

FINAL

**RECORD OF DECISION FOR THE Y-LINE
FACILITY SOILS**

*Louisiana Army Ammunition Plant
Doyline, LA*

February 2000



Prepared for:

**U.S. Army Industrial Operations Command (USIOC)
Rock Island, Illinois**

Under Contract Number: DACA31-92-D-0045/0014

Prepared by:

**Engineering Technologies Associates, Inc.
3458 Ellicott Center Drive, Suite 101
Ellicott City, Maryland 21043
Project Number: 92307.014**

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1 DECLARATION FOR THE RECORD OF DECISION (ROD)

1.1 SITE NAME AND LOCATION

- Soils at the Y-Line Facility of the Louisiana Army Ammunition Plant (LAAP)
- Doyline, Louisiana

1.2 STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for the soils at the Y-Line Facility, designated as Operable Unit 8, at the Louisiana Army Ammunition Plant in Doyline, Louisiana, chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA) and, to the extent practicable, the National Contingency Plan (NCP). The decision is based on the administrative record file for this site.

The State of Louisiana concurs with the selected remedy.

1.3 DESCRIPTION OF SELECTED REMEDY

No CERCLA remedial action is necessary for this operable unit. A determination has been made that in an industrial use scenario, there is no unacceptable exposure to risks posed by the soils at the operable unit. If land use at the site changes from industrial or if the Army gives up control of or ceases to restrict access to LAAP, this determination will be re-evaluated.

1.4 STATUTORY DETERMINATIONS

No further remedial action is necessary to ensure protection of human health and the environment at the site.

It is anticipated that the Army will continue to control LAAP and to restrict access to the facility and that the use of the Y-Line site will continue to be industrial. The baseline human and ecological risk assessments concluded that unacceptable exposures to hazardous substances will not occur from the Y-Line facility soils in the industrial use scenario. If the Army gives up control of or ceases to restrict access to LAAP or if land use at the Y-Line changes from industrial, the remedy will be re-evaluated.

Because this remedy will result in hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure, a five-year review is required for this remedial action.

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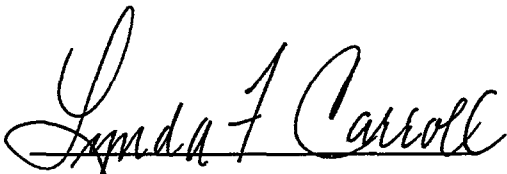
1.5 SIGNATURE AND AGENCY CONCURRENCE ON THE REMEDY



U.S. Army
LAWRENCE J. SOWA
Colonel, O.D., Director, Munitions
and Armaments Center, IOC

1 April 00

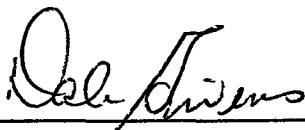
Date



Gregg A. Cooke, Regional Administrator
U.S. Environmental Protection Agency, Region VI

5-19-00

Date



Dale Givens
State of Louisiana Department of Environmental Quality

March 27, 2000

Date

2 DECISION SUMMARY

2.1 SITE NAME, LOCATION, AND DESCRIPTION

LAAP (Environmental Protection Agency ID# LA0213820533) is located in the northwestern portion of the State of Louisiana on lands situated in Bossier and Webster Parishes (Township 18 North, Ranges 10 and 11 West). The plant is located approximately 22 miles east of Shreveport. It is bounded to the north by Interstate 20 and U.S. 80 and by State Route 164 to the south. The Dorcheat Bayou, a perennial body of water, bounds the plant to the east, and Clarke Bayou, a small stream, forms the western boundary. Two creeks, Boone and Caney, flow through LAAP from north to south. (Figure 2-1). The Y-Line Facility is located in the north-central portion of the installation (Figure 2-2).

The Army (Department of Defense), in consultation with the United States Environmental Protection Agency (EPA) and the Louisiana Department of Environmental Quality (LDEQ) are in the process of evaluating several operable units at the installation. The source of funding for these efforts is the Environmental Restoration Account, Army.

LAAP is a government-owned, contractor-operated facility equipped with production lines and mission support structures. Land use at LAAP is considered to be industrial, with most work performed indoors. LAAP contains significant acreage of woodlands surrounding the many individual industrial sites. These woodlands act as a buffer zone between the industrial operations and the surrounding countryside, most of which is also forested. Non-forested lands surrounding LAAP are primarily rural residential land use.

The Y-Line Facility is a former metal parts manufacturing facility. It is currently not in use; however, it is being maintained for future industrial applications. A soils assessment was conducted to determine if there were any site risks to human health and the environment. The assessment was initiated based on the history of chromium releases into the environment at this facility and the results of previous investigations which concluded that significantly elevated levels of chromium were present in the surface soils surrounding the facility.

2.2 SITE HISTORY AND REGULATORY OVERSIGHT ACTIVITIES

2.2.1 LAAP HISTORY

The primary functions of LAAP as an U.S. Army Industrial Operations Command (IOC) installation were as follows:

- Loading, assembly, and packing of ammunition items;
- Manufacture of ammunition metal parts;

- Operation and maintenance of active facilities in support of current production operations; and,
- Maintenance and/or layaway of standby facilities (including any machinery and package lines and production equipment packages received from industry or other government installations).

In 1941, the United States government acquired 15,868 acres of land for the LAAP installation. This was later reduced to 14,974 acres by the construction of highway I-20 and the sale of nonessential land. Major construction work was initiated by Silas Mason Company in July 1941. By May 1942, construction was completed for eight ammunition lines and one ammonium nitrate graining plant. Production ceased in August 1945 at the conclusion of World War II. In November 1945, the Federal government relieved Silas Mason Company of responsibility for plant operations and placed the installation on standby status.

Remington Rand, Inc., under contract with the government, reactivated the installation in February 1953 in support of the Korean Conflict. Ammunition production was suspended in February 1958, and the installation was again placed on standby. The Vietnam Conflict brought about the reactivation of the installation by Sperry Rand, Inc. in September 1962. Sperry Rand Corporation relinquished the contract in December 1974 to Thiokol Corporation. Thiokol operated the plant until 1996. Valentec Systems Inc. began as the contractor in 1997 and is the current operator. The production and loading of ammunition ceased in October 1994. The plant is currently on modified caretaker status with the Y-Line laid away for future mobilization.

The current working population of LAAP is less than 100, which includes military personnel, contractor personnel, and Army civilian workers. Historically, the number of workers at the installation has exceeded 7,000 during high production periods.

2.2.2 Y-Line Facility History

The Y-Line (Building 2600) Assembly Area, referred to as the Y-Line Facility in this ROD, is located in the north-central portion of LAAP approximately 1.5 miles east of the LAAP Administration Area. The facility was constructed during the Korean conflict (1952-1953). The Y-Line Facility houses the assembly line for forging, machining, and painting 155-mm shells. Shell forging operations occurred at the east end of the building; shell machining and welding in the central portion of the building; and paint preparation, painting and chromic acid etching occurred in the west end of the building. The Y-Line Chromium Etching Facility is located on the covered north loading dock along the west-end of Building 2600 (Figure 2-3). This facility used a chromic acid bath to etch metal bands that had been welded onto the ends of 155-mm shells. This etching served as a quality assurance function to determine if the metal bands were properly adhered to the shell. Also located in the west-end of the building were two Jack Miller machines that phosphatized the shells in preparation for painting. A weak chromic acid solution was used as a rinse in the process, and excess solution was cycled into floor sumps at the west end of each machine. These chromic acid etching and rinse operations began in the early 1960s and continued until production ceased in 1994. Two spills of chromic acid are reported to have occurred on October 28, 1986 and November 23, 1987.

2.2.3 Regulatory Oversight Activities

The Army is investigating waste disposal areas, manufacturing areas, burning grounds, and testing areas for any detrimental environmental impact by implementing its environmental response authority under CERCLA and the Superfund Amendments and Reauthorization Act (SARA). A series of investigations and studies have taken place at LAAP to evaluate the potential for, and extent of, contamination from waste management activities at the installation.

In 1978, the Installation Assessment Study (USATHAMA, 1978) presented findings which indicated potential contamination derived from explosive wastes at several locations. These locations included explosive loading areas, unlined waste ponds, pink water leaching ponds, abandoned landfills, and burning grounds.

The installation was proposed for the National Priorities List (NPL) in October of 1984 due to groundwater contamination from the Area P pink water lagoons (Figure 2-4). LAAP was placed on the NPL on March 31, 1989 with a Hazard Ranking Score of 30.60. The U. S. Environmental Protection Agency (EPA) Region VI, the Louisiana Department of Environmental Quality (LDEQ), and the Army signed a Federal Facilities Agreement (FFA) in January of 1989. This agreement sets deadlines, objectives, responsibilities, and procedural framework for implementing the Environmental Restoration Account at LAAP.

A Remedial Investigation/Feasibility Study (RI/FS) identified seven initial Areas of Concern (AOCs). These areas include Area P, Burning Ground 8 Landfill/Lagoon, Burning Ground 5, Landfill 3, Oily Waste Landfill and the M-4 Lagoon. Area P was determined sufficiently contaminated to require an Interim Remedial Action (IRA) due to explosives-contaminated soil and water. Over 100,000 cubic yards of explosives-contaminated soil and over 50,000,000 gallons of wastewater were treated in 1989 and 1990. With the completion of the IRA at Area P, the Army negotiated a no further action Record of Decision for the AOCs. A Record of Decision was approved and signed in March 1997 for the 7 areas of concern supporting no further action at these 7 areas for the soil sources. It was determined at this time that the site wide groundwater should be dealt with as a separate operable unit.

The field work for a separate Remedial Investigation at the Y-Line Chromium Etching Facility was completed in November 1996. The report concluded that no further action is required for the soils/sources at the Y-Line. Other related investigations of the Y-Line Facility include:

- Remedial Investigation, ESE (1987)
- Updated Remedial Investigation, Weston (1989)
- Geohydrologic Study No. 38-26-K968-91, USAEHA (1991a and b)
- LAAP Feasibility Study, Final Comprehensive Remedial Investigation, ESE (1992)
- Final Remedial Investigation, Y-Line Chromium Etching Facility, LAAP, WCFS (1996)
- Follow-on Investigation of the Y-Line at the LAAP, ETA (1997).

Based upon the results of these investigations, a proposed plan for no further remedial action for the Y-Line soils operable unit was developed.

2.3 HIGHLIGHTS OF COMMUNITY PARTICIPATION

The Proposed Plan for the Y-Line Facility soils was made available to the public on May 17, 1999. The public was invited to comment on the Proposed Plan and to attend a public meeting at which the Army presented the selected remedy of no further remedial action for the Y-Line Facility soils. The meeting was held at the City Court Room in the Minden Civic Center at 7:00 p.m. on June 3, 1999. The minutes from the public meeting are included in Appendix C.

This ROD is based on the contents of the RI conducted at the Y-Line Facility. The RI provides information about the soils at the Y-Line Facility and the selected remedy. This document is available at the Information Repository at the LAAP installation.

The following is a list of resources for information on the Y-Line Facility soils and LAAP's environmental program that are available to the public.

Administrative Record- The Administrative Record contains information used to support LAAP decision-making. All the documents in the Administrative Record are available to the public for review.

Information Repository- The Administrative Record and additional information concerning each aspect of LAAP's environmental program are available at the established Information Repository located at the installation.

Community Relations Plan (CRP)- A CRP was prepared and accepted by EPA and the State of Louisiana. The CRP is currently being implemented. This plan was last updated in August of 1996.

Mailing List- A mailing list of all interested parties in the community is maintained by LAAP and updated regularly.

Public Comment- A public comment period for the Record of Decision was held from May 17, 1999 to June 16, 1999 and a public meeting was held on June 3, 1999 at 7:00 p.m. at the Civic Center in Minden, LA. At this meeting, representatives from LAAP were prepared to answer questions concerning the proposed remedial action. No comments were received during the public comment period or during the public meeting.

The Army encourages citizens to review site-related documents and submit written comments to the following individual:

Commander
Louisiana Army Ammunition Plant
ATTN: SIOLL-OR (Mr. Doyle Williams)
P.O. Box 658
Doyline, Louisiana 71023

2.4 SCOPE AND ROLE OF RESPONSE ACTION

This ROD addresses the selected alternative for soils at the Y-Line Facility at LAAP. It was determined that no action is warranted for the Y-Line Facility soils since the soils at this site pose no current or potential threat to human health or to the environment. This is supported by the baseline risk assessment.

A Remedial Investigation (RI) of the contamination at the Y-Line Facility of the LAAP concluded the following:

- soil concentrations of heavy metals were not significantly above background and were not a significant risk to human health or the environment.
- polynuclear aromatic hydrocarbons (PAHs) were detected in some, but not all, surface soil samples. The highest concentrations were found in localized areas adjacent to the foundation of Building 2600, where exposure potential is low.

Potential human health or environmental risks from groundwater at the Y-Line Facility will be addressed under the installation-wide groundwater operable unit.

2.5 NATURE AND EXTENT OF CONTAMINATION

This section describes the presence and distribution of contaminants at the Y-Line Facility resulting from past activities.

2.5.1 Known/Suspected Sources and Releases of Contamination

On October 28, 1986, a release of chromic acid into the environment occurred at the Y-Line Facility near the northwest corner of Building 2600. The release consisted of the seepage of approximately 50 gallons of chromic acid from cracks in the dock retainer wall along the north side of the Y-Line Facility. It was believed that chromic acid leaked or spilled from the etch bath and entered the foundation soils beneath the building floor. The solutions then seeped through the cracks in the dock retainer wall to affect surrounding soils.

Another release from the Y-Line Facility was discovered on November 23, 1987 and consisted of seepage of chromium-bearing liquid again apparently from cracks in the dock retainer wall located north of the Y-Line Facility. The chromium-bearing liquid entered the foundation soils beneath the floor as the result of spills, washdown of parts, and chromium mist associated with the Etch Facility. Once the seepage was noticed, PVC piping was installed through the retainer wall to collect water and/or liquids in the foundation soils and route the fluids into a catchment tank. Approximately 300 gallons of fluid were reported to have been collected. The fluid was analyzed and found to contain a concentration of 13.2 ppm of hexavalent chromium. All fluids were subsequently treated by an on-site wastewater treatment system.

There is evidence that chromium was released into foundation soils beneath other parts of Building 2600. Green staining was apparent along many cracks and seams in the foundation wall

along the north and south sides and west end of the building. The green stains were thought to be precipitated chromium and/or copper. This staining suggests that foundation soils beneath the building contain metal bearing waters that may have subsequently leaked into the surface soils surrounding the building by way of cracks in the foundation walls.

The high velocity exhaust fans on the roof of Building 2600 were used to vent mists and fumes from the Jack Miller system. The Jack Miller system phosphatizes shells in preparation for painting. The Jack Miller machines consist of elongated tanks that enclose a moving mechanical rack. The rack passes the shells through several enclosed spray stations that clean or prepare the 155mm shells prior to painting. A weak chromic acid solution was used as a rinse in the process, and excess solution was cycled into floor sumps at the west end of each machine (Figure 2-3). These chromic acid etching operations began in the early 1960s. The metal parts of the exhaust fans are stained with a green residue. This staining may be due to the presence of chromium and/or copper precipitants. While conducting the investigation, it was assumed that if metal-bearing fumes were emitted from these fans, dispersion along prevailing wind directions at LAAP would have spread metal contamination to the surface soils surrounding the west end of the Y-Line Facility.

A portion of the loading dock floor slab and retainer wall along the south side of the building buckled in 1988. The buckled section is located in the vicinity of borehole BH-Y16 (see Figure 2-5 for location). The buckling was apparently caused by the buildup of hydraulic pressure in the artificial fill beneath the dock floor, suggesting the presence of abnormal amounts of water in foundation soils. The cause of this abnormal water content was supposedly a broken water main located beneath the southwest portion of Building 2600 (Sniffen, 1994).

2.5.2 Soil Sampling Activities and Analysis

Surface soils, subsurface soils, and groundwater surrounding the west end of Building 2600 were sampled and analyzed to identify chemical contamination possibly related to the process stream from the Etch Facility and other surrounding industrial operations of the Y-Line complex. Environmental samples collected from the media were analyzed for target compound list (TCL) metals (target analyte list [TAL]) and hexavalent chromium. Due to industrial operations surrounding the Etch Facility, samples were also analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), and total petroleum hydrocarbons (TPHC).

2.5.2.1 Surface Soils

Contamination of surface soils is potentially the result of spills near Building 2600 and wind dispersion of metal emitted from the high velocity fans on top of Building 2600. Redistribution of surface soil contaminants by surface water runoff could also have subsequently occurred.

Three background surface soil samples were collected for the RI from soils covering a low upland area located to the northwest of Building 2600 (Figure 2-6). This area was believed to be unaffected by LAAP industrial operations. These surface soil samples were analyzed for TCL metals (TAL), hexavalent chromium, VOCs, SVOCs, TPHC, TOC, and pH (Table 2-1).

Locations of the 20 surface soil samples collected during the RI are illustrated in Figure 2-7. Thirteen of the twenty samples were collected from soils located north of the building; seven were collected from soils south of the building. Samples were collected from the upper 6 inches of soil below rock, leaf, and vegetation cover.

All surface soil samples were analyzed for TCL metals (TAL) and hexavalent chromium to determine if wind dispersion of metal contaminants has occurred. Soil sampling locations close to Buildings 2600 and 2628 may have been affected by other Y-Line Assembly area operations. Building 2628 is located north of the Jack Miller system in Building 2600 and housed the wastewater treatment operations for Building 2600. Therefore, the samples taken at these locations were also analyzed for VOCs, SVOCs, TPHC, TOC, and pH.

Of the 28 target metals analyzed, including hexavalent chromium, 27 were detected in surface soils surrounding the west-end of the Y-Line Facility. Surface soil samples collected during the RI were positioned along a grid pattern surrounding the west end of Building 2600. Sample spacing was 175 feet. The main objective of this sampling pattern was to determine if wind dispersion of metals, emitted from the high velocity fans on the roof of the building, had occurred. Results of metal analyses indicated that wind dispersion of chromium and hexavalent chromium is not significant, since mean concentrations of these metals in on-site samples did not differ significantly from background concentrations.

Metals identified as exceeding background levels in surface soils, on the basis of statistical methods, are presented in Table 2-3. The Student's t-test was applied to lognormally transformed concentrations to determine if mean metal concentrations in background vs. on-site samples were significantly different. Sample locations and concentrations of the metals detected statistically above background are shown in Figure 2-8.

Chromium was detected in all site samples at concentrations ranging from 11.5 to 1,800 $\mu\text{g/g}$. The mean background concentration was found to be 22.3 $\mu\text{g/g}$ and the mean concentration of chromium in samples (excluding the sample with the chromium concentration of 1,800 $\mu\text{g/g}$) was 29.6 $\mu\text{g/g}$; however, this is not statistically above background. Hexavalent chromium was detected in 16 site samples, with a mean concentration of 5 $\mu\text{g/g}$. A maximum concentration of 13.68 $\mu\text{g/g}$ was reported in the sample with the highest chromium concentration. The mean background concentration for hexavalent chromium in background samples was 8.1 $\mu\text{g/g}$. Figure 2-9 shows surface soil sample locations and concentrations of chromium and hexavalent chromium reported in the samples.

An earlier investigation of potential chromium contamination surrounding the Etch Facility (USAEHA, 1991b) detected elevated chromium concentrations in surface soils surrounding the west end of Building 2600 and in sediments in a ditch along the south side of Building 2628. The soil sampling plan of this investigation was aimed at identifying "hot spots" where there was a high probability that releases of chromium into the environment had occurred. Samples were collected from soils near the Chromic-Acid Etch Facility, near the down spouts from the roof, and in ditches carrying runoff water from the Y-Line Facility. USAEHA (1991b) reported chromium concentrations in surface soils ranging from 11.5 to 5,300 $\mu\text{g/g}$, with a mean

concentration of 236 $\mu\text{g/g}$. The highest concentrations were reported in soils near the chromic-acid bath.

The difference between the mean concentration reported in the USAEHA report and the RI is believed to be due to the selective sampling plan used in the earlier study vs. the random sampling plan performed for the RI. Grid point sampling performed in the RI evaluates wind dispersion of metal concentrations at the site as a whole rather than individual "hot spot" concentrations.

Thirteen surface soil samples were analyzed for VOCs and SVOCs (Figure 2-10). One VOC, toluene, was detected in one of the samples, but at a low concentration of 0.26 $\mu\text{g/g}$. No other VOCs were detected in surface soils. Seventeen SVOCs were detected in the surface soil samples and are reported in Table 2-2. All seventeen SVOCs were reported at low concentrations, ranging from 0.32 $\mu\text{g/g}$ for fluoranthene to 100 $\mu\text{g/g}$ for phenanthrene and pyrene. Samples located between the north side of the building and railroad tracks contained the highest number of detected SVOCs per sample.

TPHC was detected in six of the thirteen surface soil samples analyzed for the compound. Detected TPHC concentrations range from 13 to 3,000 $\mu\text{g/g}$, with a mean concentration of 530 $\mu\text{g/g}$, whereas detected background concentrations for TPHC range from 13 to 19 $\mu\text{g/g}$. The highest concentration (3000 $\mu\text{g/g}$) was detected in a sample located between the north side of the building and the railroad tracks.

Overall, organic (VOC, SVOC, and TPHC) contamination occurs at low frequencies and is located immediately adjacent to Building 2600, other buildings in the Assembly area, and the railroad tracks that service Building 2600. The absence of organic detections in surface soil samples further away from Building 2600, especially north of the building, suggest that significant wind dispersion or redistribution by surface water runoff of organic contaminants has not occurred at this site.

2.5.2.2 Subsurface Soils

A total of 44 subsurface soil samples were collected. Twenty subsurface samples (four samples per borehole) were collected from 20-foot-deep boreholes. Twenty-four subsurface soil samples (two per borehole) were collected from shallow (8 to 10-foot-deep) boreholes.

All subsurface soil samples were analyzed for TCL metals (TAL), hexavalent chromium, VOCs, SVOCs, TPHC, TOC, and pH (Figures 2-11, 2-12, and 2-13). No background subsurface soil samples were collected during the RI. Concentrations in on-site subsurface soil samples were compared to background surface soil concentrations. The frequency and concentration range for contaminants of concern (COCs) that exceeded background levels for subsurface soils are presented in Tables 2-4 and 2-5. COCs for the health risk assessment were selected following procedures outlined in EPA guidance documents.

Chromium and hexavalent chromium concentrations in subsurface soils did not statistically exceed background levels, but the concentrations and distributions of these metals are included in Table 2-5.

Overall, organic compounds occur at very low frequencies and very low concentrations within the subsurface soil samples collected. The number of organic compounds (especially PAHs), frequency of detections, and compound concentrations were lower than those reported for surface soils with one exception. Seven PAHs and TPHC were detected in this sample, with a total concentration of 32 $\mu\text{g/g}$. According to the geologist's field observations during the drilling of the borehole, the upper few feet of the soil core had a diesel fuel odor. This borehole is located south of Building 2600, between the loading dock and the railroad tracks that service the building.

No organic contamination was encountered in subsurface soils below a depth of ten feet.

2.5.3 Transport Processes

2.5.3.1 Vadose Zone Transport

COCs released to surface soils surrounding the Y-Line Facility are believed to have possibly migrated downward to the vadose zone, also known as the unsaturated zone or zone of aeration (the area between the ground surface and the top of the water table). This may result in residual contamination in the vadose zone and possibly in the underlying saturated zone. As the contaminants migrate downward through the vadose zone with infiltrating water, the dissolved-phase contaminants may be adsorbed onto subsurface soils or organic matter.

The soils at the Y-Line Facility are moderately well drained, have a moderately low permeability in the upper part of the subsoil, and low permeability in the lower part. For extended periods following the initial release of contaminants, infiltrating precipitation moving downward through the vadose zone can leach contaminants from the zone of residual contamination and transport them to the saturated zone. This is an important transport mechanism for contaminants with high aqueous solubility. Contaminants with lower solubilities (e.g., metals) are less likely to be leached from the vadose zone.

In addition to mobilization to groundwater, VOCs in vadose zone soils may become volatilized and migrate as soil gas. Soil gas may migrate through the vadose zone to the atmosphere or collect in subsurface man-made structures, such as basements of buildings.

2.5.3.2 Air Transport

Processes that affect the movement of contaminants via air pathways include:

- Natural wind erosion of contaminated surface soils.
- Wind dispersion of chemicals emitted from point sources (e.g., fans on top of Building 2600).

- Volatilization and diffusion of VOCs (contained within subsurface materials and groundwater) as soil gas to the surface.

2.5.4 Contaminant Migration Pathways

2.5.4.1 Soil to Groundwater

Organic contamination was released from the Y-Line Facility as a result of small spills and leaks in areas where chemicals were used and waste materials were disposed of or stored. The spill sites are potential sources of contamination to subsurface soils and groundwater. Contamination may migrate from these locally affected areas and could affect other media (i.e., surface water and air). The organic compounds detected in soils (PAHs and other SVOCs) tend to adsorb to soil materials; thus, the potential for these compounds to migrate to groundwater is small. This is supported by the results of groundwater monitoring, which indicate that PAHs and other SVOCs occur in minor numbers and concentrations in groundwater when compared to surface soils.

The potential for VOCs spilled at the surface to migrate to groundwater is higher because they tend to be more soluble and do not adsorb to soil materials as readily as SVOCs and metals. Although VOCs were detected in groundwater south of and at the west-end of the Y-Line Facility, they were rarely detected in soils; therefore, their origin is unknown. Groundwater contamination by VOCs will be examined in the Groundwater Operable Unit Remedial Investigation. Metal transport in soil systems is generally retarded due to fixation and adsorption reactions with soil particles. The COC metals that were detected in groundwater beneath the Y-Line Facility (aluminum, copper, nickel, and zinc) were not detected above background concentrations at the 6 to 20 foot depth interval in subsurface soil, which indicates that the soil at the site may not be the primary source for these COC metals in groundwater. In addition, the metals detected in the surface soil (aluminum, arsenic, copper, nickel, and zinc) generally decreased in concentration with depth to background levels except for arsenic (arsenic is not a COC in groundwater). Metal transport in soil to groundwater does not appear to be a significant transport pathway at the site.

2.5.4.2 Soil to Air

Chemicals in site soils may enter the atmosphere by volatilization from soil or from suspension of surface soil particulates. Volatilization of chemicals to air from soil, sediment, or surface water is not considered a significant transport pathway since only two volatile chemical compounds, toluene and 1,1,1-trichloroethane, were detected at low frequencies and concentrations in the surface and subsurface soils respectively. Volatilization of the other COCs, PAHs, and other semivolatiles, is not a significant transport pathway due to their low tendency to enter the vapor phase as a result of their low Henry's constant and high adsorption coefficients.

Suspension of contaminated surface soil particles in air, as a result of wind erosion, does not appear to be a significant transport pathway at the Y-Line Facility. This is because a large

portion of the Y-Line Facility is paved, and those portions that are not paved have a high soil moisture content and are vegetated or graveled, limiting wind erosion potential.

2.5.4.3 Air to Soil

Some metals (copper and zinc) appear to be transported via air pathways associated with discharge from exhaust vents on the roof of Building 2600, and subsequent dispersion of metals and deposition on surface soils. Once in surface soils, these metals may be transported via wind erosion or surface water runoff; however, these sediment transport processes do not appear to be significant at the site. The concentrations of copper and zinc in Boone Creek sediment samples were highest upstream of potential inputs from the Y-Line Facility.

2.5.4.4 Surface Soils to Surface Water/Sediment

Chemicals in surface soils at the site have the potential to impact stream sediments and surface water in the unnamed drainages north and south of the Y-Line Facility and in Boone Creek. These chemicals can be transported with surface water runoff from the facility and subsequently discharged into the drainages and the creek. This transport pathway is not considered a significant pathway, however, because analytical results indicate that most organic compounds do not occur above background concentrations in the same media. Sampling of surface water/sediments verifies that Y-Line COCs have not been transported to Boone Creek and its tributaries in significant amounts (ETA, 1997; WCFS, 1996).

2.6 CURRENT AND POTENTIAL FUTURE SITE AND RESOURCE USES

The Army plans to retain control of LAAP and to restrict access to the installation for the foreseeable future. Existing army regulations and protocol make the sale of the LAAP property unlikely. Areas at the LAAP installation are presently being used for munitions production and will continue to be used for that purpose in the future. The Y-Line Area is currently not operating, but it is being maintained for future industrial use.

Future use of the Y-Line area for other than industrial use is very unlikely. The Y-Line is situated on land that is not suitable for residential use. The topography is low and somewhat swampy. Railroad tracks run through the Y-Line area and Highways 20 and 80 are located north of the railroad tracks and Y-Line (Figures 2-2 and 2-3) making the location very desirable for industrial use and rather undesirable for residential use.

2.7 SITE RISK SUMMARY

A baseline risk assessment (BRA) for human health and ecological risks was prepared in accordance with USEPA guidance documents for risk assessment in the RI. The following sections summarize the BRA for site soils.

2.7.1 Human Health Risks

A baseline human health risk assessment was performed to evaluate potential human health hazards (both non-carcinogenic and carcinogenic effects) that could result from exposure to chemicals that may have been released to environmental media (soil and groundwater) from operations at the LAAP Y-Line Facility. This record of decision only addresses the soils; groundwater is being addressed in a site-wide operable unit RI.

The identification of site COCs and the choice of human exposure parameters were critical for estimating site risks. Surface soil and shallow groundwater sampled at the Y-Line Facility were evaluated in order to select COCs for the human health risk assessment. Two sets of exposure parameters were used to estimate site risk, one representing high-end exposure (Reasonable Maximum Exposure or RME) and the other representing central tendency or average exposure. The development of quantitative risk estimates for potentially exposed populations was based on guidance provided in the Risk Assessment Guidance for Superfund (RAGS), Volume 1 (USEPA, 1989b). Mean concentrations of the COCs identified in the RI for surface soils at the Y-Line Facility are as follows:

<u>Chemical of Concern</u>	<u>Mean (Arithmetic)</u>	<u>Concentration Range (µg/g)</u>	
	<u>Concentration (µg/g)</u>	<u>Maximum</u>	<u>Minimum</u>
Aluminum	19,491	38,400	4,760
Arsenic	5.9	16.9	2.99
Chromium (III)	121	1,800	11.5
Chromium (IV)	5	13.86	1.28
Nickel	20	243	3.48
Bis(2-ethylhexyl)phthalate	2.1	2.6	1.5
Acenaphthene	5.1	10	0.55
Anthracene	14	17	10
Benzo(a)anthracene	19	70	0.51
Benzo(a)pyrene	41	80	2.9
Benzo(b)fluoranthene	5.7	8.6	2.8
Benzo(ghi)perylene	36	70	2.5
Benzo(k)fluoranthene	26	37	14
Chrysene	42	80	3.4
Dibenz(ah)anthracene	5.2	10	0.4
Fluoranthene	17	90	0.32
Fluorene	5.2	10	0.42
Indeno(1,2,3-cd)pyrene	36	70	2.6
Naphthalene	5.4	9	1.9
Phenanthrene	29	100	1.1
Pyrene	20	100	0.51

2.7.1.1 Toxicity Assessment

The purpose of the toxicity assessment is to evaluate the toxicity of chemicals of concern and provide an estimate of the relationship between extent of exposure and extent of toxic injury (dose-response relationship) for each chemical.

Toxicity factors for carcinogenic effects are termed slope factors (SFs). These are estimates of the cancer dose-response relationship at low doses and are usually derived from dose-response relationships observed in laboratory experiments using high chemical doses. The SF is used to estimate the upperbound probability of an individual developing cancer as a result of exposure to a potential carcinogen. The EPA slope factors are upper 95th percentile confidence limits of the probability of response per unit intake of a chemical over a lifetime. EPA states that carcinogenic risks estimated using slope factors are upperbound estimates. This means that the actual risk is likely to be less than the predicted risk (USEPA 1989c) and could be zero. SFs for each chemical of concern are presented in Table 2-6. The units of SFs are (mg/kg/day)⁻¹.

Non-carcinogenic effects are evaluated by dividing the estimated daily chemical intake by the reference dose (RfD) for that chemical. The resulting value is referred to as the hazard quotient :

$$\text{Non-carcinogenic Hazard Quotient} = \text{Daily Chemical Intake/RfD}$$

The RfD is an estimate of a daily human intake that is likely to be without an appreciable non-carcinogenic hazard of deleterious effects during a lifetime, or a portion of a lifetime (USEPA, 1989b). RfDs are established by the EPA and are designed to be protective of sensitive populations. The EPA has developed chronic RfDs to evaluate long-term potential exposures (seven years to a lifetime) and subchronic RfDs to evaluate potential exposures occurring over a portion of a lifetime (two weeks to seven years). If the chemical intake exceeds the RfD, the hazard quotient will exceed unity (1.0). This is an indication that the estimated intake may represent a level of concern. It should be noted, however, that the hazard quotient is not a measure of the probability of a health effect occurring, and a hazard quotient of greater than one does not necessarily mean that an adverse effect will occur. RfDs for the COCs are shown in Table 2-7. Subchronic RfDs are used to evaluate non-carcinogenic effects for the 6-year childhood soil ingestion scenario.

Oral RfDs and SFs were used to evaluate both the oral and dermal exposure routes. Data on oral absorption efficiency may be used to convert an administered-dose (oral) RfD or SF to an absorbed-dose (dermal) RfD or SF for use in calculation of risk from dermal absorption. However, because of the limited information on oral absorption efficiencies, conversion of administered-dose oral toxicity values to absorbed-dose values was not attempted. This approach could somewhat underestimate potential risk associated with dermal absorption of chemicals of concern if oral absorption efficiencies are significantly lower than 100 percent (e.g., 50 percent or less). Most of the organic chemicals detected in groundwater and soil are expected to be well absorbed in the gastrointestinal tract under the experimental conditions used to develop toxicity factors. Therefore, the uncertainty associated with evaluating absorbed dermal doses with toxicity factors developed from administered oral doses is not expected to have an important effect on risk estimates for organic chemicals at this site.

2.7.1.2 Exposure Assessment

The purpose of the exposure assessment is to estimate the magnitude of potential chemical exposure among various human receptor populations. The steps required to perform an exposure assessment include the following:

- Identification of potential receptor populations
- Evaluation of the completeness of potential exposure pathways
- Evaluation of potential exposure parameters
- Estimation of exposure point concentrations
- Estimation of daily intake factors

Reasonable but protective exposure assumptions were used so that potential risks posed by the site were not underestimated. Exposure scenarios considered 'unlikely' were not evaluated. The RME is meant to represent an exposure on the high end for an individual in a population, while the average exposure represents the central tendency for the potentially exposed population.

2.7.1.2.1 Potentially Exposed Populations

According to the Baseline Risk Assessment, the major categories of human receptors that may be exposed to chemicals in environmental media at the Y-Line Facility were current workers, future industrial workers, and hypothetical future residents. The future residents scenario is thought to be rather unlikely since future residential use is not anticipated here. It was considered, however, for conservative purposes. The Y-Line area is being currently maintained for future industrial use. The installation will continue to be used for munitions production in the future and access to LAAP will remain restricted for safety and national security reasons. Only workers and other authorized personnel can enter the installation through security checkpoints, as the installation is completely fenced and trespassing is unlikely. Therefore, current on-site worker exposure, future worker exposure, and future recreational exposure just outside the installation boundaries are the most likely human exposure scenarios that would occur at the installation.

2.7.1.2.2 Exposure Pathway Analysis

An exposure pathway is the mechanism by which a receptor may come into contact with a chemical. As defined by RAGS, the following four major elements characterize a complete exposure pathway:

- a source and mechanism of chemical release;
- a transport medium for the chemical;
- a point of potential receptor contact with the medium (exposure point); and
- a route of exposure (e.g., ingestion) for the chemical uptake by the receptor.

For an exposure pathway to be complete, all four elements must be present. The absence of any one of these elements results in an incomplete exposure pathway for which site-related health

risks do not exist. Thus, for the evaluation of potential exposure pathways, it is necessary to focus only on those pathways that have the potential to impact human health.

Potential exposure pathways that may exist at and surrounding the Y-Line Facility are depicted in the site conceptual model in Figure 2-14 and are discussed in the following sections. For consistency, the pathways evaluated at the Y-Line Facility are analogous to those evaluated by the Final and Revised Comprehensive Risk Assessments (ESE, 1992 and 1993) for other areas at LAAP.

2.7.1.2.2.1 Surface Soil Exposure Pathways

Typically, the potential for exposures to contaminants in soil is greatest for soil layers comprising the 0 to 6-inch soil horizon (i.e., surface soils). Potential exposures to chemicals in soils can result from incidental ingestion, dermal contact, or inhalation of airborne particulate matter.

Ingestion of, dermal contact with, and inhalation of contaminated soils could represent potentially complete exposure pathways for current workers, future industrial workers, and hypothetical future residents at the Y-Line Facility. These pathways, therefore, were evaluated quantitatively in the risk assessment. Since volatile chemicals were detected infrequently in surface soils, inhalation of volatiles from this medium was considered to be a minor pathway and was not evaluated.

2.7.1.2.2.2 Air Exposure Pathways

Potential exposure pathways involving air generally involve chemical releases either through fugitive dust emissions or the direct release of organic compounds from soils as gaseous emissions (particulates) from soils was considered a potentially complete pathway for current workers, future industrial workers, and hypothetical future residents and was evaluated quantitatively. Because volatile organic concentrations in surface soils are minor, inhalation of gaseous emissions from soils was considered a negligible pathway and was not evaluated quantitatively.

2.7.1.3 Risk Characterization

In this section, toxicity values for chemicals of concern were used in conjunction with the estimated chemical intakes to evaluate potential carcinogenic and non-carcinogenic health hazards.

2.7.1.3.1 Carcinogenic Risk

Carcinogenic risk is defined as the upperbound incremental probability of an individual developing cancer over a lifetime as a result of exposure to a potential carcinogen. Assuming the linear multistage model for carcinogenesis, the numerical estimate of excess lifetime cancer risk

is calculated by multiplying the daily chemical intake by the risk per unit dose of carcinogen or carcinogenic SF:

$$Risk = CI \times SF$$

where: Risk = the unitless probability of an individual developing cancer
CI = daily chemical intake (mg/kg/day)
SF = carcinogenic slope factor (mg/kg/day)⁻¹

EPA uses the 1E-04 to 1E-06 risk range as a "target range" to manage risks as part of a Superfund Cleanup. "For sites where the cumulative site risk to an individual based on reasonable maximum exposure for both current and future land use is less than 1E-04, action generally is not warranted, but may be warranted if a chemical specific standard that defines acceptable risk is violated or unless there are non-carcinogenic effects or an adverse environmental impact that warrants action" (USEPA, 1991b).

EPA guidance for the evaluation of carcinogenic risks associated with simultaneous exposure to multiple carcinogens assumes that incremental cancer risks are additive (USEPA, 1989a). If these assumptions are incorrect, over or under-estimation of the actual risk could result (USEPA, 1989b). The total cancer risk is estimated as follows:

$$Risk_T = \sum Risk_i$$

where Risk_T = total cancer risk
Risk_i = that carcinogenic risk estimate for the ith toxicant

Where a given receptor may be exposed to chemicals of concern via multiple pathways (e.g., inhalation of particulates, soil ingestion, and dermal contact with soil), the risk from each pathway is also summed.

2.7.1.3.2 Hazard Index for Non-Carcinogenic Effects

To evaluate potential non-carcinogenic health hazards posed by simultaneous exposure to multiple chemicals, the hazard quotients for each chemical of concern within a given exposure pathway are summed. The resulting value is referred to as the hazard index (HI). The summation of hazard quotients to obtain a hazard indexes assumes additivity of toxic effects and is appropriate only for chemicals with similar toxic endpoints (e.g., liver toxicity). In this risk assessment, hazard quotients for all non-carcinogens have been summed, regardless of toxic endpoint or mechanism of action. The HI is expressed as follows:

$$HI = E_1/RfD_1 + E_2/RfD_2 + \dots + E_i/RfD_i$$

where: E_i = chemical intake for the ith toxicant
RfD_i = reference dose for the ith toxicant.

Where a given receptor may be exposed to chemicals of concern via multiple pathways (e.g., inhalation of particulates, soil ingestion, and dermal contact with soil), the HIs from each pathway are also summed. If the cumulative hazard index is less than one, there is no cause for concern for adverse non-carcinogenic health effects. If the sum is greater than one, a more detailed and critical evaluation of potential non-carcinogenic health hazards may be warranted. Such additional evaluations may include the consideration of the specific target organ(s) and mechanism(s) of action for significant chemicals of concern and consideration of exposure assumptions and exposure concentrations used to estimate risk.

2.7.1.3.3 Risk Characterization Results

A BRA for human health risks was prepared in accordance with USEPA guidance documents for risk assessment. The human health risk assessment evaluated potential risks associated with long-term exposure to chemicals of concern detected in surface soil and groundwater, which are the two media of primary concern for human exposure. Concentrations of chemicals in subsurface soil did not differ significantly from those in surface soil, so the risk assessment performed for surface soil is protective of exposure to both surface and subsurface soil.

COCs for the health risk assessment were selected following procedures outlined in EPA guidance documents. The chief chemicals of concern in surface soil included arsenic and PAHs. It should be noted that hexavalent chromium was not detected in groundwater and did not exceed background levels in surface soil and that chromium did not statistically exceed background levels in surface soil. As a conservative measure, these compounds were retained for quantitative evaluation in the risk assessment.

Exposure pathways evaluated for estimating site risk included ingestion, dermal contact, and inhalation exposure to surface soil by current workers, future industrial workers, and hypothetical future residents.

Chemical intakes by receptors and the resulting risks were calculated for both average and reasonable maximum exposure (RME) scenarios. RME exposure assumptions were developed using USEPA standard Default Exposure Factors (USEPA, 1991b). Average exposure assumptions were developed to result in the most likely estimates of exposure for an individual with normal activity patterns, assuming that long-term future industrial or residential use occurs.

In an effort to be conservative, a hypothetical child resident was evaluated only for the soil ingestion exposure route. This was done because young children are thought to ingest a greater amount of soil by hand-to-mouth activity, compared to adults. Cancer risk for residential exposure was estimated by adding cancer risk calculated for children (6-year exposure) and adults (24-year exposure), which is equivalent to the time-weighted approach recommended by USEPA (1991a). Other intake routes such as dermal absorption, and inhalation were conservatively evaluated only for adults because risks calculated for these pathways are greater for the adult than for the child.

The 95 percent upper-confidence limit (UCL) of the lognormally transformed data was used to estimate conservative exposure point concentrations for both average and high-end risk. Chemical-specific toxicity factors, i.e., reference doses (RfDs) and cancer slope factors (SFs), were used in estimating risk. These were obtained from EPA-approved sources (IRIS and HEAST (USEPA, 1993 and 1994)).

Potential health risks were assessed by combining the estimated daily exposure, chemical concentrations, and toxicity factors. A total cancer risk was estimated for each receptor (current worker, future industrial worker, and hypothetical future resident) for multiple-pathway exposures.

Chemical-specific, pathway-specific, and cumulative non-carcinogenic and carcinogenic HIs were calculated for each exposure scenario evaluated in the risk assessment. A summary of cancer risk and non-carcinogenic HIs is presented in Table 2-8 for each receptor and pathway. USEPA guidance states that if the total cancer risk does not exceed $1E-04$ and non-carcinogenic HI is less than 1, then remedial action is generally not warranted to protect public health (USEPA, 1991b).

The findings of the risk assessment are summarized below:

Current on-post workers: Current on-post workers were assumed to be exposed for up to 25 years to chemicals of concern in surface soil via ingestion, dermal contact, and inhalation. The total estimated RME cancer risk was $4.35E-05$ (5 in 100,000). This level is within EPA's target cancer risk range of $1E-06$ to $1E-04$ (1 in 1,000,000 to 1, in 10,000) for exposure to hazardous chemicals released to the environment. The total HI was below 1, indicating no cause for concern for non-carcinogenic health effects.

Future industrial workers: Future industrial workers were assumed to experience the same exposure to surface soil as the current on-post workers. The estimated RME cancer risk for exposure to surface soil was $4.35E-05$ (i.e., the same as for current on-post workers), which is within the acceptable risk range. The HI for exposure to chemicals in soil was below 1, indicating no cause for concern for non-carcinogenic health effects.

Hypothetical future residents: Hypothetical future residents were assumed to be exposed for 30 years to surface soil via ingestion, dermal contact, and inhalation. The estimated RME cancer risk (adult and child total) for exposure to soil was $3.7E-04$, which exceeds the upper-end of EPA's target risk range. The HI associated with exposure to soil is below 1.

The RME cancer risk for exposure to soil exceeds EPA's target risk range for hypothetical future residents; however, residential use of the LAAP is an unlikely scenario as stated in sections 2.6 and 2.7.1.2.1. In addition, the chemicals that contributed most of the cancer risk were arsenic and PAHs. Arsenic was identified as a chemical of concern in surface soil on the basis of comparison with local background samples. Arsenic was detected in on-site surface soil samples in concentrations ranging from 2.99 to 16.9 mg/kg, and the 95% UCL concentration used in risk calculations was 7.6 mg/kg. This range of arsenic concentrations is well within the natural range

reported for Louisiana soils of 1-32 mg/kg (Dragun and Chaisson, 1991). In addition, the available historical information did not indicate that arsenic was used in processes at the Etch Facility. Because arsenic is present at relatively low concentrations that are within the normal range for Louisiana soils and it had no known uses at the site, the BRA recommended eliminating arsenic as a site-related contaminant. PAHs were detected in some, but not all, surface soil samples. The highest concentrations were found in localized areas adjacent to the foundation of Building 2600, where exposure potential is low.

2.7.2 Environmental Risks

An Ecological Risk Assessment was performed to assess the potential for impacts to aquatic and terrestrial species that may be exposed to site-related chemicals in soil (Figure 2-15).

Exposure pathways from COCs in surface soil (metals, PAHs, and petroleum hydrocarbons) to terrestrial biota in the grassy upland areas are considered incomplete or insignificant because of lack of habitat in the areas of elevated chemical concentrations. Although transient biota may be intermittently exposed to COCs in a small area of concern adjacent to the Y-Line Facility, forage and/or prey do not occupy this area; therefore, the risk potential for adverse effects on key receptor populations is negligible.

Periodic episodes of stormwater runoff from areas of surface soil exposed to releases of chromic acid from the Y-Line Facility may contribute site-related chemicals to Boone Creek. However, the weight of evidence suggests that this potential exposure pathway represents minimal risks to organisms in a limited area and that key receptors in a mainstream of Boone Creek are not at risk from this potential episodic exposure.

While no known federally listed endangered species have been identified on LAAP since 1987, certain species have either been identified previously or may exist at LAAP. Therefore, some endangered species habitat(s) exist and are managed in accordance with existing regulations (Assessment of Applicable or Relevant and Appropriate Requirements (ARARs) for LAAP, dated March 12, 1992).

2.7.3 Risk Assessment Conclusions

Based on the results of the human health risk assessment, the chemicals of chief concern identified for surface soils were arsenic and PAHs. RME cancer risks associated with soil exposure (PAHs and arsenic) are within EPA's target risk range of 1E-06 to 1E-04 for workers, but exceed this range for hypothetical future residents (3.7E-04). The risk for soil exposures may be overestimated because (1) they assume long-term exposure to PAHs in soil, whereas PAH contamination was localized to small areas, adjacent to the foundation of Building 2600, that may not be of sufficient size to support chronic exposure, and (2) although arsenic is above background levels at LAAP, the arsenic concentrations in the surface soils were within the natural range for arsenic levels found in Louisiana soils.

Based on the results of the ecological risk assessment, the chemicals of concern identified for the different habitats and environmental media were various metals, PAHs, and petroleum hydrocarbons in surface soil. It was determined that the ecological pathways for the chemicals of concern in surface soil to terrestrial biota were incomplete or insignificant as a result of the lack of habitat in the isolated areas of elevated chemical concentrations.

In summary, the results of the baseline human and ecological risk assessment indicate that unacceptable exposures to hazardous substances will not occur from the Y-Line Facility soils in the industrial use scenario. Therefore, no further action appears to be warranted. If land use at the site changes from industrial or if the Army gives up control of or ceases to restrict access to LAAP, this determination will be re-evaluated.

3 RESPONSIVENESS SUMMARY

The preferred alternative recommended for the Y-Line soils by the Army was no action. No action is warranted for the Y-Line Facility soils since the soils at this site pose no current or potential threat to human health or to the environment. This is supported by the baseline risk assessment.

The Army has not received any comments from the public concerning the no action remedy for the Y-Line Facility soils.

4 LIST OF ACRONYMS AND ABBREVIATIONS

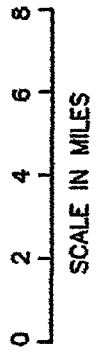
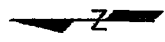
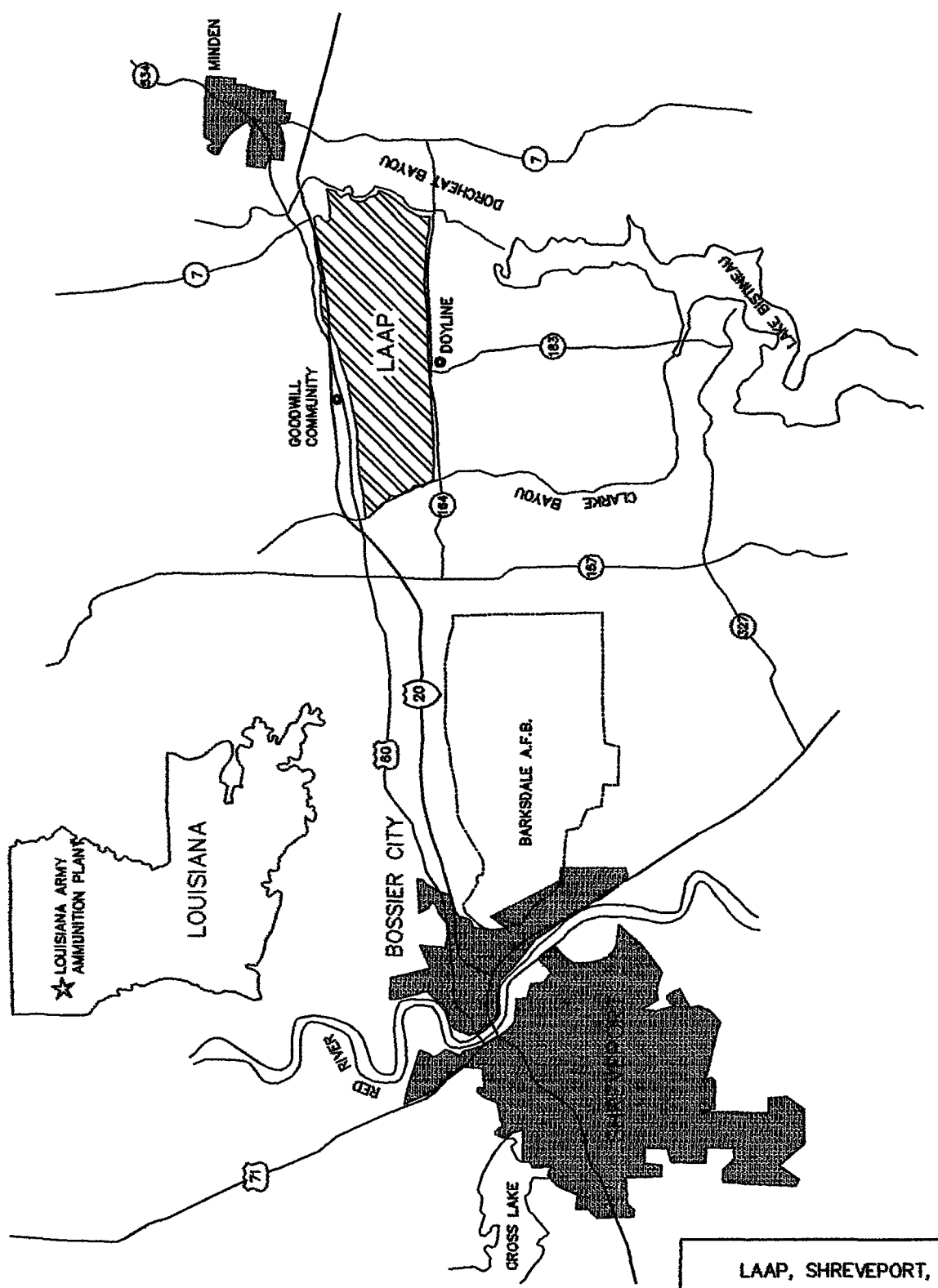
bgs	below ground surface
AOC	Area of Concern
ARARs	Applicable or Relevant and Appropriate Requirements
BRA	Baseline Risk Assessment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	Chemical(s) of Concern
CRL	Certified Reporting Limit
DCL	DataChem Laboratories
ESE	Environmental Science and Engineering, Inc.
E	Chemical Intake
ETA	Engineering Technologies Associates, Inc.
ft	foot, feet
HI	Hazard Index
HQ	Hazard Quotient
in	inch, inches
LAAP	Louisiana Army Ammunition Plant
LAP	Load, Assemble, Pack
LDEQ	Louisiana Department of Environmental Quality
msl	mean sea level
NCP	National Contingency Plan
NPL	National Priorities List
PAH	Polynuclear Aromatic Hydrocarbon
ppm	parts per million
RAGS	Risk Assessment Guidance for Superfund
RfD	Reference Dose
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
RME	Reasonable Maximum Exposure
SARA	Superfund Amendments and Reauthorization Act
SF	Cancer Slope Factor
SVOC	Semivolatile Organic Compound
TAL	Target Analyte List (metals)
TPHC	Total Petroleum Hydrocarbons
USAEC	United States Army Environmental Center
USAEHA	United States Army Environmental Hygiene Agency
USATHAMA	United States Army Toxic and Hazardous Materials Agency
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound
WCFS	Woodward-Clyde Federal Services
WESTON	Roy F. Weston, Inc.
µg/g	micrograms per gram

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Appendix A

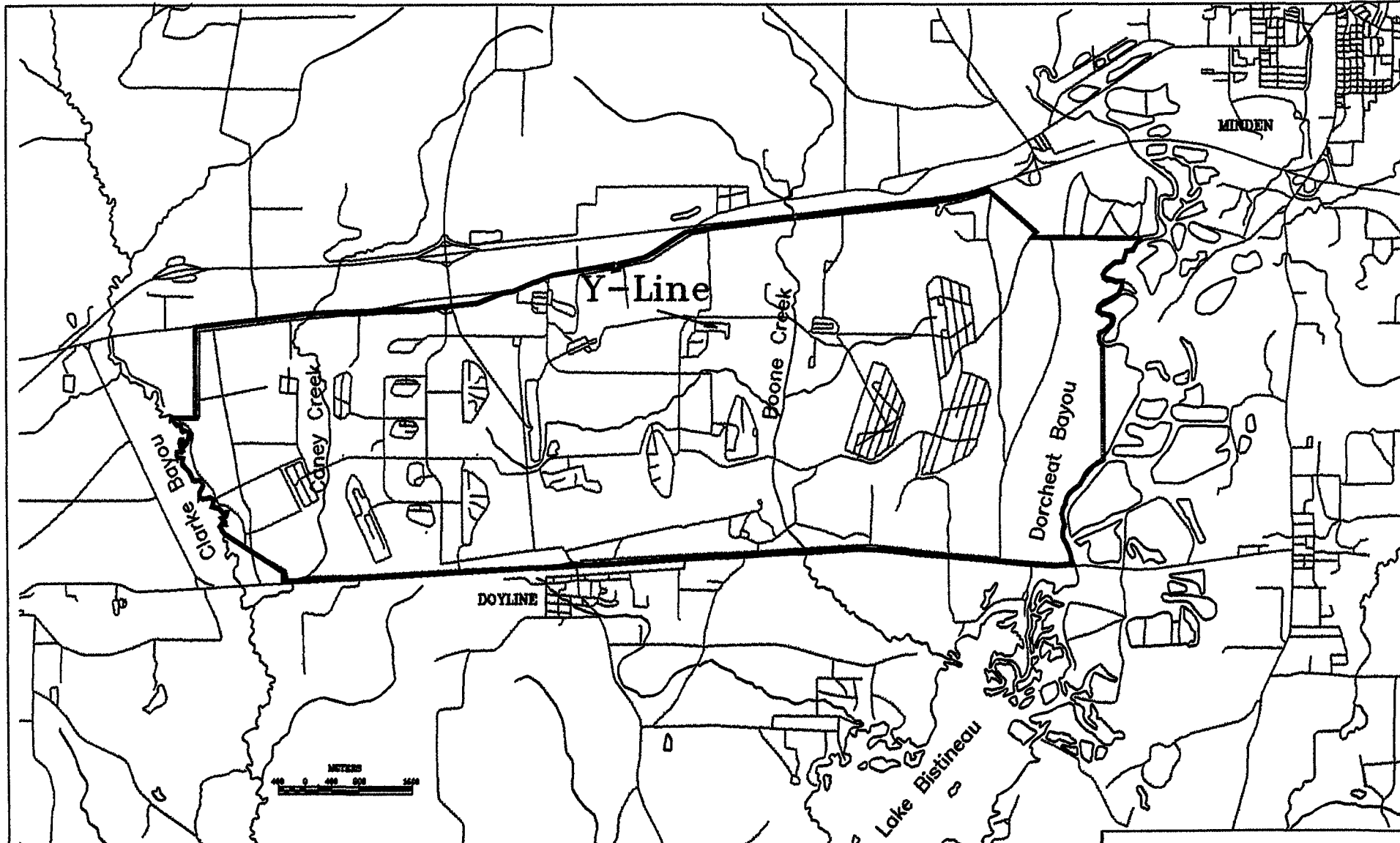


SOURCE: ESE, 1992

LAAP, SHREVEPORT, LOUISIANA

LOCATION MAP
LOUISIANA ARMY AMMUNITION
PLANT

Figure 2-1

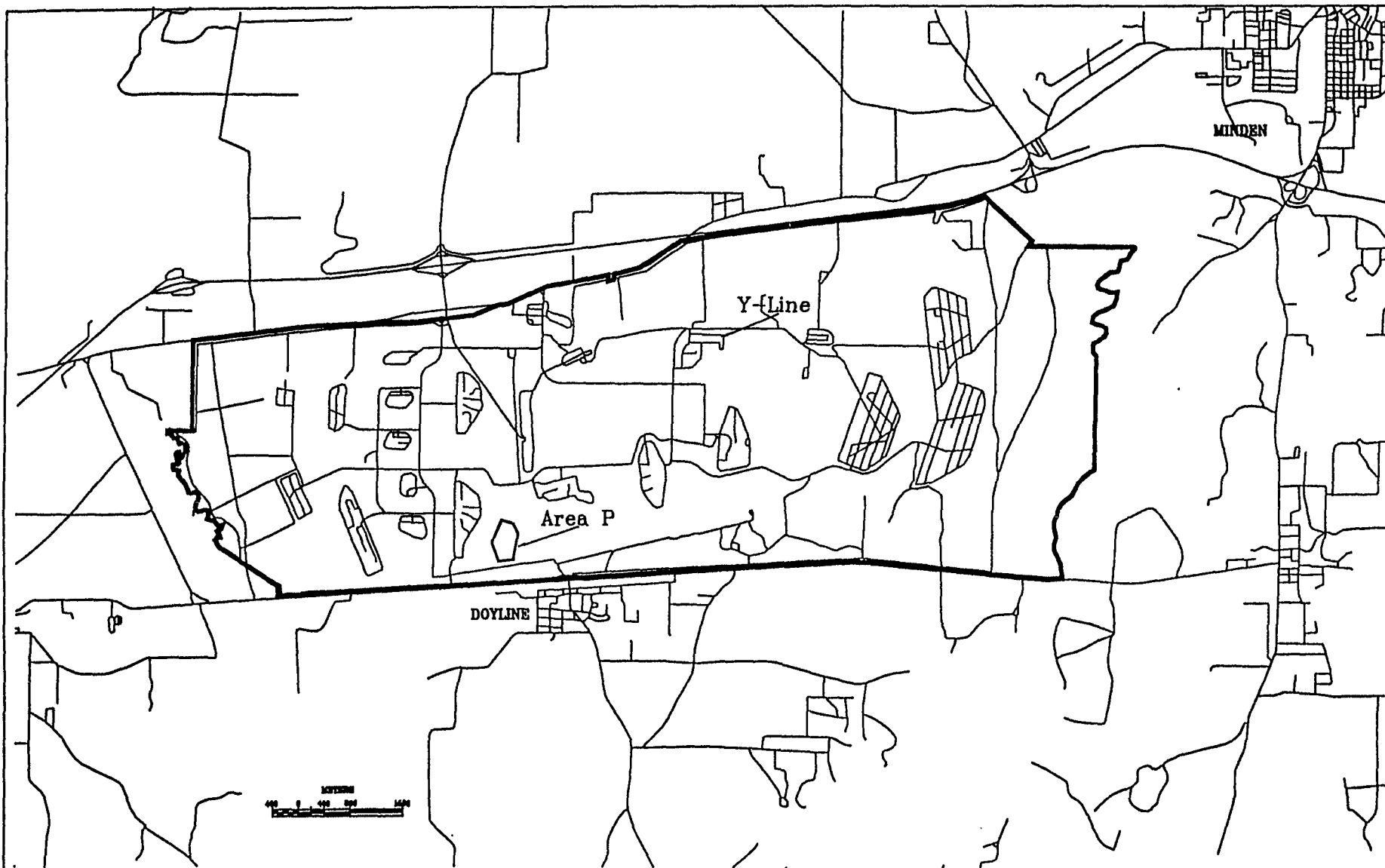


DESIGNED BY: DEK 9/88	REVISIONS		
DRAWN BY: DEK 9/88	DATE	BY	REVISION
CHECKED BY: DEK			
APPROVED BY: DEK			

ENGINEERING TECHNOLOGIES ASSOCIATES, INC.
 ENGINEERS * PLANNERS * SURVEYORS
3448 ELIZABETH AVENUE, SUITE 101
 SLICHOFF CITY, MISSISSIPPI 39208
 PHONE: 601-879-1100 FAX: 601-879-1100

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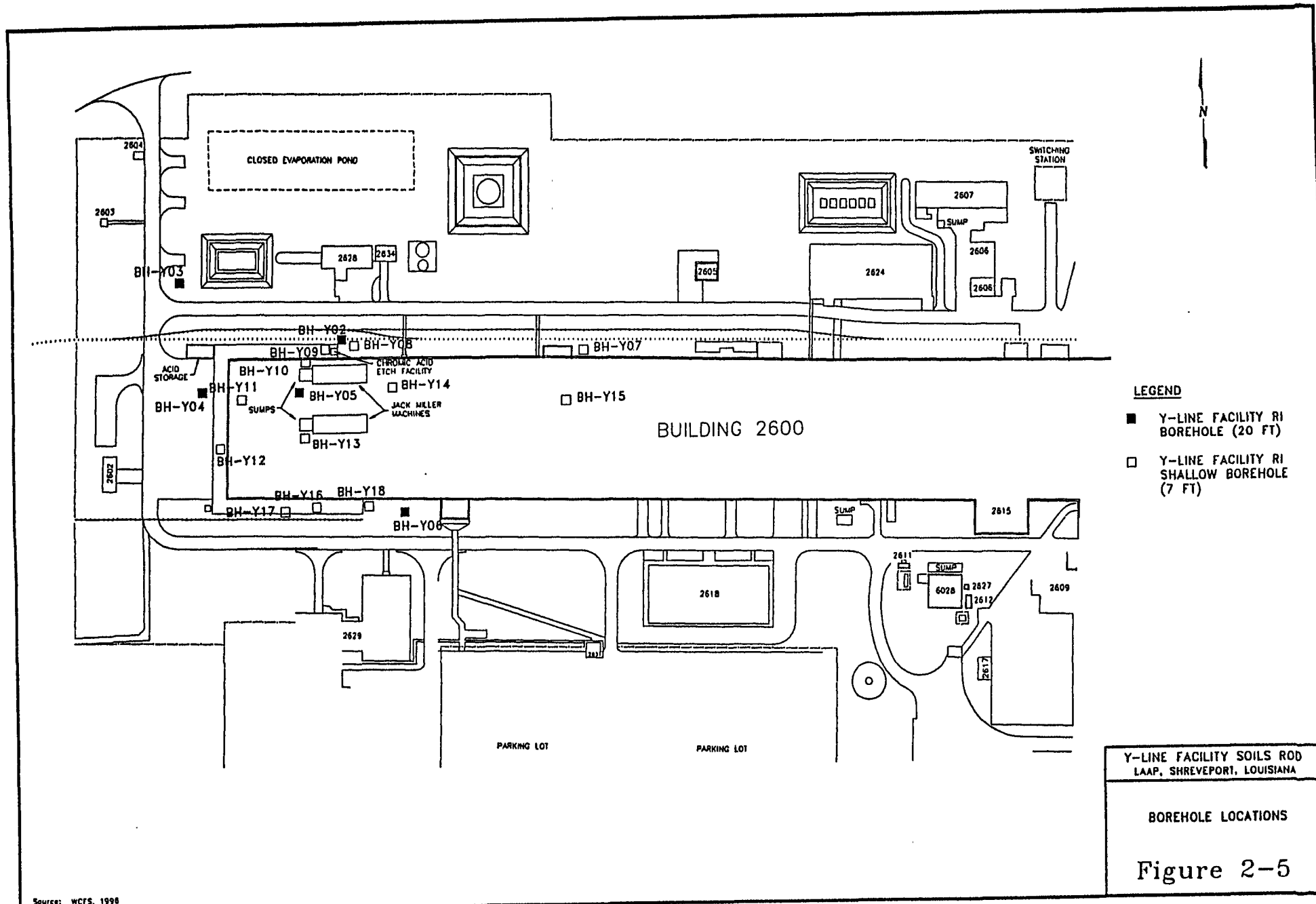
LOUISIANA ARMY AMMUNITION PLANT			
Y-Line Location			
Figure 2-2			
SCALE: 1" = 1000'	CONTRACT NO: D6047264	DATE: March 1988	SHEET: 10

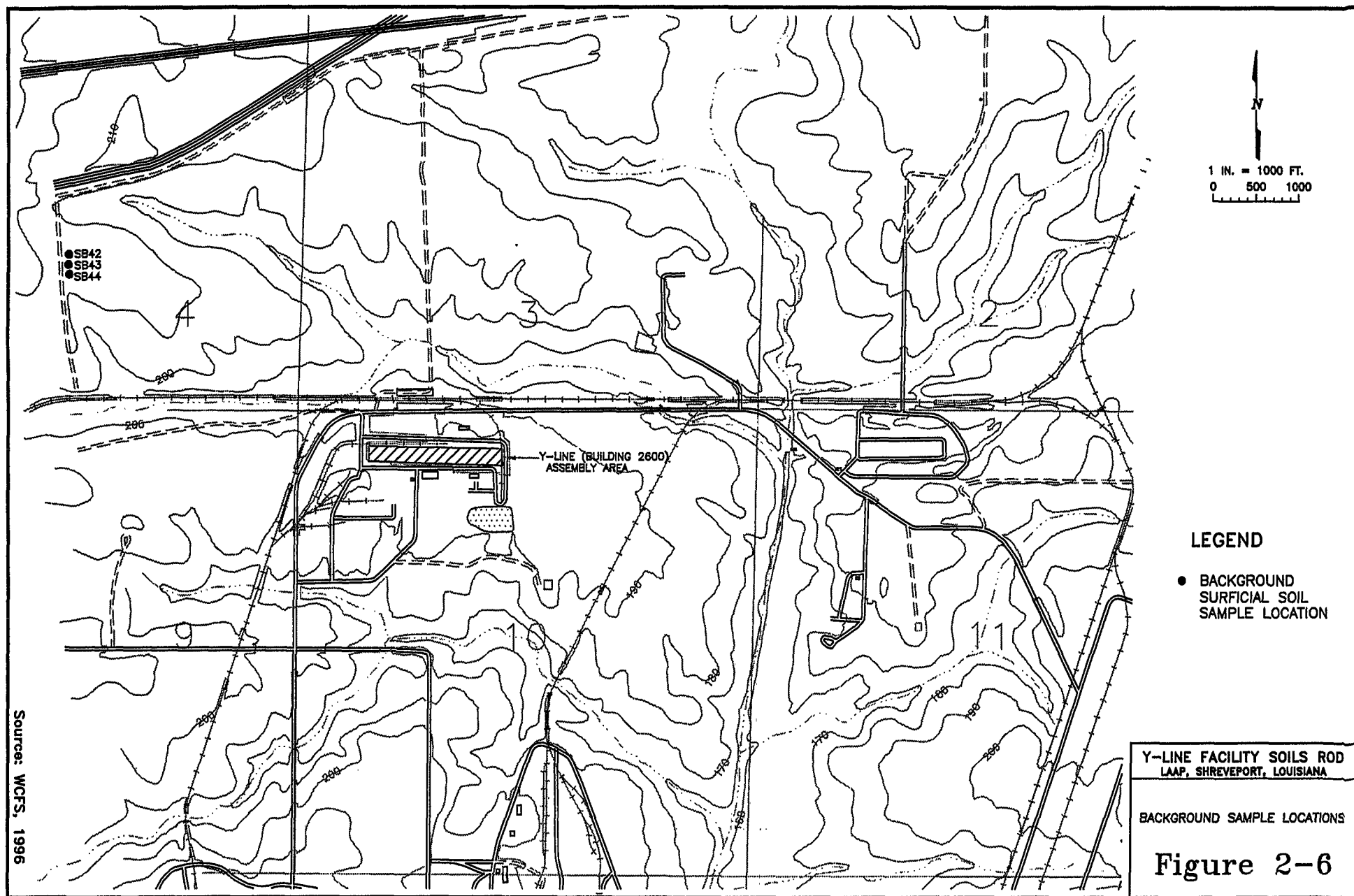


REVISIONS	
DATE	DESCRIPTION

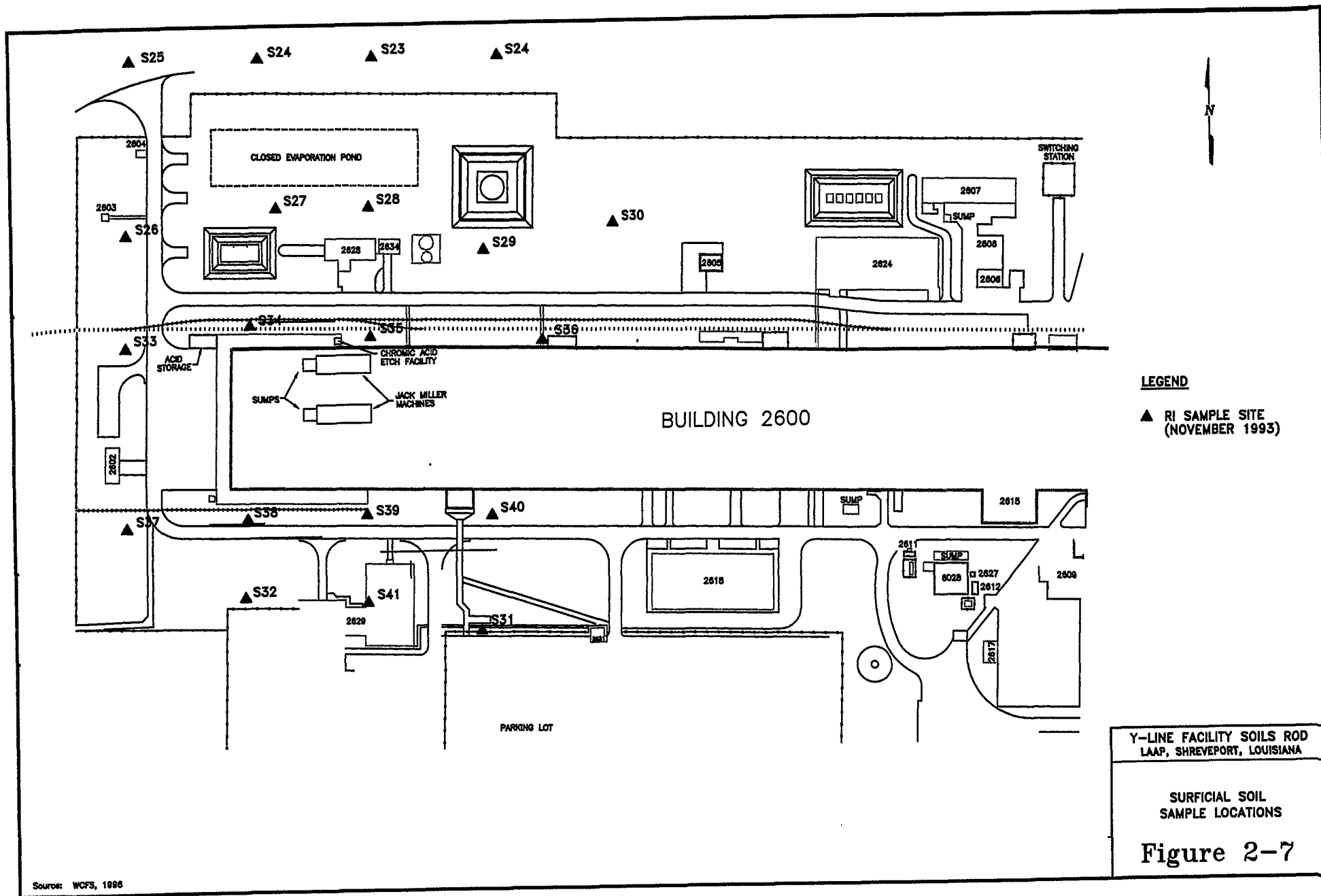
ENGINEERING TECHNOLOGIES ASSOCIATES, INC.
 ENGINEERS • PLANNERS • SURVEYORS
2408 ELBERT STREET SUITE 101
 ELBERT CITY, MISSOURI 64532
 TEL. 816-235-1100 FAX 816-235-1101

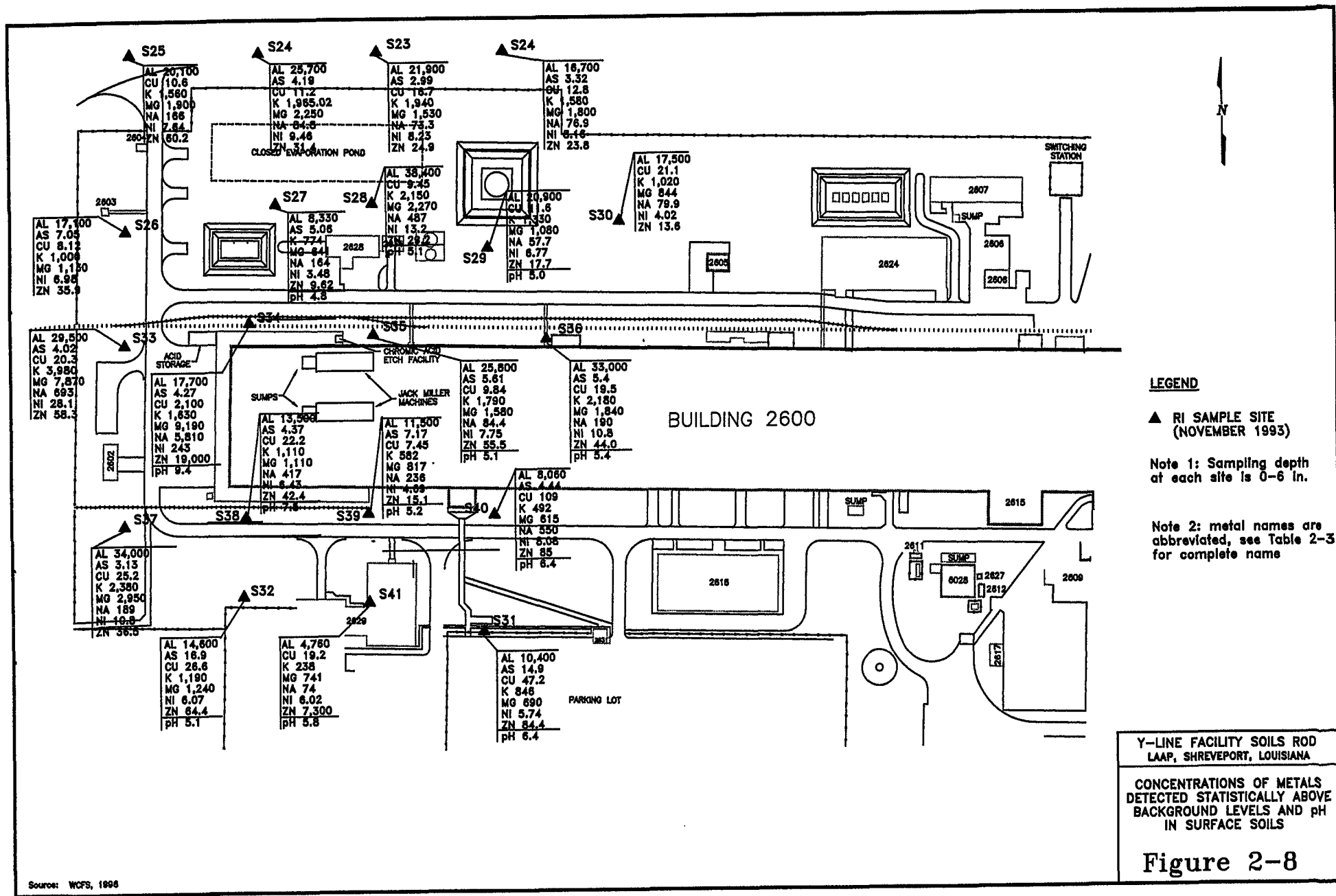
Louisiana Army Ammunition Plant Y-Line Proposed Plan
Area P Location
Figure 2-4
DATE: 4/23/88 SHEET: 1 OF 1

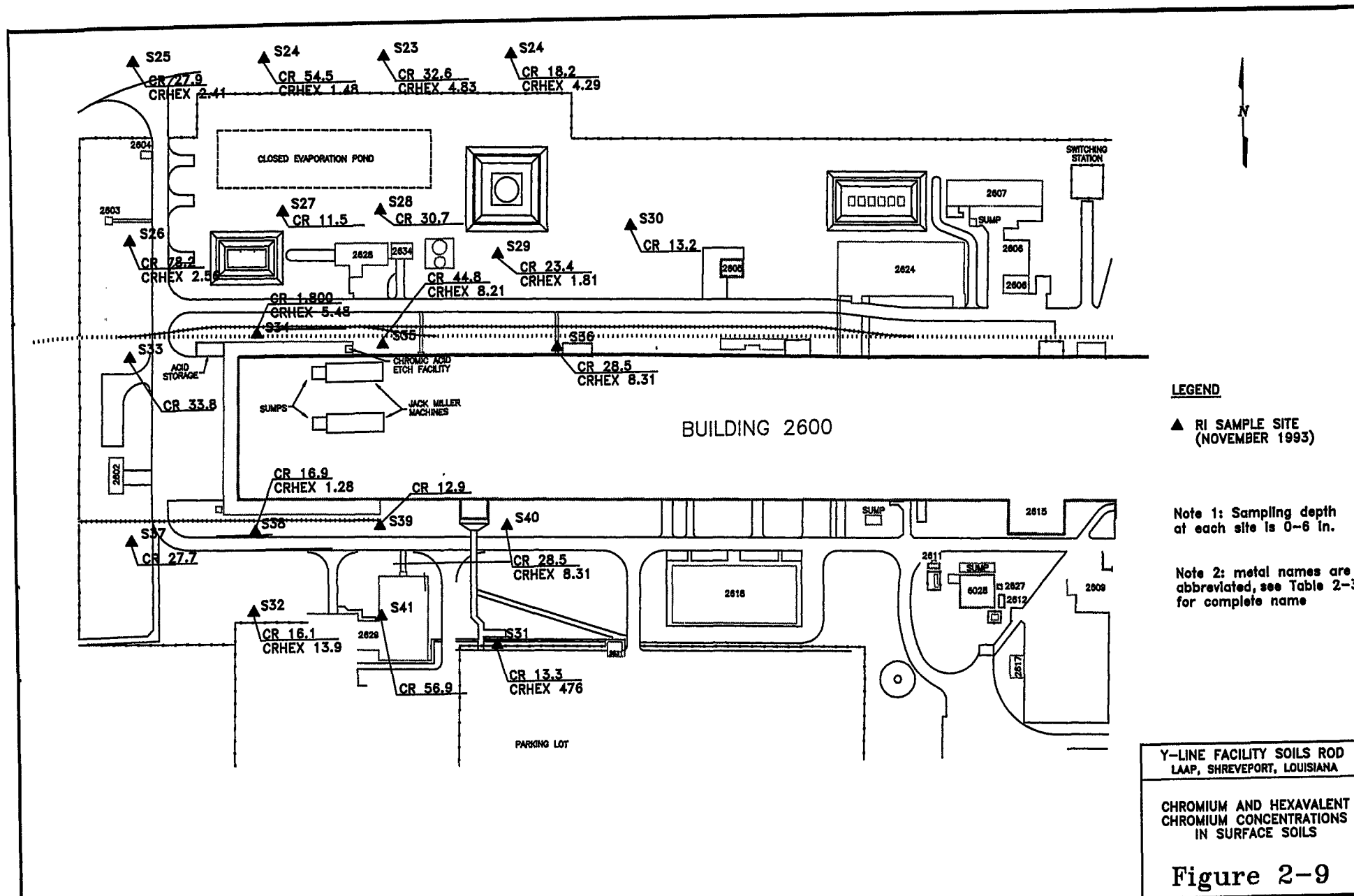


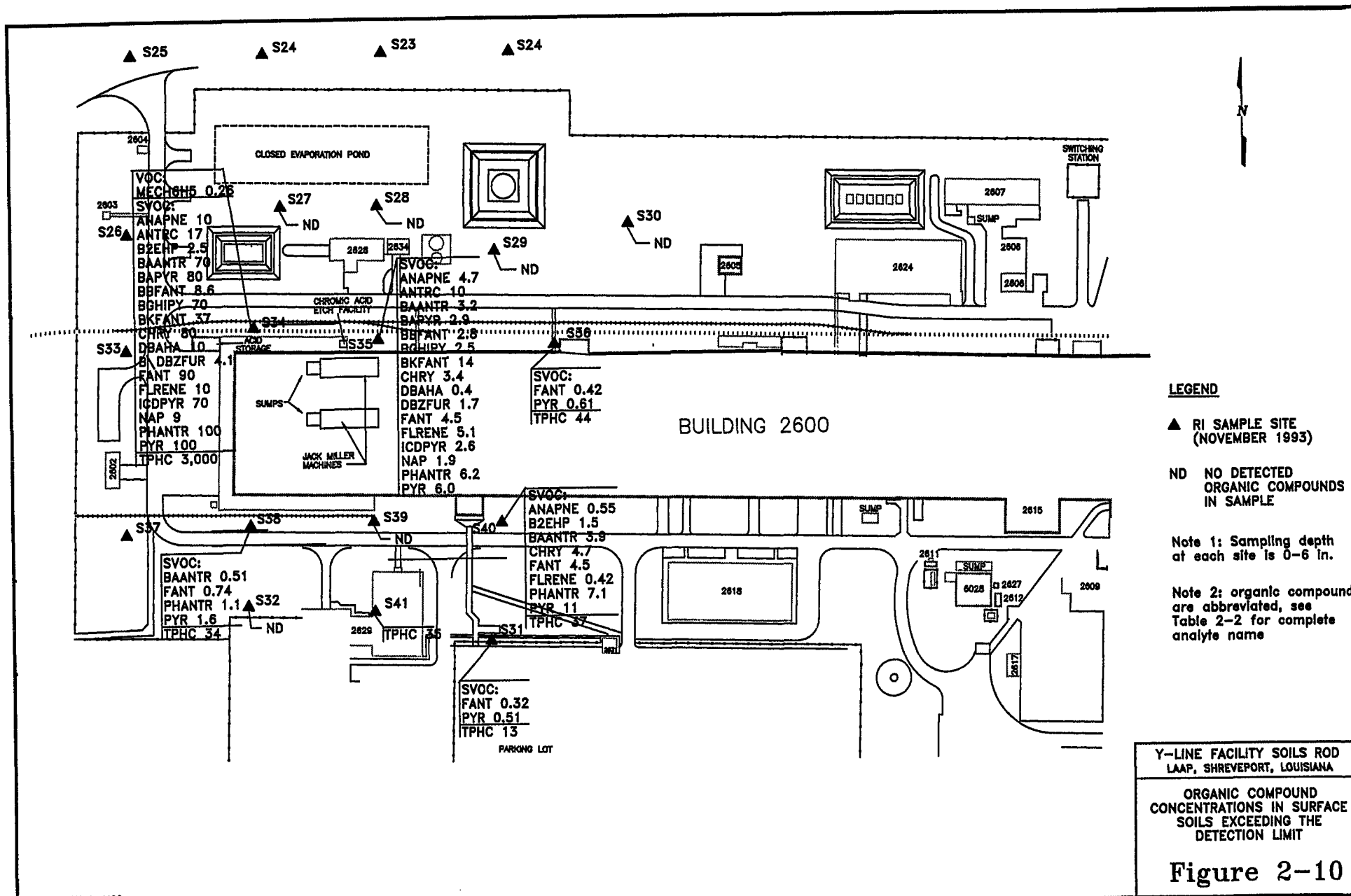


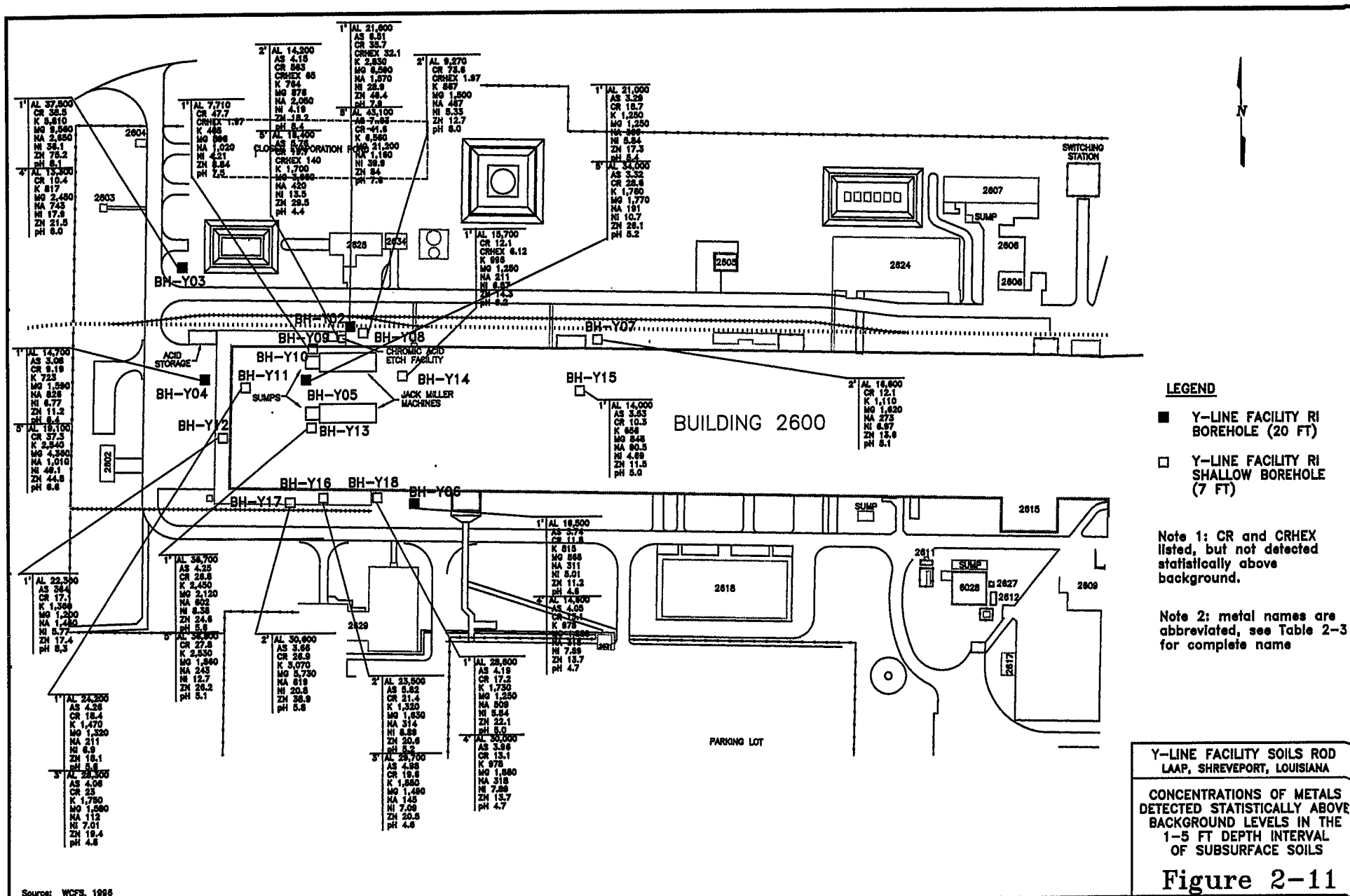
Source: WCFS, 1996

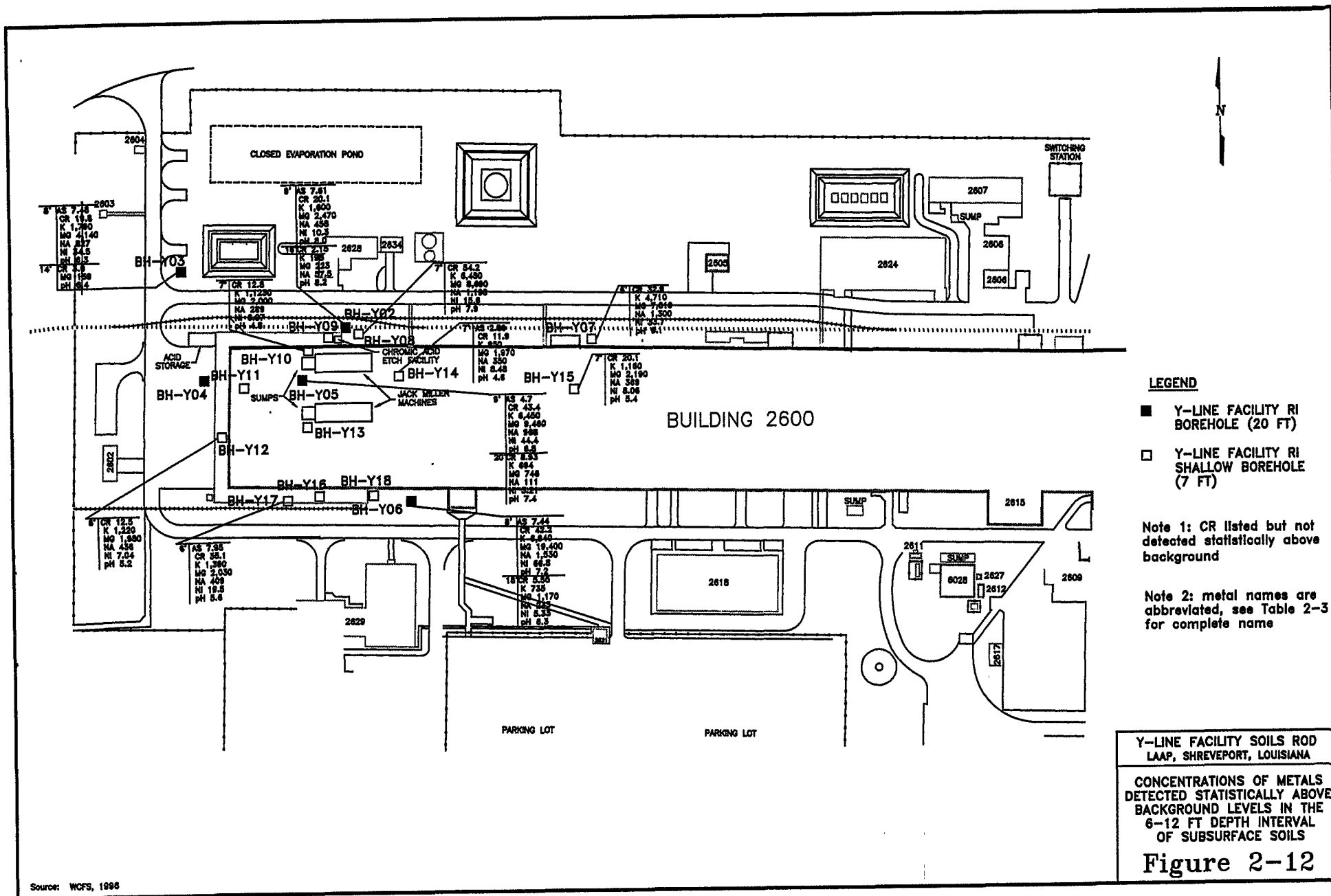


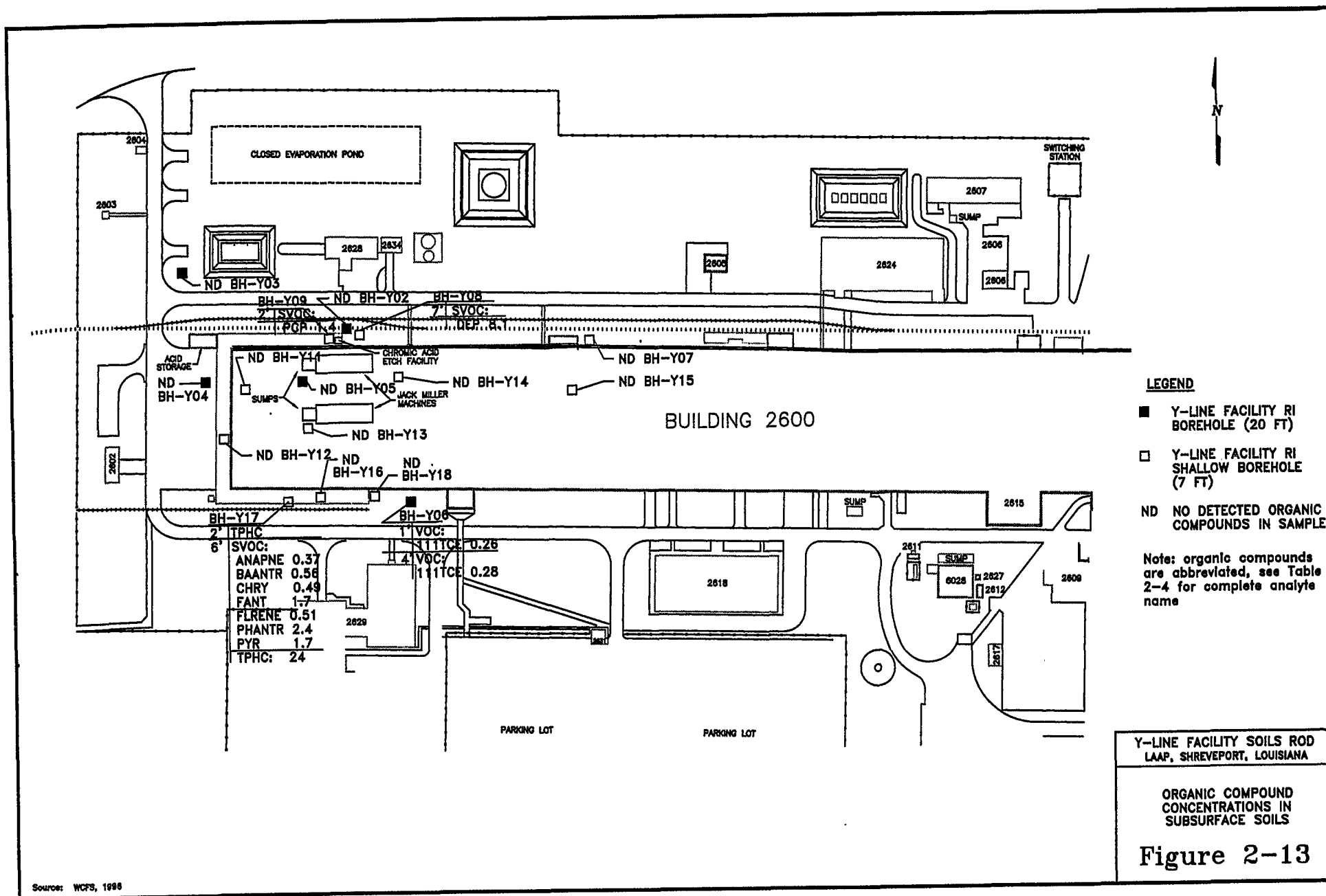


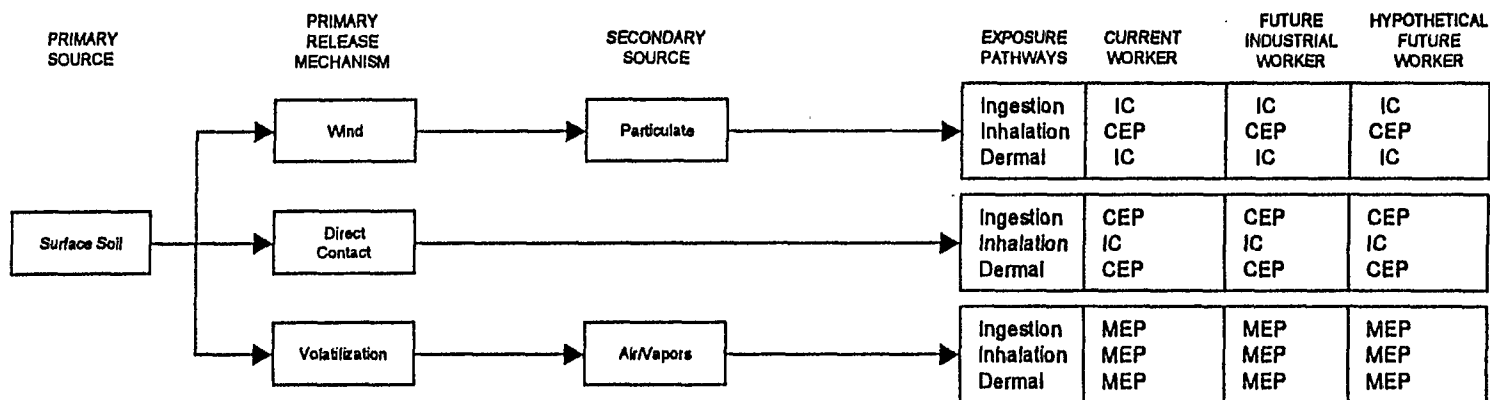




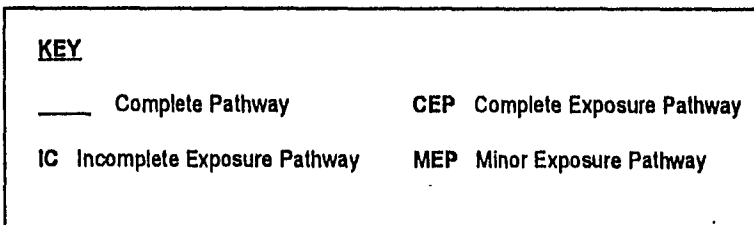








Source: WCFS, 1996



LAAP, SHREVEPORT, LOUISIANA
 SITE CONCEPTUAL
 EXPOSURE MODEL
 FOR THE Y-LINE SOILS
 Figure 2-14

Appendix B

TABLE 2-1
DETECTED METAL CONCENTRATIONS IN BACKGROUND SURFACE SOILS

Metal	Background Sample Sites				Arithmetic Mean	Native Uncontaminated Soil*	
	SB42	SB43	SB44	Maximum		Typical Range	Extreme Limits
Aluminum (AL)	8,460	9,220	8,990	9,220	8,890	10,000-300,000	--
Barium (BA)	52.5	66.9	102	102	73.8	100-3500	10-10,000
Beryllium (BE)	0.604	0.84	0.556	0.84	0.67	0.1-40	0.1-100
Boron(B)	LT	LT	9.95	9.95	---	2.0-130	0.1-3,000
Calcium (CA)	752	824	578	824	718	100-400,000	--
Chromium (CR)	22.5	25.3	19.1	25.3	22.3	5.0-3,000	0.5-10,000
CR hexavalent	16	1.42	6.78	16	8.1	NA	NA
Cobalt(CO)	6.89	7.14	8.15	8.15	7.39	1.0-40	.01-500
Copper (CU)	6.15	5.47	5.08	6.15	5.57	2.0-100	0.1-14,000
Iron (FE)	13,800	14,600	20,900	20,900	16,433	7,000-550,000	--
Lead (PB)	15.41	9.93	22.07	22.07	15.80	2.0-200	0.1-3,000
Magnesium (MG)	617	604	558	617	593	600-6,000	--
Manganese (MN)	701	519	1,900	1,900	1,040	100-4,000	1.0-70,000
Mercury (HG)	0.0631	LT	0.0705	0.0705	0.0668	.01-.08	--
Nickel (NI)	4.75	3.41	4.53	4.75	4.23	5.0-1,000	0.8-6,200
Potassium (K)	434	388	526	526	449	400-30,000	--
Selenium (SE)	LT	0.597	LT	0.597	---	0.1-2.0	0.01-400
Silver (AG)	0.0529	0.0531	0.055	0.055	0.054	0.1-5.0	0.1-50
Vanadium (V)	28.1	29.1	37.8	37.8	31.7	20-500	1.0-1,000
Zinc (ZN)	11.7	11.2	12.4	12.4	11.8	10-300	3.0-10,000

NOTES:

All concentrations in micrograms per gram ($\mu\text{g/g}$).

LT = Less than the certified reporting limit (CRL).

* Source: Dragan 1988.

TABLE 2-2

**FREQUENCY AND RANGE OF DETECTION FOR METALS DETECTED
STATISTICALLY ABOVE BACKGROUND IN SURFACE SOILS**

Metals/pH	Frequency*	Concentration Range (µg/g)		Arithmetic Mean (µg/g)
		Maximum	Minimum	
Aluminum (AL)	20	38,400	4,760	19,491
Arsenic (AS)	16	16.9	2.99	5.9
Copper (CU)	19	2,100	7.45	141
Magnesium (MG)	20	9,190	615	2,013
Nickle (NI)	20	243	3.48	20
Potassium (K)	20	3,980	238	1,486
Sodium (NA)	17	5,810	57.7	557
Zinc (ZN)	20	19,000	9.62	1,325
pH	12**	9.44	4.82	6.10

NOTES: * Detection frequency based on 20 samples analyzed.
 ** 12 samples tested.

TABLE 2-3

**FREQUENCY AND RANGE OF DETECTION CONCENTRATIONS FOR VOCs,
SVOCs, AND TPHC IN SURFACE SOILS**

Analyte	Frequency*	Concentration Range (µg/g)		Arithmetic Mean (µg/g)
		Maximum	Minimum	
Volatile Organic Compounds (VOCs)				
Toluene (MEC6H5)	1	0.26	---	---
Semivolatile Organic Compounds (SVOCs)				
Polynuclear Aromatic Hydrocarbons				
Acenaphtylene (ANAPNE)				
Magnesium (MG)	20	9,190	615	2,013
Nickle (NI)	20	243	3.48	20
Potassium (K)	20	3,980	238	1,486
Sodium (NA)	17	5,810	57.7	557
Zinc (ZN)	20	19,000	9.62	1,325
pH	12**	9.44	4.82	6.10

NOTES: * Detection frequency based on 20 samples analyzed.
 ** 12 samples tested.

TABLE 2-4
FREQUENCY AND RANGE OF DETECTED CONCENTRATIONS FOR VOCs,
SVOCs, AND TPHC IN SUBSURFACE SOILS

Depth Interval	Analyte	Frequency*	Concentration Range (µg/g)		
			Maximum	Minimum	Mean
1-5 FEET					
	Volatile Organic Compounds (VOCs)				
	1,1,1-Trichloroethane (111TCE)	2	0.28	0.26	0.27
	Semivolatile Organic Compounds (SVOCs)				
	Pentachlorophenol (PCP)	1	1.4	---	---
	Total Petroleum Hydrocarbons				
	TPHC	1	17	---	---
6-10 FEET					
	Semivolatile Organic Compounds (SVOCs)				
	Polynuclear Aromatic Hydrocarbons				
	Acenaphthene (ANAPNE)	1	0.37	---	---
	Benzo[a]anthracene (BAANTR)	1	0.56	---	---
	Chrysene (CHRY)	1	0.49	---	---
	Fluoranthene (FANT)	1	1.7	---	---
	Fluorene (FLRENE)	1	0.51	---	---
	Phenanthrene (PHANTR)	1	2.4	---	---
	Pyrene (PYR)	1	1.7	---	---
	Phthalate Esters				
	Diethyl phthalate (DEP)	1	8.1	---	---
	Total Petroleum Hydrocarbons				
	TPHC	1	24	---	---
11-20 FEET					
	No Detects				

Notes: * Detection frequencies within depth intervals based upon the following:

- 1 to 5 feet - 27 samples collected.
- 6 to 10 feet - 11 samples collected.
- 11 to 20 feet - 6 samples collected.

TABLE 2-5

FREQUENCY AND RANGE OF DETECTED CONCENTRATIONS FOR
METALS DETECTED STATISTICALLY ABOVE BACKGROUND
LEVELS IN SUBSURFACE SOILS

Depth Interval	Metals/pH	Frequency*	Concentration Range (µg/g)		Arithmetic Mean (µg/g)
			Maximum	Minimum	
<u>1-5 FEET:</u>	Aluminum (AL)	27	43,100	7,710	23,036
	Arsenic (AS)	19	7.93	3.08	4.43
	Magnesium (MG)	27	21,200	848	3,135
	Nickle (NI)	27	49.1	4.19	12.9
	Potassium (K)	27	6,560	405	1,886
	Sodium (NA)	27	2,650	90.5	670
	Thallium	2	75	64.5	69.8
	Zinc (ZN)	27	84	8.84	26
	pH	27	9.2	4.4	6.10
<u>6-20 FEET:</u>	Arsenic (AS)	6	7.95	2.89	6.34
	Magnesium (MG)	17	19,400	139	3,846
	Nickle (NI)	14	66.8	3.05	19.1
	Potassium (K)	16	6,940	198	2,274
	Sodium (NA)	15	1,530	57.5	583
	Thallium	1	144	---	---
	pH	17	8.2	4.6	6.4

NOTE: * Frequency for 1-5 feet interval is based upon 27 subsurface soil samples collected.
** Frequency for 6-20 feet interval is based upon 17 subsurface soil samples collected.

Source: WCFS, 1996

TABLE 2-6
SUMMARY OF CANCER SLOPE FACTORS
FOR CHEMICALS OF POTENTIAL CONCERN^a

Chemical	Route, Target Organ, Species	Weight of Evidence	Slope Factor (mg/kg/day) ⁻¹	
			Oral	Inhalation
1,1-Dichloroethane	Oral, rat and mouse.	C	_ ^b	_ ^b
1,1-Dichloroethene	Oral, adrenal, rat Inhalation, kidney, mouse.	C	6E-1	1.75E+1
1,1,2,2,-Tetrachloroethane	Liver	C	2E-1	2E-1
Benzo(a)anthracene	(c)	B2	7.3E-1	_ ^b
Benzo(a)pyrene	Oral, forestomach, mouse.	B2	7.3E+0	_ ^b
Benzo(b)fluoranthene	(c)	B2	7.3E-1	_ ^b
Benzo(k)fluoranthene	(c)	B2	7.3E-1	_ ^b
Bis(2-ethylhexyl)phthalate	Oral, liver.	B2	1.4E-2	_ ^b
Chrysene	(c)	B2	7.3E-2	_ ^b
Dibenzo(a,h)anthracene	(c)	B2	7.3E+0	_ ^b
Indeno(1,2,3-cd)pyrene	(c)	B2	7.3E-1	_ ^b
Tetrachloroethene		C-B2	5.2E-2 ^f	2E-3 ^f
Trichloroethene		C-B2	1.1E-2 ^f	6E-3 ^f
Arsenic	Inhalation, lung, human. Oral, skin, human.	A	1.75E+0	1.5E+1
Beryllium	Oral, multiple combined sites, rat. Inhalation, site not specified, human.	B2	4.3E+0	8.4E+0 ^d
Chromium (VI)	Inhalation, respiratory system, human.	A	_ ^b	4.1E+1
Nickel	Inhalation, respiratory system, human.	A ^{d,e}	_ ^b	8.4E-1

^a Information from IRIS database unless otherwise indicated.

^b Slope factor not available in IRIS or HEAST (1993).

^c The slope factors are based on relative toxic equivalence to benzo(a)pyrene (Clement 1988).

^d HEAST (1993).

^e Refinery dust is a human carcinogen by the inhalation route; however, there are no data to indicate that the soluble salts of nickel are carcinogenic by any route (IRIS).

^f Environmental Criteria and Assessment Office (ECAO) (no date). Memo from Joan S. Dollarhide EPA to Dan Stralka, EPA Region IX re: Carcinogenic Characterization of trichloroethylene and perchloroethylene.

TABLE 2-7

**SUMMARY OF REFERENCE DOSES (RfD)
FOR CHEMICALS OF POTENTIAL CONCERN WITH NONCARCINOGENIC EFFECTS***

Chemical	Route, Target Organ, Species	Oral Reference Dose			Inhalation Reference Dose		
		Subchronic RfD (mg/kg/day)	Chronic RfD (mg/kg/day)	Confidence Level	Subchronic RfD (mg/kg/day)	Chronic RfD (mg/kg/day)	Confidence Level
1,1-Dichloroethane	Oral, kidney, rat. Inhalation, kidney, cat.	1E+0 ^c	1E-1 ^c	--	1.43E+0 ^c	1.43E-1 ^c	--
1,1-Dichloroethene	Oral, liver, rat.	9E-3 ^c	9E-3	Medium	.. ^b	.. ^{b,d}	--
1,1,1-Trichloroethane	Oral and Inhalation, liver, guinea pig.	9E-1 ^c	9E-2 ^c	--	.. ^b	.. ^b	--
1,2 -Dichloroethene	Oral, liver, rat.	9E-3 ^c	9E-3 ^c	--	.. ^b	.. ^b	--
Acenaphthene	Oral, hepatotoxicity, mouse.	6E-1 ^c	6E-2	Low	.. ^b	.. ^b	--
Anthracene	Oral, no effects observed, mouse.	3E+0 ^o	3E-1	Low	.. ^b	.. ^b	--
Arsenic	Oral, hyperpigmentation/keratosis, vascular complications, human.	3E-4 ^c	3E-4	Medium	.. ^b	.. ^b	--
Beryllium	Oral, no adverse effects, rat.	5E-3 ^c	5E-3	Low	.. ^b	.. ^b	--
Bis(2-ethylhexyl) Phthalate	Oral, liver, guinea pig.	.. ^b	2E-2	Medium	.. ^b	.. ^b	-
Chromium III	Oral, no effects, rat.	1E+1 ^o	1E+0	Low	.. ^b	.. ^b	--
Chromium VI	Oral, no effects, rat.	2E-2 ^c	5E-3	Low	.. ^b	.. ^b	--
Fluoranthene	Oral, kidney, liver, blood, mouse.	4E-1 ^c	4E-2	Low	.. ^b	.. ^b	--

TABLE 2-7

**SUMMARY OF REFERENCE DOSES RfD FOR
CHEMICALS OF POTENTIAL CONCERN WITH NONCARCINOGENIC EFFECTS^a**

Chemical	Route, Target Organ, Species	Oral Reference Dose			Inhalation Reference Dose		
		Subchronic RfD (mg/kg/day)	Chronic RfD (mg/kg/day)	Confidence Level	Subchronic RfD (mg/kg/day)	Chronic RfD (mg/kg/day)	Confidence Level
Fluorene	Oral, blood, mouse.	4E-1 ^c	4E-2	Low	.. ^b	.. ^b	--
Naphthalene	Oral, decreased weight, rat.	.. ^b	4E-2 ^f	--	.. ^b	.. ^b	--
Nickel	Oral, decreased body and organ weights, rat.	2E-2 ^c	2E-2	Medium	.. ^b	.. ^b	--
Pyrene	Oral, kidney effects, mouse.	3E-1 ^c	3E-2	Low	.. ^b	.. ^b	--
Tetrachloroethene	Oral, kidney, liver, rat	1E-1 ^c	1E-2	Low	.. ^b	.. ^b	--
Trichloroethene	Oral, liver, mouse.	.. ^b	6E-3 ^g	Low	.. ^b	.. ^b	--
Vanadium	Oral, no effects observed, rat.	7E-3 ^c	7E-3 ^c	--	.. ^b	.. ^b	--

^a Information from IRIS database unless otherwise indicated.

^b Toxicity value not available in IRIS or HEAST (1993).

^c HEAST 1993.

^d A risk assessment for this chemical is under review by an EPA work group.

^e HEAST 1992

^f ECAO (1993)

^g ECAO (1990)

TABLE 2-8

SUMMARY OF ESTIMATED CANCER RISKS
AND NON-CARCONGENIC HAZARD INDEXES

Receptor/Pathway	Average Exposure			Reasonable Maximum Exposure		
	Cancer Risk	Subchronic H.I.	Chronic H.I.	Cancer Risk	Subchronic H.I.	Chronic H.I.
Resident						
Child (0-6 years)						
Ingestion of Soil	1.19E-04	1.60E-01		2.59E-04	3.51E-01	
Resident Adult						
Ingestion of Soil	9.53E-06		1.08E-02	1.11E-04		4.73E-02
Inhalation of Soil Particulates	3.68E-07		0	3.58E-06		0
Dermal Contact with Surface Soil	1.83E-10		6.72E-04	4.18E-09		4.59E-03
Resident Adult Soil Total	1.00E-05		1.15E-02	1.15E-04		5.19E-02
Resident Child and Adult Soil Total	1.30E-04			3.70E-04		
Current On-Post Worker						
Ingestion of Soil	4.14E-06		8.44E-03	4.14E-05		1.69E-02
Inhalation of Soil Particulates	3.07E-07		0	2.13E-06		0
Dermal Contact with Soil Surface	2.74E-11		1.81E-04	6.85E-10		9.04E-04
Soil Total	4.45E-06		8.62E-03	4.35E-05		1.78E-02
Future Industrial Worker						
Ingestion of Soil	4.14E-06		8.44E-03	4.14E-05		1.69E-02
Inhalation of Soil Particulates	3.07E-07		0	2.13E-06		0
Dermal Contact with Surface Soil	2.74E-11		1.81E-04	6.85E-10		9.04E-04
Soil Total	4.45E-06		8.62E-03	4.35E-05		1.78E-02

Appendix C

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PUBLIC MEETING by the United States
Department of the Army concerning the Proposed Plan
for the Operable Unit, also known as the Y-Line
facility at the Louisiana Army Ammunition Plant,
beginning at 7:00 p.m. at the Minden Civic Center,
City Courtroom, Minden, Louisiana, on the 3rd day of
June, 1999.

APPEARANCES:

- MR. DOYLE WILLIAMS, Environmental Coordinator
for the Louisiana Army Ammunition Plant;
- MS. LAURI HAYNES, representing the Army
Environmental Center;
- MS. NADIA MILLER, with Engineering Technologies
Associates;
- MS. CAROLINE ZIGLER, United States
Environmental Protection Agency, Region 6;
- MR. DUANE WILSON, Louisiana Department of
Environmental Quality;
- MR. JAMES McPHERSON, Commander's
Representative, Louisiana Army Ammunition
Plant;
- MR. BILL SNIFFEN, Independent Contractor.

ORIGINAL

REPORTED BY
LEIGH G. WALKER, C.C.R.

1 MR. McPHERSON: The meeting tonight
2 was intended to invite public comment into our
3 decision making process in regard to contaminated
4 soil in one of the manufacturing areas at the
5 Louisiana Army Ammunition Plant, commonly referred
6 to as Y-Line. It's another part of the facility.

7 The 30-day comment period for the public to
8 participate in our decision making process with
9 regard to that soil contamination will expire
10 June 16th; 30 days will be up June 16th. So we had
11 hoped tonight to have public participation so that
12 we could educate, entertain questions, and we would
13 take all of the questions and comments, consider
14 those when we finalized our decision in regard to
15 that particular remedial action.

16 There's no public here, so I guess the public's
17 content for the Federal facilities agreement to go
18 on the way, and the three agencies in connection
19 with that, the Army, the EPA, and the LDEQ. So,
20 unless we receive some comments through the mail
21 before the comment period is over with, then we will
22 go on with our original decision.

23
24
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C E R T I F I C A T E

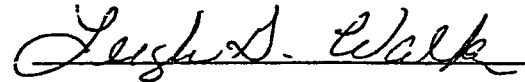
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STATE OF LOUISIANA:
PARISH OF CADDO :

I, Leigh G. Walker, Certified Court Reporter and Notary Public, do hereby certify that the foregoing proceedings were had before me, and that they were reported by me and this is a true and correct record of the proceedings.

I further certify that I am not of counsel or related to or employed by any of the parties to this cause or in any wise interested in the event thereof.

SUBSCRIBED AND SWORN TO on this the 6th day of June, 1999.



Leigh G. Walker, CCR