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REMEDIAL ACTION
ALTERNATIVES ANALYSIS
FOR THE OLD POWER PLANT, BUILDING 38,
SITE 16
U.S. NAVAL STATION ROOSEVELT ROADS

CONFIRMATION STUDY TO DETERMINE
POSSIBLE DISPERSION AND MIGRATION
OF SPECIFIC CHEMICALS
U.S. NAVAL STATION ROOSEVELT ROADS

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1.0 BACKGROUND

This report presents the remedial action alternatives analysis for the contaminated soil at the Old Power Plant, Site 16, Naval Station (NAVSTA) Roosevelt Roads, Puerto Rico. The potential contaminants at Site 16 include polychlorinated biphenyls (PCBs) and lead. The alternatives analysis presented herein includes an evaluation of four remedial action alternatives with different clean-up requirements for the soil at Site 16. The clean-up criteria used are based on a risk assessment and, for PCBs, the levels established by the Environmental Protection Agency (EPA) in the Toxic Substance Control Act (TSCA) policy for more recent spills (occurring after May 4, 1987).

The characterization of Site 16 was performed as part of the Confirmation Study of NAVSTA Roosevelt Roads. The objective of the study is to determine if specific toxic or hazardous materials have contaminated the environment at the Navy Activities and may include consideration of various remedial alternatives. The study is part of the Navy Assessment and Control of Installation Pollutants (NACIP) program designed to identify contamination of Navy lands resulting from past operations and to institute corrective measures, as needed.

The NACIP program consists of three distinct phases:

- Initial Assessment Study (IAS)--record searches and personnel interviews to collect and evaluate all evidence supporting the existence of a contamination problem at an installation.

- o Confirmation Study--on-site investigations including physical and analytical monitoring to confirm or refute the existence of contamination, and, if necessary, recommending both interim and long-term corrective measures.
- o Corrective Measures--institution of needed interim and/or long-term remedial measures to control and mitigate contamination.

The IAS phase of the NACIP for NAVSTA Roosevelt Road was conducted in 1984. IAS results for the Old Power Plant (Building 38), Site 16, indicated the potential presence of PCBs and fuel-related contamination in the soil which can pose a health or environmental threat on or off the Naval facility. Consequently, Site 16 was recommended for further investigation in the second phase of the NACIP program, the Confirmation Study.

Building 38 was a 60-megawatt steam turbine facility that generated power from the early 1940's through 1949. The plant used Bunker "C" fuel, which was stored in the two 50,000-gallon underground reinforced concrete tanks located along the northeast side of the building. This area where the underground tanks are located is paved over with concrete. According to the IAS, Bunker "C" fuel was reported to have been found in manholes near Building 38 in the 1970's and was reportedly discharged to the Enlisted Beach via the cooling water outlet for the power plant. During the period of 1956 to 1964, Site 16 was used by the Public Works Department-Power Distribution Shop for the repair and storage of electrical transformers. The majority of the repair was conducted outside of Building 38, along its northeast side. IAS interviewees reported the draining of PCB-containing

transformer oil onto the soil in order to repair the inner cores and coils. The only known exception to this practice was with transformers containing Askarel (a type of PCB). Reportedly, the Askarel fluid was drained into 55-gallon drums for disposal at the Station Landfill.

The Confirmation Study phase of the NACIP program is being performed in sequential efforts, termed Steps, which are defined below.

Step	Description
IA	Verification of existence of contamination.
IB	Characterization of extent and rate of migration of contaminants, geohydrological, geophysical, and other factors.
II	Evaluation of alternatives to achieve compliance, preparation of cost estimates, and project effectiveness of alternatives.
III	Preparation of site operation and draft Government project documentation with cost estimate(s) satisfactory for project funding requests.

Verification Step sampling and analysis for Site 16 was completed in May 1986. This sampling program consisted of the collection of soil samples for analysis of PCBs and fuel-related components, including lead. Because PCBs and lead contamination were detected, the study proceeded onto Step IB of the Confirmation Study phase of the NACIP, the Characterization Step, which was completed in January 1988. Results from the Characterization Study were then used to complete a remedial action alternatives analysis for Site 16.

Section 2.0 of this report presents the results of the Verification sampling which led to the Characterization Study of Site 16. The chemical data collected during the Characterization Step are presented in Section 3.0, and the risk assessment for the contaminants of concern is discussed in Section 4.0. Finally, in Section 5.0, the remedial action alternatives for Site 16 are described and illustrated, and a cost analysis for each proposed action is also included in Section 5.0.

2.0 VERIFICATION STEP RESULTS

During the Round 1 Verification Step (Step IA) of the NAVSTA Roosevelt Roads Confirmation Study, nine soil samples were collected at Site 16. As shown in Figure 2-1, six samples were collected along the northeast and southeast sides of Building 38, and three samples were collected north of the building around the fenced transformer station. Seven of the nine samples collected were composites of the soil in the 0- to 1-foot (ft) depth interval. The remaining two (16S7A and 16S9A) were surficial soil grab samples collected from the concrete-lined drainage ditch along the southeast side of the fenced transformer area.

The soil samples collected during the Round 1 Verification Step were analyzed for PCBs and fuel-related components, specifically oil and grease, volatile organic compounds, lead, ethylene dibromide (EDB), xylenes, methyl ethyl ketone (MEK), and methyl isobutyl ketone (MIBK). Table 2-1 presents the analytical results for the soil samples. Data is presented only for those constituents that were detected, and the complete database for the Verification sampling is contained in Appendix A. The analytical results indicate that PCB contamination exists adjacent to Building 38 as well as adjacent to the fenced area north of the building. In addition, elevated lead levels were detected along the north and northeast side of Building 38 (16S1A, 16S3A, and 16S4A). Figures 2-2 and 2-3 depict the PCB and lead concentration data, respectively. Other constituents detected, but not at levels of concern, were MEK and oil and grease.

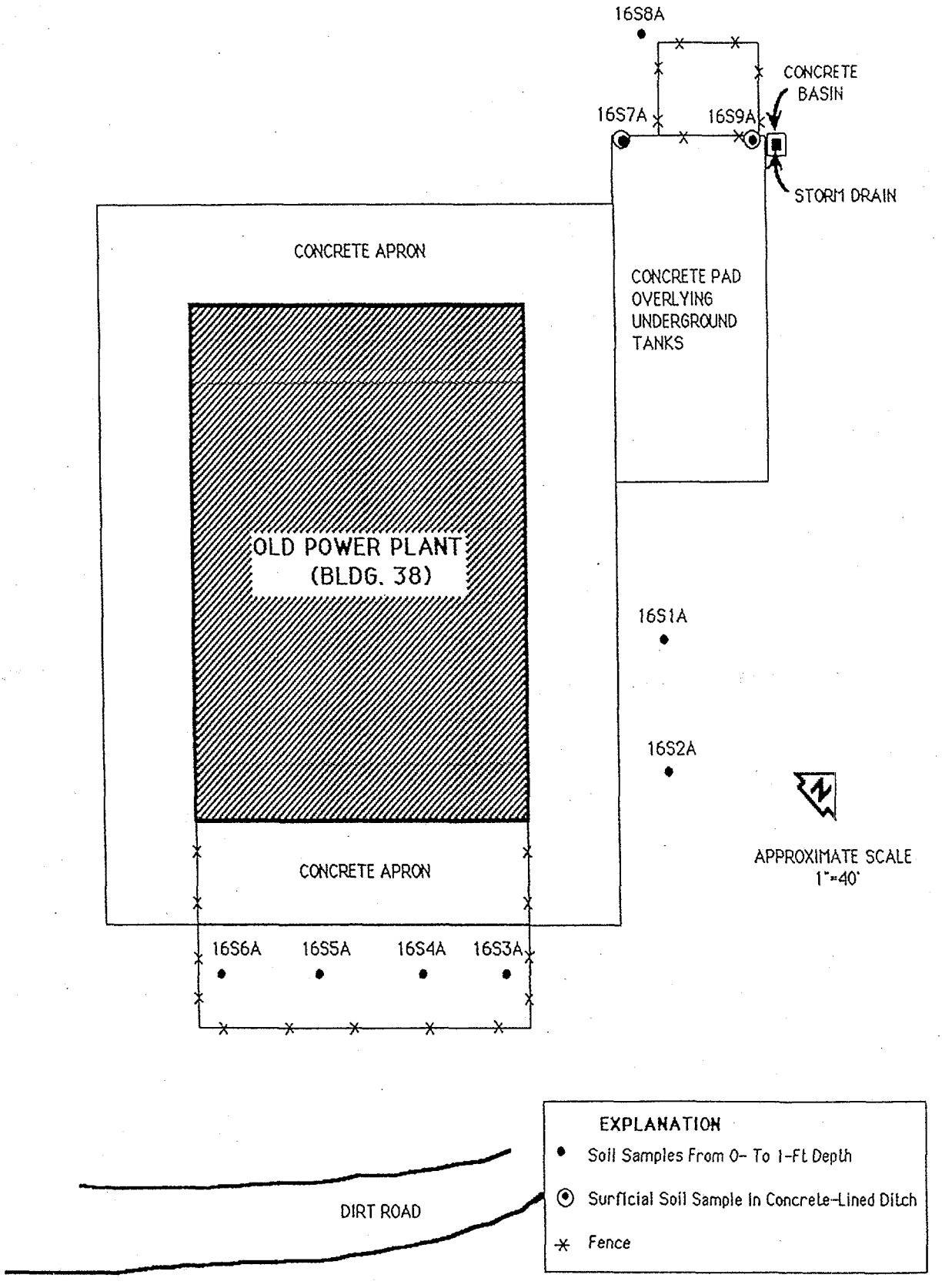

FIGURE 2-1
VERIFICATION STEP SAMPLING LOCATIONS AT SITE 16, THE OLD POWER PLANT, BUILDING 38

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Table 2-1. Verification Step Soil Sampling Results for the Old Power Plant, Building 38, Site 16

Constituent	Concentrations (ug/g, dry)								
	16S1A	16S2A	16S3A	16S4A	16S5A	16S6A	16S7A	16S8A	16S9A
Lead	3,910	420	15,700	834	151	12.7	69.8	215	---
Oil & Grease	109	---	6,350	5,720	919	574	1,310	840	221
Methyl Ethyl Ketone	---	---	---	1	---	---	---	---	1
PCB 1016	---	---	---	---	---	---	---	---	4.78
PCB 1260	---	404	92.9	55.9	3.39	8.85	22.8	---	2.73

Note: --- = Not detected.

Source: ESE, 1986.

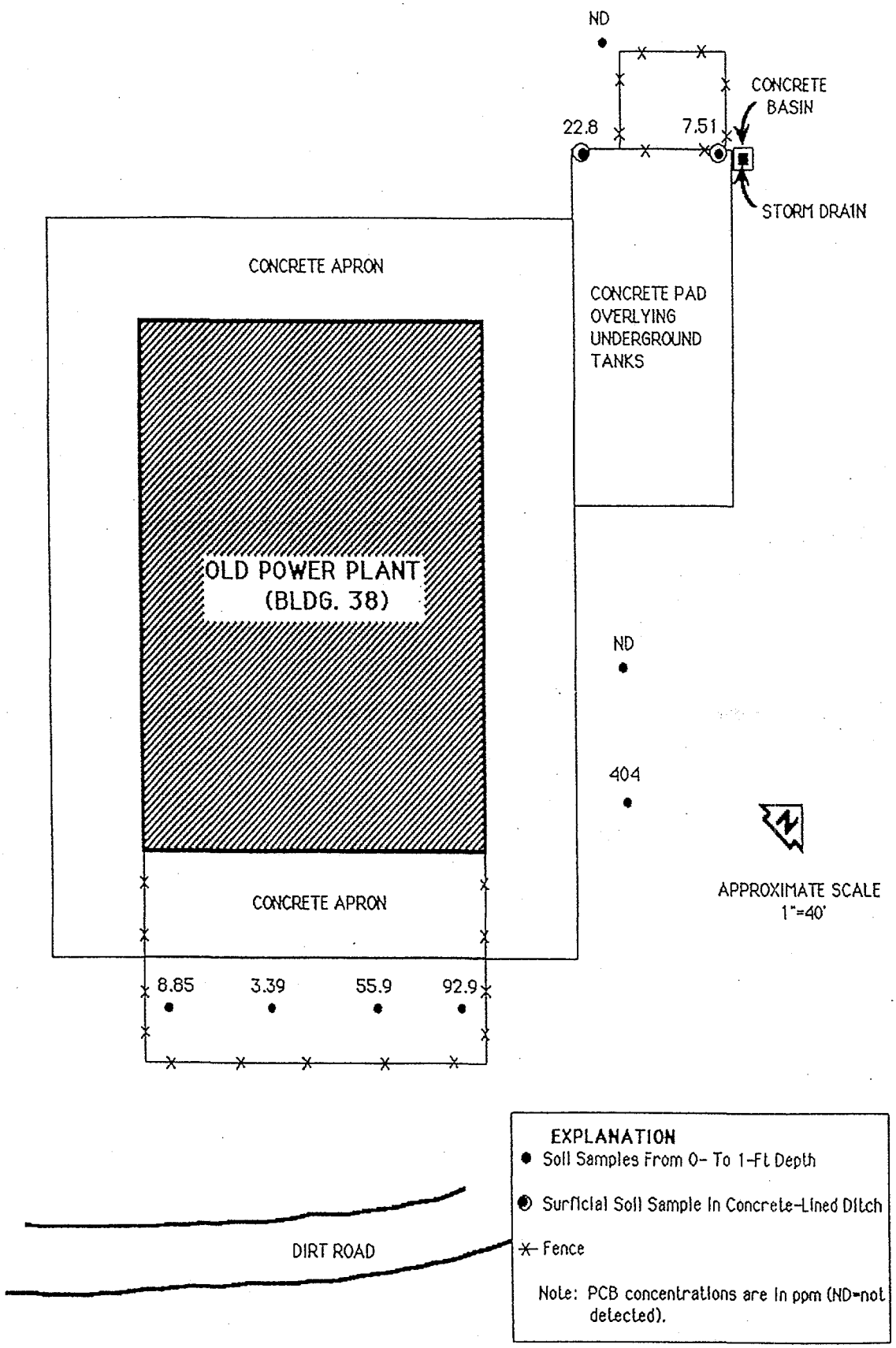

FIGURE 2-2
VERIFICATION STEP PCB RESULTS
AT SITE 16, THE OLD POWER PLANT,
BUILDING 38

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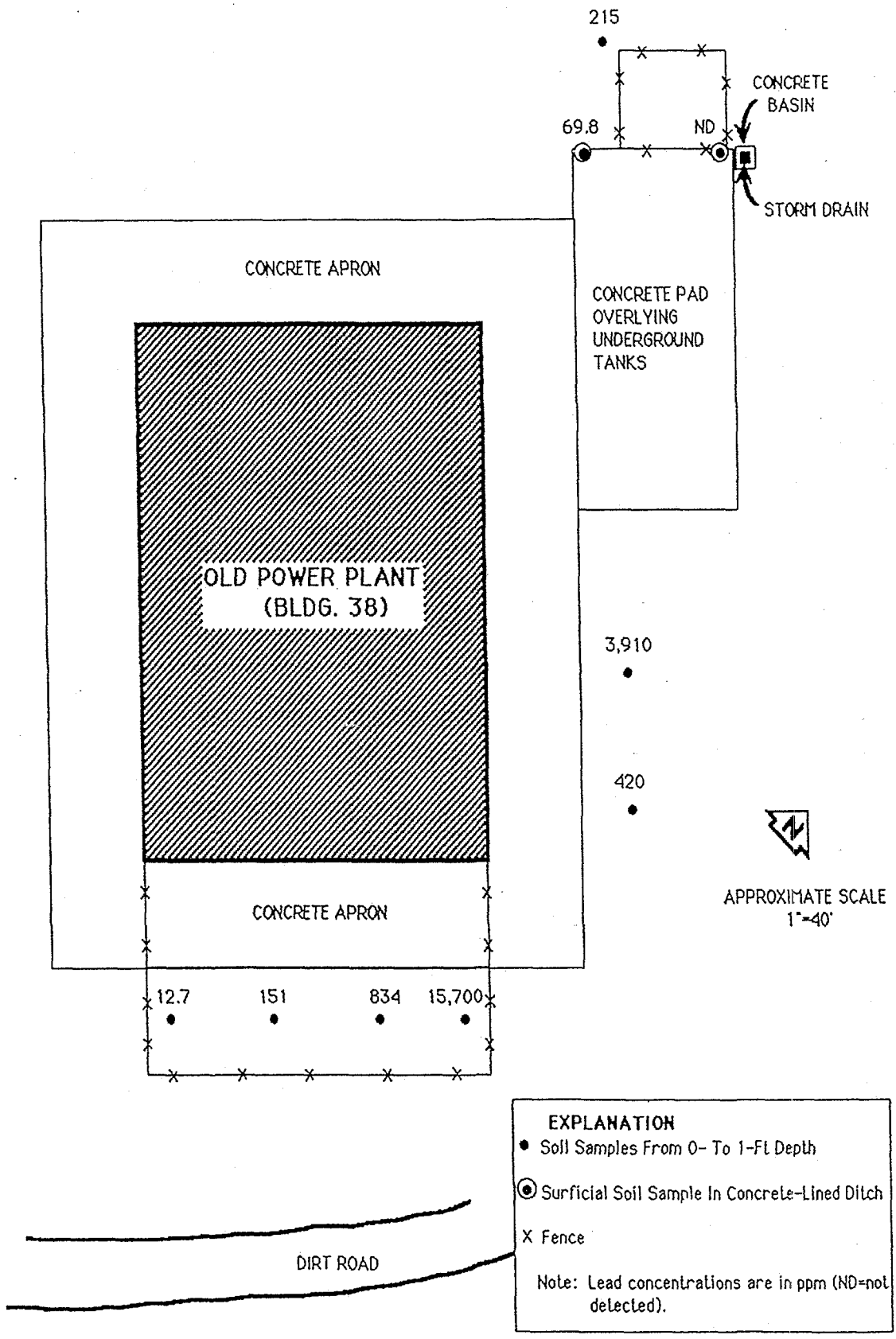

FIGURE 2-3
VERIFICATION STEP LEAD RESULTS
AT SITE 16, THE OLD POWER PLANT,
BUILDING 38

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Based on results from the Round 1 Verification Step sampling, Site 16 was recommended for additional soil sampling and analysis to delineate the extent of PCB and lead contamination. EPA Extraction Procedure (EP) toxicity testing for lead was also recommended.

3.0 CHARACTERIZATION STEP RESULTS

The work plan for the characterization of Site 16 specified the hand-augering of 20 soil borings with the collection of three soil samples per boring, and the collection of six surficial soil samples (one per sampling location) from along the concrete-lined drainage ditch. The sampling locations are shown in Figure 3-1. The borings were to be drilled to a depth of 3 ft, and composite soil samples were to be collected from the 0- to 1-ft, 1- to 2-ft, and 2- to 3-ft depth intervals. Thus, a total of 66 samples were to be collected; 60 composite samples from the 20 soil borings and 6 surficial grab samples from the concrete-lined drainage ditch. However, because coral was encountered at a depth ranging from 9 to 12 inches over most of the site, only 23 samples were collected from the twenty soil boring locations. Composite samples from the 0- to 1-ft depth interval were collected from each of the twenty soil boring locations, but composite samples from the 1- to 2-ft depth interval were collected from only three of the twenty boring locations (Boring locations 16S26, 16S27, and 16S32). None of the composite samples could be collected from the 2- to 3-ft depth interval as planned because of coral. Therefore, a total of 29 soil samples were collected as follows:

No. of Samples	Description
20	Composite from 0- to 1-ft depth interval from twenty boring locations

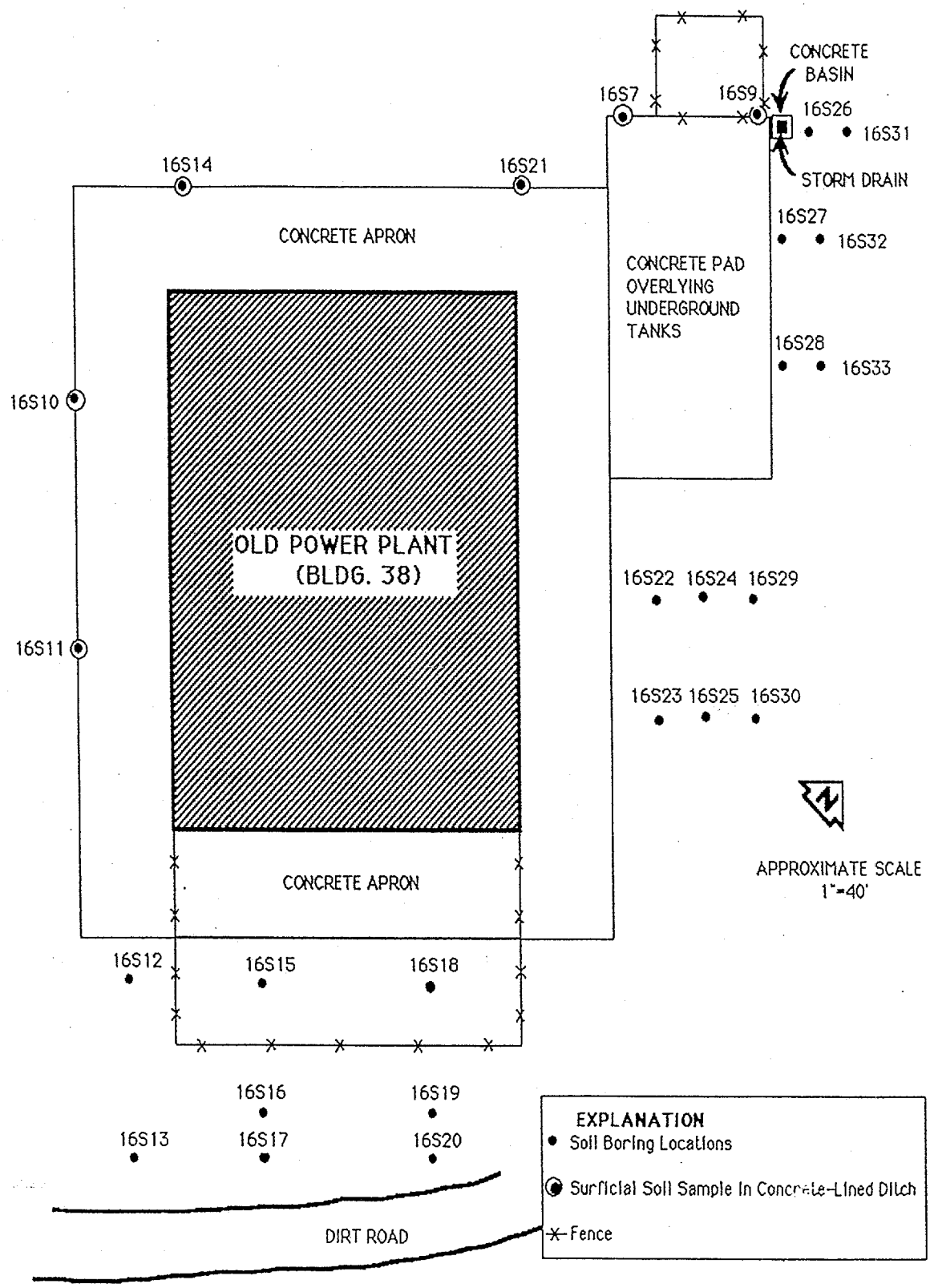

FIGURE 3-1
CHARACTERIZATION STEP SAMPLING LOCATIONS AT SITE 16, THE OLD POWER PLANT, BUILDING 38

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No. of Samples	Description
3	Composite from 1- to 2-ft depth interval from three of the twenty boring locations
6	Surficial grab samples from concrete-lined drainage ditch

The planned analytical program for the Site 16 soil samples included PCB and lead analyses, as well as EP toxicity testing for lead. A phased approach was used in the analyses for PCBs and lead to minimize the analytical costs. This approach involved analyzing one batch of samples selected on the basis of proximity to the source areas (as indicated by the Verification sampling results). Based on the analytical results for the first batch of samples, a second batch was selected for analysis to more fully delineate the extent of contamination. The maximum number of planned PCB analyses coincided with the total planned number of soil samples (66). However, with the reduced number of actual soil samples collected and the phased analytical approach, a total of 27 samples were analyzed for PCBs. Figures 3-2 and 3-3 show the PCB concentration data for the 0- to 1-ft and 1- to 2-ft depth intervals, respectively. The complete characterization sampling database is contained in Appendix B.

A maximum of 33 lead analyses was included in the planned analytical program. This maximum was derived assuming the analysis of all composite soil samples collected from the 0- to 1-ft depth interval from all twenty soil boring locations, and all six surficial grab samples from the concrete-lined drainage ditch. The remaining seven samples of the maximum of 33 were to be selected from those composite samples collected

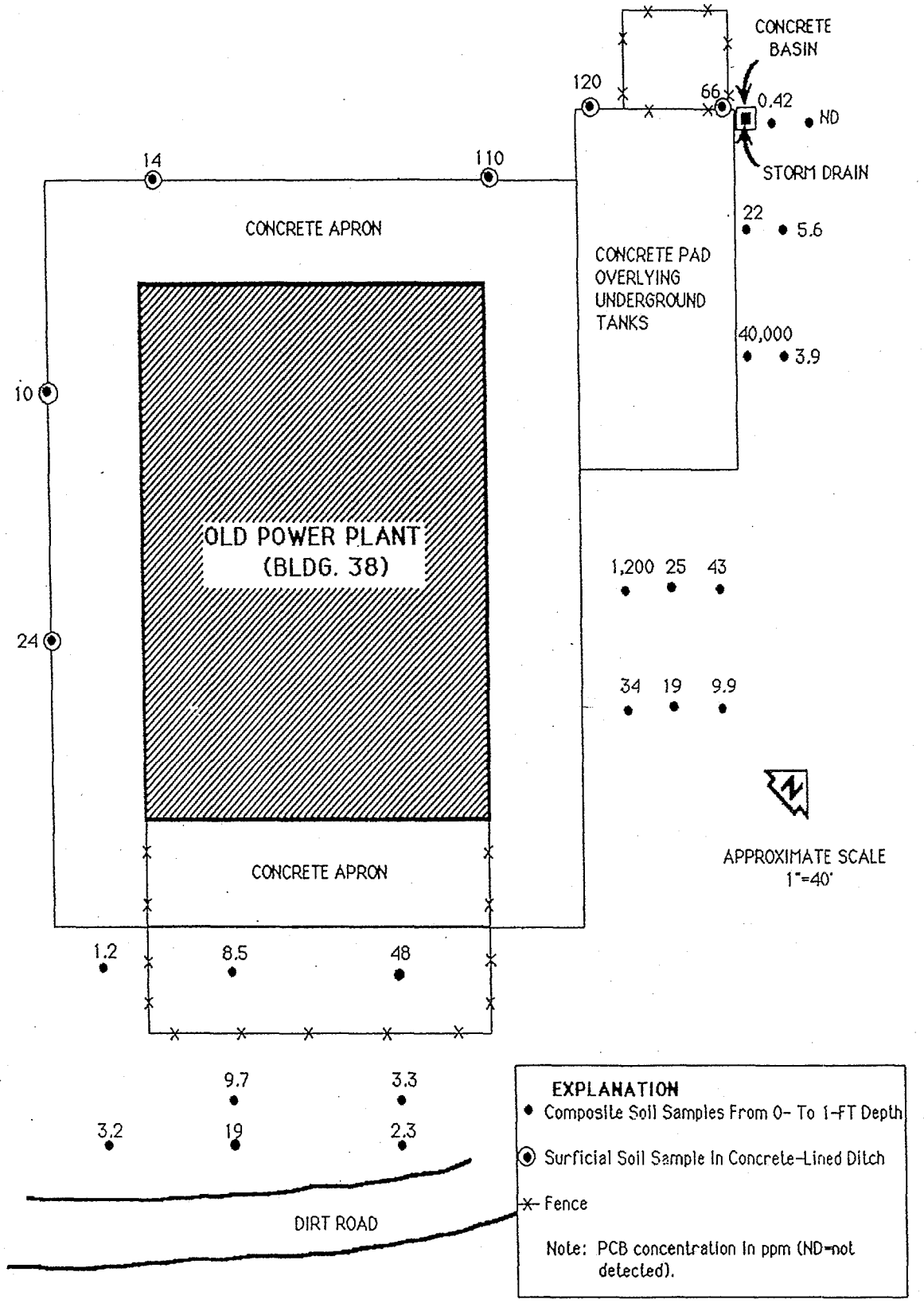

FIGURE 3-2
CHARACTERIZATION STEP PCB RESULTS FOR THE 0- TO 1-FOOT DEPTH INTERVAL AT SITE 16, THE OLD POWER PLANT, BUILDING 38

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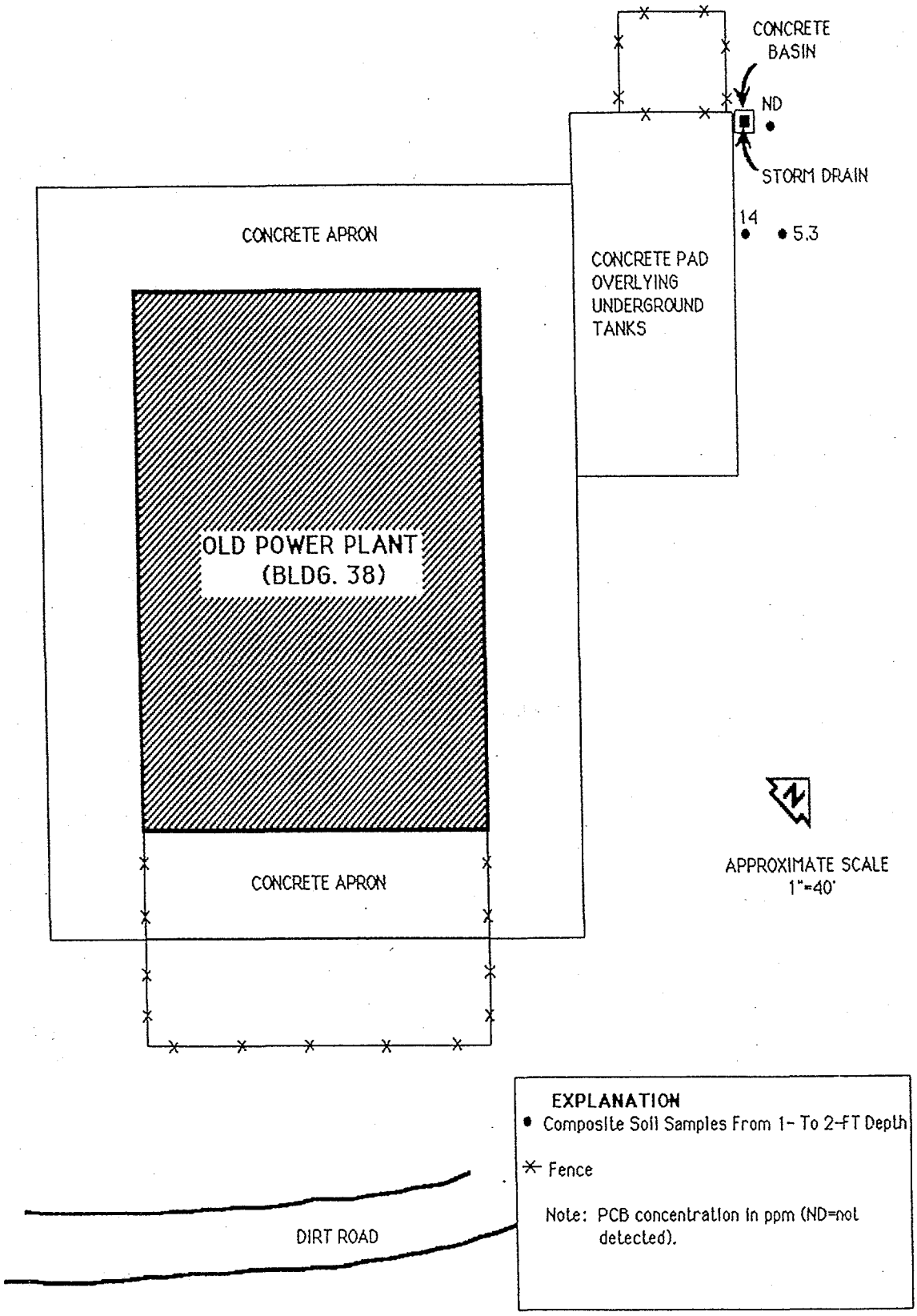

FIGURE 3-3
CHARACTERIZATION STEP PCB RESULTS FOR THE 1- TO 2-FOOT DEPTH INTERVAL AT SITE 16, THE OLD POWER PLANT, BUILDING 38

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from the 1- to 2-ft depth interval of those boring locations showing the highest lead levels in the 0- to 1-ft depth interval. However, with the reduced number of actual soil samples collected and the phased analytical approach, a total of 28 samples were analyzed for lead. Figures 3-4 and 3-5 show the lead concentration data for the 0- to 1-ft and 1- to 2-ft depth intervals, respectively.

A maximum of 14 EP toxicity tests for lead was included in the planned analytical program. This program involved the selection of those samples with the highest total lead concentration for EP toxicity testing. However, because of the generally low levels of lead detected in the soil samples, only seven samples were subjected to the EP toxicity test for lead. The EP toxicity test results are depicted in Figure 3-6. As shown in Figure 3-6, none of the EP toxicity test lead concentrations exceeded the maximum contaminant lead of 5 milligrams per liter (mg/L), or 5,000 micrograms per liter (ug/L), which would classify the soil sample as a hazardous waste.

As previously mentioned the complete analytical database for the Characterization Step is contained in Appendix B. In this database, the first two characters in all of the sample identification numbers are "16" which stands for Site 16. Following the site number, the letter "S" indicates the sample consists of soil. Next every sample location within the site is assigned a number. Finally, the letter following the sample location number indicates the depth interval from which the sample was collected, as follows:

A = 0- to 1-ft depth interval

B = 1- to 2-ft depth interval
C = 2- to 3-ft depth interval

For example, sample "16S23B" provides the following identification:

16	-	Site 16
S	-	Soil
23	-	Sample location number 23
B	-	Sample interval from 1- to 2-ft below the ground surface

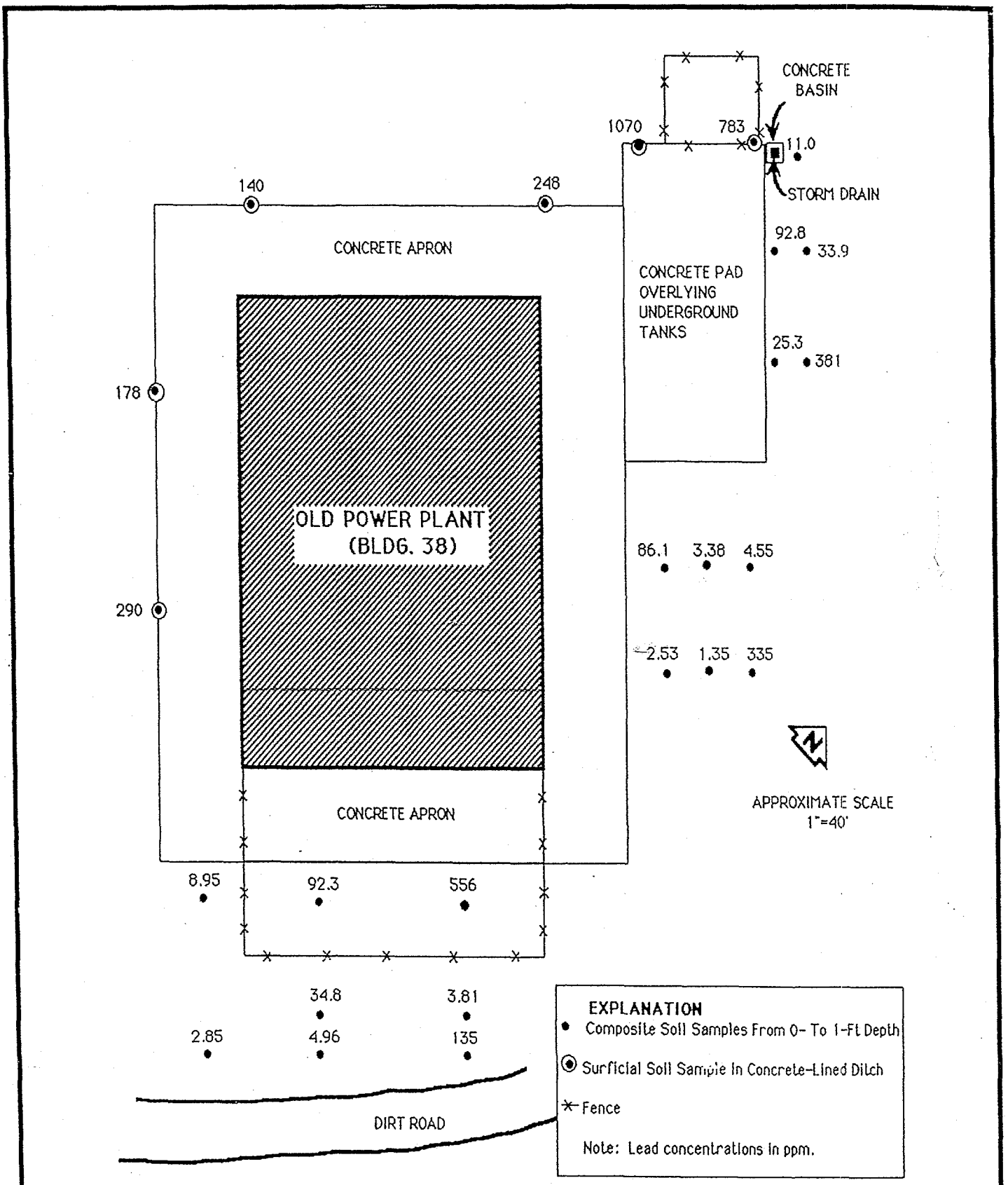

FIGURE 3-4
CHARACTERIZATION STEP LEAD RESULTS FOR THE 0- TO 1-FOOT DEPTH INTERVAL AT SITE 16, THE OLD POWER PLANT, BUILDING 38

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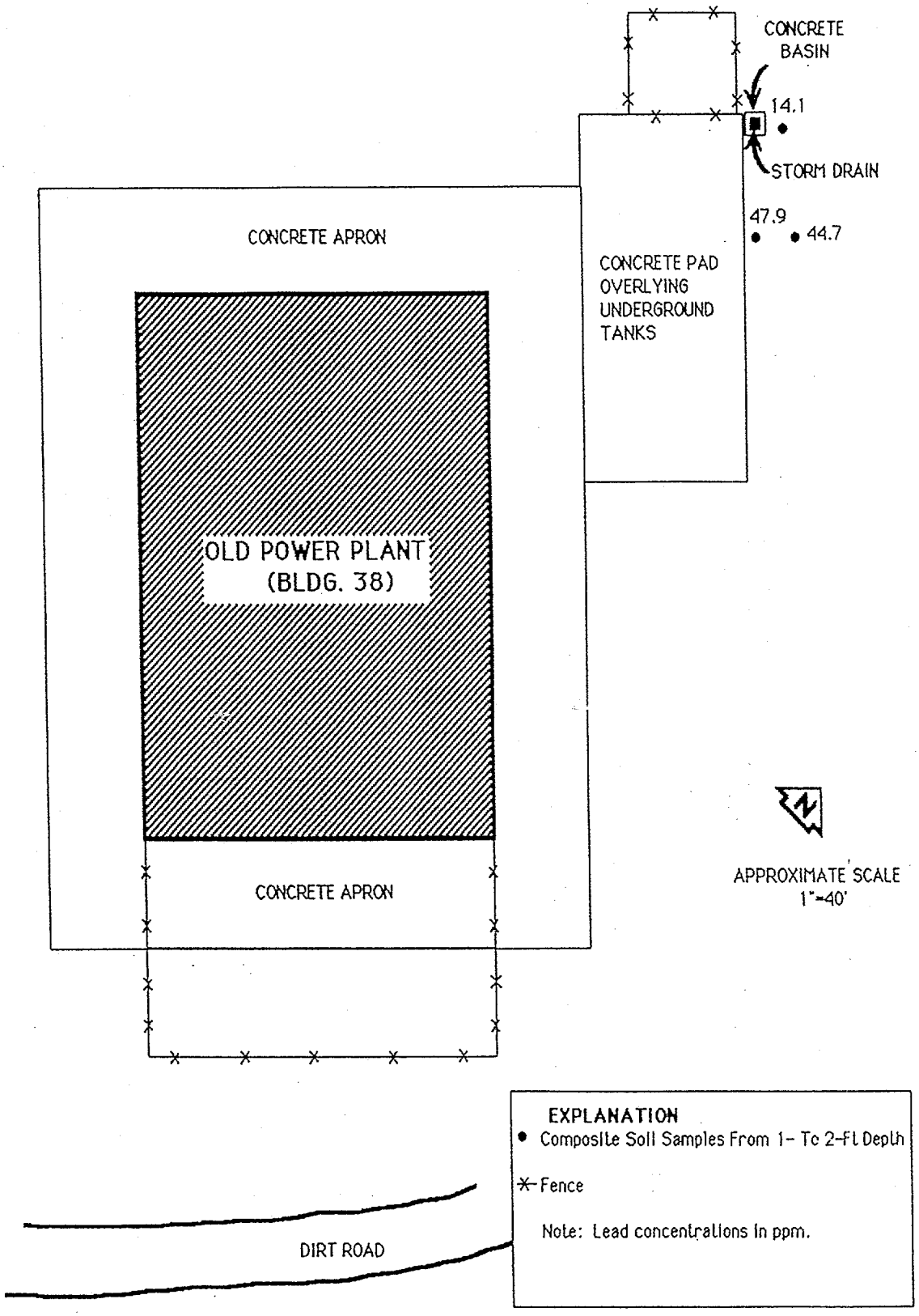

FIGURE 3-5
CHARACTERIZATION STEP LEAD RESULTS FOR THE 1- TO 2-FOOT DEPTH INTERVAL AT SITE 16, THE OLD POWER PLANT, BUILDING 38

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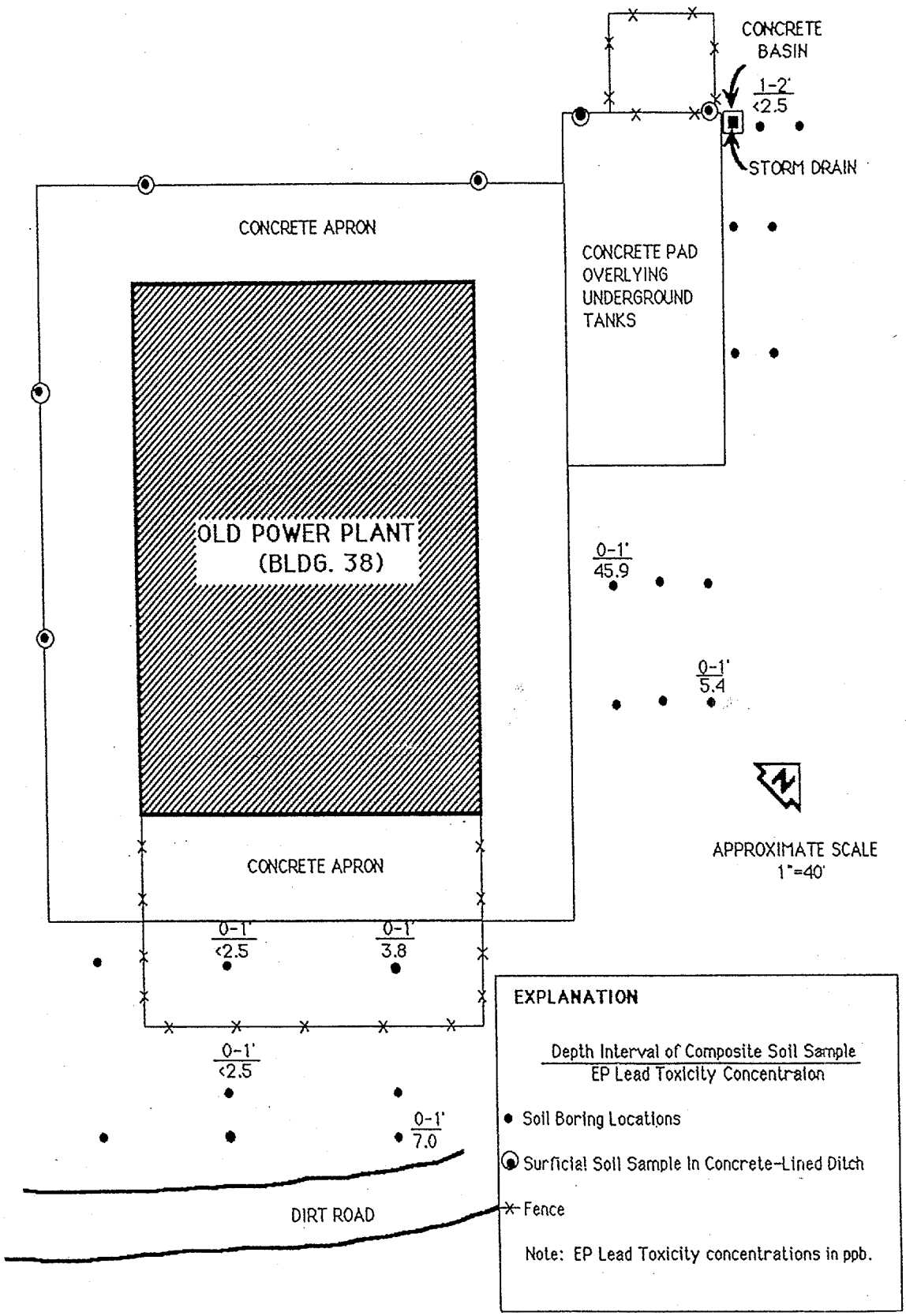

FIGURE 3-6
CHARACTERIZATION STEP EP TOXICITY TEST LEAD RESULTS AT SITE 16, THE OLD POWER PLANT, BUILDING 38

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4.0 RISK ASSESSMENT

The objective of this risk assessment is to determine if the levels of PCBs and lead in the soil at Site 16 pose a threat to human health and/or the environment, and, if so, soil criteria for PCBs and lead that represent safe levels of residual soil contamination.

The development of a PCB soil criterion involved the evaluation of the PCB clean-up requirements set forth by EPA in the TSCA policy to determine their applicability to Site 16, and the performance of a site specific risk assessment. In the TSCA policy, EPA has established criteria to be used in determining the adequacy of the clean-up of spills resulting from the release of materials containing PCBs at concentrations of 50 parts per million (ppm) or greater occurring after May 4, 1987. This policy requires clean-up of PCB-contaminated soil to different levels depending upon the spill location, potential for exposure to residual PCBs remaining after clean-up, the concentration of the PCBs initially spilled, and the nature and size of the population potentially at risk of exposure. For PCB spill areas where there is a greater potential for human exposure to the PCB contamination, the policy requires more stringent clean-up standards. The TSCA PCB regulations are presented below by spill location description.

Spill Location Description	PCB Criterion
(1) Spills at outdoor electrical substations with restricted access	25-50 ppm

Spill Location Description	PCB Criterion
(2) Spills at other restricted access locations other than electrical substations	25 ppm
(3) Spills at nonrestricted access areas	10 ppm

Because the soil contamination at Site 16 exists in an open area with nonrestricted access to lawn maintenance and other station personnel, the 10 ppm clean-up standard would be applicable to the site.

To further evaluate the appropriateness of the 10 ppm clean-up standard for Site 16, a site specific risk assessment was performed. The objective of the risk assessment was the development of a safe level of residual PCB contamination (termed target concentration) based on site specific conditions.

The first step in determining target concentrations is the identification of actual and potential exposure pathways. Only complete exposure pathways are considered for the purpose of developing target concentrations. If any of these components are not present, then the exposure pathway is incomplete and would not be expected to contribute to the total exposure from the site.

A complete exposure pathway has four components:

1. A source of chemical release,

2. An environmental transport medium,
3. A point where human or environmental receptors could be exposed, and
4. A likely exposure route.

A screening of current and potential exposure pathways was conducted to determine which pathways are most significant for the site in terms of human exposure to contaminants. This screening step serves to eliminate from consideration those exposure scenarios in which contaminants may be released from the site but for which there is little or no potential for human contact. This screening also identifies those exposure pathways that are complete and will require detailed quantitative analysis to estimate the extent of human exposure. Environmental receptors were eliminated from further consideration because the contaminated area is too small to support significant populations.

The following routes of exposure have been identified for Site 16 based on the pathway screening analysis:

1. Exposure of workers or the public through dermal absorption of contaminated surface soil,

2. Exposure of workers or the public through incidental ingestion of contaminated surface soil,

3. Exposure of workers or the public through ingestion of contaminated drinking water, and

4. Exposure of workers or the public through inhalation of contaminated dusts and/or vapors.

The following paragraphs describe the rationale for selection or exclusion of the various exposure pathways for developing a target PCB concentration for Site 16.

Exposure Of Workers Or The Public Through Dermal Absorption Of Contaminated Surface Soil--The access to Site 16 by lawn maintenance crews and other station personnel could result in direct contact with soil on exposed skin surfaces and subsequent percutaneous absorption of contaminants. This exposure to soil through dermal absorption represents a complete pathway and, therefore, was included in subsequent analysis of a target PCB concentration.

Exposure Of Workers Or The Public Through Incidental Ingestion Of Contaminated Surface Soil--As a result of persons coming into direct contact with soil contaminants at Site 16, contaminated soil may be accidentally ingested. Persons who have been exposed to soil contaminants through direct contact may consume food items with soiled hands or otherwise ingest soil as a result of unintentional hand-to-mouth contact. Through these mechanisms, persons may actually ingest small quantities of contaminated soil from the site. Because this pathway is considered to be complete, it was included in the development of a target PCB concentration for the site.

Exposure Of Workers Or The Public Through Ingestion Of Contaminated Drinking Water--There are no drinking water wells on or near the site, and it is unlikely that significant leaching and migration of PCB to the ground water, by infiltrating rainwater, is occurring because of the low solubility of PCB in water. Because no exposure point has

been identified and environmental transport is unlikely, this pathway is classified as incomplete and is eliminated from further consideration.

Exposure Of Workers Or The Public Through Inhalation Of Contaminated Dusts Or Vapors--Field investigations of Site 16 have indicated that some of the area is thinly vegetated. Consequently, dispersion of airborne PCB-contaminated dust during lawn mowing is a likely transport mechanism. However, migration via volatilization is an unlikely transport mechanism because PCBs are not very volatile and are not expected to volatilize from the soil. Therefore, dust inhalation, but not vapor inhalation, is considered a complete pathway and was included in development of a target PCB concentration for Site 16.

Based on this exposure pathways analysis, it appears likely that the worst case scenario involves dermal absorption, incidental ingestion, and dust inhalation of residual soil contaminants. Maximum conditions of exposure correspond to a worker performing ground maintenance 2 hours per day for 26 days out of the year. These assumptions were used to modify the dermal absorption factor of 38 milligrams per day (mg/day) developed by Hawley (1985) to yield an annualized average dermal human intake factor of 0.226 milligrams (mg) of soil per day using the following equation:

$$38 \text{ mg/day} \times \frac{26 \text{ workdays/year}}{365 \text{ days/year}} \times \frac{2 \text{ hours/workday}}{24 \text{ hours/day}} = 0.226 \text{ mg/day}$$

The same level of activity was used to modify the lifetime average soil ingestion rate of 100 mg/day suggested by EPA

(1986a) to yield an annualized average incidental soil ingestion human intake factor of 0.594 mg/day.

The inhalation rate for an adult male engaged in moderate activity is 2.8 cubic meters (m^3) per hour (EPA, 1986). In addition, Hawley (1985) has suggested a 75 percent retention of inhaled particles. Assuming that the concentration of suspended particulates at the site will not exceed 10 milligrams per cubic meter (mg/m^3) [threshold limit value for nuisance particles; American Conference of Governmental Industrial Hygienists (ACGIH, 1986)] of which 100 percent can be attributed to site contamination and that weather conditions favorable to airborne dust occur 70 percent of the year, based on an average of 255 dry days per year (EPA, 1986c), an average daily exposure inhalation factor of 0.209 m^3/day can be calculated in a fashion similar to the other exposure factors as follows:

$$2.8\ m^3/\text{hour} \times 24\ \text{hours/day} \times \frac{26\ \text{workdays/year}}{365\ \text{days/year}} \times$$

$$\frac{2\ \text{hours/workday}}{24\ \text{hours/day}} \times 0.75 \times 0.7 = 0.209\ m^3/\text{day}$$

According to EPA policy, a total carcinogenic risk level of 10^{-6} is an acceptable risk for exposure of an individual to a hazardous waste site. The EPA approach (1986a) is to apportion an equal level of risk to each potential carcinogen at the site. But, because PCBs is the only observed carcinogen at the site, the PCB target risk level is the same as the total carcinogen risk level.

The target PCB oral chronic daily intake (CDI) at the site was then determined by dividing the target risk level of 10^{-6} by

the oral route cancer potency factor of 4.34 $(mg/kg/day)^{-1}$ yielding a value of 2.30×10^{-7} mg/kg/day [kg = kilogram].

The target PCB inhalation CDI was calculated in a similar manner. However, because an inhalation route cancer potency factor for PCB was not available in the technical literature, an assumed inhalation factor was used. In general, the inhalation factor is about an order of magnitude less than the oral route cancer potency factor, which is 4.34 $(mg/kg/day)^{-1}$ for PCB. Therefore, an inhalation factor of 0.4 $(mg/kg/day)^{-1}$ was used to yield a target PCB inhalation CDI of 0.25×10^{-5} mg/kg/day.

Using Pathway Preliminary Pollutant Limit Values (PPLV) methodology, significant source-to-receptor pathway is quantified and the effects combined to ensure that an exposed individual will not receive an unacceptably large dose. Intermediate results of the method are referred to as single-pathway preliminary pollutant limit values (SPPPLVs) and represent residual levels of contamination that would be safe if only that single pathway were operating. Several pathways are combined by the following equation:

$$PPLV = \frac{1}{\frac{1}{SPPPLV,1} + \frac{1}{SPPPLV,2} + \ldots}$$

The dermal absorption exposure pathway is defined as:

$$SPPPLV_{(D)} = B_W/W_S \times CDI$$

where: B_W = body weight of an adult (70 kg)

W_s = annualized average dermal human intake factor (0.226 mg/day or 2.26×10^{-7} kg/day)

CDI = 2.30×10^{-7} mg/kg/day

$$SPPPLV_{(D)} = \frac{70 \text{ kg}}{2.26 \times 10^{-7} \text{ kg/day}} \times 2.30 \times 10\text{-}7 \text{ mg/kg/day}$$

$$= 71.2 \text{ mg/kg}$$

The incidental soil ingestion exposure pathway is defined as:

$$SPPPLV_{(I)} = B_W/W_{si} \times CDI$$

where: B_W = body weight of an adult (70 kg)

W_{si} = annualized average incidental soil ingestion human intake factor (0.594 mg/day or 5.94×10^{-7} kg/day)

CDI = 2.30×10^{-7} mg/kg/day

$$SPPPLV_{(I)} = \frac{70 \text{ kg}}{5.94 \times 10^{-7} \text{ kg/day}} \times 2.30 \times 10\text{-}7 \text{ mg/kg/day}$$

$$= 27.1 \text{ mg/kg}$$

The dust inhalation exposure pathway is defined as:

$$SPPPLV_{(R)} = \frac{B_W \times CDI}{RB \times C_{SS}}$$

where: B_W = body weight of an adult (70 kg)

RB = annualized average inhalation exposure factor (0.209 m^3/day)

C_{SS} = concentration of suspended particles in the air (10 mg/m^3)

CDI = 0.25×10^{-5} mg/kg/day

$$SPPPLV_{(R)} = \frac{70 \text{ kg} \times 0.25 \times 10\text{-}5 \text{ mg/kg/day}}{0.209 \text{ m}^3 \times 10 \text{ mg/m}^3}$$

$$= 8.37 \times 10^{-5} \text{ kg/kg or } 83.7 \text{ mg/kg}$$

The soil PCB PPLV criterion, i.e., the target residual PCB soil concentration, was developed assuming an average, representative scenario, where the same worker is exposed to contaminated soils through each of the 3 exposure routes. This PPLV is defined as follows:

$$PPLV = \frac{1}{\frac{1}{SPPPLV_{(D)}} + \frac{1}{SPPPLV_{(I)}} + \frac{1}{SPPPLV_{(R)}}}$$

The calculated PPLV for PCB is 16 mg/kg. Therefore, based on the site specific risk assessment, the calculated PCB clean-up level is 16 mg/kg or ppm. However, the more conservative TSCA clean-up standard of 10 ppm will be used to provide an added degree of protection to human health in the remediation of Site 16.

To determine if the PCB target level results in acceptable risk level relative to the lead concentrations detected in soil at Site 16, a chronic hazard risk index (HI) was calculated for lead to determine the associated health risk. The HI is defined as the ratio of the actual dermal exposure to the acceptable exposure. The actual exposure (3.39 x 10-7

mg/kg/day) is calculated by multiplying the average concentration at the site (105 mg/kg) by the human dermal intake factor (0.226×10^{-6} kg/day) and dividing by the average adult body weight of 70 kg. The acceptable dermal exposure for lead given by EPA is 1.40×10^{-3}. When the HI exceeds unity, a certain degree of health risk is indicated. The HI for lead was calculated as follows:

$$HI = \frac{3.39 \times 10^{-7} \text{ mg/kg/day}}{1.4 \times 10^{-3} \text{ mg/kg/day}} = 2.4 \times 10^{-4} < 1$$

This HI indicates a very low degree of risk posed by the observed concentrations of lead in the soil. Therefore, the proposed action for excavation ensures an acceptable risk level for lead at its current levels in the soil.

5.0 ALTERNATIVES ANALYSIS

The four remedial alternatives developed for Site 16 are described below, and illustrated in Figures 5-1 through 5-4 at the end of this section. These alternatives were developed based on the contaminant routes of exposure and clean-up level identified in the previous section. The four alternatives vary in the degree to which they address the PCB contamination at the site. For example, Alternative 1 applies the least stringent requirements for clean-up while Alternative 4 applies the most stringent. None of the alternatives include any action relative to the PCB contamination within the already fenced areas. The reason being, the fence restricts the public's access into these areas.

Alternative 1 is the "no action" alternative. In this alternative a 6-foot (ft) high, galvanized chain link fence is to be installed around the site to restrict public access. The fence is to encompass all areas of the site confirmed to have PCB concentrations above 10 ppm, approximately 2,246 square yards (S.Y.). Figure 5-1 shows the configuration of the proposal fenced area, and the total length of fence required is 652 linear feet (L.F.).

In Alternative 2, the concrete-lined ditch which runs along the southwest and northwest sides of Building 38 and along the southeast side of the fenced transformer station is to be scraped to remove the soil in the ditch (see Figure 5-2). The ditch is approximately 1.5 ft wide and contains about 1 inch of soil along the bottom of the ditch. This action will result in the removal of approximately 2 cubic yards (C.Y.) of soil, which will be spread out over the areas to be capped.

Then, a single-layered asphalt cap is to be installed over areas of the site confirmed to have PCB concentrations above 10 ppm. The cap is to consist of 4 inches of base material and 1 inch of bituminous paving. The areas to be capped as shown in Figure 5-2 total 1,780 S.Y. The capped areas do not include the area between Building 38 and the rock outcropping shown in Figure 5-2 because this area mainly consists of rock and weathered rock with little soil.

Alternative 3 specifies both partial excavation and capping. In this alternative, the concrete-lined ditch is to be scraped to remove the soil in the ditch (approximately 2 C.Y.), and the area having PCB concentrations above 25 ppm is to be excavated to a depth of 1 ft (see Figure 5-3). A total of 469 C.Y. of PCB-contaminated soil is to be removed from the ditch and excavated areas. The area that is excavated is to be backfilled with clean soil, which is defined by EPA as containing less than 1 ppm PCB. Furthermore, the site area having PCB concentrations between 10 and 25 ppm is to be capped with a single-layered asphalt cap as shown in Figure 5-3. The cap is to cover an area totaling 379 S.Y., and is to meet the same specifications as those specified in Alternative 2. Removed material is to be disposed of by incineration in an incinerator permitted for PCB incineration.

Alternative 4 is the most stringent in meeting PCB clean-up criteria. In this alternative site areas having PCB concentrations exceeding 10 ppm are to be removed by scraping or excavating. These areas include the soil in the concrete-lined ditch and the area shown in Figure 5-4, which will be excavated down to 1 ft. A total of 595 C.Y. of PCB-contaminated soil is to be removed. Areas that are excavated

are to be backfilled with clean soil. Removed material is to be disposed of by incineration.

Table 5-1 presents the estimated costs to implement each of the four remedial action alternatives, and Appendix C contains the detailed cost estimates for each alternative. Most of the cost estimates for these alternatives were performed using the Means Site Work Cost Data 1987. The exceptions are the hauling and disposal costs for the PCB-contaminated soil. These figures were obtained from ENSCO, the firm that operates the PCB-permitted incinerator nearest to Site 16, which is located in El Dorado, Arkansas. Hauling costs include freight charges from Site 16 to this location in Arkansas.

As shown in Table 5-1, the two alternatives with the lowest costs are Alternative 1, which involves the construction of a fence around the area with a PCB concentration exceeding 10 ppm, and Alternative 2, capping. The costs for Alternatives 3 and 4 are significantly higher than those for Alternatives 1 and 2 because of the high costs associated with hauling and incineration of the contaminated soil.

The disadvantage of Alternatives 1 and 2 is that although the fencing/capping eliminates the human exposure pathways, these alternatives do not accomplish any reduction in toxicity or volume of the contamination. Likewise, Alternative 3, which provides treatment and destruction of a portion of the contaminated soil, only provides partial reduction of waste volume. The highest cost alternative, Alternative 4, provides treatment and destruction of all of the contaminated soil with PCB concentrations exceeding 10 ppm.

Table 5-1. Summary of Cost Estimates for Remedial Action Alternatives for Site 16, the Old Power Plant, Building 38

Alternative	Capital Cost ($)	Annual O&M Cost ($/YR)	Total Cost ($)*
1	$9,670	$50	$10,070
2	$7,758	$50	$8,158
3	$1,177,219	$50	$1,117,619
4	$1,491,415	0	$1,491,415

* Total Cost = Sum of capital cost and present worth of annual O&M cost assuming a period of 20 years at 10 percent interest rate.

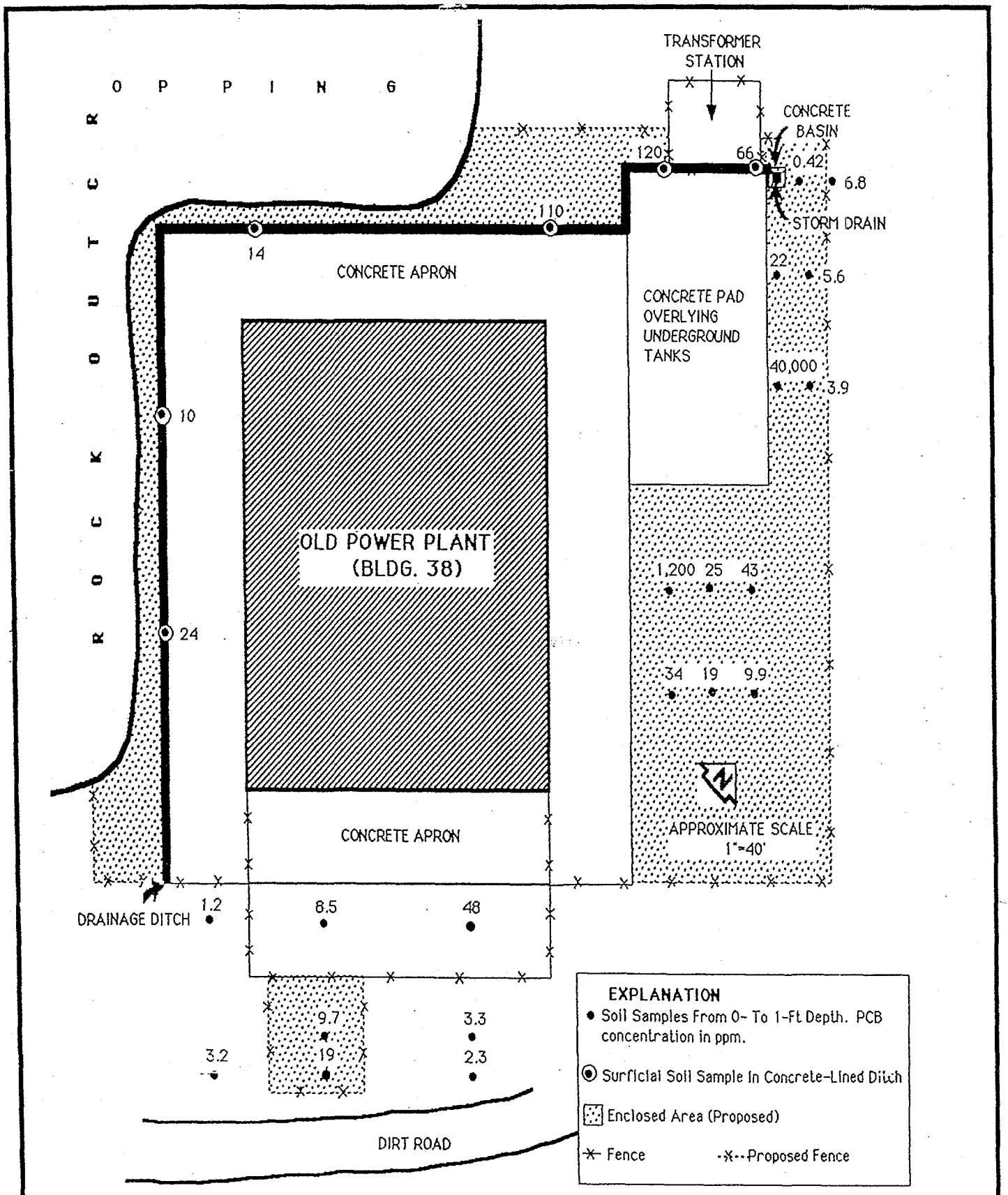

FIGURE 5-1
ALTERNATIVE 1, NO ACTION,
SITE 16, THE OLD POWER PLANT,
BUILDING 38

ESE
ENVIRONMENTAL SCIENCE AND ENGINEERING, INC.

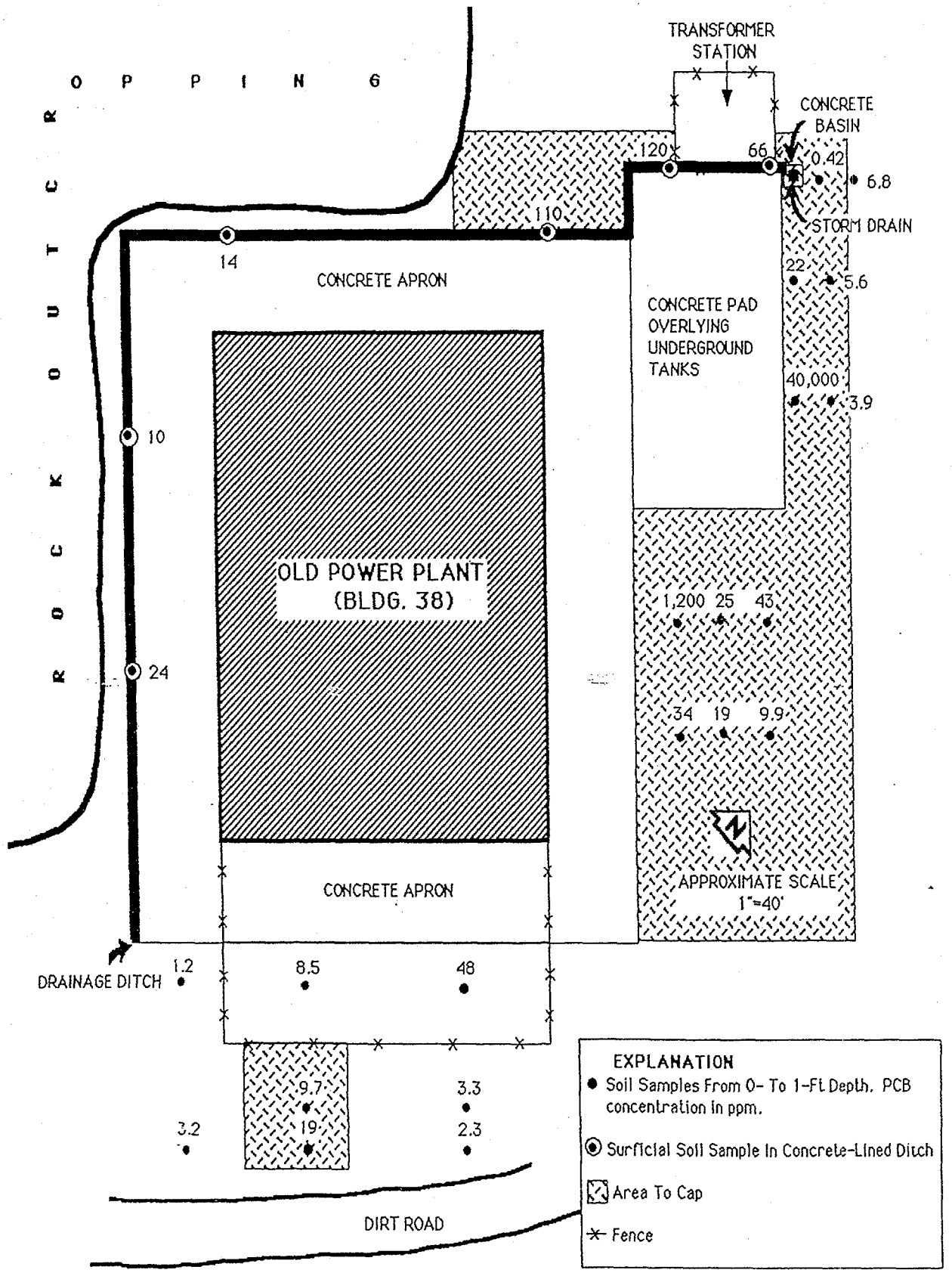

FIGURE 5-2
ALTERNATIVE 2, CAPPING,
SITE 16, THE OLD POWER PLANT,
BUILDING 38

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ENVIRONMENTAL SCIENCE AND ENGINEERING, INC.

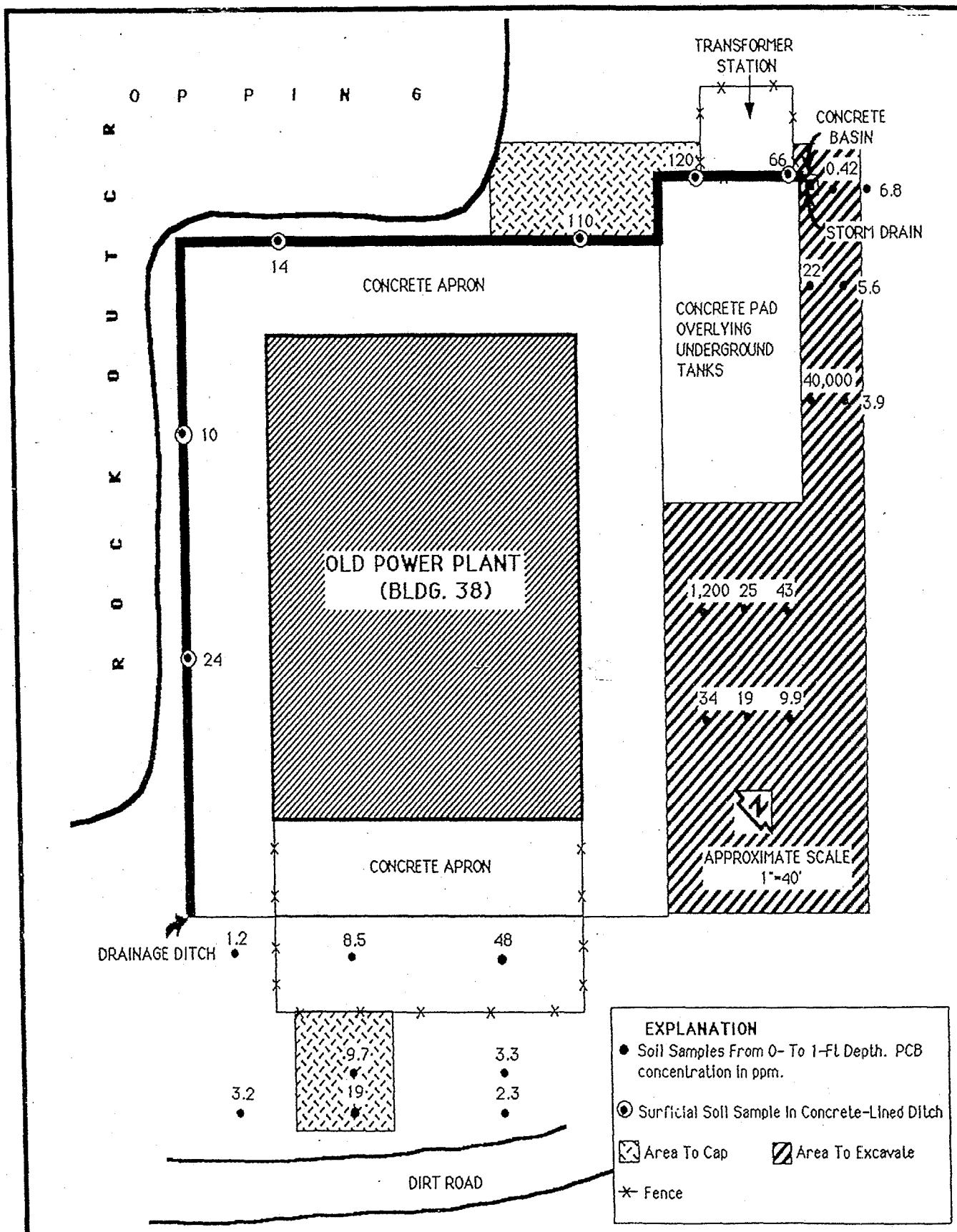

FIGURE 5-3
ALTERNATIVE 3, PARTIAL EXCAVATION AND CAPPING, SITE 16, THE OLD POWER PLANT, BUILDING 38

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ENVIRONMENTAL SCIENCE AND ENGINEERING, INC.

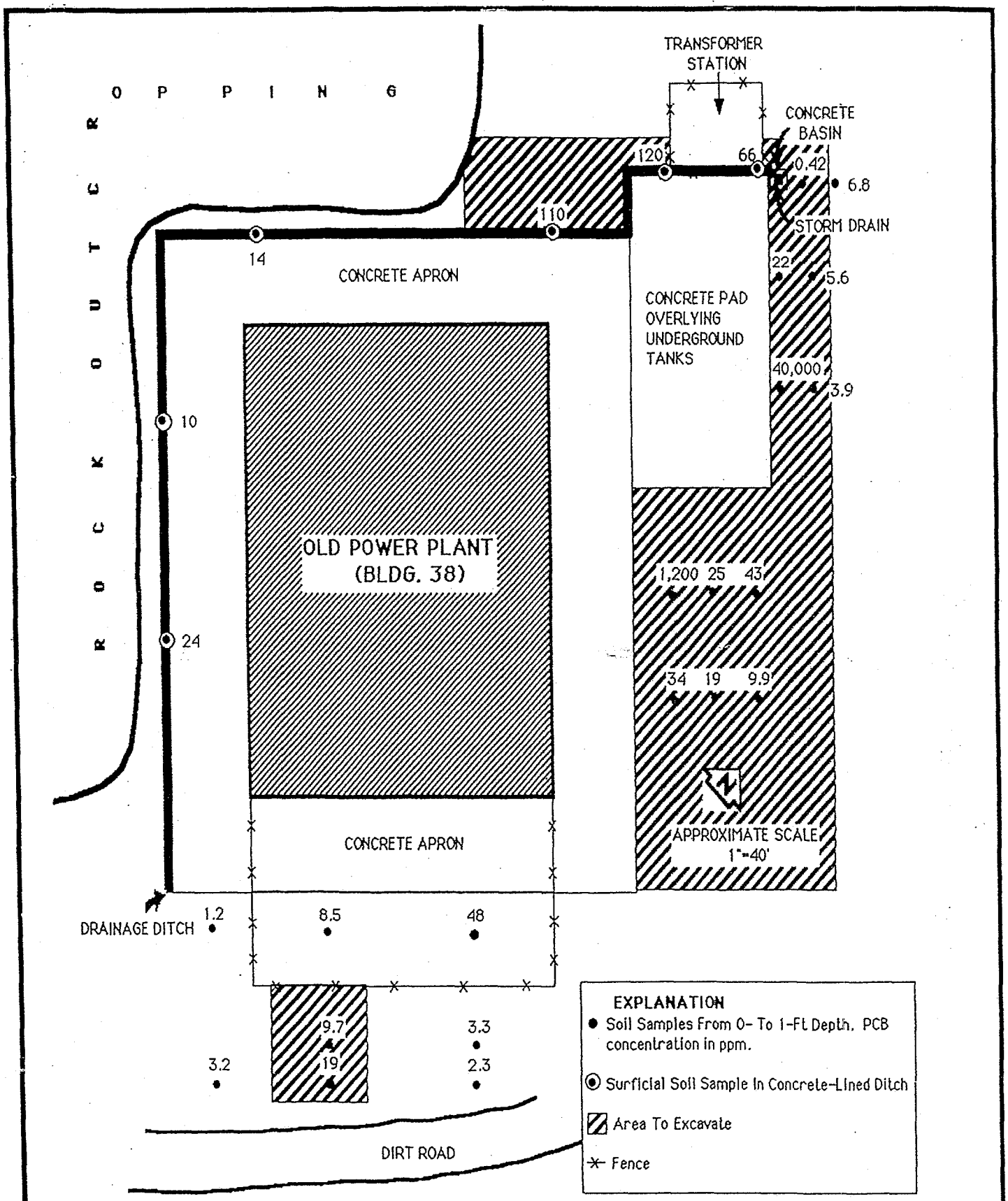

FIGURE 5-4
ALTERNATIVE 4, EXCAVATION,
SITE 16, THE OLD POWER PLANT,
BUILDING 38

ESE
ENVIRONMENTAL SCIENCE AND ENGINEERING, INC.

6.0 REFERENCES

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APPENDIX A
SITE 16 VERIFICATION STEP DATABASE

PROJECT NUMBER 85275 3000 PROJECT NAME PUERTO RICO CONFIRMATION STUDY
FIELD GROUP PRS01 PROJECT MANAGER R. BOWEN
NAVYPS LAB COORDINATOR LISA BARE

PARAMETERS	STORET #	16S1A	16S2A	16S3A	16S4A	16S5A	16S6A	16S7A	16S8A	16S8A	16S9A
		SAMPLE ID/#									
		PRS01	PRS01	PRS01	PRS01	PRS01	PRS01	PRS01	PRS01	PRS01	PRS01
UNITS	METHOD	49	50	51	52	53	54	55	56	109	57
DATE		11/30/85	11/30/85	11/30/85	11/30/85	11/30/85	11/30/85	11/30/85	11/30/85	12/03/85	11/30/85
TIME		07:10	07:23	07:40	07:45	08:00	08:10	08:20	08:30	08:09	08:40
MOISTURE	70320	11.8	11.5	11.1	13.1	11.6	9.6	11.5	14.4	13.7	12.1
%WET WT	0										
OIL&GR,IR,SED	561	3910	420	6350	5720	919	574	1310	840	NRQ	221
UG/G- DRY	0										
PCB 1016,SED	98140	<1.13	<1.13	<1.12	<1.15	<1.13	<1.11	<1.13	<1.17	NRQ	4.78
UG/G-DRY	0										
PCB-1221,SOIL	98351	<1.13	<1.13	<1.12	<1.15	<1.13	<1.11	<1.13	<1.17	NRQ	<1.14
UG/G-DRY	0										
PCB-1232,SOIL	98352	<1.13	<1.13	<1.12	<1.15	<1.13	<1.11	<1.13	<1.17	NRQ	<1.14
UG/G- DRY	0										
PCB-1242,SOIL	98353	<1.13	<1.13	<1.12	<1.15	<1.13	<1.11	<1.13	<1.17	NRQ	<1.14
UG/G-DRY	0										
PCB1254-SOIL	98354	<1.13	<1.13	<1.12	<1.15	<1.13	<1.11	<1.13	<1.17	NRQ	<1.14
UG/G- DRY	0										
PCB-1248 SOIL	98802	<1	<1	<1	<1	<1	<1	<1	<1	NRQ	<1
UG/G-DRY	0										
PCB 1260,SED	98139	<1.13	404	92.9	55.9	3.39	8.85	22.8	<1.17	NRQ	2.73
UG/G-DRY	0										
BENZENE	98699	<0.06	<0.09	<0.04	<0.10	<0.10	<0.10	<0.10	NA	<0.07	<0.10
UG/G-DRY	10										
BROMODICHLOROMETHANE	98783	<0.08	<0.10	<0.08	<0.12	<0.13	<0.13	<0.12	NA	<0.13	<0.12
UG/G-DRY	10										
BROMOFORM	98784	<0.18	<0.25	<0.19	<0.27	<0.46	<0.47	<0.26	NA	<0.26	<0.27
UG/G-DRY	10										
BROMOMETHANE	98785	<0.22	<0.22	<0.18	<0.25	<0.21	<0.21	<0.24	NA	<0.26	<0.25
UG/G-DRY	10										
CARBON TETRACHLORIDE	98680	<0.07	<0.09	<0.16	<0.09	<0.11	<2.2	<0.09	NA	<0.23	<0.09
UG/G-DRY	10										
CHLOROBENZENE	98681	<0.06	<0.08	<0.06	<0.08	<0.08	<0.09	<0.08	NA	<0.09	<0.09
UG/G-DRY	10										
CHLOROETHANE	98786	<0.43	<0.46	<0.26	<0.55	<0.63	<0.64	<0.54	NA	<0.36	<0.56
UG/G-DRY	10										
2-CHLOROETHYLVINYLET	98796	<0.81	<0.49	<0.17	<0.53	<0.89	<0.91	<0.52	NA	<0.27	<0.54
HER UG/G-DRY	10										
CHLOROFORM	98682	<0.068	<0.090	<0.072	<0.102	<0.101	<4.43	<0.100	NA	<0.111	<0.104
UG/G-DRY	10										
CHLOROMETHANE	98787	<0.21	<0.22	<0.21	<0.39	<0.35	<0.36	<0.39	NA	<0.34	<0.40
UG/G-DRY	10										
DIBROMOCHLOROMETHANE	98788	<0.12	<0.17	<0.14	<0.17	<0.23	<0.23	<0.17	NA	<0.20	<0.18
UG/G-DRY	10										

PROJECT NUMBER 85275 3000 PROJECT NAME PUERTO RICO CONFIRMATION STUDY
FIELD GROUP PRS01 PROJECT MANAGER R. BOWEN
NAVYPS LAB COORDINATOR LISA BARE

SAMPLE ID/#

PARAMETERS	STORET #	16S1A PRS01	16S2A PRS01	16S3A PRS01	16S4A PRS01	16S5A PRS01	16S6A PRS01	16S7A PRS01	16S8A PRS01	16S8A PRS01	16S9A PRS01
UNITS	METHOD	49	50	51	52	53	54	55	56	109	57
DATE		11/30/85	11/30/85	11/30/85	11/30/85	11/30/85	11/30/85	11/30/85	11/30/85	12/03/85	11/30/85
TIME		07:10	07:23	07:40	07:45	08:00	08:10	08:20	08:30	08:09	08:40
1,1-DICHLOROETHANE	98683	<0.11	<0.14	<0.07	<0.18	<0.16	<0.16	<0.18	NA	<0.10	<0.18
UG/G-DRY	10										
1,2-DICHLOROETHANE	98684	<0.09	<0.12	<0.13	<0.14	<0.13	<1.7	<0.14	NA	<0.21	<0.15
UG/G-DRY	10										
1,1-DICHLOROETHENE	98789	<0.20	<0.24	<0.15	<0.30	<0.30	<0.31	<0.30	NA	<0.21	<0.31
UG/G-DRY	10										
TRANS-1,2-DICHLOROET	98687	<0.20	<0.23	<0.14	<0.30	<0.31	<0.32	<0.29	NA	<0.21	<0.30
ENE UG/G-DRY	10										
1,2-DICHLOROPROPANE	98790	<0.19	<0.30	<0.08	<0.33	<0.27	<0.28	<0.33	NA	<0.14	<0.34
UG/G-DRY	10										
CIS-1,3-DICHLOROPROP	98791	<0.08	<0.11	<0.06	<0.12	<0.14	<0.14	<0.12	NA	<0.10	<0.12
ENE UG/G-DRY	10										
TRANS-1,3-DICHLOROPR	98792	<0.08	<0.11	<0.16	<0.12	<0.36	<0.37	<0.12	NA	<0.28	<0.12
OPENE UG/G-DRY	10										
ETHYLBENZENE	98688	<0.13	<0.17	<0.13	<0.19	<0.18	<0.19	<0.19	NA	<0.22	<0.19
UG/G-DRY	10										
METHYLENE CHLORIDE	98689	<0.16	<1.5	<0.13	<0.26	<6.1	<35	<0.26	NA	<0.20	<0.27
UG/G-DRY	10										
1,1,2,2-TETRACHLOROE	98793	<0.24	<0.33	<0.09	<0.40	<0.29	<0.29	<0.39	NA	<0.12	<0.40
THANE UG/G-DRY	10										
TETRACHLOROETHENE	98690	<0.12	<0.16	<0.21	<0.17	<0.18	<1.2	<0.17	NA	<0.29	<0.17
UG/G-DRY	10										
TOLUENE	98691	<0.09	<0.12	<0.07	<0.13	<0.13	<0.13	<0.13	NA	<0.11	<0.13
UG/G-DRY	10										
1,1,1-TRICHLOROETHAN	98692	<0.08	<0.10	<0.14	<0.11	<0.12	<0.71	<0.11	NA	<0.23	<0.11
E UG/G-DRY	10										
1,1,2-TRICHLOROETHAN	98693	<0.18	<0.25	<0.14	<0.25	<0.27	<0.28	<0.25	NA	<0.20	<0.26
E UG/G-DRY	10										
TRICHLOROETHENE	98694	<0.11	<0.16	<0.14	<0.19	<0.18	<0.18	<0.19	NA	<0.21	<0.20
UG/G-DRY	10										
TRICHLOROFLUOROMETHA	98794	<0.30	<0.34	<0.11	<0.36	<0.34	<0.35	<0.35	NA	<0.20	<0.37
NE UG/G-DRY	10										
VINYL CHLORIDE	98795	<0.19	<0.19	<0.17	<0.28	<0.35	<0.36	<0.28	NA	<0.23	<0.29
UG/G-DRY	10										
DICHLOROBENZENE,TOTA	98803	<0.07	<0.08	<0.08	<0.07	<0.09	<0.09	<0.07	NA	<0.13	<0.07
L UG/G-DRY	10										
LEAD,SED	1052	109	<3.25	15700	834	151	12.7	69.8	215	NRQ	<2.81
UG/G-DRY	0										
1,2-DIBROMOETHANE (E	98798	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	NRQ	<0.002
DB) MG/KG-DRY	0										

PROJECT NUMBER 85275 3000 PROJECT NAME PUERTO RICO CONFIRMATION STUDY
FIELD GROUP PRSO1 PROJECT MANAGER R. BOWEN
NAVYPS LAB COORDINATOR LISA BARE

PARAMETERS	STORET #	16S1A PRSO1 49	16S2A PRSO1 50	16S3A PRSO1 51	16S4A PRSO1 52	16S5A PRSO1 53	16S6A PRSO1 54	16S7A PRSO1 55	16S8A PRSO1 56	16S8A PRSO1 109	16S9A PRSO1 57
		SAMPLE ID/#									
UNITS	METHOD										
DATE		11/30/85	11/30/85	11/30/85	11/30/85	11/30/85	11/30/85	11/30/85	11/30/85	12/03/85	11/30/85
TIME		07:10	07:23	07:40	07:45	08:00	08:10	08:20	08:30	08:09	08:40
M-XYLENE	98799	<0.05	<0.05	<0.04	<0.05	<0.05	<0.05	<0.05	NA	<0.19	<0.05
MG/KG-DRY	10										
O,P-XYLENE	98800	<0.04	<0.05	<0.02	<0.05	<0.19	<0.43	<0.05	NA	<0.08	<0.05
MG/KG-DRY	10										
METHYL ETHYL KETONE	98801	<0.58	<2.4	<0.17	1.0	<11	<7.6	<0.98	NA	<1.5	1.0
UG/G-DRY	10										
MIBK	98696	<0.45	<0.62	<0.14	<0.68	<0.30	<0.31	<0.67	NA	<0.19	<0.69
UG/G-DRY	10										

APPENDIX B
SITE 16 CHARACTERIZATION STEP DATABASE

ENVIRONMENTAL SCIENCE & ENGINEERING [illegible] STATUS [illegible]

PROJECT NUMBER 87488 0000 [illegible] NAME PUERTO RICO - NAVSTA
FIELD GROUP RPR16S PROJECT MANAGER RUSS BOWEN
ROOSEVELT ROADS SITE 16 SOILS LAB COORDINATOR LISA BARE

PARAMETERS	UNITS	STORET # METHOD	16S07A RPR16S 1	16SP9A RPR16S 2	16S010A RPR16S 3	16S011A RPR16S 4	16S012A RPR16S 5	16S013A RPR16S 8	16S014A RPR16S 11	16S015A RPR16S 12	16S016A RPR16S 15	16S017A RPR16S 18	16S018A RPR16S 21	16S019A RPR16S 24	16S020A RPR16S 27	16S021A RPR16S 30	16S022A RPR16S 31
			SAMPLE ID/#														
DATE			11/10/87	11/10/87	11/10/87	11/10/87	11/11/87	11/11/87	11/10/87	11/11/87	11/11/87	11/11/87	11/11/87	11/11/87	11/11/87	11/10/87	11/10/87
TIME			14:13	14:10	14:28	14:38	08:20	08:13	14:23	08:38	08:46	08:00	08:28	07:55	07:45	14:18	11:51
MOISTURE	%WET WT	70320 I	32.2	28.7	40.2	30.4	7.5	13.0	10.6	12.7	10.7	14.6	13.6	5.2	4.9	46.3	11.9
PCB 1016	UG/KG-DRY	39514 EC	<37900	<36000	<4270	<3680	<220	<2370	<2300	<2930	<2850	<2410	<29400	<2680	<2160	<47800	<117000
PCB-1221	UG/KG-DRY	39491 EC	<38000	<36000	<4300	<3700	<220	<2400	<2300	<2900	<2800	<2400	<29000	<2700	<2200	<48000	<120000
PCB-1232	UG/KG-DRY	39495 EC	<38000	<36000	<4300	<3700	<220	<2400	<2300	<2900	<2800	<2400	<29000	<2700	<2200	<48000	<120000
PCB-1242	UG/KG-DRY	39499 EC	<38000	<36000	<4300	<3700	<220	<2400	<2300	<2900	<2800	<2400	<29000	<2700	<2200	<48000	<120000
PCB-1248	UG/KG-DRY	39503 EC	<38000	<36000	<4300	<3700	<220	<2400	<2300	<2900	<2800	<2400	<29000	<2700	<2200	<48000	<120000
PCB-1254	UG/KG-DRY	39507 EC	<38000	<36000	<4300	<3700	<220	<2400	<2300	<2900	<2800	<2400	<29000	<2700	<2200	<48000	<120000
PCB-1260	UG/KG-DRY	39511 EC	120000	66000	10000	24000	1200	3200	14000	8500	9700	19000	48000	3300	2300	110000	1200000
LEAD,SED	UG/G-DRY	1052 GFAA	1070	783	178	290	8.95	2.85	140	92.3	34.8	4.96	556	3.81	135	248	86.1
LEAD,DISS	UG/L	1049 GFAA	NRQ	NRQ	NRQ	NRQ	NRQ	NRQ	NRQ	<2.5	<2.5	NRQ	3.8	NRQ	7.0	NRQ	45.9
EP-TOX,DATE OF EXTRACTION		97078 M	NRQ	NRQ	NRQ	NRQ	NRQ	NRQ	NRQ	3-3-88	3-3-88	NRQ	3-3-88	NRQ	3-3-88	NRQ	3-3-88

ENVIRONMENTAL SCIENCE & ENGINEERING 88 STATUS: FINAL PAGE#

PROJECT NUMBER 87488 0000 PROJECT NAME PUERTO RICO - NAVSTA
FIELD GROUP RPR16S PROJECT MANAGER RUSS BOWEN
ROOSEVELT ROADS SITE 16 SOILS LAB COORDINATOR LISA BARE

PARAMETERS	UNITS	STORET # METHOD	SAMPLE ID/# 16S023A RPR16S 34	16S024A RPR16S 37	16S025A RPR16S 40	16S026A RPR16S 43	16S026B RPR16S 44	16S027A RPR16S 46	16S027B RPR16S 47	16S028A RPR16S 49	16S029A RPR16S 52	16S030A RPR16S 55	16S031A RPR16S 58	16S032A RPR16S 61	16S032B RPR16S 62	16S033A RPR16S 64
DATE			11/10/87	11/10/87	11/10/87	11/10/87	11/19/87	11/10/87	11/19/87	11/10/87	11/10/87	11/10/87	11/10/87	11/10/87	11/19/87	11/10/87
TIME			12:40	12:15	12:50	13:50	09:05	13:30	09:30	13:15	12:30	13:00	14:00	13:40	09:45	13:25
MOISTURE	%WET WT	70320 I	6.7	6.0	7.2	7.2	10.8	14.0	21.4	15.9	7.4	5.1	NA	10.2	15.7	11.5
PCB 1016	UG/KG-DRY	39514 EC	<27600	<2690	<2770	<222	NA	<2990	<2600	<3790000	<21900	<2160	NA	<2290	<2430	<23300
PCB-1221	UG/KG-DRY	39491 EC	<28000	<2700	<2800	<220	NA	<3000	<2600	<3800000	<22000	<2200	NA	<2300	<2400	<23000
PCB-1232	UG/KG-DRY	39495 EC	<28000	<2700	<2800	<220	NA	<3000	<2600	<3800000	<22000	<2200	NA	<2300	<2400	<23000
PCB-1242	UG/KG-DRY	39499 EC	<28000	<2700	<2800	<220	NA	<3000	<2600	<3800000	<22000	<2200	NA	<2300	<2400	<23000
PCB-1248	UG/KG-DRY	39503 EC	<28000	<2700	<2800	<220	NA	<3000	<2600	<3800000	<22000	<2200	NA	<2300	<2400	<23000
PCB-1254	UG/KG-DRY	39507 EC	<28000	<2700	<2800	<220	NA	<3000	<2600	<3800000	<22000	<2200	NA	<2300	<2400	<23000
PCB-1260	UG/KG-DRY	39511 EC	34000	25000	19000	420	NA	22000	14000	40000000	43000	9900	NA	5600	5300	39000
LEAD,SED	UG/G-DRY	1052 GFAA	2.53	3.38	1.35	11.0	14.1	92.8	47.9	25.3	4.55	335	NRQ	33.9	44.7	381
LEAD,DISS	UG/L	1049 GFAA	NRQ	NRQ	NRQ	NRQ	<2.5	NRQ	NRQ	NRQ	NRQ	5.4	NRQ	NRQ	NRQ	NRQ
EP-TOX,DATE OF EXTRACTION		97078 M	NRQ	NRQ	NRQ	NRQ	3-3-88	NRQ	NRQ	NRQ	NRQ	3-3-88	NRQ	NRQ	NRQ	NRQ

APPENDIX C
COST ESTIMATES FOR REMEDIAL ACTION ALTERNATIVES

ALTERNATIVE 1 NO ACTION

CAPITAL COST

FENCE, CHAIN LINK INDUSTRIAL 6' HIGH PLUS 3 STRANDS BARBED WIRE, 2" LINE POST @ 10' O.C. 1 - 5/8" TOP RAIL

6 GA WIRE, GALV. STEEL

652 L.F. X $11.90/L.F.	=	$7,759

CORNER POSTS, 3" DIA GALV. STEEL

5 POSTS X $66 EA	=	$330

BRACES, GALV. STEEL

10 BRACES X $23 EA	=	$230

GATE FOR 6' HIGH FENCE, 1-5/8" FRAME 3' WIDE, GALV. STEEL

1 X $90	=	$90
SUBTOTAL		$8,409
CONTINGENCY (15%)		$1,261
TOTAL CAPITAL COST		$9,670

ANNUAL O&M COST

ASSUME $50/YR

ALTERNATIVE 2 CAPPING

CAPITAL COST

SCRAPING (2 CY)	8 HRS X $15/HR	=	$120
BITUMINOUS CAP, 1" THICK PAVING, 4" GRAVEL BASE			
BORROW	198 CY X $7.30/CY	=	$1,445
COMPACTION	198 CY X $3.24/CY	=	$642
BITUMINOUS CAP	1,780 SY X $2.55/SY	=	$4,539
SUBTOTAL			$6,746
CONTINGENCY (15%)			$1,012
TOTAL CAPITAL COST			$7,758

ANNUAL O&M COST

ASSUME $50/YR

ALTERNATIVE 3 PARTIAL EXCAVATION & CAPPING

CAPITAL COST

EXCAVATION & BACKFILL

EXCAVATING	467 CY X $2.83/CY	=	$1,322
SCRAPING (2 CY)	8 HRS X $15/HR	=	$120
BORROW	467 TONS X $1.98/TON	=	$925
HAUL BACKFILL	467 CY X $6.95/TON	=	$3,246
BACKFILL & COMPACTION	467 CY X $2.82/CY	=	$1,317
REVEGETATION	1,400 SY X $3.24/SY	=	$4,536

HAULING & INCINERATION

CONTAINERIZATION	469 CY X $251.46/CY	=	$117,935
FREIGHT SOIL	469 CY X $237.50/CY	=	$111,388
INCINERATION SOIL	469 CY X $1666.25/CY	=	$781,471

CAP

BORROW	42 CY X $7.30/CY	=	$307
COMPACTION	42 CY X $3.24/CY	=	$136
CAP	379 SY X $2.55/SY	=	$966

SUBTOTAL	$1,023,669
CONTINGENCY (15%)	$153,550
TOTAL CAPITAL COST	$1,177,219

ANNUAL O&M COST

ASSUME $50/YR

ALTERNATIVE 4 EXCAVATION

CAPITAL COST

EXCAVATION & BACKFILL

EXCAVATING	593 CY X $2.83/CY	=	$1,678
SCRAPING (2 CY)	8 HRS X $15/HR	=	$120
BORROW	593 TONS X $1.98/TON	=	$1,174
HAUL BACKFILL	593 CY X $6.95/TON	=	$4,121
BACKFILL & COMPACTION	593 CY X $2.82/CY	=	$1,672
REVEGETATION	1,780 SY X $3.24/SY	=	$5,767

HAULING & INCINERATION

CONTAINERIZATION	595 CY X $251.46/CY	=	$149,619
FREIGHT	595 CY X $237.50/CY	=	$141,313
INCINERATION	595 CY X $1666.25/CY	=	$991,419
SUBTOTAL			$1,296,883
CONTINGENCY (15%)			$194,532
TOTAL CAPITAL COST			$1,491,415

ANNUAL O&M COST

ASSUME $0/YR