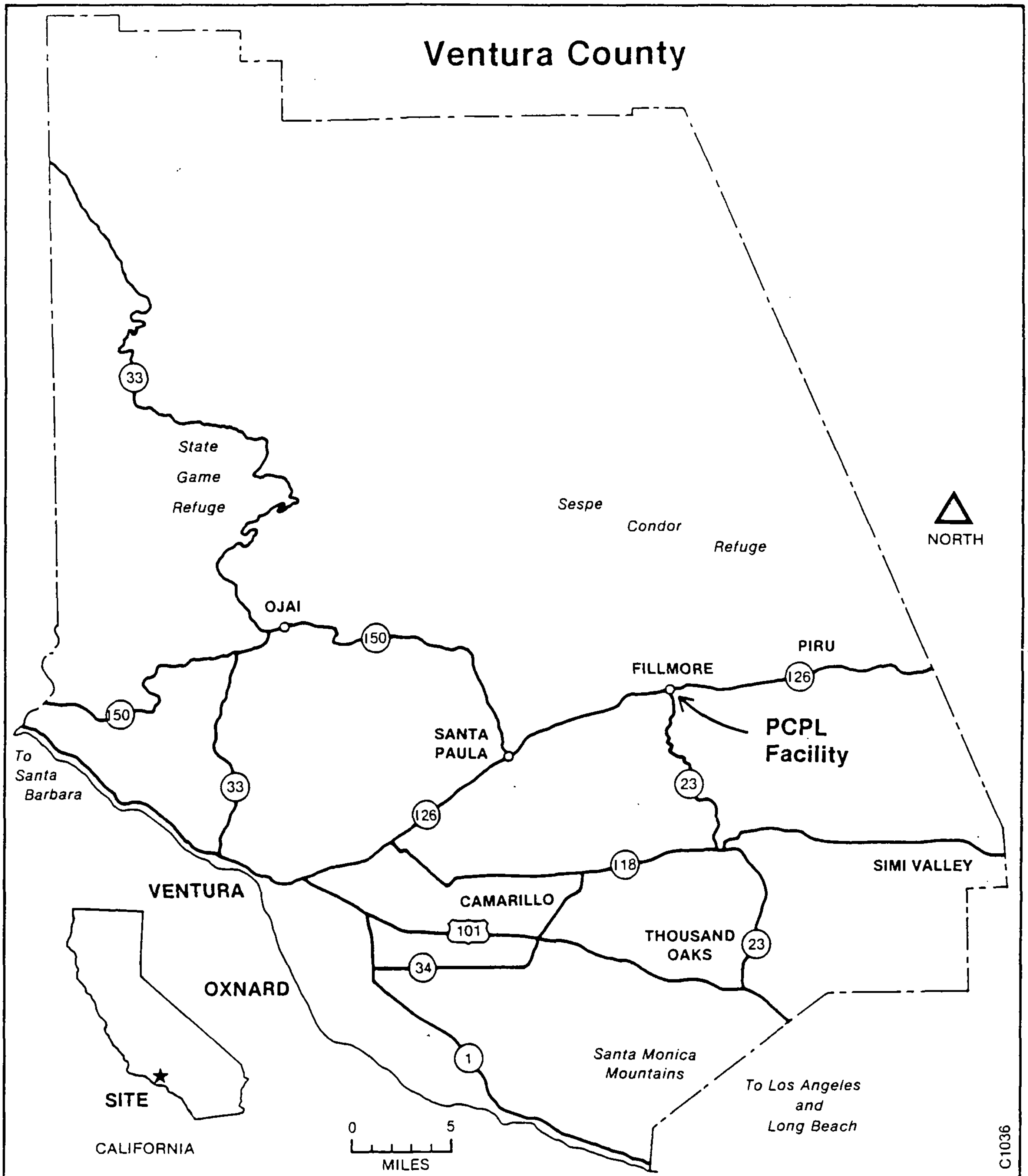

Figure 3-1. General Site Location

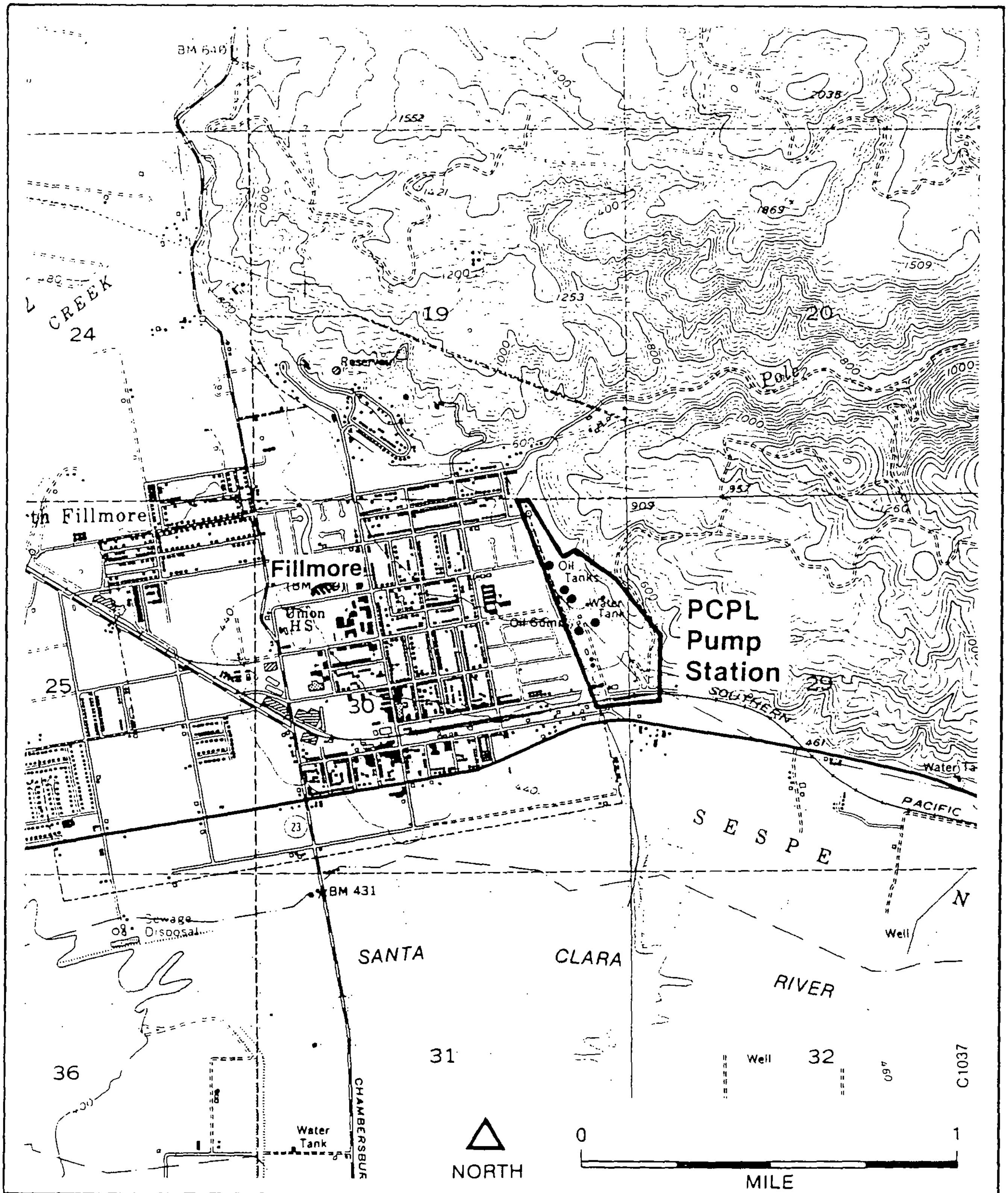

Figure 3-2. Site Location and Topography

As stated earlier, the PCPL facility lies on the northern edge of the Santa Clara syncline. The syncline is marked by extraordinary thicknesses of sedimentary strata. Pliocene mudstones, sandstones, shales, and conglomerates may reach 15,000 feet in thickness and Quarternary clays, sands, gravels, and alluvium are up to 5,000 feet thick. The mountains supplying this erosional material are generally Eocene sandstones, black shales, and conglomerates.

The City of Fillmore, and the PCPL facility, are located on a large alluvial fan deposited predominantly by Sespe Creek and by smaller drainage systems such as Pole Creek. Ground water within this alluvium is generally found at elevations of 380-420 feet above mean sea level (MSL) in the vicinity of the site. Flow is estimated to be southwesterly, toward the center of the syncline and along the synclinal axis. In the site area, surface elevations range from approximately 490 to 600 MSL and ground water exists at approximately 85 feet below the waste pit. There exists significant fluctuations of water levels from year to year depending on climatic conditions.

Water supply for the town of Fillmore is derived from two water wells located in the northwest section of the city. These wells are not considered downgradient of the PCPL facility. Prior to the installation of these wells (1963, 1978), Fillmore obtained water from three wells located 1/2 to 2/3 of a mile southwest of the facility. These wells (installed 1918, 1936, 1947) have been abandoned as a supply source, except in extreme emergencies. High concentrations of total dissolved solids (TDS), and a bent casing, led to abandonment of these wells. High TDS is a local problem with well water, and although considered to be downgradient of the site, there is no indication that the site had impacted the water quality at the wells, based on limited water quality analyses.

The nearest water well to the site, excluding Texaco wells, is listed by Ventura County records as 4N/19W-30J4, located 400 ft. west of Pole Creek Bridge and 200 ft. south of Telegraph Road. This well was completed May 30, 1922 as an irrigation well and the last record of water level measurement is January 16, 1932. The well is located approximately 1400 ft. southwest of the main pit. It is unknown if this well is still active or is abandoned.

Climatologically, Fillmore is subject to warm to hot summers and mild winters. Precipitation is approximately 20 inches per year, occurring predominantly during the winter months. Winds are generally light and easterly or northeasterly during cooler periods. During warmer periods, onshore sea breezes yield moderate breezes from the west and southwest.

3.2 Previous Studies

Relatively little information was known about the PCPL waste site or associated environmental impacts prior to the Radian investigation. However, some waste samples were taken and analyzed and a Texaco report on the site was compiled.

In November 1980, Texaco contacted the California Regional Water Quality Control Board (CRWQCB) with a letter proposal to remove the waste material and apply it to site roads. CRWQCB requested additional information including chemical analysis of the waste. Two sets of waste samples were taken and sent to separate laboratories, IT Corporation and SCS Engineers. It is unkown where, or how these samples were collected, preserved, or analyzed. It is also unknown if the sample numbers reported by the different laboratories represent the same samples. The results are given in Tables 3-1 and 3-2.

Although the details of the original sampling are unclear, the concentration of lead (total) in the samples prompted further investigation to characterize the waste.

A 1982 Texaco report discussed waste samples in Texaco's Port Arthur Research Lab (PARL). These samples were described as "tar-like" and "granular." Tables 3-3 through 3-6 give the results of the PARL analyses. The study also stated that:

- the granular material had a 0.19 pH and a conductivity of >100,000 µmhos/cm;

- SO_4 concentrations in a 1:1 granular waste to water mix equals 40,000 mg/L;

- Gas chromatograph patterns for the tar-like portion resembled weathered gasoline;

TABLE 3-1. WASTE ANALYSIS RESULTS FROM IT CORPORATION
(ppm, except pH)

Sample	As	Cd	Cr	Pb	pH
1	1.4	<0.5	<2.0	2000	8.0
2	<0.4	<0.5	<20	<5.0	5.0
3	<.23	<0.5	<2.0	455	6.9
4	<.5	<0.5	<2.0	4167	6.9
5	175	<0.5	<2.0	29570	9.0
6	27.8	<0.5	<2.0	5556	2.9
7	<.5	<0.5	<2.0	500	7.9
8	<.5	<0.5	2.0	1294	2.4

NOTE: Information reported as supplied by Texaco. It is not known if samples shown are the same as samples in subsequent tables.

TABLE 3-2. WASTE ANALYSIS RESULTS FROM SCS ENGINEERS (ppm, except pH)

Sample	As	Cd	Cr	Pb	pH	PCBs
2	0.2	0.1	6.5	5,450	7.1	<0.1
3	0.08	0.6	5.0	7,150	7.1	<0.1
4	0.18	0.8	9.5	13,300	8.0	<0.1
5	0.15	0.85	7.5	7,330	8.2	<0.1
6	0.10	0.15	2.5	1,900	6.7	<0.1
7	0.18	0.35	6.5	16,100	8.0	<0.1

NOTE: Information reported as supplied by Texaco. It is not known if samples shown are the same as samples in Table 3-1 or subsequent tables.

TABLE 3-3. PARL ANALYSIS - PHYSICAL CHARACTERISTICS
TAR-LIKE PORTION

Volatile Material	82.4 - 84%
Ash	16 - 17.6%
Extractable Organics	39.2 - 44.6%
Volatile Organics	20.3 - 27.9%
Water	0.0 - 2.9%
Extracted Residue	29.1 - 36.7%
Oxidizable - Non-extractables	11.5 - 20.7%

TABLE 3-4. PARL ANALYSIS - PHYSICAL CHARACTERISTICS
GRANULAR-LIKE PORTION

Volatile Material	92.9 - 93.2%
Ash	6.8 - 7.1%
Extractable Organics	19.8 - 22.8%
Volatile Organics	18.0 - 11.6%
Water	0.0 - 0.0%
Extracted Residue	62.2 - 65.6%
Oxidizable - Non-extractables	55.4 - 58.5%

TABLE 3-5. PARL ANALYSIS - METALS - TAR-LIKE PORTION

Parameter	Original Solid* mg/kg	Ash mg/kg	Solvent Extraction Solids mg/kg	Solvent Extraction Extractant mg/L
As	666	46.7	19	16
Cd		10		
Cr	319	371	24	6
Cu		504		
Fe	31,981		6,900	577
Pb	13,114	27,911	4,050	230
Ni	2,030	5,556	185	38
V	6,974	1,406	730	130
Zn		520		

*Data calculated from Solvent Extraction Data.

TABLE 3-6. PARL ANALYSIS - METALS - GRANULAR-LIKE PORTION

Parameter	Ash mg/kg	USEPA EP Test Extractant mg/L	USEPA EP Test Limits mg/L
Ag	9	<0.05	5.0
As	80	0.015	5.0
Ba	85	0.11	100.0
Be	<3	<0.05	
Cd	<5	<0.05	1.0
Co	10	<0.05	
Cr	47	0.13	5.0
Cu	262	0.16	
Hg	0.2	<0.002	0.2
Mo	<30	<0.10	
Ni	158	<0.05	
Pb	44,800	2.8	5.0
Sb	2.1	<0.005	
Se	0.8	<0.005	1.0
Tl	5	<0.05	
V	650	<0.03	
Zn	157	<0.81	

- GC patterns for the granular portion were similar but displayed a very large SO_2 fraction; and

- Granular material was not EP toxic.

Through the time of the Texaco report (May 1982), most emphasis had been placed on waste characterization for the main pit and essentially no activities had been conducted to determine waste volumes, environmental impacts, emissions characteristics, or waste existence and type in other suspected disposal areas. These subjects, plus a more detailed chemical characterization of the wastes, were the goals of the Radian study described in the following sections.

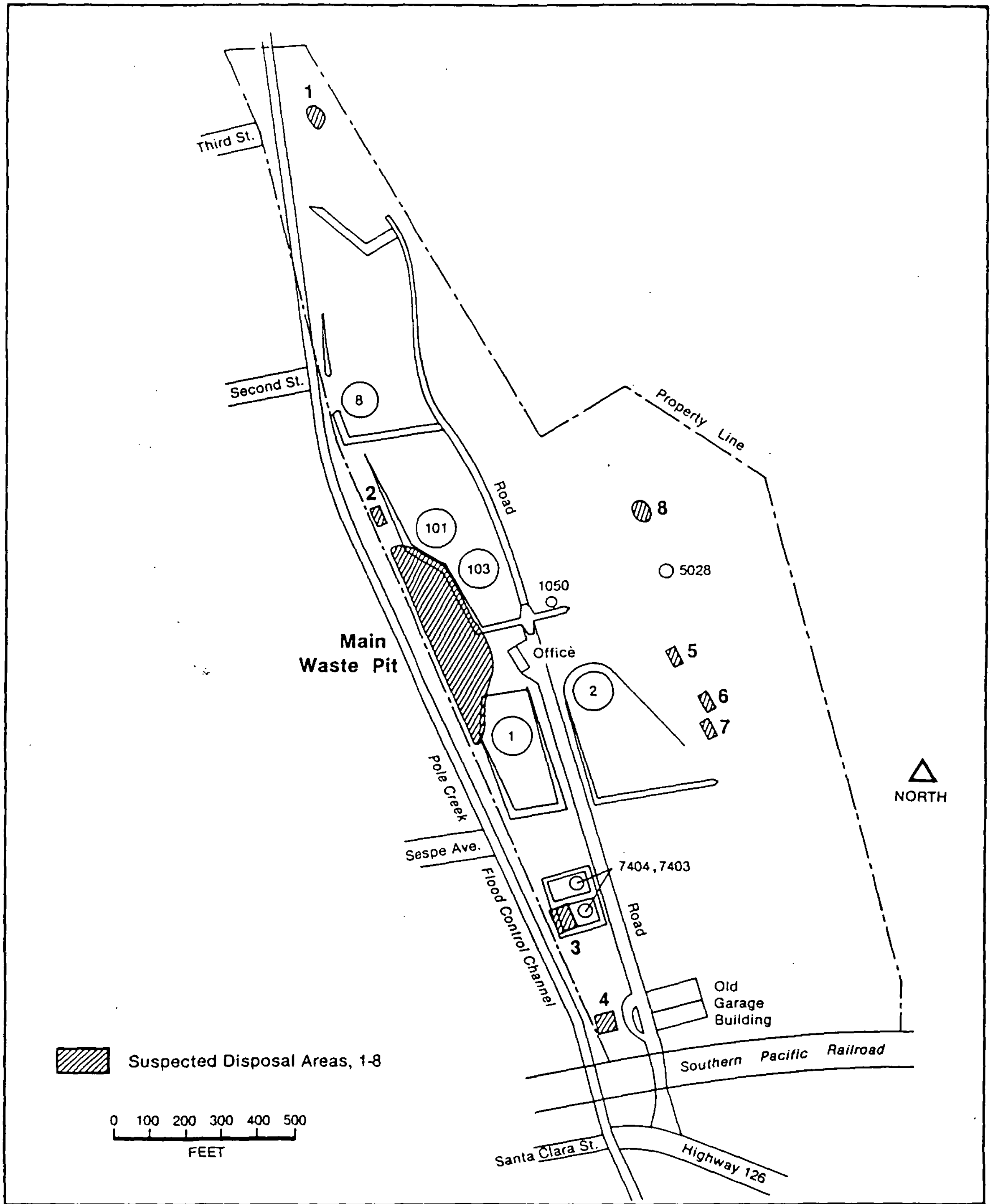

Figure 4-3. Location of Suspected Disposal Areas

(1) Locate equipment at grid point.

(2) Position SO_2/THC sample inlets six inches above the surface, directly upwind of the equipment and operators. (During periods of soil disturbances, the position of the sampling inlet will be six inches above the surface directly downwind from the activity.)

(3) Allow a two-to five-minute instrument stabilization period.

(4) Obtain ambient air temperature and surface temperature during instrument stabilization.

(5) Monitor gas concentrations for 2-5 minutes or until a stable value is recorded.

(6) Document all necessary data.

Undisturbed Surface Emission Measurement Protocol

Based on the gas concentration survey, a total of 9 surface measurements were performed to assess the undisturbed emissions from the main waste pit area. The measurements were performed using a surface isolation flux chamber constructed of chemically inert materials (see Figure 4-7). The chamber had a volume and surface area exposure (once placed on the soil/waste surface) of 26.0 liters and $0.319m^2$, respectively. The chamber was stirred with an 8 bladed, 3.5" diameter impellor driven by a 12-volt DC motor. The sweep air was introduced from a bottle supply, regulator and rotometer through 0.25" teflon rubing, 0.25" stainless swage bulkhead fitting, and a 6.0" teflon inlet line extending to a corner of the chamber in close proximity (but not venting on) the undisturbed soil/waste surface. The chamber output manifold consisted of a 0.25" stainless swage bulkhead fitting an 0.25" teflon tubing leading to the instrument manifold. The entire internal surface area of the chamber and associated components were teflon

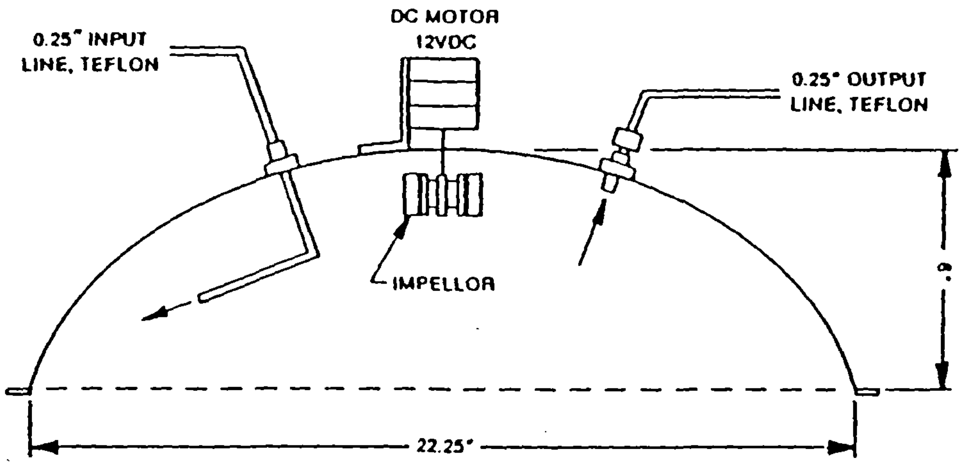

Figure 4-7. Schematic Diagram of the Surface Isolation Flux Chamber

coated. The chamber material, prior to coating, had a transmittance rating of 92% for visible light and 85% for solar energy (manufacturer published values). The range of sweep air flow rates used was 3.11 to 23.4 liters per minute.

Chemical measurements performed on the air leaving the emission chamber consisted of the following:

- Continuous determination of SO_2;
- Continuous determination of THC;
- Continuous determination of benzene; and
- Grab sampling for organic speciation.

The chamber operating procedure was as follows:

(1) Locate equipment at a sampling location;

(2) Begin sweep air flow;

(3) Place isolation flux chamber on exposed soil/waste surface, T = 0 min.

(4) Monitor SO_2/Benzene/THC concentrations continuously, recording on a data stripchart.

(5) Monitor for several residence times, after waiting 3-5 residence time values from T = 0; and

(6) Stop purge and remove isolation chamber.

The surface flux chamber had a narrow (0.25 in.) lip as a footer on the bottom edge of the chamber. No attempt was made to force seal the chamber on the soil/waste surface. Any attempt to do so would either introduce an unwanted effect (i.e., contaminant source or sink) or constitute a surface disturbance. Therefore, the output manifold was operated on negative pressure relying on the combined instrument sampling pump motive. The total consumption of output gas was less than 1 liter per minute with a larger input flow. The excess chamber gas was vented at the chamber/surface interface without effect on emission rate measurements, since the chamber is a well-mixed system.

4.2.2 Undisturbed Emission Survey Results

Concentration Survey Results

Along with real time gas species measurements at the grid points (SO_2, THC, benzene) and air/surface temperatures, visual observations were made at each grid point location. The description of each grid point sampled is given in Table 4-5. The results of the concentration survey are given in Table 4-6a through 4-6e. These tables reflect the sampling order followed during the survey. Both peak and average values for SO_2, THC, and benzene were documented for the sampling period. Each block of grid points includes background and duplicate sampling data (or control point sampling). The background sampling data represents the "uncontaminated" upwind atmosphere. The difference in concentration between the grid point and background indicates the contribution from the sampled grid point. No difference in these values indicates no contribution in air contaminants from that grid point.

In summary, a total of 27 grid nodes were sampled including sampling at 5 background locations (upwind of each block), 5 duplicate sample points, and sampling at one control point location at 3 different times of the day (morning, noon and afternoon).

The conclusions drawn from these data are detailed in Section 6.0. However, it should be noted that very low gas concentrations over exposed waste were observed. Most of the gas measurements showed background levels at the locations sampled.

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TABLE 4-5. DESCRIPTION OF GRID SURVEY (CONCENTRATION)

	Sampling Order Node Point	Description
Block 3	Background	Upwind-clean
	400-90	Brown grass, waste buried below
	400-60	Brown grass, waste buried below
	400-30	Cracked mud and weeds
	300-30	Under trees-dry leaf cover
	300-60	Under trees-dry leaf cover
	300-90	Dry grass and weeds
	300-90	(Duplicate)
Block 1	800-90	Old tank farm area, gravel
	800-60	Old tank farm area, gravel
	800-30	Old tank farm area, gravel
	Background	Upwind-clean
	700-30	Sand/gravel, dried oil
	700-60	Old tank farm area, gravel
	700-90	Old tank farm area, gravel
	700-90	(Duplicate)
	∿750'-200'	Middle of old tank farm area
Block 4	200-90	Firm waste, eroded soil cover, hard waste
	200-60	Fluid waste-tar like
	200-90	(Duplicate)
	200-60	(Duplicate)
	100-30	Firm waste with mud crust (thin)
	Background	Upwind-clean
	100-60	Waste, soft and hard
	100-90	Weed, gravel
Block 5	100-60	Control point sample (waste)
	Background	Upwind-clean
	000-90	Next to tank-gravel/oil coated
	000-60	Oil coated berm wall
	000-30	Gravel
Block 2	Background	Upwind-clean
	600-90	Oil berm wall
	600-60	Dirt cover
	600-30	Dirt cover
	500-30	Dirt cover
	500-60	Gravel, dirt
	500-90	Oil berm wall
	500-90	(Duplicate)
	100-600	Control point sample (waste)

TABLE 4-6a. UNDISTURBED CONCENTRATION SURVEY RESULTS

Block #3 Weather Sunny, Westerly Wind 5-8 MPH

Date 7/28/83

Time	Node Point	Surface Temp °C	Air Temp °C	SO_2 (ppmv)		THC (ppmv)		Benzene (ppmv)		Comment
				Peak	Average	Peak	Average	Peak	Average	
1521	Background[1/]	26	26	0.005	0.005	4	4	0.01	0.01	Instrument zero
1533	400-90	27	26	0.005	0.005	4	4	0.01	0.01	Bkgr level
1538	400-60	27	29	0.005	0.005	4	4	0.01	0.01	Bkgr level
1543	400-30	27	28	0.005	0.005	4	4	0.01	0.01	Bkgr level
1548	300-30	30	33	0.005	0.005	4	4	0.01	0.01	Bkgr level
1553	300-60	31	33	0.005	0.005	4	4	0.01	0.01	Bkgr level
1557	300-90	31	30	0.005	0.005	4	4	0.01	0.01	Bkgr level
1604	300-90	26	28	0.005	0.005	4	4	0.01	0.01	Duplicate
										Note: All Bkgr Levels!

THC = Total Hydrocarbons
Bkgr = Background

1/ 'Background' node point measurements do not necessarily represent the lowest concentration measurements.

NOTE: Field portable analyzers were used to monitor for SO_2 (Interscan), total hydrocarbons (OVA) and benzene (HNU Instruments). The background data represents the lowest possible detection limit per analyzer per day.

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TABLE 4-6b. UNDISTURBED CONCENTRATION SURVEY RESULTS

Block #1 Weather Sunny, Westerly Wind 8-10 MPH

Date 7/28/83

Time	Node Point	Surface Temp °C	Air Temp °C	SO_2 (ppmv) Peak	SO_2 (ppmv) Average	THC (ppmv) Peak	THC (ppmv) Average	Benzene (ppmv) Peak	Benzene (ppmv) Average	Comment
1613	800-90	32	31	0.005	0.005	3	3	0.01	0.01	Bkgr levels
1618	800-60	32	32	0.005	0.005	3	3	0.01	0.01	Bkgr levels
1621	800-30	32	32	0.005	0.005	3	3	0.01	0.01	Bkgr levels
1623	Background 1/	32	32	0.005	0.005	3	3	0.01	0.01	Bkgr levels
1630	700-30	32	35	0.005	0.005	3	3	0.01	0.01	Bkgr levels
1633	700-60	32	37	0.005	0.005	3	3	0.01	0.01	Bkgr levels
1636	700-90	31	35	0.005	0.005	3	3	0.01	0.01	Bkgr levels
1642	700-90	30	34	0.005	0.005	3	3	0.01	0.01	Duplicate
1644	750-200	30	33	0.005	0.005	3	3	0.01	0.01	Middle of old tank farm

THC = Total Hydrocarbons
Bkgr = Background

1/ 'Background' node point measurements do not necessarily represent the lowest concentration measurements.

NOTE: Field portable analyzers were used to monitor for SO_2 (Interscan), total hydrocarbons (OVA) and benzene (HNU Instruments). The background data represents the lowest possible detection limit per analyzer per day.

TABLE 4-6c. UNDISTURBED CONCENTRATION SURVEY RESULTS

Block #4 Weather Sunny, Westerly Wind 5-7 MPH

Date 7/28/83

Time	Node Point	Surface Temp °C	Air Temp °C	SO_2 (ppmv) Peak	SO_2 (ppmv) Average	THC (ppmv) Peak	THC (ppmv) Average	Benzene (ppmv) Peak	Benzene (ppmv) Average	Comment
1702	200-90	32	32	0.005	0.005	4	4	0.010	0.010	Bkgr level
1707	200-60	33	34	NA	NA	4	4	0.50	0.40	Slight ϕ
1712	200-90	33	34	0.005	0.005	3	3	0.45	0.45[1]	Slight ϕ Dup
1723	200-60	34	29	0.005	0.005	3	3	0.45	0.45	Slight ϕ Dup
1727	200-30	33	36	0.005	0.005	3	3	0.45	0.45	Slight ϕ
1741	Background[2]	32	33	0.005	0.005	3	3	0.45	0.45	Slight ϕ
1746	100-30	29	33	0.005	0.005	3	3	0.60	0.55	Slight ϕ
1749	100-60	30	33	0.005	0.005	4	4	0.80	0.70	Slight THC,ϕ
1756	100-90	31	35	0.005	0.005	3	3	0.45	0.45	Slight ϕ

THC = Total Hydrocarbons
Bkgr = Background
ϕ = Benzene
NA = Not Analyzed
Dup = Duplicate Sample

1/ Instrument background (zero/span data) as shown in Appendix E Figure 7-2 are representative of instrument lowest detectible concentration. Elevated background readings were believed to be related to ambient temperatures.

2/ 'Background' node point measurements do not necessarily represent the lowest concentration measurements.

NOTE: Field portable analyzers were used to monitor for SO_2 (Interscan), total hydrocarbons (OVA) and benzene (HNU Instruments). The background data represents the lowest possible detection limit per analyzer per day.

TABLE 4-6d. UNDISTURBED CONCENTRATION SURVEY RESULTS

Block #5 Weather Sunny, West Wind <5 MPH

Date 7/29/83

Time	Node Point	Surface Temp °C	Air Temp °C	SO_2 (ppmv)		THC (ppmv)		Benzene (ppmv)		Comment
				Peak	Average	Peak	Average	Peak	Average	
1006	Background[1/]	34	33	0.005	0.005	4	4	0.30	0.30	High zero, ϕ
1012	100-60 Control point	31	30	0.005	0.005	3	3	0.25	0.25	Cool,shade
1019	Background[1/]	31	30	0.005	0.005	3	3	0.30	0.30	High zero, ϕ
1023	000-30	32	32	0.005	0.005	3	3	0.30	0.30	Bkgr level
1025	000-60	31	32	0.005	0.005	4	4	0.20	0.20	Ova zeroed 3 bkgr
1031	000-90	31	31	0.005	0.005	3	3	0.25	0.25	Bkgr levels

THC = Total Hydrocarbons
Bkgr = Background
ϕ = Benzene

[1/] 'Background' node point measurements do not necessarily represent the lowest concentration measurements.

NOTE: Field portable analyzers were used to monitor for SO_2 (Interscan), total hydrocarbons (OVA) and benzene (HNU Instruments). The background data represents the lowest possible detection limit per analyzer per day.

TABLE 4-6e. UNDISTURBED CONCENTRATION SURVEY RESULTS

Block #2 Weather Sunny, West Wind 2-3 MPH

Date 7/29/83

Time	Node Point	Surface Temp °C	Air Temp °C	SO_2 (ppmv) Peak	SO_2 (ppmv) Average	THC (ppmv) Peak	THC (ppmv) Average	Benzene (ppmv) Peak	Benzene (ppmv) Average	Comment
1040	Background 1/	32	31	0.005	0.005	3	3	0.20	0.20	Bkgr levels
1050	600-90	28	28	0.005	0.005	2	2	0.20	0.20	Bkgr levels
1100	600-90	27	27	0.005	0.005	2	2	0.20	0.20	Duplicate
1104	600-60	27	27	0.005	0.005	2	2	0.20	0.20	Bkgr levels
1108	600-30	28	28	0.005	0.005	2	2	0.20	0.20	Bkgr levels
1111	500-30	29	31	0.005	0.005	3	3	0.20	0.20	Bkgr levels
1113	500-60	29	32	0.005	0.005	3	3	0.20	0.20	Bkgr levels
1115	500-90	30	33	0.005	0.005	3	3	0.20	0.20	Bkgr levels
1127	100-60	33	31	0.005	0.005	3	3	0.20	0.20	Control point

THC = Total Hydrocarbons
Bkgr = Background

1/ 'Background' node point measurements do not necessarily represent the lowest concentration measurements.

NOTE: Field portable analyzers were used to monitor for SO_2 (Interscan), total hydrocarbons (OVA) and benzene (HNU Instruments). The background data represents the lowest possible detection limit per analyzer per day.

Emissions Survey Results

The results of the undisturbed steady state emissions survey are given in Table 4-7 and shown in Figures 4-8, 4-9, 4-10. A total of 9 surface flux measurements were conducted on-site. The locations sampled were selected based on inspection and the concentration survey results and represent the following site areas:

- Site background (Run #5);
- Undisturbed waste, main pit - south (Run #1, #2, #3, #7 and #9);
- Old tank farm area (Run #6);
- Undisturbed waste, main pit - north (Run #7);
- Suspect area #2 (Run #8); and
- Control point sampling (Run #1, #2, and #9).

For all points samples, data is given for SO_2, THC, and Benzene including emission date (mass/surface area/time) for peak (PK) emissions and steady-state (SS) emissions. The time at which these values were recorded is indicated along with these data as the residence time (τ) the event was recorded. Data shown in Figures 4-8, 4-9, 4-10 are steady state values which best represent site emissions.

Residence time (τ) is defined as the enclosure volume divided by the flow rate of purge air into the chamber and has units of inverse time. This time unit is convenient for it illustrates the level of mixing in the chamber. A minimum of 3 residence times is needed for enclosure mixing. Steady-state values usually occur after peak values at higher number of residence times. Two canister samples were also collected during this survey. Those data are reported in Section 4.4.2.

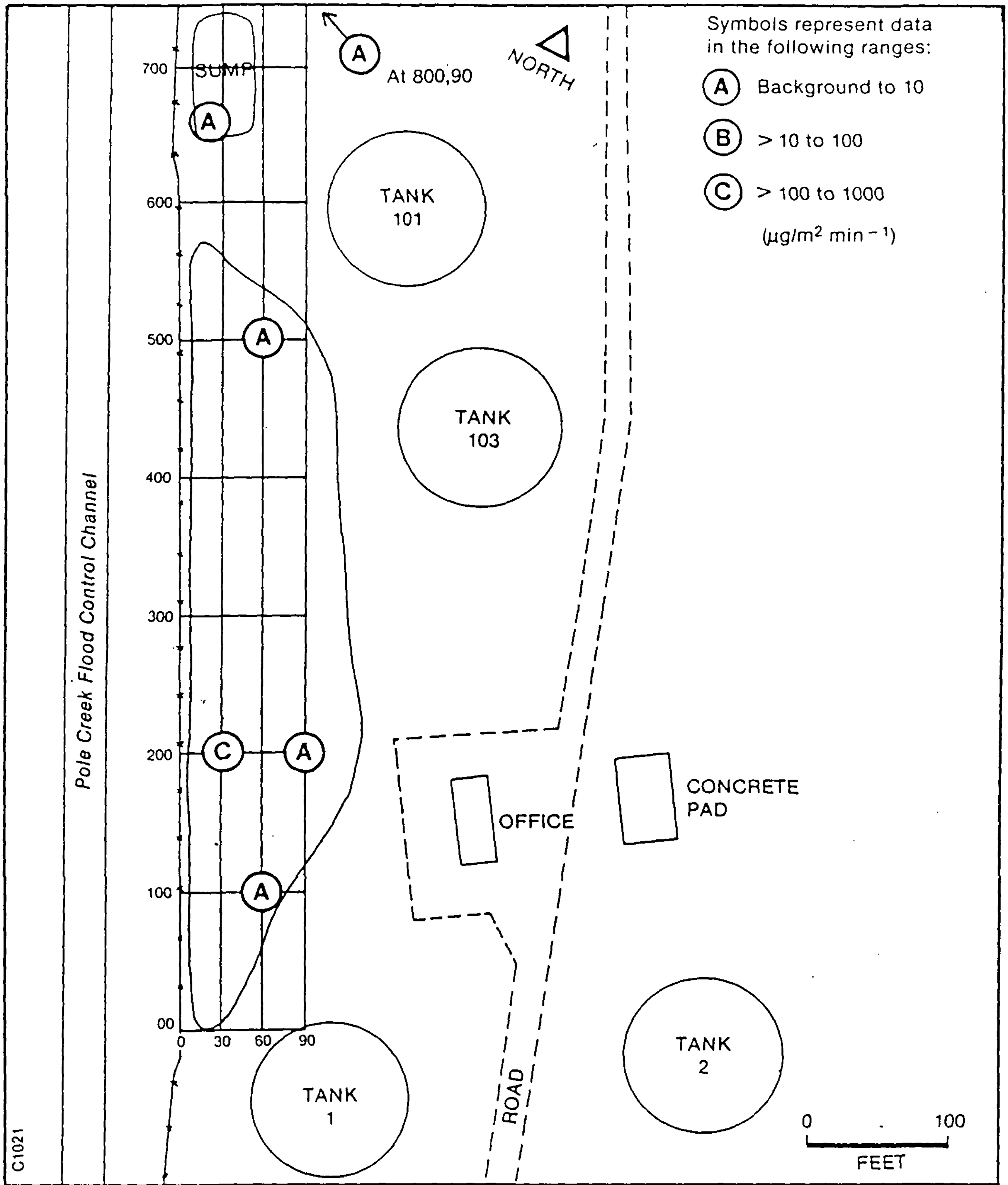

Figure 4-8. Undisturbed Emissions Survey - Steady State Benzene

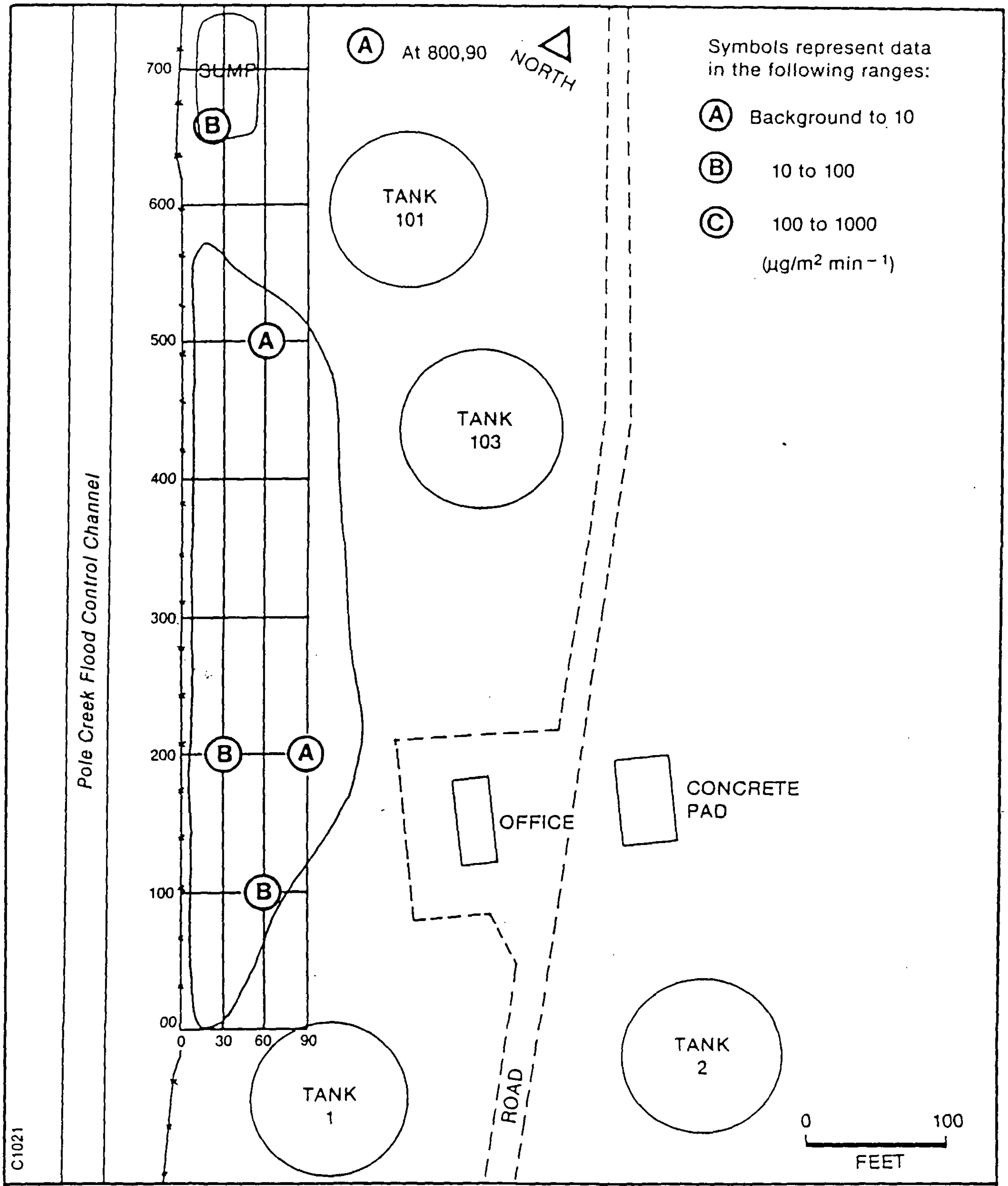

Figure 4-9. Undisturbed Emissions Survey - Steady State Total Hydrocarbon

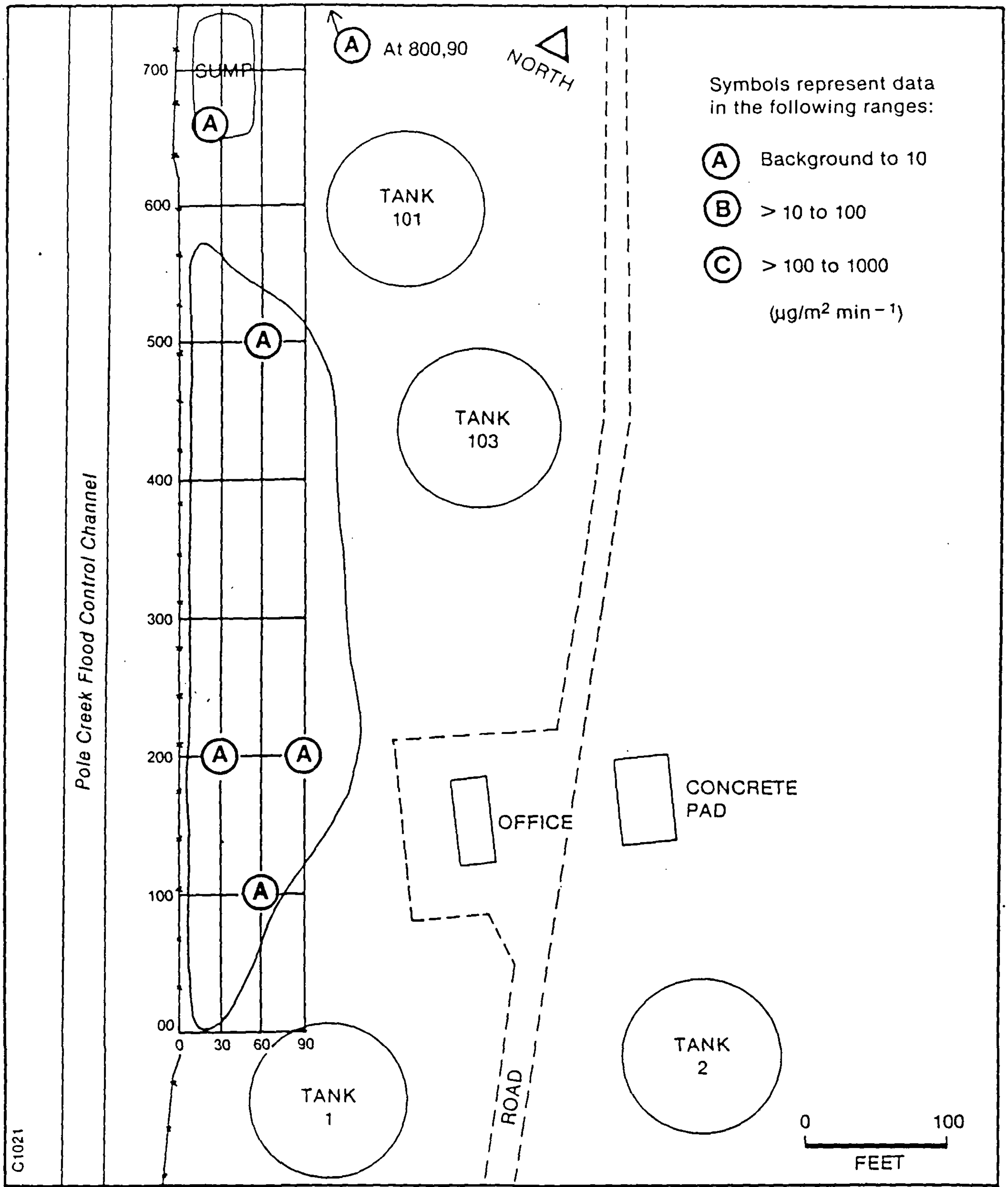

Figure 4-10. Undisturbed Emissions Survey - Steady State SO_2

TABLE 4-7. UNDISTURBED SURFACE FLUX SURVEY RESULTS

Run Number	SO_2 ($\mu g/m^2\ min^{-1}$)				THC ($\mu g/m^2\ min^{-1}$)				Benzene ($\mu g/m^2\ min^{-1}$)			
	τ	PK	τ	SS	τ	PK	τ	SS	τ	PK	τ	SS
#1, 100'-60' Control Point No Waste Exposed South-Main Sump	3	Bkgr[a]	3	Bkgr[a]	3	$1.8E^{1}$	3	1.8E	3	4.7	3	4.7
#2, 100'-61' Control Point Broken Tar Surface	3	Bkgr[a]	3	Bkgr[a]	3	$4.4E^{1}$	3	$4.4E^{1}$	3	3.6	3	1.8
#3, 200'-30' South-Main Sump	3	Bkgr[a]	3	Bkgr[a]	2	$1.4E^{2}$	3	$1.2E^{2}$	3	$4.7E^{2}$	3	$4.7E^{2}$
#4, 200'-90' South-Main Sump	3	Bkgr[a]	3	Bkgr[a]	2	7.3	3	Bkgr[b]	2	3.6	3	Bkgr[c]
#5, Background Location (Off Gravel Road)	3	Bkgr[a]	3	Bkgr[a]	3	7.3	3	7.3	3	7.2	3	7.2
#6, 800'-90' Old Tank Farm Area	3	Bkgr[a]	3	Bkgr[a]	3	Bkgr[b]	3	Bkgr[b]	3	7.2	3	7.2
#7, 500'-60' North-Main Sump	3	Bkgr[a]	3	Bkgr[a]	2	7.3	3	Bkgr[b]	3	3.6	3	3.6
#8, 650'-10' Suspect Area-2, Tar Sink Holes	4	$5.9E^{-1}$	3	Bkgr[d]	3	$3.6E^{1}$	4	$2.9E^{1}$	3	5.3	4	3.6
#9, 100'-60' Control Point Broken Tar Surface South-Main Sump	3	5.6	3	5.6	3	7.3	3	7.3	3	$1.1E^{1}$	3	$1.1E^{1}$
Range		Bkgr-5.6		Bkgr-5.6		Bkgr-$1.4E^{2}$		Bkgr-$1.2E^{2}$		3.6-$7.4E^{2}$		Bkgr-$4.7E^{2}$

[a] SO_2 Background = $1.4E^{-1}$ ($\mu g/m^2\ min^{-1}$)
[b] THC Background = 7.3 ($\mu g/m^2\ min^{-1}$)
[c] Benzene Background = 4.3 ($\mu g/m^2\ min^{-1}$)
[d] SO_2 Background (Interscan Analyzer) = 1.4 ($\mu g/m^2\ min^{-1}$)

Bkgr = Background
τ = Residence Time
PK = Peak
SS = Steady State
E = Exponential Notation ($1.8E^{1} = 1.8 \times 10^{1} = 18$)

The results of the emissions testing show that:

- The emissions are highest in the main waste pit where wastes are exposed (especially where natural disturbances have occurred, i.e., cracking of surface, waste seeps, etc.);

- Control point sampling at various times of the day (same location) indicated a large temporal variation in emissions due primarily to solar surface heating; and

- Emissions in areas surrounding the waste pit or in overburden on top of waste material, show background levels of emission.

4.5 Suspected Disposal Areas

Several areas of the PCPL facility have been identified by review of old facility maps and photographs, PCPL personnel interviews, and site reconnaissance, as possibly containing waste materials. These areas are shown in Figure 4-22. The description of each area, method of investigation, and waste volume estimates are discussed in the following paragraphs.

Area #1

Area #1 is located at the northern end of the PCPL facility. Originally identified by PCPL personnel, this area is a depression adjacent to, and north of, old tank #7. The area is identified as a 'sump' on the 1952 Topo Map and the 1952 Firewall Map.

Radian investigated this area with six hand-driven coreholes. Figure 4-23 shows Area #1 and the location of the coreholes. Table 4-18 summarizes the materials encountered and concentration of volatile species, when above background conditions.

It can be seen that wastes in Area #1 do exist, but apparently not over the entire sump. While corehole 1-B encountered 2½ ft. of waste material, no other corehole encountered any wastes. The volume of waste present is impossible to calculate with only one corehole in waste material. As a worst case, if 2½ feet of waste existed over the entire sump, an area of approximately 3700 sq. ft., a volume of 9250 ft^3 ($\sim$340 yd^3) of waste would exist. Since 2½ ft. of waste was seen in only one location, the actual volume present should be significantly less than this volume.

Area #2

Suspected Area #2 is located north of the main waste pit. Surface runoff in the area has exposed some waste material in the form of small holes

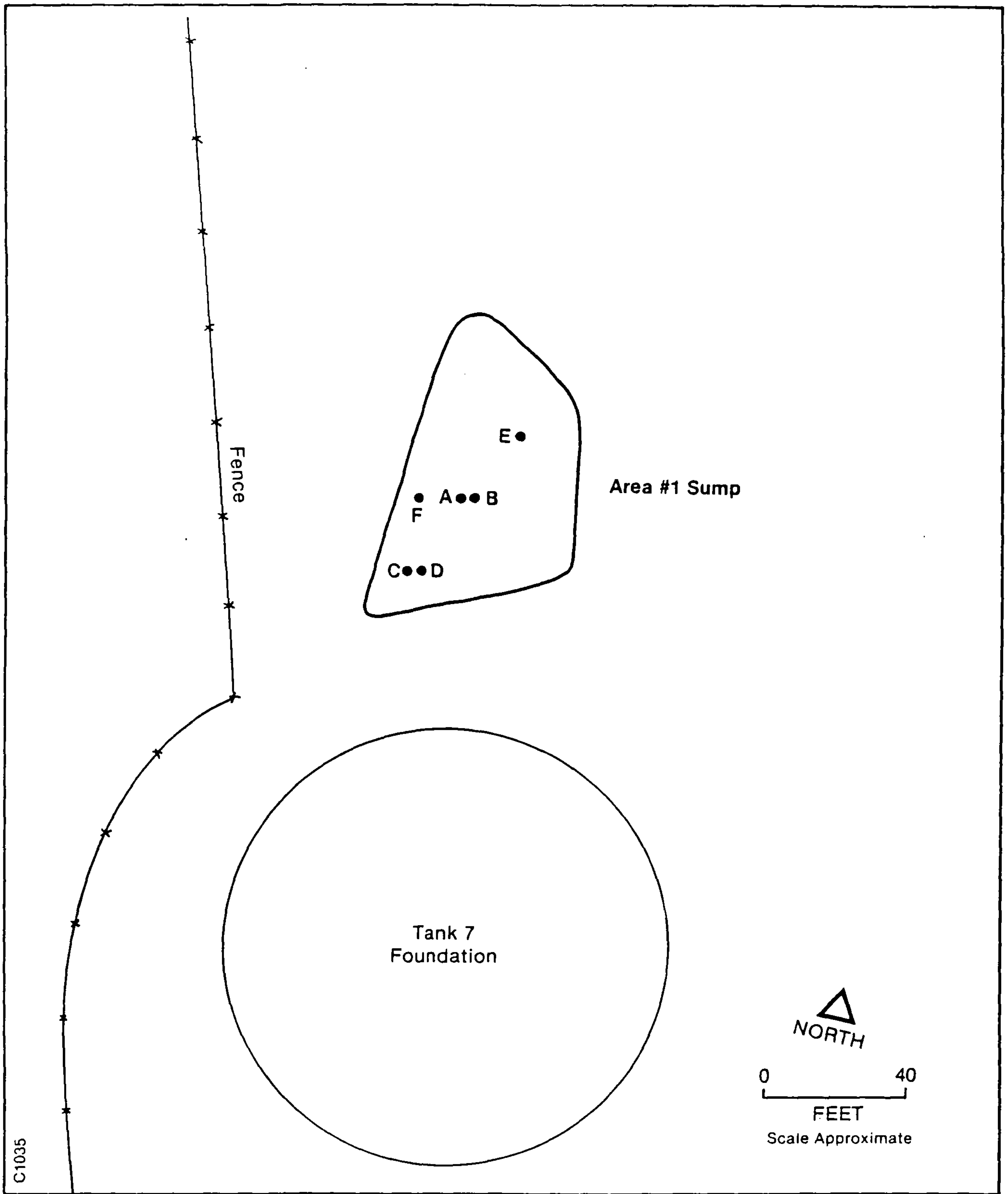

Figure 4-23. Location of Coreholes in Area 1

TABLE 4-18. COREHOLE LOGS FOR SUSPECTED AREA #1

Corehole	Log
1-A	0-1.5 ft. Soil or fill, clean, no waste, obstruction at 1.5 ft.
1-B	0-4 ft. Soil or fill, clean, no waste.
	4-6.5 ft. Waste, soft, clayey, black - OVA = 30 ppmv, HNU = 4 ppm, SO_2 = 0.1 ppm.
	6.5-7 ft. Soil, no waste visible.
1-C	0-1.5 ft. Soil or fill, clean, no waste, obstruction at 1.5 ft.
1-D	0-7.5 ft. Soil or fill, clean, no waste.
1-E	0-7 ft. Soil or fill, clean, no waste.
1-F	0-6.5 ft. Soil or fill, clean, no waste, obstruction at 6.5 ft.

OVA = Organic Vapor Analyzer
HNU = Benzene Analyzer
SO_2 = SO_2 Analyzer

(1 ft. diameter, ½-1 ft. deep). The area is labeled as a sump on the 1952 Topo Map and the 1952 Firewall Map, and as an unlabeled rectangle on the 1933 Plant Map and 1942 Utility Map. It is unknown what was disposed of in this area.

Radian drilled four coreholes in this area with a hand-driven auger. The location of the coreholes is shown in Figure 4-24 and a summary of materials encountered is given in Table 4-19.

Of the two coreholes which were able to pass surface obstructions, corehole 2-A encountered 4 ft. of waste and waste with soil and gravel, and corehole 2-D passed through approximately 4.5 ft. of waste and waste with soil and gravel before hitting an obstruction. It is estimated that an average of 5 ft. would be adequate in the estimation of waste depth, including areas of soil with waste. An area of approximately 3,000 ft^2 was measured from the 1952 Topo Map yielding a total waste volume of approximately 15,000 ft^3 or approximately 560 cubic yards.

Area #3

Suspected Area #3 is located west of tank 7403. It is shown on the 1942 Utility Map as a 'separator.' The area was apparently supplied by an open ditch which received materials from miscellaneous drains and sewers, including a drain pipe from the main waste pit. On the 1933 Plant Map and the 1952 Topo Map, the area is labeled 'pit' and 'sump' and is larger than the area shown on the 1942 map. On the 1933 map it is shown having a baffle separating a smaller pit section (east of tank 7404) from the larger pit or separator. The area now lies predominantly within the firewall for tank 7403 although sections of the old waste area probably lie beneath the western section of the firewall, beneath the firewall between 7403 and 7404, and within the firewall west of 7404. Figure 4-25 shows the boundary of the old pit (from 1952 Topo), present features, and the three coreholes drilled in the area. Table 4-20 presents the logs for the coreholes in Area #3. No emission 'snooping' was conducted at Area #3.

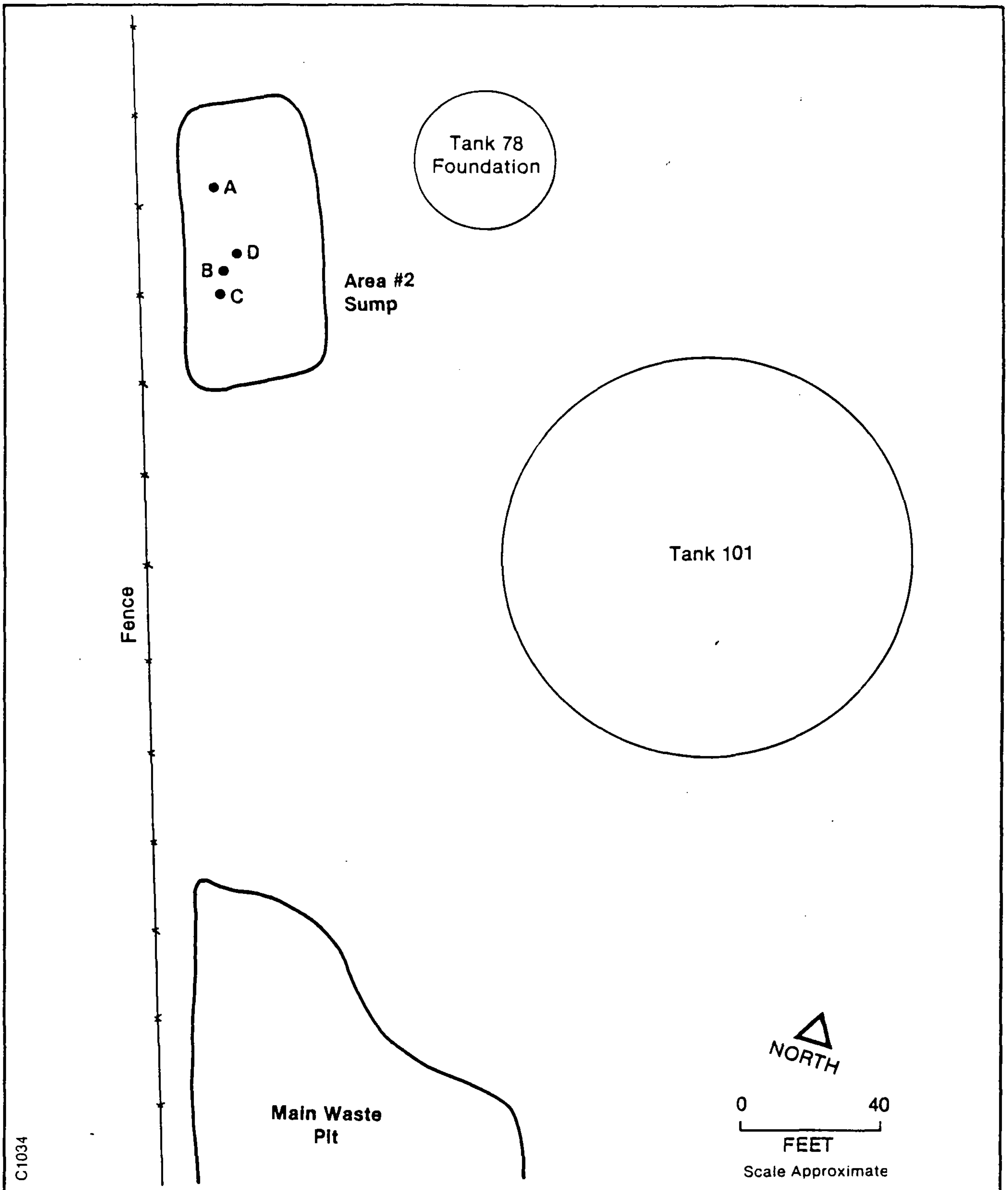

Figure 4-24. Location of Coreholes in Area 2

TABLE 4-19. COREHOLE LOGS FOR SUSPECTED AREA #2

Corehole	Log
2-A	0-1 ft. Soil, gravel, no waste.
	1-2 ft. Soil with black waste.
	2-4.5 ft. Waste, black, hard to moderately soft. OVA = 100 ppmv, HNU = 20 ppm, SO_2 = 2.5 ppm.
	4.5-5 ft. Waste with gravel.
	5-6 ft. Soil, no waste visible.
2-B	0-2 inch. Soil, gravel.
	2"-6" Waste, tar-like, soft.
	6"-1 ft. Waste with soil, obstruction at 1 ft.
2-C	0-2 inch. Soil, gravel.
	2"-1.25'. Waste, tar-like, soft, obstruction at 1.25 ft.
2-D	0-8 inch. Soil, gravel. (8 inch small zone at the tar-like waste.)
	1-2 ft. Soil, no waste.
	2-4 ft. Waste, hard granular, black with slight soil content. OVA = 30 ppmv, HNU = 7 ppm.
	4-6 ft. Waste with gravel, hard drilling. OVA = 400 ppmv, HNU = 4 ppm, SO_2 = 4 ppm.
	6-6.5 ft. Waste, soft, black, obstruction at 6.5 ft.

OVA = Organic Vapor Analyzer
HNU = Benzene Analyzer
SO_2 = SO_2 Analyzer

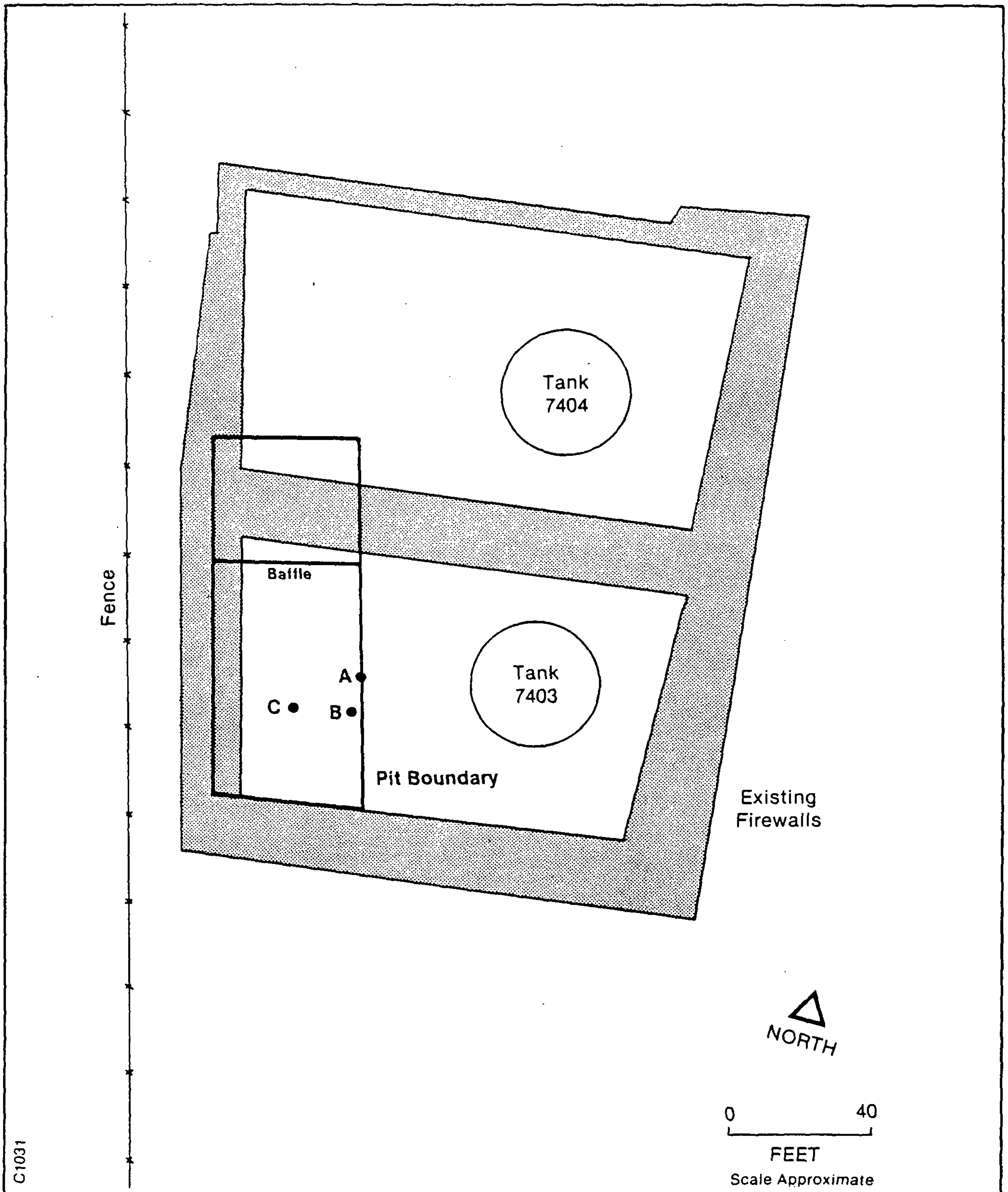

Figure 4-25. Location of Coreholes in Area 3

TABLE 4-20. COREHOLE LOGS FOR SUSPECTED AREA #3

Corehole	Log
3-A	0-.75 ft. Gravel and soil, obstruction at .75 ft., probably concrete.
3-B	0-1.5 ft. Gravel and soil, no waste.
	1.5-3.67 ft. Waste, black, generally soft, possibly mixed with fine soil. SO_2 = 4 ppm, obstruction at 3.67 ft.
3-C	0-1.25 ft. Gravel with soil, no waste.
	1.25-2.5 ft. Grey clay material with waste.
	2.5-7 ft. Waste, soft to moderately hard, black, old wood at 5 ft., gravel with waste 5.5 ft., obstruction 7.0 ft.

It is probable that Area #3 is a concrete pit. This is based primarily on the use of the term 'separator' on the 1942 map, the existence of a baffle (not common in an excavated pit), and the relative exactness by which the area is drawn on the old maps. Also, corehole 3-A was unknowingly placed on the edge of the area and hit an obstruction at less than 1 ft., which was smooth, characteristic of concrete but not usually rocks. While it is apparently advantageous that the waste are held in concrete, it is possible that cracks exist. Water ponded within the firewall may percolate through the waste and out through cracks in the pit floor.

The first two coreholes were placed near the pit boundary. Corehole 3-B encountered 3½ ft. of waste before hitting an obstruction. Corehole 3-C, located in the center of the separator, passed through 4½-5½ ft. of waste and soil with waste before hitting an obstruction at 7 ft. It should be noted that 3 other coreholes were attempted but could not penetrate the surface gravels.

It is estimated that waste averages 5 ft. deep in the separator. The area was measured to be approximately 4000 sq. ft., yielding an estimated volume of 20,000 ft^3 or approximately 740 cubic yards.

Area #4

Suspected Area #4 lies near the southwestern corner of the PCPL facility. It is labeled 'separator' (as is Area #3) on the 1942 Utility Map. The area was fed by a 6" tile sewer from a septic tank and a tank farm area (Tanks 152-157), and by a 4" line from a building near the garage labeled '79' Ethyl Building. The separator shows four compartments separated by 3 baffles. The area is shown on the 1933 Plant Map as a 'pit,' including baffles. The 1952 Topo Map does not extend to this area.

Figure 4-26 is a diagram of the area. Radian attempted to drill hand-driven coreholes in Area #4 but could not penetrate the coarse, compacted gravel in the area. At least ten unsuccessful drilling attempts were

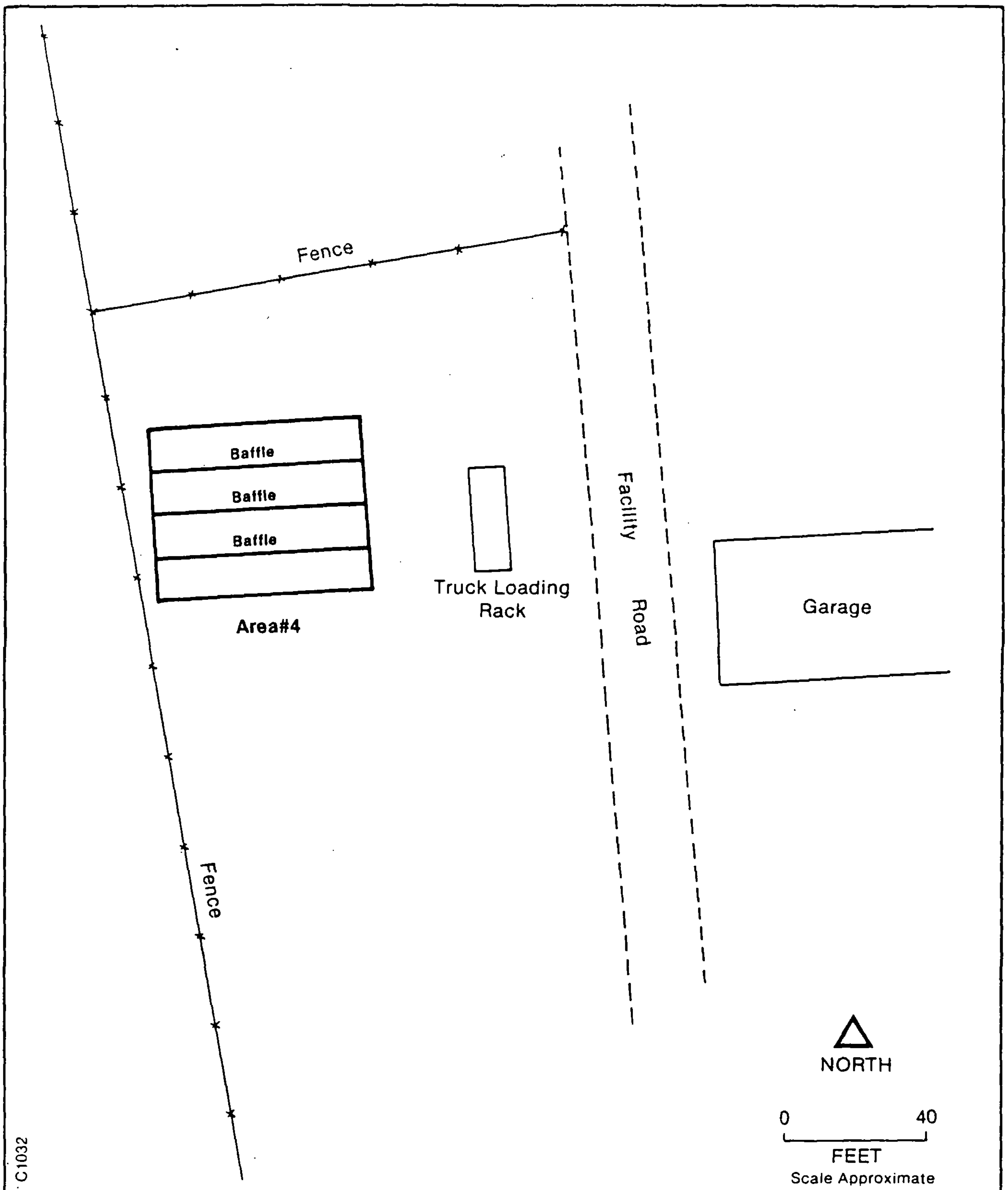

Figure 4-26. Location of Area 4

made. Because no successful coreholes were emplaced, it is impossible to determine if wastes are even present. The following assumptions are probably correct:

- Area #4 is drawn similar to Area #3, and has baffles; therefore, it probably is a concrete pit.

- Since no construction or significant change has occurred in the area, it is likely that the pit still remains.

- The pit was probably constructed similar to Area #3 and thus is probably the same depth.

Therefore, assuming that 5 ft. of wastes still exist at Area #4, the area of 2,000 ft^2 would yield a volume of 10,000 ft^3 or 370 cubic yards.

Area #5

Areas 5, 6, and 7 are located part way up the hill which bounds the eastern side of the site. An old road is partially visible in the area but is unknown how the wastes were brought to these areas.

Area #5 is the northern most of the three areas and is located east of tank #2 approximately 200 feet. This area, as well as #6 and #7 are only shown on the 1942 Utility Map (as 'pits') and, since no other mappable features occur nearby, these areas were difficult to pinpoint in the field. Once Area 5 was located, 5 coreholes were drilled as shown in Figure 4-27. The logs for these coreholes are given in Table 4-21. No emission 'snooping' was conducted at Area #5.

Drilling in the vicinity of suspected Area #5 did not uncover significant wastes. Tar-like wastes exist on the surface as thin as 1 inch and within the first 2 feet as thin layers. Shallow obstructions between 1 and

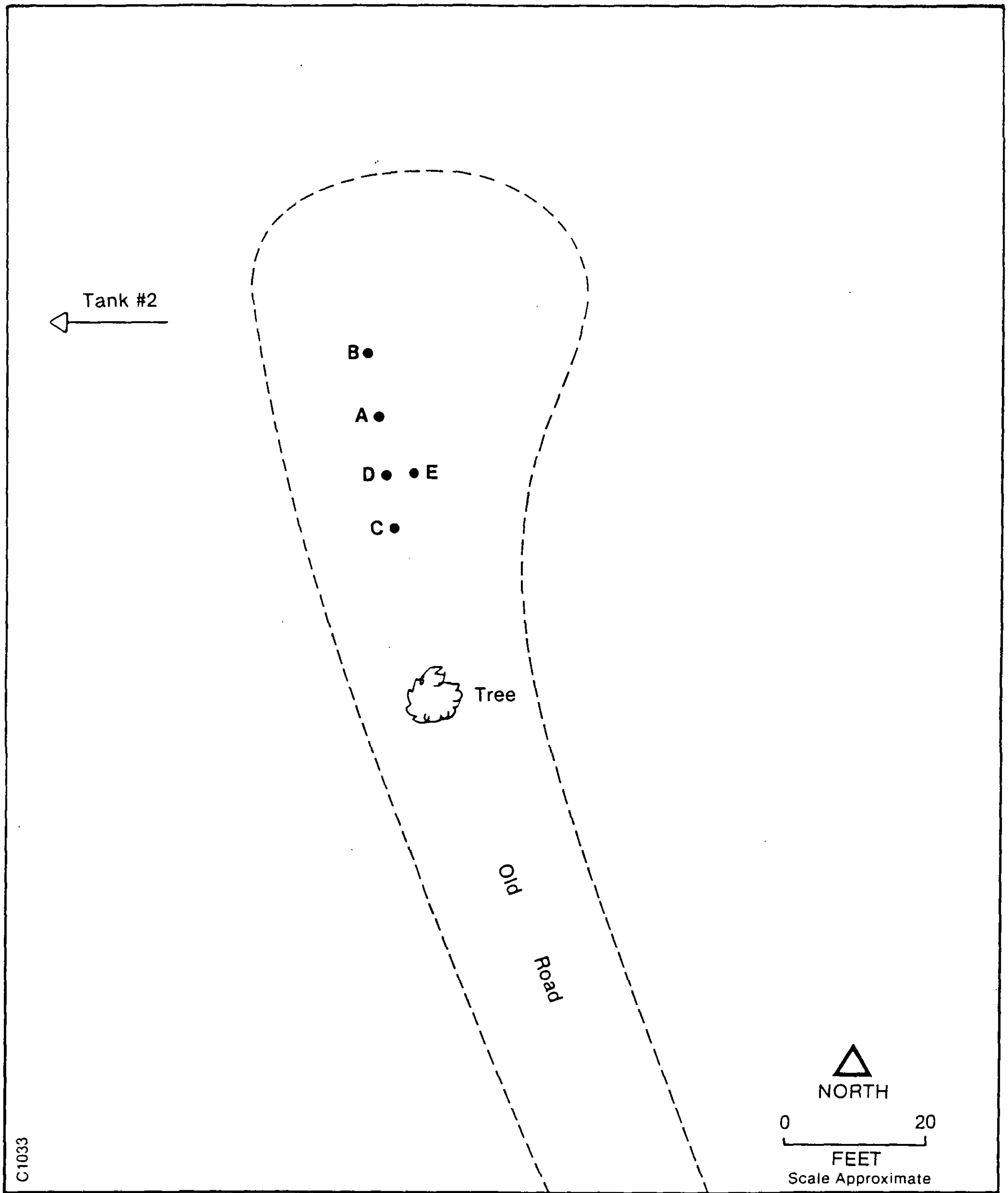

Figure 4-27. Location of Coreholes in Area 5

TABLE 4-21. COREHOLE LOGS FOR SUSPECTED AREA #5

Corehole	Log
5-A	0-1 in. Tar-like material on surface.
	1 inch-1 ft. Soil, no waste.
	1-1.5 ft. Tar-like waste, OVA = 20 ppm, HNU = 2 ppm.
	1.5-2 ft. Hard drilling, soil and gravel, obstruction at 2 ft.
5-B	0-1 ft. Soil, obstruction at 1 ft.
5-C	0-.5 ft. Soil, no waste.
	.5-1 ft. Waste, black, moderately hard.
	1-1.5 ft. Soil, no waste.
	1.5 ft. Small amount of waste.
	1.5-3.0 ft. Soil, no waste.
5-D	0-1.25 ft. Soil or fill, brown, small amount of waste at 1 ft., obstruction at 1.25 ft.
5-E	0-1.25 ft. Soil or fill, brown, no waste.

2 feet in all but the southern-most corehole (5-C) indicates that there may be some type of manmade material, possibly a foundation. Examination of a 1953 photograph of the site (oblique, black and white) shows some type of platform or other low structure in the vicinity of Area #5. It is also possible that the object in the photograph is a concrete lined pit. Because of the limited data collected, no waste volume estimate can be made for Area #5. The 1942 Utility Map does show that the pit is only 20 ft. by 30 ft. Therefore, if the pit exists, the waste volume should be small.

Area #6

Area #6 was originally identified from the 1942 Utility Map where it is shown as a 15 ft. by 20 ft. pit. It is located just east of a line between Area #5 and Area #7, and is therefore slightly uphill.

In the field, a small cleared area does exist just east of the road connecting Areas 6 and 7. When drilling was attempted in this area, all coreholes hit obstructions at shallow depth. Examination of the 1953 photograph shows a small structure in the vicinity, although the exact location cannot be determined due to the obliqueness of the photo. The structure is rectangular and has a low, curved roof.

It is unknown if refinery wastes exist at Area #6 but the area does have brick and rubble debris on the surface.

Area #7

Although Area #7 is shown only on the 1942 Utility Map as a 'pit', the area is easily visible both in the field and in all aerial photographs (1953, 1980, 1981). It is located at the south end of the road connecting Areas 5, 6, and 7. A metal pipe stack is located adjacent to the south end of the area.

On the surface, Area #7 has a yellow clay-like material and metal scaling or rust fragments. No vegetation grows in the surface material except where soil has washed onto the area. Figure 4-28 is a diagram of Area #7 including the corehole locations. Table 4-22 is a listing of the corehole logs.

The southern section of Area #7 apparently has some type of concrete pad beneath the clay-like material at 1½-3½ ft. Wastes are thicker further from the stack as evidenced by a small, 1 foot berm which splits the southern section. This area was probably a filter clay drying area with a pad and low walls.

The northern section of the area does not have a concrete bottom. Black wastes were probably placed in a shallow excavation or mixed with the natural gravels. Yellow-brown clay (more filter clay) was then spread on top of the black wastes.

The volume of wastes present is

-2500 ft^2 @ 1½ ft	=	3,750 ft^3
-2050 ft^2 @ 3 ft	=	6,120 ft^3
-1900 ft^2 @ 7 ft	=	13,160 ft^3
Total	=	23,030 ft^3
		≈850 cubic yards

Area #8

Suspected Area #8 was located as a result of the visual survey of the site. Tar-like waste material was noted on the ground surface in a depression north of the site water tank. The 1942 Utility Map shows a water tank (#5028) with a small tank to the north approximately 50 ft. The small tank is labeled only 'No. 166.' Area #8 is located approximately 125-150 ft. north of the water tank which exists today but it is unknown if this is the same tank as shown on the 1942 map. Area #8 probably served as a clean

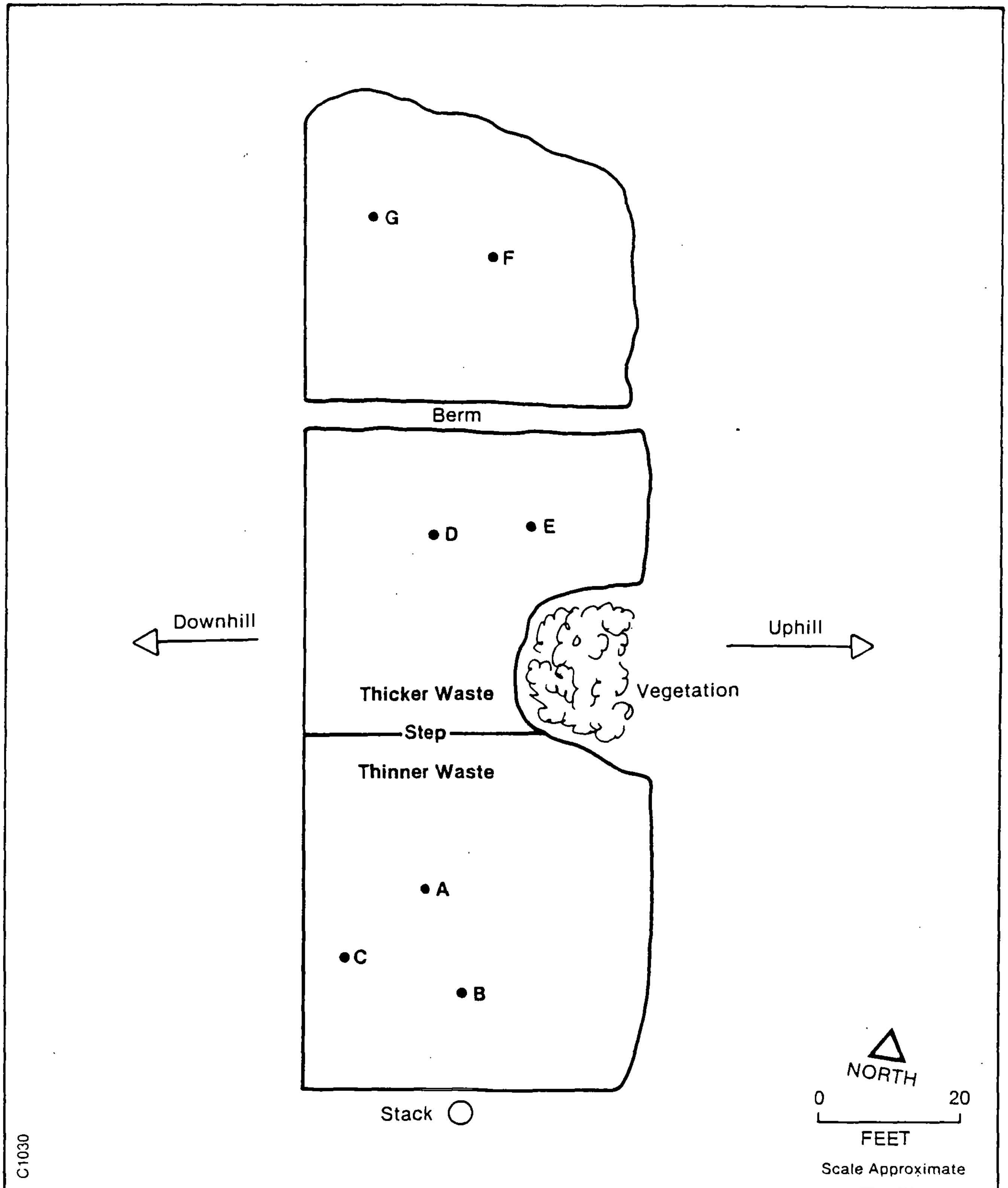

Figure 4-28. Location of Coreholes in Area 7

TABLE 4-22. COREHOLE LOGS FOR SUSPECTED AREA #7

Corehole	Log
7-A	Surface - white powder. 0-.25 ft. Clay, rust colored, soft. .25-1.5 ft. Yellow clay, soft, well sorted, OVA = 170 ppmv, HNU = 10-20 ppm, SO_2 = 4.5 ppm. 1.5 ft. Hard, brown material. Obstruction, possibly concrete.
7-B	Same as 7-A.
7-C	Same as 7-A and 7-B.
7-D	0-2 ft. Soft, yellow clay. OVA = 30 ppmv, HNU = 20 ppm, SO_2 = 1.5. 2-2½ ft. Black waste, soft, clayey. OVA = 450 ppmv, HNU >200 ppm, SO_2 >5 ppm. Obstruction at 2½ ft. Possibly concrete.
7-E	0-3 ft. Soft, yellow clay. 3-3½ ft. Black waste, soft, clayey. OVA = 1500-2000 ppm, SO_2 >5 ppm. Obstruction at 3½ ft., possibly concrete.
7-F	0-1 ft. Soft clay, yellow-brown. 1 ft. Small lens of white material. 1-2½ ft. Clay, becoming browner in color. 2½ ft. Yellow clay. OVA = 6000 ppm, HNU >200 ppm, SO_2 >5 ppm. 2½-5½ ft. Brown clay, soft, oily from 3½ to 5 ft. 5½-6½ ft. Soil, some waste. OVA = 400 ppm. 6½ ft. Clean soil, gravel.
7-G	0-1½ ft. Soft clay, yellow-brown. 1½-4½ ft. Brown clay, soft. OVA = 500-1000 ppm. 4½-6 ft. Black waste, hard. 6-7 ft. Soil, gravel with waste. 7 ft. Clean soil, gravel.

out area for materials in tank 166. Figure 4-29 is a schematic of suspected Area #8. Table 4-23 shows the logs of three coreholes emplaced.

Because Area #8 is not shown on any map, the size of the area and thus volume of wastes present cannot be estimated. Apparently, the wastes were deposited in the vicinity of Corehole C and later covered with fill material. In the field, it can easily be seen how the fill was pushed into the area forming a higher zone. The band of tar-like material around the soil has been formed by the weight of the fill material squeezing out the liquid waste fraction.

Field Analysis of Suspected Area Samples

During the hand drilling of coreholes in suspected disposal areas, wastes encountered in each corehole were composited and placed in quart, glass jars with teflon-lined lids. A small VOA vial sample was retained for onsite analysis. These analyses included pH, benzene, and spectrum complexity. Table 4-24 summarizes the samples taken and analysis results.

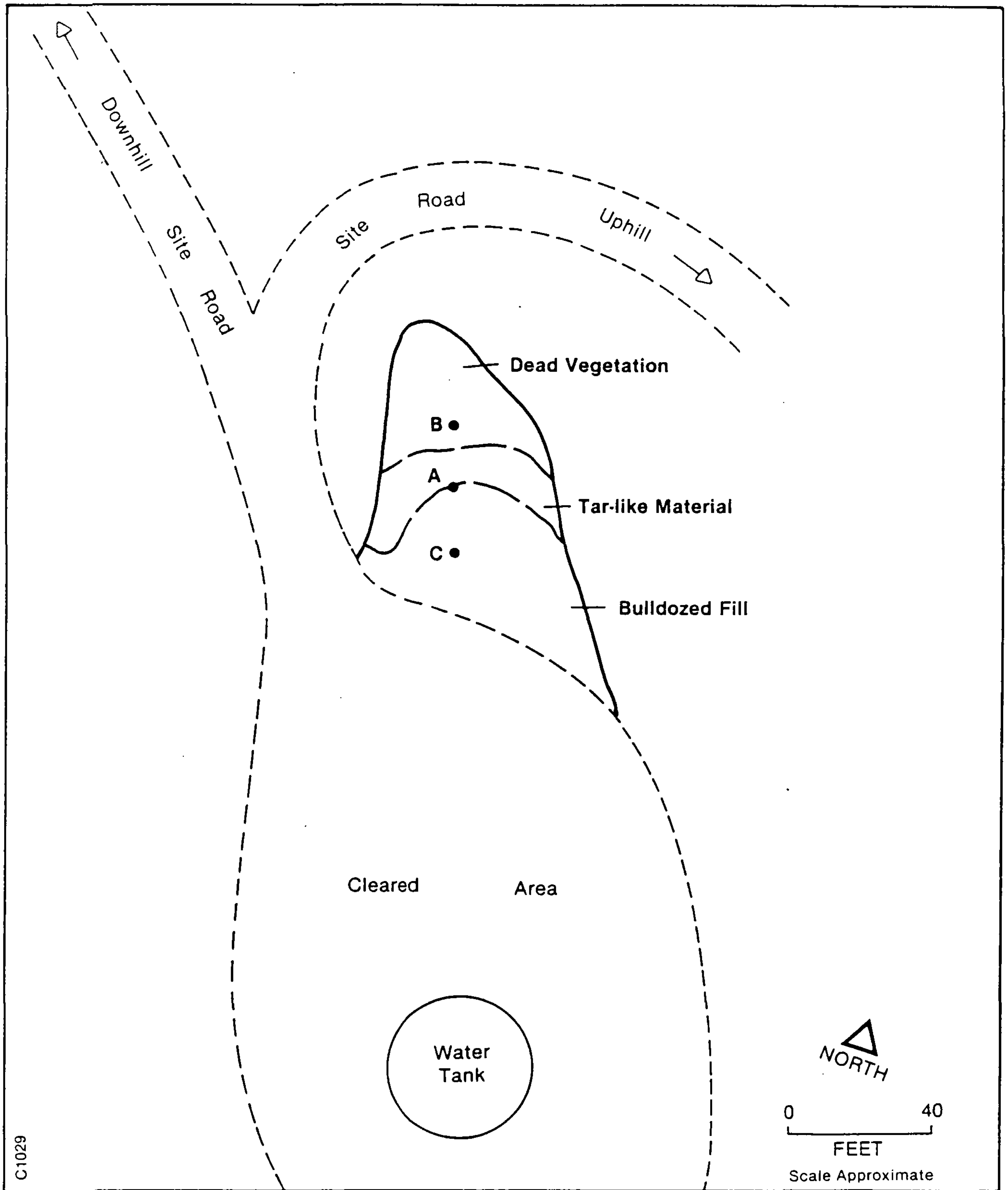

Figure 4-29. Location of Coreholes in Area 8

TABLE 4-23. COREHOLE LOGS FOR SUSPECTED AREA #8

Corehole	Log
8-A	0-3 in. Soil, fill material.
	3 in.-2 ft. Tar-like waste, black, soft. OVA = 70 ppm, HNU = 20 ppm, SO_2 = 3 ppm.
	2-3 ft. Soil, soft, brown, clayey.
8-B	0-4½ ft. Soil, no waste. OVA = 7 ppm, HNU = 0.5 ppm.
8-C	0-1.5 ft. Soil, fill material.
	1.5-4 ft. Waste and waste with soil, black, soft. OVA = 7 ppm @ 2 ft. OVA = 70 ppm, HNU = 20 ppm @ 3 ft.
	4-4.5 ft. Soil, no waste, obstruction at 4.5 ft.

TABLE 4-24. PHOTOVAC RESULTS FOR OTHER SUSPECTED AREA SAMPLES

Core ID	Sample ID	Benzene (ppmv)	Complexity
1-B	A129[a]	4.8	Y/N
2-A	A139	55	Y/Y
2-D	A140[a]	NA	NA
3-B	A043[a]	NA	NA
3-C	A044	9.4	Y/Y
3-C	A045	11	Y/Y
5-A	A136[a]	15	Y/N
7-SURF	A130	NA	NA
7-A	A131	ND	N/Y
7-D	A132[a]	270	N/Y
7-E	A133	NA	NA
7-F	A134	570[b]	Y/Y
7-G	A135	110	Y/Y
8-A	A137	41	Y/Y
8-C	A138[a]	18	Y/Y

[a]Samples selected for waste analyses.

[b]Estimated from off-scale peak, extrapolation >standard.

NA Not Analyzed.

ND Not Detected.

4.6 Monitor Well Installation

In support of the Fillmore site investigation, a ground-water monitor well installation and sampling program was conducted. The principal objectives of the monitoring well installation program were to locate and sample the ground water at the site and to determine if (and to what degree) ground water has been impacted.

4.6.1 Design of Monitor Wells and Method of Installation

Based on a review of local and regional geologic data, it was determined that the site is underlain by Quaternary alluvium of the Pole Creek Fan. Ground water was reported to occur under water-table conditions at a depth of approximately 100 feet below the average ground surface during wetter years and at approximately 130 feet during drier periods. During the period of the investigation, it was estimated that water levels would most closely correspond to those of wetter periods and possibly above the 100 foot depth level. The direction of ground-water flow in the Fillmore area was estimated to be generally southwesterly with local variations ranging from west to south.

Using these hydrogeologic data and the location, size and configuration of the main waste area, it was determined that three monitor wells would be installed. These three wells would provide "first-look" data on the nature of the ground-water system below the site and the chemical impact of the wastes on ground water quality.

Monitor well specifications were developed to satisfy both the objectives of the monitor well installation program and the standards and regulation of Ventura County and the State of California. Permit applications detailing the locations, specifications and completion procedures for each well were submitted to the Ventura County Health Department for approval prior to the initiation of the well installations. On 21 July 1983 Ventura County Well Construction Permit No. 1316 was issued for the three site monitor wells.

Monitor Well Locations

The locations of the monitor wells installed at the site for this investigation are illustrated in Figure 4-30. Well W-1, referred to as the "background well", was installed to the northeast of the main waste area near the base of the hill bordering the site to the northeast. This location afforded the sampling of ground water upgradient of the principal waste area as an indication of background conditions. Water level data and information on the materials encountered during the drilling of well W-1 were used to confirm/refute preliminary data and conclusions as a guide to the subsequent installations of wells W-2 and W-3.

Well W-2, referred to as the "first down-gradient well", was installed near the southwestern corner of the principal waste area, immediately west of the chain-link fence along the western border of the site. This well was positioned such that the southwesterly flowing ground water (assumed) would be intercepted immediately after it passed under the main waste areas. Analysis of ground water sampled at this point provided information pertaining to the effect on ground-water quality by potential leachate generated from the main waste areas.

Well W-3 was installed to the south of the main waste areas near Texaco storage tank no. 1. This well, which was the last installation performed for this study, was positioned such that ground water flowing below the waste areas would be intercepted if the shallow ground water exhibited a more southerly direction of flow than previously estimated. In addition, because of the position of the well, water level data obtained from this well provided the third loci of the triangular well network configuration such that an interpolation of the ground-water surface at the site could be made.

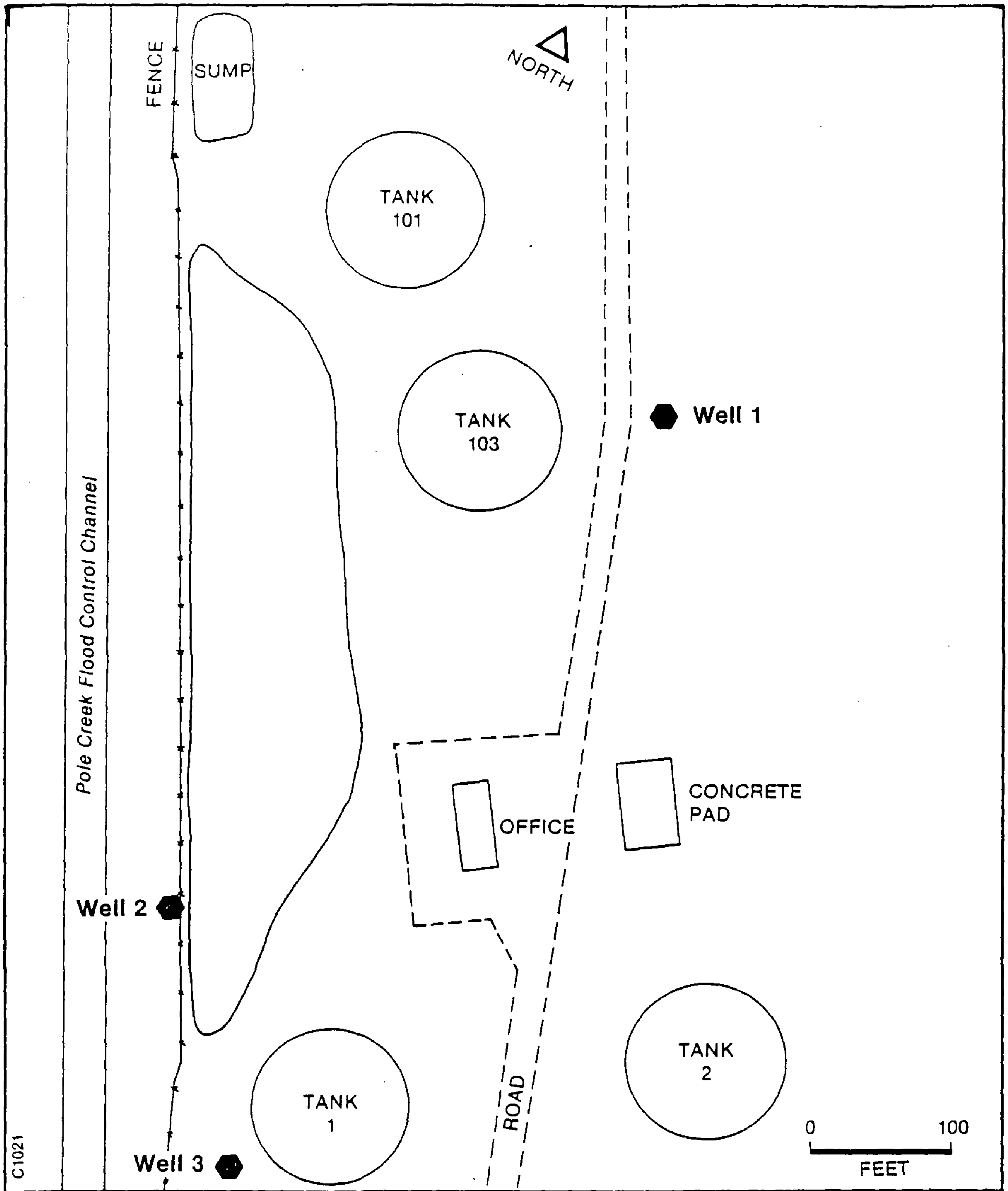

Figure 4-30. Location of Monitoring Wells

Total Depth and Interval of Screening

Based on the composition of the wastes at the Fillmore site and the near-proximity of the monitor wells to the waste areas, the wells were screened 10 feet into the first encountered water table to total depth. The decision to screen and complete each well only 10 feet into the first encountered water table was based on the assumption that leachate or potential contaminates generated by the wastes would remain at or near the water table surface in the vicinity of the wastes. This assumption appears reasonable based on the tendency of petroleum compounds to float on water.

The decision to install 10 foot long screens was made with the recognition that the wells may go dry in following years. Because the wells were emplaced during a period of high ground-water conditions, it is possible that water levels may drop below the screens during drier periods. The basis for designing the wells with a short screen was to prevent sample over-dilution which can occur when a sample is pumped from a well with a long screen in a chemically stratified system. As stated earlier, the installation of the monitor wells for this investigation was to provide a "first look" or a screening of potential chemical impacts of the site and not to provide long term monitoring.

Drilling Methodology

Drilling operations were performed by Eaton Drilling of Woodland, California. Eaton Drilling operated under California State Contractors Licence No. 133783C57 as well as a Ventura County driller's certification during the monitor well installation program. Monitor well installation efforts commenced on 3 August 1983 and were completed on the 19 August 1983 under the direct observation of a Radian hydrogeologist.

All well drilling was performed with Eaton's Cyclone model TH-60 air-rotary drilling rig equipped with casing drive. This type of drilling rig was selected for it's ability to drill in both consolidated and unconsolidated materials with reasonable speed. Because the materials to be encountered during drilling consisted of alluvium of an undetermined texture, air-rotary with casing drive was selected as the drilling method because of it's ability to bore through unconsolidated materials of variable texture without borehole collapse, and because of its ability to penetrate sediments containing boulders, cobbles and gravels of indurated or crystalline materials.

Prior to the initiation of drilling at each monitor well site, the area of drilling was thoroughly scanned with a Fisher M-5 inductive pipe and cable detector for objects such as buried pipelines and debris which could be a potential hazard to drilling operations. In accordance with Texaco site safety rules, Hot Work Permits were obtained from Texaco staff prior to each day's activities when required.

Drilling was performed using a 7.9-inch diameter tri-cone bit that followed 9.5-inch diameter temporary steel casing being driven by a casing hammer. The temporary casing sections averaged 20 feet in length. Casing sections were arc-welded together at the completion of each 20 foot drilling interval. To preserve the chemical integrity of each monitor well, drill cuttings were evacuated from the borehole using compressed air blown through the drill stem and bit. Biodegradable drilling foam was used on a very limited basis when an over accumulation of drill cuttings occurred in the temporary casing. No drilling foam was used within or near the interval where ground water was encountered in drilling. All drilling tools and temporary casing materials were thoroughly washed with water prior to the commencement of drilling activities in an effort to prevent cross-contamination. Water used for washing and the limited production of foam was obtained from the deep water supply well located in the southern section of the site.

During drilling operations, a written log of materials encountered was recorded by the on-site Radian hydrogeologist. Descriptions of drill cuttings produced from the discharge line included:

- Depth of occurrence;
- General appearance;
- Textural composition;
- Color;
- Moisture content; and
- Odor (if not significantly contaminated).

Geologic logs for the three monitor well borings are listed in Appendix C. Samples of the drill cuttings were retained at intervals of five feet (where possible) during drilling as a cross-check and back-up to the written geologic logs. In the case of the sample collection and geologic description efforts, care was taken to insure that the cuttings being examined or retained were fresh cut by obtaining them from the discharge line during cutting cycles. Measurements of the pH of the retained cuttings were made for wells W-1 and W-2 as a field check for background soil pH values. Measurement for the pH cuttings from W-3 boring were not made.

Well Completion Methods and Materials

Well completion activities were performed by Eaton Drilling under the technical direction of a Radian hydrogeologist and with approval of grouting activities by Dana Determan, a Ventura County inspector. The following discussion provides a general description of the monitor well completions. Detailed well completion information and specifications are listed in Appendix C.

Following the drilling of each well to total depth, water level measurements were made to confirm the presence of at least 10 feet of standing water in the well. Upon the confirmation of suitable water levels, well screen and casing were lowered into the temporarily-cased borehole to begin the completion operations.

The well screen emplaced in each well consisted of a 10-foot section of 4-inch diameter wire-wound (0.020 inch slots), stainless steel with a closed bottom. Stainless steel was selected because of its relatively low chemical reactivity and its inorganic composition, thus preserving sample integrity. Schedule 40 PVC pipe, 4-inches in diameter, was used to case the remainder of the well. The casing used had flush joints and was threaded, precluding the use of glues or solvents. Ground water contact with the PVC casing should be minimal based on existing water levels and well grouting.

Following the emplacement of the permanent casing in each well, a "gravel pack" consisting of a well sorted, sub-rounded Monterey Sand, was placed around the screen inside the temporary casing. After the gravel pack was in place, the temporary steel casing was pulled back approximately 10-feet to expose the sand to the formation. Additional sand was added when settling occurred, to insure that the sand extended along the total length of the screen. A layer of fine-grained silica sand was emplaced immediately above the gravel pack.

Next, a four-sack, cement grout mix was placed into the annular space with a tremie pipe. During the grouting of monitor wells W-2 and W-3, the temporary steel casing was lifted above the screens, but not completely to the surface. At these locations, a 5-inch diameter hole was drilled outside of the 8-inch casing and grout was tremied into the hole to a depth of 40 feet. This alternate method of grouting was approved by the Ventura County Environmental Health Department as an acceptable means of emplacing a surface seal.

Grouting operations for well W-1 differed somewhat from that of wells W-2 and W-3. After the temporary steel casing had been lifted approximately 3 feet to partially expose the well screen and gravel pack, the weld joining the first section of casing to be pulled with the remaining sections, failed. As a result, the remainder of the casing in the borehole was left in place and the annulus between the 8-inch steel and 4-inch PVC casing was sealed with grout. The exposure of only 3 feet of screen should not affect the use of well W-1 as a sampling point provided the well is properly pumped or bailed before sampling.

At the completion of the grouting efforts a section of steel casing was set in the hardening grout to provide protection for the PVC casing exposed above ground. Additional grout was then added to the borehole if significant settling had occurred. A locking cap was welded to the protective casing at each well so that access to each well could be controlled.

Each well was developed using a bailer specifically designed for well development. The wells were bailed continuously, as yields would allow, until water produced from the wells cleared significantly.

4.6.2 Ground-Water Sampling

Following the completion of the three monitor wells, each was purged and sampled using a 2-inch diameter, bottom-discharge bailer consisting solely of Teflon®. Purging operations for each well were performed until at least one wetted well volume had been evacuated. The available bladder pump was not used due to the need to use an electric air compressor in the rain.

The bailer was thoroughly washed between sampling episodes to prevent potential cross-contamination. Each sample was containerized and preserved for shipment in the manner described in Table 4-25.

5.2.2 Ground Water

Ground water samples collected from wells 1, 2 and 3 were analyzed for indications of contamination from the wastes present in the Fillmore pits. Based on the previously discussed waste and soil analysis, the best indicators of contamination in the ground-water were the mobile organic compounds--benzene, toluene and xylene.

Table 5-14 presents results of analysis of water quality parameters in the three well samples. These results indicate that, in general, constituents of the water in the three wells do not exceed the National Interim Primary or Secondary Drinking Water Standards (1976). Only iron and manganese concentrations, for which standards are based upon aesthetic quality rather than health considerations, are slightly above drinking water limits. This is probably a result of depleted oxygen in the aquifer, which may be an indication of natural or man-made organic contamination (Stumm and Morgan, Aqueous Chemistry, Wiley-Interscience, 1970). Typical TOC (total organic carbon) concentrations for natural waters are a few mg/L. Samples from wells 2 and 3 are rather high in TOC, 19 and 30 mg/L, respectively. However, the source of the organic matter is unknown.

Table 5-15 presents results of volatile aromatic analysis for the ground-water samples. If contamination from the waste pits was occurring, it would likely result in the presence of aromatic hydrocarbons in the samples, in particular, benzene, toluene, and dichlorobenzenes. As seen in Table 5-15, benzene concentrations in well 2 (96 ppb) and well 3 (800 ppb) exceed the concentration in well 1 (1.4 ppb). There are currently no national drinking water standards for benzene; however, the U.S. EPA has set a non-regulatory limit of 70 ppb. 1,3 dichlorobenzene occurred in only one of 3 well water samples at a concentration of 14 ppb. There is currently no national drinking water standard for 1,3 dichlorobenzene.

TABLE 5-14. GROUND WATER QUALITY ANALYSIS
(ppm except as noted)

Parameter	Well Sample Number 1	2	3
AG	<.002	<.002	<.002
AS	0.005	0.005	0.005
BA	0.12	0.56	0.37
CD	0.003	0.005	0.003
CL	82	91	74
CR	<.001	<.001	<.001
FE	7.6	4.4	9.9
F	0.94	0.94	1.3
HG	0.0031	0.0031	0.0031
MN	0.45	0.114	0.26
NA	131	214	283
PB	0.013	0.033	0.045
Phenol	<.005	<.005	<.005
SE	<.003	<.003	<.003
SO_4	760	<1	52
Total Organic Carbon	9	19	30
Total Organic Halogens	3.9	1.2	1.0
Conductivity (μMHO)	2000	1430	1430
pH (units)	7.96	7.28	9.27

TABLE 5-15. VOLATILE AROMATIC ANALYSIS OF GROUND-WATER SAMPLES* (ppb)

	Well Sample Number		
	1	2	3
Benzene	1.4	96	800
Toluene	ND	ND	ND
1,3-Dichlorobenzene	ND	ND	14
1,2-Dichlorobenzene	ND	ND	ND
1,4-Dichlorobenzene	ND	ND	ND

*EPA Method 602

Note: Only specific peaks are identified. A complete analysis of all peaks is not performed under the 602 method.

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D.4 WATER QUALITY ANALYSIS OF GROUND-WATER SAMPLES

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PAGE 1 | Analytical Serv | REPORT | LAB # 83-08-235

RECEIVED: 08/19/83 | 09/30/83 15:38:21

REPORT TO	Texaco Fillmore c/o Radian Sacramento	PREPARED BY	Radian Analytical Services 8501 MoPac Blvd. P.O. Box 9948 Austin, Texas 78766
ATTEN	Ken Strom	ATTEN	
		PHONE	(512) 454-4797
CLIENT	TEXACO FILL	SAMPLES	3
COMPANY	Texaco Fillmore		
FACILITY			

CERTIFIED BY ______________

CONTACT STROM

Duplicate of report of 09/21/83.

WORK ID	groundwater samples
TAKEN	8/83
TRANS	Fed Ex
TYPE	
P.O. #	224-035-17-60
INV. #	1734

SAMPLE IDENTIFICATION

01	WQ-1
02	WQ-2
03	WQ-3

Analytical Serv TEST CODES and NAMES used on this report

AG E	Silver, ICPES
AS HA	Arsenic Hydride
BA E	Barium, ICPES
CD E	Cadmium, ICPES
CL IC	Chloride IC
CR E	Chromium, ICPES
FE E	Iron, ICPES
F IC	Fluoride, IC
HG CA	Mercury, Cold Vapor
MHO A	Specific Conductance
MN E	Manganese, ICPES
NA E	Sodium, ICPES
PB GA	Lead, low level
PHEN A	Total Phenolics
PH A	pH
SE HA	Selenium Hydride
SO4 IC	Sulfate IC
TOC	Total Organic Carbon
TOX 1	TOX Single Analysis

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Analytical Serv REPORT LAB # 83-08-235

RECEIVED: 08/19/83

RESULTS BY TEST

TEST CODE default units	Sample 01 (entered units)	Sample 02 (entered units)	Sample 03 (entered units)
AG_E ug/ml	<.002	<.002	<.002
AS_HA ug/ml	0.005	0.012	0.013
BA_E ug/ml	0.12	0.56	0.37
CD_E ug/ml	0.003	0.005	0.003
CL_IC mg/L	82	91	74
CR_E ug/ml	<.001	<.001	<.001
FE_E ug/ml	7.6	4.4	9.9
F_IC mg/L	0.94	0.94	1.3
HG_CA ug/ml	0.0031	0.0031	0.0031
MHO_A umhos	2000	1430	1430
MN_E ug/ml	0.45	0.114	0.26
NA_E ug/ml	131	214	283
PB_GA ug/ml	0.013	0.033	0.045
PHEN_A mg/L	<.005	<.005	<.005

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 Analytical Serv REPORT LAB # 83-08-235

RECEIVED: 08/19/83 RESULTS BY TEST CONTINUED FROM ABOVE

PH_A pH units	7.96	7.28	9.27
SE_HA ug/ml	<.003	<.003	<.003
SO4_IC mg/L	760	<1	52
TOC mg/L	9	19	30
TOX_1 mg/L	3.9	1.2	1.0

D-123

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D.5 ORGANIC ANALYSIS OF GROUND-WATER SAMPLES

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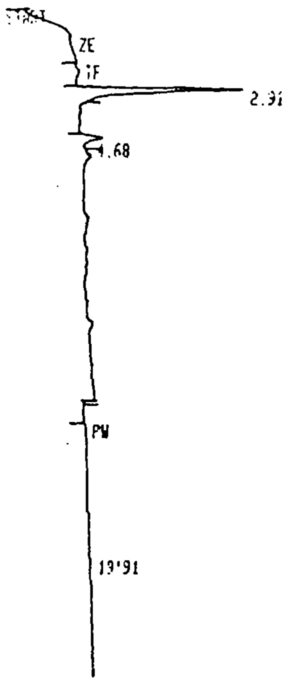

STOP

RUN # 170

AREA%

RT	AREA	TYPE	AR/HT	AREA%
2.91	145170	PB	0.184	88.439
4.68	18978	PB	0.188	11.561

TOTAL AREA= 164150
MUL FACTOR= 1.0000E+00

GC Scan of Well 1 Sample - EPA 602 Method

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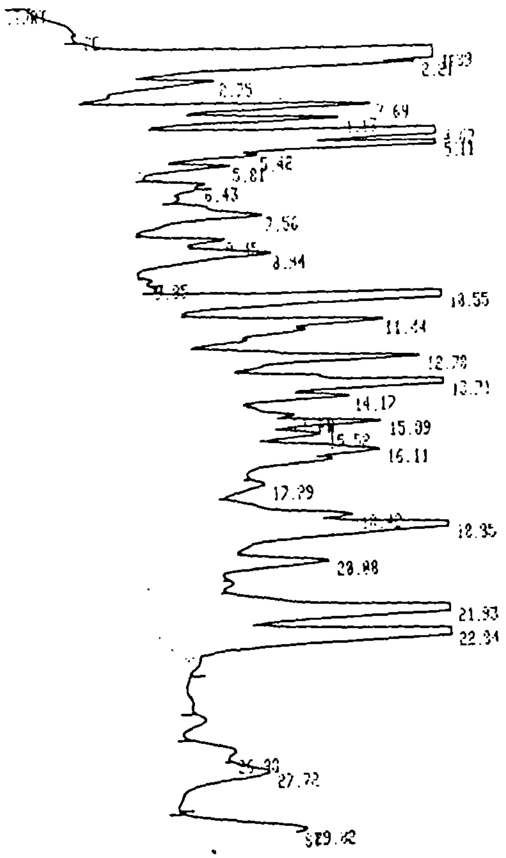
CORPORATION



RUN # 171

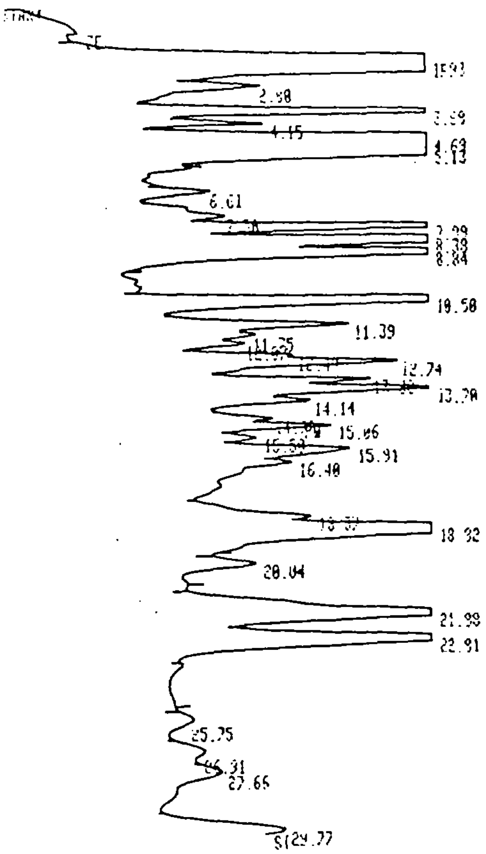
AREA%

RT	AREA	TYPE	AR/HT	AREA%
1.89	509390	I PB	0.062	3.971
2.75	126150	PP	0.309	0.984
3.69	361640	PV	0.267	2.820
4.13	334720	VV	0.291	2.610
4.67	1301800	VV	0.230	10.150
5.11	535530	VV	0.223	4.176
5.42	137520	VV	0.222	1.072
5.81	104970	VB	0.235	0.818
6.43	28583	PB	0.176	0.223
7.56	207170	BP	0.413	1.615
8.45	110640	PV	0.264	0.863
8.94	279560	VP	0.438	2.180
9.85	6698	PB	0.143	0.052
10.55	1004500	PV	0.272	7.832
11.44	352440	VV	0.326	2.748
12.78	551260	VV	0.444	4.298
13.71	780680	VV	0.444	6.087
14.17	271810	VV	0.307	2.119
14.81	240180	VV	0.394	1.873
15.09	322490	VV	0.314	2.514
15.52	249370	VV	0.343	1.944
16.11	465770	VV	0.463	3.631
17.29	285720	VV	0.660	2.228
18.42	413850	VV	0.492	3.227
18.85	808870	VV	0.587	6.330
20.08	356580	VV	0.507	2.780
21.93	996210	VV	0.593	7.767
22.84	906110	VB	0.544	7.065
26.98	135750	BV	0.544	1.058
27.72	283160	VB	0.680	2.208
29.82	277130	I BH	0.457	2.161

TOTAL AREA= 1.2826E+07
MUL FACTOR= 1.0000E+00

GC Scan of Well 2 Sample - EPA 602 Method

RADIAN
CORPORATION



RUN # 173

AREA%

RT	AREA	TYPE	AR/HT	AREA%
2.80	116510	BP	0.298	0.493
3.68	535520	PV	0.208	2.267
4.15	111310	VP	0.195	0.471
4.69	1.0781E+07	PV	0.202	45.648
5.13	1726900	VB	0.237	7.312
6.61	78685	BP	0.259	0.333
7.50	164420	PV	0.388	0.696
7.89	541080	VV	0.256	2.291
8.38	1050500	VV	0.262	4.448
8.84	777980	VB	0.303	3.294
10.50	937070	PV	0.263	3.968
11.39	323950	VV	0.329	1.372
11.75	143410	VV	0.279	0.607
12.07	121480	VV	0.270	0.514
12.49	116500	VV	0.173	0.493
12.74	421100	VV	0.359	1.783
13.38	252320	VV	0.248	1.068
13.70	430710	VV	0.328	1.824
14.14	237710	VV	0.341	1.007
14.78	140100	VV	0.286	0.593
15.06	217910	VV	0.286	0.923
15.50	112300	VV	0.294	0.476
15.91	357860	VV	0.433	1.515
16.40	323720	VP	0.620	1.371
18.37	181080	PV	0.343	0.767
18.82	1021100	VB	0.434	4.324
20.04	62786	BB	0.249	0.266
21.88	914260	PV	0.585	3.871
22.81	777340	VP	0.529	3.291
25.75	54214	BP	0.500	0.230
26.91	104470	PV	0.571	0.442
27.66	216390	VP	0.780	0.916
29.77	265890	I PH	0.485	1.126

TOTAL AREA= 2.3613E+07
MUL FACTOR= 1.0000E+00

GC Scan of Well 3 Sample - EPA 602 Method

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PAGE 1 Analytical Serv REPORT LAB # 83-09-132

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REPORT TO: Texaco Fillmore
c/o Radian
Sacramento

ATTEN: Ken Strom

PREPARED BY: Radian Analytical Services
8501 MoPac Blvd.
P.O. Box 9948
Austin, Texas 78766

CERTIFIED BY

ATTEN:

PHONE: (512) 454-4797

CONTACT: STROM

CLIENT: TEXACO FILL SAMPLES: 3

COMPANY: Texaco Fillmore

FACILITY:

WORK ID: volatiles-groundwater

TAKEN:

TRANS:

TYPE:

P.O. #: 224-035-17-60

INVOICE: under separate cover

SAMPLE IDENTIFICATION

01 WG-1

02 WG-2

03 WG-3

Analytical Serv TEST CODES and NAMES used on this report

GC 602 EPA Method 602/GC

1

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