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Environment, Safety and Health
Office of Environmental Audit

Environmental Survey
Preliminary Report

Pantex Facility
Amarillo, Texas

September 1987

PREFACE
TO
THE DEPARTMENT OF ENERGY
PANTEX FACILITY
ENVIRONMENTAL SURVEY PRELIMINARY REPORT

This report contains the preliminary findings based on the first phase of an Environmental Survey at the Department of Energy (DOE) Pantex Facility, located near Amarillo, Texas. The Survey is being conducted by DOE's Office of Environment, Safety and Health.

The Pantex Facility Survey is a portion of the larger, comprehensive DOE Environmental Survey encompassing all major operating facilities of DOE. The DOE Environmental Survey is one of a series of initiatives announced on September 18, 1985, by Secretary John S. Herrington, to strengthen the environmental, safety and health programs and activities within DOE. The purpose of the Environmental Survey is to identify, via a "no-fault" baseline Survey of all the Department's major operating facilities, environmental problems and areas of environmental risk. The identified problem areas will be prioritized on a Department-wide basis in order of importance in 1988.

The findings in this report are subject to modification based on the results from the sampling and analysis phase of the Survey. The findings are also subject to modification based on comments from the Albuquerque Operations Office concerning the technical accuracy of the findings. The modified preliminary findings and any other appropriate changes will be incorporated into an Interim Report. The Interim Report will serve as the site-specific source for environmental information generated by the Survey, and ultimately as the primary source of information for the DOE-wide prioritization of environmental problems in the final Survey report.

September 1987
Washington, D.C.

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EXECUTIVE SUMMARY

Introduction

This report presents the preliminary findings from the first phase of the Environmental Survey of the United States Department of Energy (DOE) Pantex Facility, conducted November 3 through 14, 1986.

The Survey is being conducted by an interdisciplinary team of environmental specialists, led and managed by the Office of Environment, Safety and Health's Office of Environmental Audit. Individual team components are outside experts being supplied by a private contractor. The objective of the Survey is to identify environmental problems and areas of environmental risk associated with the Pantex Facility. The Survey covers all environmental media and all areas of environmental regulation. It is being performed in accordance with the DOE Environmental Survey Manual. The on-site phase of the Survey involves the review of existing site environmental data, observations of the operations carried on at the Pantex Facility, and interviews with site personnel.

The Survey team developed a Sampling and Analysis Plan to assist in further assessing certain of the environmental problems identified during its on-site activities. The Sampling and Analysis Plan will be executed by the Oak Ridge National Laboratory. When completed, the results will be incorporated into the Pantex Facility Environmental Survey Interim Report. The Interim Report will reflect the final determinations of the Survey for the Pantex Facility.

Site Description

The Pantex Facility is located on a 10,300-acre site in the Texas panhandle. An additional 3,200 acres is leased to provide a government-controlled safety and security zone on the south side of the facility. The facility is approximately 17 miles northeast of downtown Amarillo, Texas. It is operated by the Mason & Hanger - Silas Mason Company, Inc. (MHSM). The Sandia National Laboratory also operates a small department at Pantex. The main mission at Pantex is weapons assembly. The mission also entails explosives development, stockpile maintenance and testing, and weapons disposal. DOE and its predecessor agencies have been responsible for the site since 1951. Prior to DOE involvement in the site, the site and the adjoining leased property were part of a Department of War facility used from the early 1940's to 1947 for the production of conventional ordnances.

Few concerns were raised in meetings with Federal and State regulators. Rather, the regulators demonstrated an interest in understanding specific operations of the plant and suggested environmental processes (e.g., the wastewater collection system) upon which the Survey should focus. These areas are among those discussed in the report.

Summary of Findings

The major preliminary findings of the Environmental Survey for the Pantex Facility are:

- o ineffective waste segregation has resulted in instances of comingling and improper disposal of hazardous waste;
- o a lack of attention to drum and tank handling which has resulted in leaks in the past and has the potential for additional leaks in the future; and
- o based upon our interpretation of the requirements of the Resource Conservation and Recovery Act (RCRA) as they apply to certain waste streams, there are several instances where the site is treating and disposing of RCRA-regulated-and potentially-regulated wastes without appropriate regulatory authority.

Overall Conclusions

The Survey found no environmental problems at the Pantex Facility that represent an immediate threat to human life. The identified problems vary in terms of their magnitude and risk, as described in this report. Although the sampling and analysis performed by the Pantex Facility Survey will assist in further identifying environmental problems at the site, a complete understanding of the significance of some of the environmental problems identified requires a level of study and characterization that is beyond the scope of the Survey. Actions currently under way or planned at the site, particularly the Phase II activities of the Comprehensive Environmental Analysis and Response Program (CEARP) as developed and implemented by the Albuquerque Operations Office, will contribute toward meeting this requirement.

Transmittal of Results

The findings of the Environmental Survey for the Pantex Facility were shared with the DOE Albuquerque Operations Office, the DOE Amarillo Area Office, and MHSM at the Survey closeout briefing held on November 14, 1986. Since that time, informal coordination with the site and with representatives of the Albuquerque Operations Office have been ongoing in an effort to keep this report current. Those problems that involve extended studies and multiyear budget commitments will be the subject of the DOE-wide Environmental Survey final report and DOE-wide prioritization.

Within the Office of Environment, Safety and Health, the Office of Environmental Guidance and Compliance has immediate responsibility for monitoring environmental compliance and the status of the Pantex Facility Survey findings. The Office of Environmental Audit will continue to assess the environmental problems through the program of systematic environmental audits that will be initiated toward the conclusion of the DOE Environmental Survey in 1988.

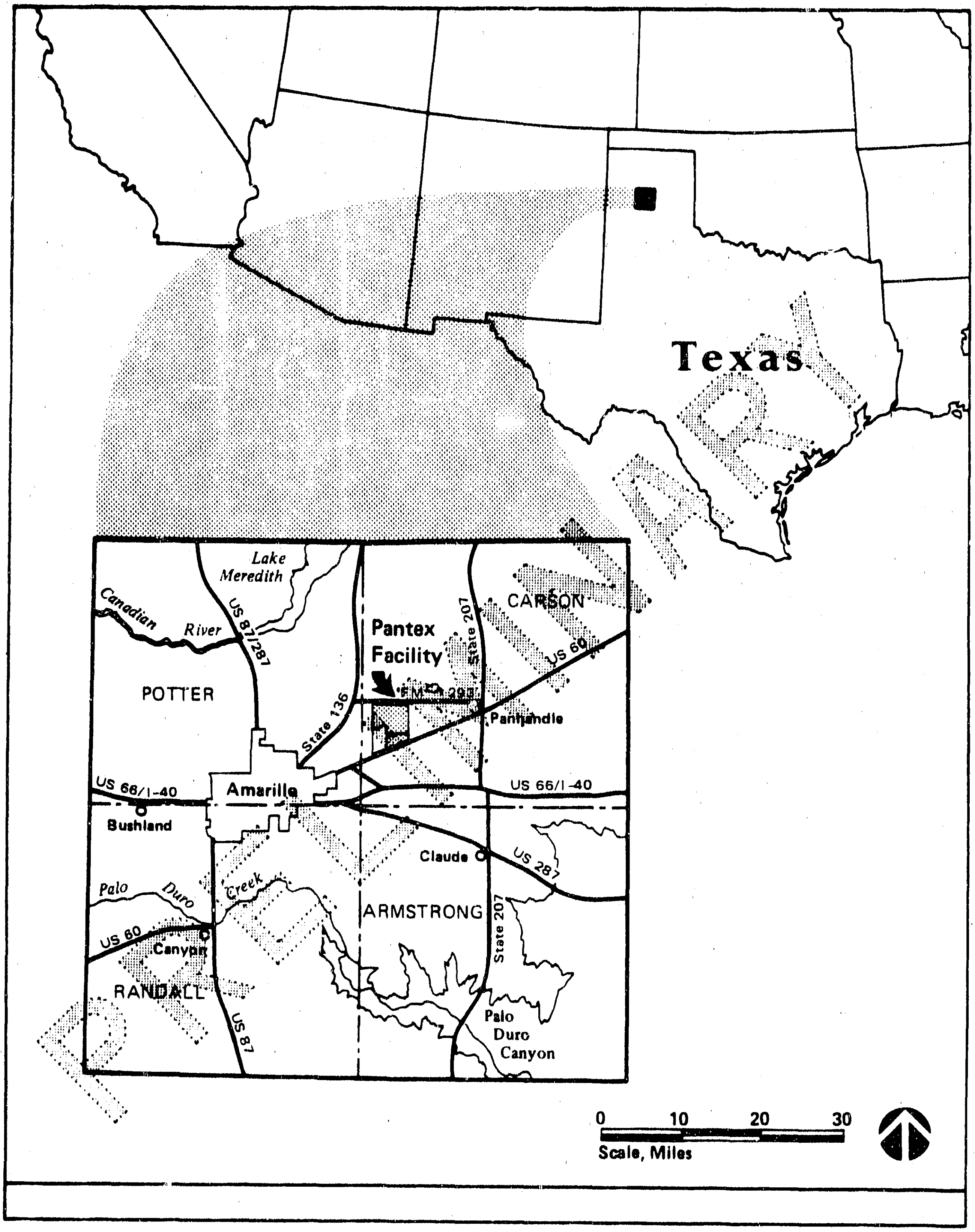
1.0 INTRODUCTION

The purpose of this report is to present the preliminary findings made during the Environmental Survey, November 3 through 14, 1986, at the Department of Energy's (DOE) Pantex Facility, Amarillo, Texas (Figure 1-1). The Mason & Hanger - Silas Mason Co., Inc., operates Pantex for DOE. Sandia National Laboratory also operates a small department at Pantex.

The Pantex Survey is part of the larger DOE-wide Environmental Survey effort announced by Secretary John S. Herrington on September 18, 1985. The purpose of this effort is to identify, via "no fault" baseline surveys, existing environmental problems and areas of environmental risk at DOE facilities, and to rank them on a DOE-wide basis. This ranking will enable DOE to more effectively establish priorities for addressing environmental problems and allocate the resources necessary to correct these problems. Because the Survey is "no fault" and is not an "audit," it is not designed to identify specific isolated incidents of noncompliance, or to analyze environmental management practices. Such incidents and/or management practices will, however, be used in the Survey as a means of identifying existing and potential environmental problems.

The Pantex Environmental Survey was conducted by a multidisciplinary team of technical specialists headed and managed by a Team Leader and Assistant Team Leader from DOE's Office of Environmental Audit. A complete list of the Pantex Survey participants and their affiliations is provided in Appendix A.

The Survey team focused on all environmental media, using Federal, state, and local environmental statutes and regulations, accepted industry practices, and professional judgment to make the preliminary findings included in this report. The team carried out its activities in accordance with the guidance and protocols of the Environmental Survey Manual (May 1986). Substantial use of existing information and of interviews with knowledgeable field office and site-contractor personnel accounted for a large part of the on-site effort. A summary of the site-specific Survey activities is presented in Appendix B.



LOCATION OF PANTEX FACILITY AND AMARILLO, TEXAS FIGURE 1-1

The preliminary Survey findings, in the form of existing and potential environmental problems, are presented in Sections 3.0 and 4.0. Section 3.0 includes those findings that pertain to a specific environmental medium (e.g., air or soil), whereas Section 4.0 includes those that are non-media specific (e.g., waste management, direct radiation, and quality assurance. Because the findings are highly varied in terms of magnitude, risk, and characterization, and consequently require different levels of management attention and response, they are further subdivided into four categories within Sections 3.0 and 4.0.

The criteria for placing a finding into one or more of the four categories are as follows:

- Category I includes only those findings which, based upon the information available to the Team Leader, involve immediate threat to human life. Findings of this type shall be immediately conveyed to the responsible Environmental Safety and Health personnel at the scene or in control of the facility or location in question for action. Category I findings are those environmental problems where the potential risk is highest, the confidence in the finding, based on the information available, is the strongest, and the appropriate response to the finding is the most restrictive in terms of alternatives.

- Category II findings encompass one or more of the following situations:

  - Multiple or continuing exceedances, past or present, of a health-based environmental standard where there is immediate potential for human population exposure, or a one-time exceedance where residual impacts pose an immediate potential for human population exposure.

  - Evidence that a health-based environmental standard may be exceeded, as discussed in the preceding situation, within the timeframe of the DOE-wide Survey.

  - Evidence that the likelihood is high for an unplanned release due to, for example, the condition or design of pollution abatement or monitoring equipment or other environmental management practices.

- Noncompliance with significant regulatory procedures, i.e., those substantive technical regulatory procedures designed to directly or indirectly minimize or prevent risks, such as inadequate monitoring or failure to obtain required permits.

o Category II findings include those environmental problems where the risk is high but where the definition of risk is broader than in Category I. The information available to the Team Leader is adequate to identify the problem but may be insufficient to fully characterize it. Finally, in this category, most discretion is available to the Operations Offices and Program Offices as to the appropriate response; however, the need for that response is such that management should not wait for the completion of the entire DOE-wide Survey to respond. Unlike Category I findings, a sufficient near-term response by the Operations Office may include further characterization prior to any action taken to rectify the situation.

o Category III findings encompass one or both of the following criteria:

- The existence of pollutants or hazardous materials in the air, water, groundwater, or soil resulting from DOE operations that pose or may pose a hazard to human health or the environment.

- The existence of conditions at a DOE facility that pose or may pose a hazard to human health or the environment.

Category III findings are those environmental problems for which the broadest definition of risk is used. As in Category II, the information available to the Team Leader may not be sufficient to fully characterize the problem. Under this category, the range of alternatives available for response, and the corresponding timeframes for response, are the greatest. Environmental problems included within this category will typically require lengthy investigation and remediation phases, as well as multi-year budget commitments. These problems will be included in the DOE-wide prioritization effort to ensure that DOE's limited resources are used effectively.

In general, the levels of pollutants or materials that constitute a hazard or potential for hazard are those that exceed some Federal, state, or local regulations for release of, contamination by, or exposure to such pollutants or materials. However, in some cases, the Survey may determine that the presence of some nonregulated material is in a concentration that presents a concern for local populations or the environment that is sufficient to be included as an environmental problem. Likewise, the presence of regulated materials in concentrations, even though below those established by regulatory authorities, that nevertheless present a potential for hazard or concern may be classified as an environmental problem. In general, however, conditions that meet regulatory or other requirements, where such exist, should not present a potential hazard and will not be identified as an environmental problem.

Conditions that pose or may pose a hazard are generally those which are violations of regulations or requirements (e.g., improper storage of hazardous chemicals in unsafe tanks). Such conditions present a potential hazardous threat to human health and the environment and should be identified as an environmental problem. Additionally, potentially hazardous conditions are those where the likelihood of the occurrence of release is high.

The definition of the term environmental problem is broad and flexible to allow for the wide differences among the DOE sites and operations. Therefore, a good deal of professional judgment must be applied to the identification of environmental problems.

- Category IV findings include instances of administrative noncompliance and management practices that are indirectly related to environmental risk, but are not appropriate for inclusion in Categories I-III. Such findings can be based upon any level of information available to the Team Leader, including direct observations by the team members. Findings in this category are generally expected to lend themselves to relatively simple, straightforward resolution without further evaluation or analysis. These findings, although not part of the DOE-wide prioritization effort, will be passed along to the Operations Offices and appropriate program office for appropriate action.

Based on the professional judgment of the Team Leader, the findings within the categories are arranged in order of relative significance. Comparing the relative significance of one finding to another, either between categories within a section, or within categories between sections, is neither appropriate nor valid. The categorization and listing of findings in order of significance within this report constitute only the first step in a multi-step, iterative process to prioritize DOE's problems.

The next phase of the Pantex Survey included sampling and analysis (S&A). Oak Ridge National Laboratory (ORNL), the S&A team for Pantex, collected samples over a 2-week period beginning in June 1987. Prior to sampling, an S&A plan was prepared by DOE and ORNL in accordance with the protocols in the Environmental Survey Manual. The S&A plan was designed to fill existing data gaps or weaknesses. The results generated by the S&A effort will be used to assist the Survey team in further defining the existence and extent of potential environmental problems identified during the Survey.

An Interim Report will be prepared 4 to 6 weeks after the completion of the S&A effort. The Interim Report will incorporate the results of the S&A effort as well as any changes or comments resulting from the review of the Preliminary Report. Based on the S&A results, the preliminary findings and observations made during the on-site Survey may be modified, deleted, or moved within or between categories. The Interim Report will serve both as the site-specific repository for information generated by the Survey, and ultimately as the site-specific source of information for the DOE-wide prioritization of environmental problems.

It is clear that certain of the findings and observations contained in this report, especially those in Category II, can and should be addressed in the near-term, i.e., prior to the DOE-wide prioritization effort. It is also clear that the findings and observations in this report vary greatly in terms of magnitude, risk, and characterization. Consequently, the priority, magnitude, and timeliness of near-term responses will require careful planning to ensure appropriate and effective application. The information in this Preliminary Report, albeit provisional, will assist the Albuquerque Operations Office (ALO) in the planning of these near-term responses.

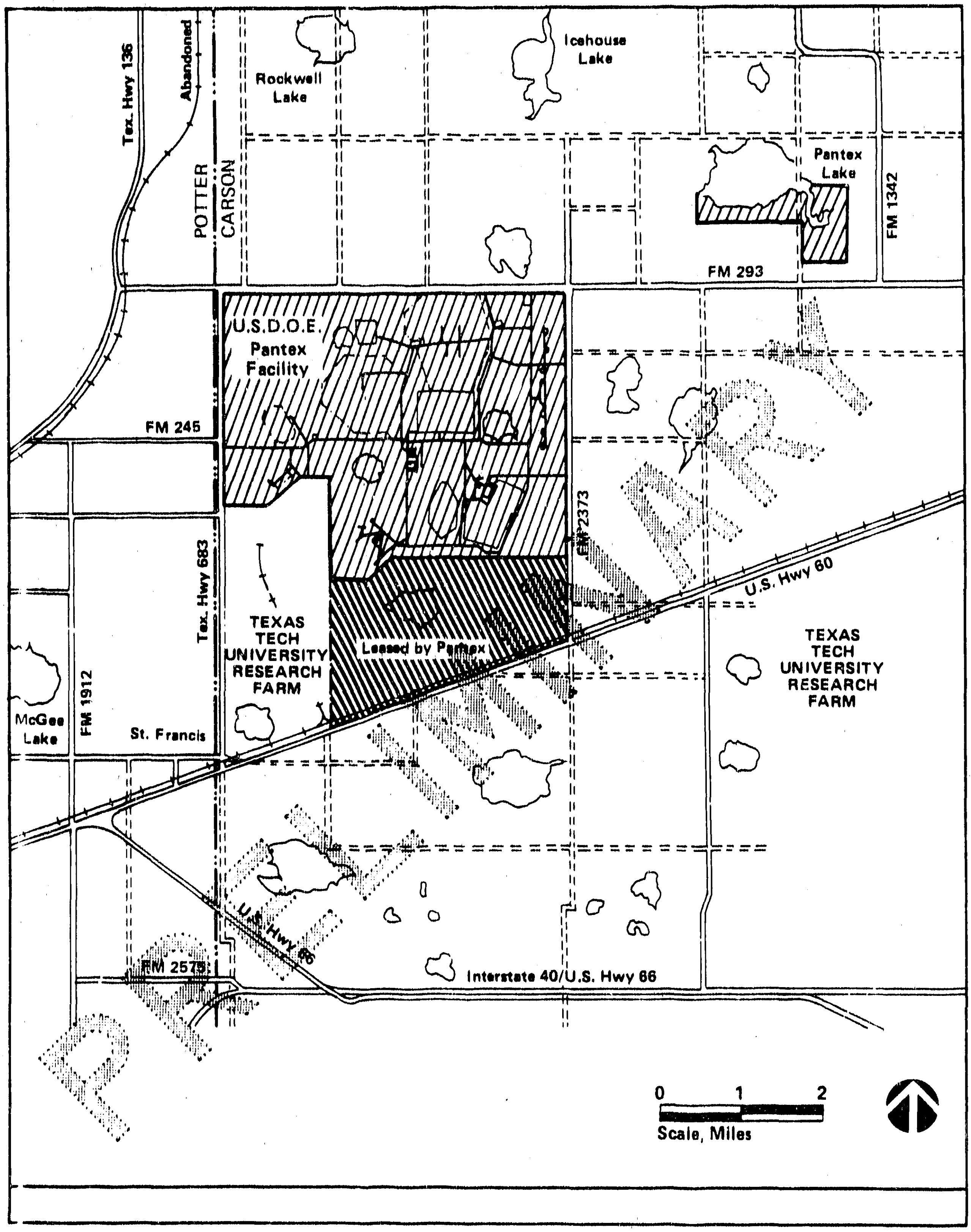
2.0 GENERAL SITE INFORMATION

2.1 Site Setting

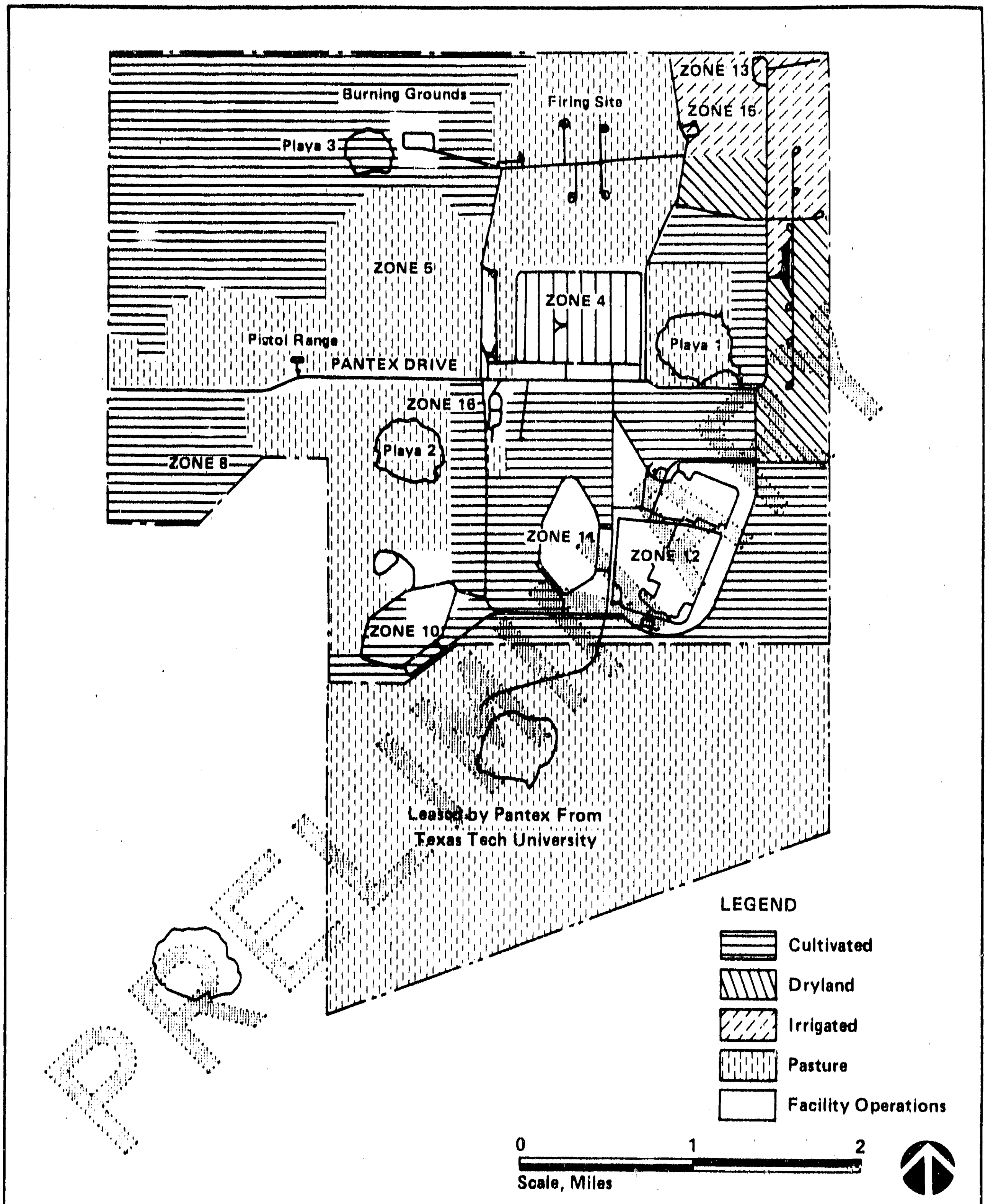
The Pantex Facility is approximately 17 miles northeast of downtown Amarillo, Texas, between U.S. Highway 60 on the south, Texas Farm-to-Market (FM) Road 293 on the north, FM 683 on the west, and FM 2373 on the east (see Figure 2-1). The facility is on a 10,300-acre portion of the former Pantex Army Ordnance Plant. The Pantex site was constructed in the first half of the 1940s by the U.S. Army for the production of conventional ordnance. At the end of World War II, the plant was deactivated and the property eventually reverted to the War Assets Administration. In 1949, the entire installation (approximately 16,000 acres) was sold to Texas Technological College for one dollar. The land was to be used for experimental farming, but was subject to recall under the National Security Clause. Following an extensive survey of World War II ordnance plants, the Pantex site was chosen in 1951 by the Atomic Energy Commission (AEC) for expansion of its nuclear weapons assembly facilities. The Army Ordnance Corps reclaimed the site for the AEC and contracted the Silas Mason Company to rehabilitate it.

The Pantex facility includes over 323 buildings containing 1,900,000 square feet of space, not counting ramps. Approximately 2000 acres are dedicated to facility operations; the remainder are used as security and safety buffer zones. About 3200 acres of adjoining land are leased from Texas Tech University (formerly Texas Technological College) to provide a Government-controlled safety and security zone on the south side of the facility. The buffer zones are used by Texas Tech University for agricultural research, and some acreage is leased for private farming (see Figure 2-2). An additional 1100 acres northeast of the facility provide supplemental water rights and include a lake formerly used for the disposal of sewage effluent.

All the land within a 3-mile radius of the plant site is used for agricultural purposes, either farming or grazing. There are about three dozen farm houses and the settlement of St. Francis, population about 30, within a 5-mile radius.



PANTEX FACILITY SITE AND VICINITY FIGURE 2-1



Source: Pantex Site Development Plan 1986

LAND USE OF PANTEX FACILITY

FIGURE 2-2

Approximately 255,000 people reside within a 50-mile radius of Pantex (see Figure 2-3). The closest town is Panhandle, Texas, population 2300, located 10 miles to the east. Amarillo, with a population of about 150,000, lies 17 miles to the southwest (Laseter, 1986a).

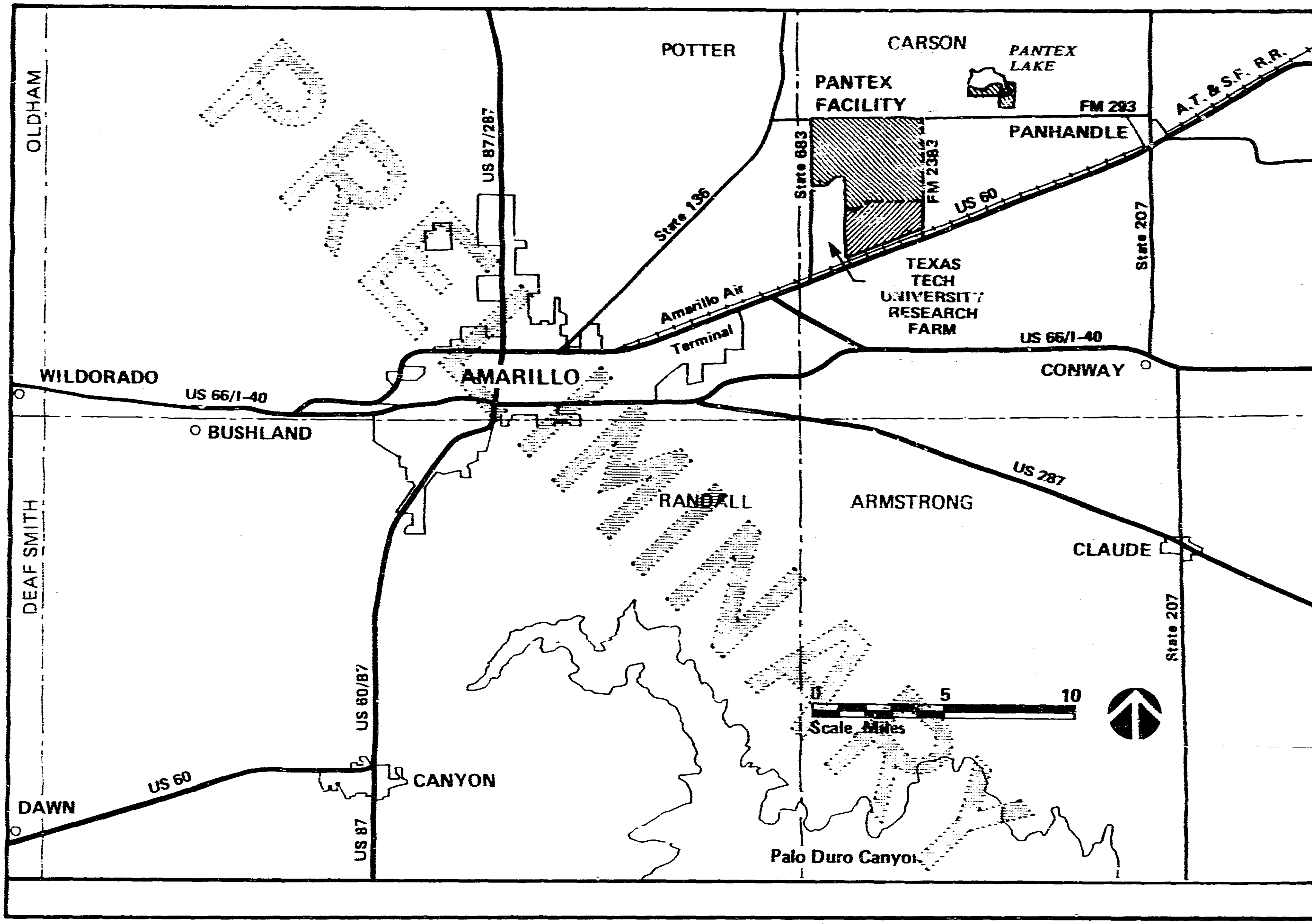
Pantex is in one of the more vulnerable tornado areas within the United States. The highest winds recorded have been in connection with thunderstorms, occasionally accompanied by hail, lighting, and rain. Local winds are predominantly from the south and southwest, and they attain an average speed of 13.7 miles per hour. The average annual rainfall is 20.28 inches, although as little as 9.56 inches and as much as 39.75 inches have been recorded. Thunderstorm activity from April through September account for three-fourths of the total annual precipitation. The annual winter snowfall is 14 inches, but snowfalls of 10 inches or more have occurred over a 2- or 3-day period under near blizzard conditions (ERDA, 1976).

2.2 Overview of Major Site Operations

The main mission of Pantex is the assembly and maintenance of nuclear weapons. Activities in support of the mission are conducted in portions of the facility referred to as zones. The major zones are shown in Figure 2-4.

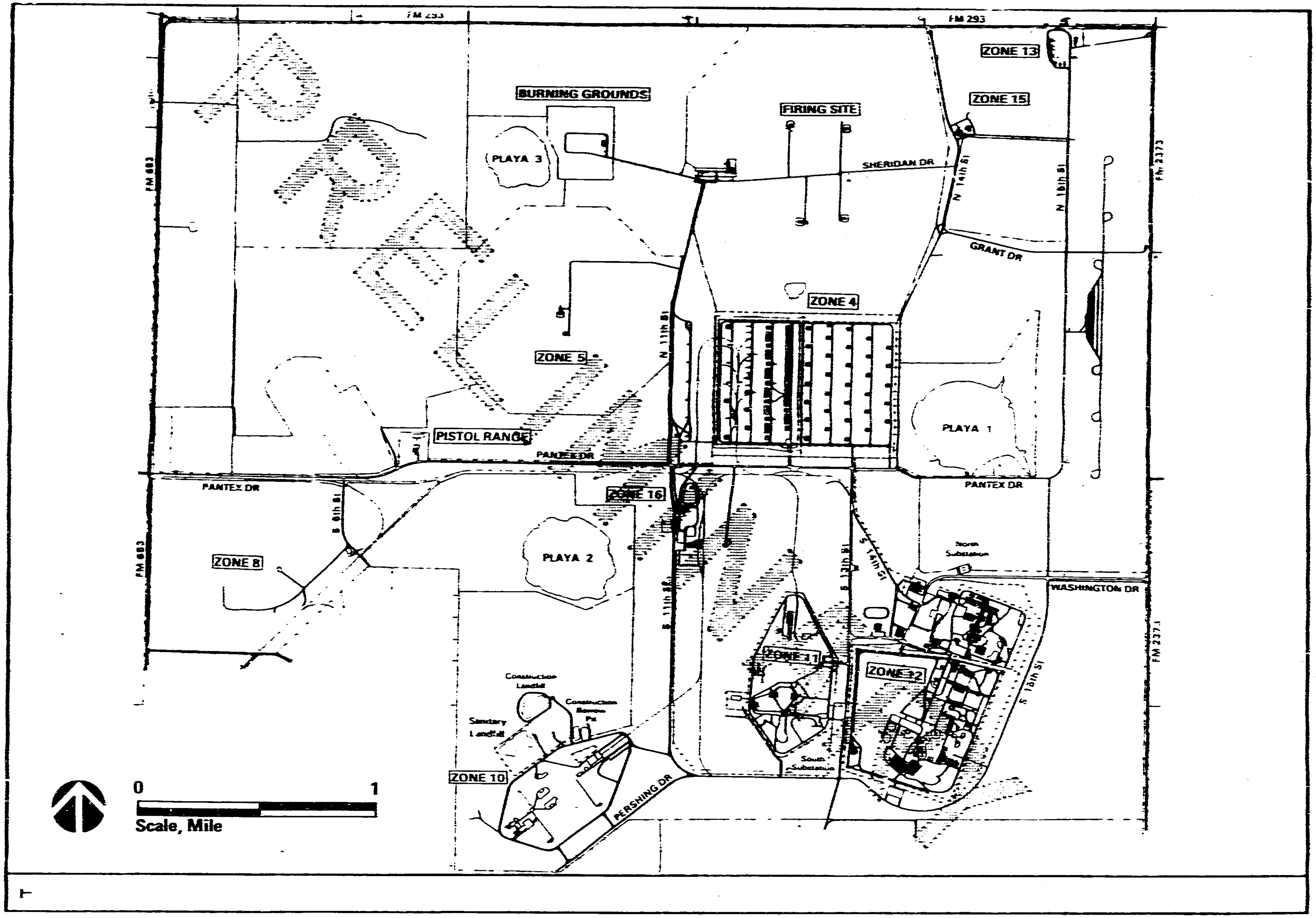
The mission of Pantex can be divided into several functions:

1. New-weapon production. High-explosive raw materials are received from private industry and the Holston Army Ammunition Plant. The materials are inspected, sampled, and, upon acceptance, prepared for compaction pressing into billets in Zone 12. The billets are inspected to ensure quality and safety, and they are X-rayed for any cavities or foreign matter. They also go through a series of machining operations and inspections to produce a finished, shaped charge. To ensure a quality product, samples of a lot are test-fired at the firing sites to determine if the desired explosive characteristics have been attained. The billet may require some subassembly preparation in Zone 12. Certain attachments may be made to the shaped charge prior to the mating of the high explosive to the nuclear material. Assembly of the high-explosive and



POPULATED AREAS NEAR LOCATION OF PANTEX FACILITY

FIGURE 2-3



OPERATIONAL ZONES OF PANTEX FACILITY

FIGURE 2-4

nuclear material is accomplished in a special containment cell within the materials access area (MAA) in Zone 12. The MAA is a highly restricted area where special nuclear materials are stored and assembled. Once the nuclear material and high-explosive components are encased, the assembly is moved into an assembly bay for installation of the fusing and firing components. Upon final acceptance by the DOE, the weapon is packaged and deployed to the staging area in Zone 4.

2. Stockpile maintenance. Weapons that require maintenance beyond the capability of the U.S. Department of Defense are returned to the Pantex Facility for maintenance and/or repair. Units returned may have been inadvertently damaged or may have become nonoperational. Upon arrival, the weapons are subject to receipt, inspection, and safety checks in Zone 12. Disassembly to the degree necessary to accomplish the maintenance and/or repair is performed. The weapon is then reassembled, tested, and returned to the staging area.

3. Stockpile and new-material testing. Weapons samples are randomly drawn from the stockpile or the production line for quality assurance testing and processed through the receipt, inspection, and safety checks. The weapon is then disassembled. The Pantex Facility performs surveillance testing of the physics package on behalf of Los Alamos and Lawrence Livermore National Laboratories.

   Electrical component testing at Pantex is executed by the Sandia Systems Test Laboratory located in Zone 12. Essentially, the laboratory simulates the conditions typical of a functioning weapon. Critical functions are measured and checked for conformity with design criteria, and the weapon is then reassembled. In cases of destructive testing, new material is used. Upon final acceptance, the weapon is returned to the staging area.

4. Stockpile and new-material flight tests. Weapons are randomly withdrawn from the stockpile or production line and are subjected to Pantex receipt, inspection, and safety checks. Upon acceptance, the weapon undergoes the amount of disassembly necessary for removal of the nuclear portion; the fusing and firing are not disturbed. The nuclear

material goes back into the production process. The nuclear portion of the weapon is replaced by an assembly that consists of a test bed and the instrumentation required for the test. The instrumentation package contains various telemetry devices for recording and transmitting critical weapon function data. Test flights are not conducted at Pantex.

5. Weapons disposal. Surplus or outmoded weapons are returned to the Pantex Facility; processed through receipt, inspection, and safety checks; and disassembled. Some limited evaluation work is performed to provide information on the older systems in the stockpile. All nuclear materials are returned to the DOE vendors who supplied them. High-explosives and high-explosive scrap are disposed of on-site at the burning grounds.

6. Explosives development. Pantex is also responsible for the synthesis and formulation of explosives and the physical property testing of adhesive and potting compound formulations. Instrumental analysis and compatibility study of weapon materials include the destructive and nondestructive testing of explosive components, devices, and systems. Explosive components are developed and evaluated for their sensitivity to unintended detonation.

Additional sources of support to the Pantex mission include the administrative offices in Zone 12, warehousing and landfill operations in Zone 10, a new sewage treatment plant in Zone 12 (the old plant in Zone 13 was operating at the time of the Survey), water wells and a water treatment plant in Zone 15, and a vehicle maintenance facility in Zone 16.

2.3 State and Federal Concerns

Members of the Survey team met with representatives of the U.S. Environmental Protection Agency (EPA), Region VI, and the State of Texas environmental agencies on September 19, 1986, as part of the pre-Survey information exchange. At this meeting, the team members requested that the Federal and state representatives identify and discuss their environmental concerns about the Pantex Facility so that these could be reviewed during the DOE Survey.

The EPA was interested in seeing the information that the Survey would gather on wastewater discharges, since the site had no National Pollutant Discharge Elimination System (NPDES) permit. Representatives of the EPA pointed out that Pantex does not discharge to a navigable waterway and thus needs no NPDES permit. However, there is a possibility that playas will be considered navigable waterways. If so, Pantex will be required to obtain an NPDES permit.

The state representatives posed several specific questions that they would like to be addressed during the Survey. These included the following:

- How effective is the wastewater collection system and the analysis of that system?

- How often is the Silver Bullet decontaminated? Could there be a build-up of contaminants inside the chamber?

- Is any lithium getting into the environment from any operation?

- What are the procedures for the decontamination and decommissioning (D&D) of old facilities? What are the record-keeping procedures for spills, and do these procedures allow for the tracking of D&D requirements?

The substantive concerns identified by the state and Federal regulatory agencies are addressed in this report.

3.0 MEDIA-SPECIFIC SURVEY FINDINGS

The discussions in this section pertain to existing or potential environmental problems in the air, soil, surface water, and groundwater. Included are a summary of the available background environmental information on each media, a description of the sources of pollution and techniques for pollution control, a review of the environmental monitoring programs specific to each medium, and a categorization and explanation of the medium-specific environmental problems identified by the Survey.

3.1 Air

3.1.1 Background Environmental Information

The air section describes the emissions to the atmosphere of radionuclides and other chemicals that are regulated or considered hazardous. The Pantex site is in the Amarillo-Lubbock Intrastate Air Quality Control Region (AQCR). That region (AQCR 211) is designated by the U.S. Environmental Protection Agency (EPA) as either attaining or unclassified for concentrations of total suspended particulates (TSP), nitrogen dioxide, sulfur dioxide, and carbon monoxide (40 CFR Part 81.344), relative to the National Ambient Air Quality Standards (NAAQS). Table 3-1 lists the NAAQS for these criteria pollutants, that is, the limits for the protection of public health (Primary Standards) and welfare (Secondary Standards) (40 CFR Part 50). These same limits have been adopted by the State of Texas (Texas Administrative Code, Title 31, Part III, Chapter 101). Radioactive and other applicable hazardous air emissions are regulated under the National Emission Standards for Hazardous Air Pollutants (NESHAP) (40 CFR Part 61). Texas also regulates the ambient concentration of inorganic fluoride compounds and beryllium (Texas Administrative Code, Title 31, Chapter 113). Table 3-1 provides the regulatory limits for these substances.

Radioactive materials discharged to the atmosphere at Pantex consist of small amounts of tritium, as well as some uranium-238 particles that may be emitted during the high explosives testing of parts with depleted uranium parts. Gaseous emissions of regulated and hazardous pollutants consist primarily of combustion products from the steam plant and from the burning or evaporation of wastes

TABLE 3-1

NATIONAL AND TEXAS STATE AMBIENT AIR QUALITY STANDARDS

Pollutant	Type of Standard	Averaging Time	Frequency Parameter	Concentration	
				µg/m3	ppm
Carbon monoxide	Primary and secondary[a]	1 hr 8 hr	Annual maximum[b]	40,000 10,000	35 9
Lead	Primary and secondary	Calendar quarter	Arithmetic mean	1.5	NA[c]
Nitrogen dioxide	Primary and secondary	1 yr	Arithmetic mean	100	0.05
Ozone	Primary and secondary	1 hr	Annual maximum[d]	235	0.12
Particulate matter	Primary	24 hr 1 yr	Annual maximum[b] Annual geometric mean	260 75	NA
	Secondary	24 hr 1 yr	Annual maximum[b] Annual geometric mean	150 60	NA
Sulfur dioxide	Primary	24 hr 1 yr	Annual maximum[b] Arithmetic mean	365 80	0.14 0.03
	Secondary	3 hr	Annual maximum[b]	1,300	0.5
Inorganic fluoride	Texas toxic	3 hr[d] 12 hr 24 hr 7 day 30 day	Emission limitation Annual maximum Annual maximum Annual maximum Annual maximum	4.5 3.5 2.7 1.5 0.8	.0060 .0045 .0035 .0020 .0010
Beryllium	Texas toxic	24 hr	Annual maximum	.01	NA

Source: U.S. EPA 1985 and Texas Air Control Board, 1986.

a. Primary standards are for protection of health; secondary standards are for protection of welfare.
b. Not to be exceeded more than once per year.
c. Not applicable to particulates suspended in air
d. Expected exceedance to be less than one day per year.
e. Concentration at property line of emission source.

contaminated with high-explosive material. Information on the general air quality and background radiation levels for the area around Pantex is presented below. This is followed by descriptions of the pollutant sources and the monitoring program for airborne emissions from Pantex.

3.1.1.1 Air Quality

The major air pollutant in the Amarillo area is suspended particulate matter from local activities such as plowing, feedlot operations, traffic on unpaved roads, and blowing dust. Major sources of air pollutants near the Pantex facility include the Harrington Generating Station, a coal-fired electric power generation facility operated by Southwestern Public Services Company, and an Iowa Beef Packers' (IBP) butchering plant. Harrington Station is a major source of emissions for carbon monoxide, nitrogen oxides, and sulfur oxides, but particulate emissions from the station are controlled. A source of noxious odors, the IBP plant is 10 kilometers (6 miles) southwest of the Pantex area. The Harrington station is located 17 kilometers (10 miles) west of the Pantex facility.

Tables 3-2 provides the most recent annual data on TSP, sulfur dioxide, and nitrogen oxides for regional monitoring stations near the Pantex facility. These data were collected at locations around population centers and, therefore, represent ambient air quality conditions in urban areas of the southwest, as opposed to conditions in more rural and undeveloped areas. The monitoring station closest to the site is in Amarillo, about 25 kilometers (16 miles) southwest of the site. Use of these data to define background air quality levels at the facility is likely to result in the overestimation of actual concentrations, because sources of air pollutants tend to be more concentrated in urban than in rural areas.

Atmospheric transport and dispersion depend on wind direction, wind speed, and atmospheric stability. Wind direction is predominantly from the south through southwest. Cold air masses from the north result in more northerly and westerly wind from November to March. Figure 3-1 presents the annual wind rose for Amarillo, as measured at the Amarillo airport over the 5-year period from 1976 through 1980.

TABLE 3-2

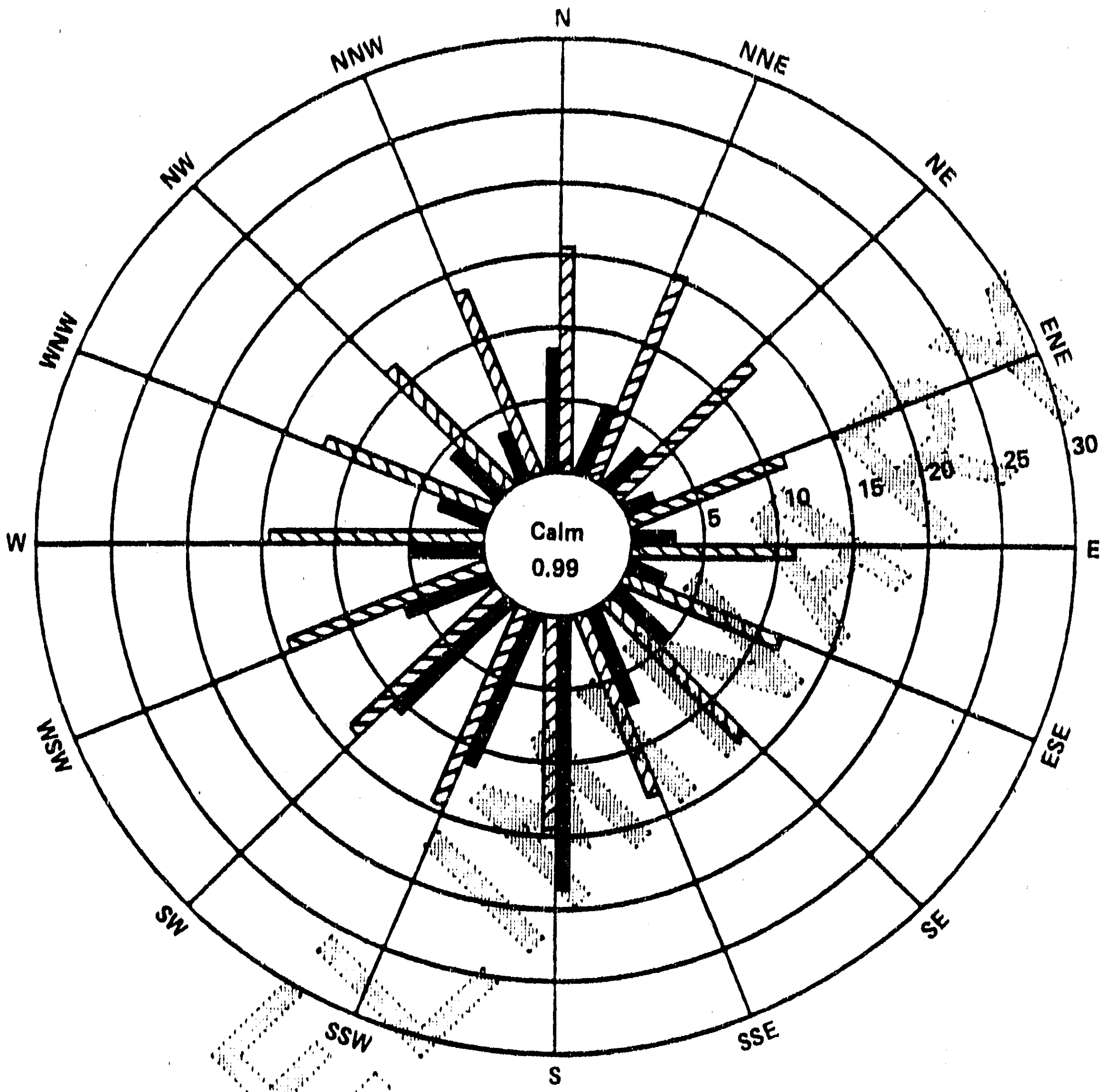
MOST RECENT REGIONAL AIR MONITORING DATA

Location	Site ID Number	1984 Total Suspended Particulates, ug/m3			1981 Sulfur Dioxide, ug/m3			1980 Nitrogen Oxides ug/m3		
		Highest 24-Hour Values[a]		Geometric Mean	Highest 24-hour Values		Annual Arithmetic Mean	Highest 24-hour Values		Annual Arithmetic Mean
		1st	2nd		1st	2nd		1st	2nd	
Amarillo, Texas	45 007 002 F01	175	169	48	22	21	8	67	51	23
Lubbock, Texas	45 334 0001 F01	390	283	71	17	17	8	72	43	20
Clovis, New Mexico	32 024 0002 F01	454	249	70[b]	-	-	-	-	-	-

Source: EPA, 1981a, 1982, 1985.

a. 1st = highest value; 2nd = second highest value.
b. Mean does not satisfy U.S. Environmental Protection Agency summary criteria, since it was not calculated with four valid quarters of data.

Source: EPA, 1981, 1982, 1985.



Period of Record 1/1/76 - 12/31/80

LEGEND
Wind Direction (%)
Wind Speed (mph)
Calm = Percent Calms
Note: To convert miles per hour to kilometers per hour, multiply by 1.6093

Source: NOAA, 1981.

ANNUAL WIND ROSE FOR AMARILLO, TEXAS FIGURE 3-1

Stability characteristics of the atmosphere can be described in terms of stability classes ranging from extremely unstable to extremely stable, as listed below:

Class A: Extremely Unstable
Class B: Moderately Unstable
Class C: Slightly Unstable
Class D: Neutral
Class E: Slightly Stable
Class F: Moderately to Extremely Stable.

Table 3-3 presents seasonal and annual distributions of atmospheric stability classes for the period 1976-1980 as measured at the Amarillo airport. Analysis of the dispersion climatology indicates that neutral stability and high wind speeds predominate in the area. Class F stability, an indicator of the potential for reduced dispersion at night, occurs only 5 percent of the time.

The potential vertical limit of pollutant dispersion is controlled by the depth of the mixing layer. That mixed layer develops during the day as a result of surface heating by the sun. In general, the higher the mixing level, the greater the dispersion potential. The early morning hours usually have the lowest mixing levels and wind speeds, hence the lowest dispersion potential. The annual average morning mixing level for Amarillo is 328 meters (1076 feet) and the annual average afternoon level is 1973 meters (6473 feet) (Holzworth, 1972).

Poor dispersion conditions that persist for several days, commonly known as "episodes," may result in a buildup of ambient ground-level concentrations. An episode is defined as the occurrence of mixing levels of less than 1500 meters (4921 feet) and wind speeds of less than 4 meters per second (9 miles per hour) on at least two consecutive days with no significant precipitation. In a 5-year period, only two episodes, totaling 4 episode days, were observed in Amarillo. The observations occurred in winter, when the average afternoon mixing level is at its seasonal minimum (Holzworth, 1972).

TABLE 3-3

ATMOSPHERIC STABILITY DISTRIBUTIONS (PERCENT) FOR AMARILLO, TEXAS (JANUARY 1, 1976, THROUGH DECEMBER 31, 1980)

Period	Stability Class					
	Unstable			Neutral	Stable	
	A	B	C	D	E	F
Winter	0.00	0.61	4.56	71.85	15.87	7.11
Spring	0.30	1.96	8.37	74.32	11.28	3.77
Summer	0.54	3.56	13.53	68.61	11.66	2.10
Fall	0.14	2.17	8.82	60.71	19.26	8.90
Annual	0.25	2.08	8.84	68.88	14.50	5.45

Source: NOAA, 1981.

Although meteorological conditions are continuously monitored at the Pantex site, no processed meteorological data were available at the time of the Survey. Site-specific data will be compiled in a microprocessor by 1988 or 1989. A 60-meter meteorological tower in the northeast corner of the site is instrumented at the 10- and 60-meter levels for the measurement of wind speed, wind direction, and temperature. A heated rain gauge and a pyranometer (a device for measuring solar radiation) are situated near the base of the tower.

3.1.1.2 Radiation

Worldwide background atmospheric radioactivity is composed largely of particulate fallout from past atmospheric nuclear weapons tests; natural radioactive constituents from the decay chains of thorium and uranium in dust, and materials resulting from interactions with cosmic radiation (e.g., natural tritiated water vapor produced by interactions of cosmic radiation and stable water).

The EPA determines airborne radiation levels at major cities throughout the United States as part of its program of monitoring for fallout from nuclear devices and other forms of radioactive contamination of the environment. The major focus of that program is trends in the accumulation of long-lived radionuclides in the environment. Agency monitoring stations closest to the Pantex facility are those in Austin and El Paso, Texas; Santa Fe, New Mexico; and Oklahoma City, Oklahoma. Table 3-4 reveals the 1985 average gross beta, uranium, plutonium, and gamma radiation levels at each of these cities. Measured ambient levels of uranium and plutonium are significantly less than the Derived Concentration Guide (DCG) values for off-site uranium-238 and for plutonium-239 of 1×10^5 and 2×10^4 attocuries per cubic meter, respectively, promulgated by the U.S. Department of Energy (DOE). (One attocurie equals 10^{-18} curies.) A DCG is the concentration of a radionuclide in air that results in a whole-body or organ dose equal to the DOE Radiation Protection Standard of 100 millirem per year above background.

The measured exposure rates from naturally occurring gamma radiation translate into annual dose rates of 128 and 76 millirem for Santa Fe and Oklahoma City, respectively, for full-time outdoor exposure.

TABLE 3-4
AVERAGE BACKGROUND CONCENTRATIONS OF RADIOACTIVITY IN ATMOSPHERE, 1985

Radioactive Constituent	Units[a]	Austin, TX	El Paso, TX	Santa Fe, NM	Oklahoma City, OK
Gross beta	pCi/m^3	0.01	0.015	0.01	0.01
Uranium -234, 235, 238	aCi/m^3	56	134	50	51
Plutonium - 238, 239	aCi/m^3	.03	2.3	.09	1.5
External gamma	uRem/hr	NA	NA	14.6	8.7

SOURCE: EPA Environmental Radiation Data Reports 41-45.
a. pCi, picocurie (10^{-12} curie); aCi, attocurie (10^{-18} curie; urem, microrem (10^{-6} rem).

There is very little variation in the background levels between the cities. However, El Paso appears to have slightly higher levels of uranium and plutonium than the other cities.

3.1.2 General Description of Pollution Sources and Controls

Since the Pantex facility is essentially an assembly plant rather than a chemical processing plant, the amounts of regulated pollutants are fairly small. The largest emissions of regulated pollutants come from the boiler houses in Zones 11 and 12 (Figure 2-4). The largest source of toxic and hazardous air emissions is an area called the burning grounds. Some uranium particles may be emitted during burning, during the destruction of retired weapons charges, and in the course of special test firings. Gaseous radioactive emissions are limited to small quantities of tritium that escape from shipping containers and from retired weapons undergoing disassembly. Additional information on these sources and their emissions is provided below.

3.1.2.1 Boiler Houses

The Zone 11 and 12 boiler houses contain three industrial-size boilers for steam production. All the boilers are fired by natural gas, and the number operating at one time depends on steam demand. The Zone 12 boiler house is approximately 35 years old; only two of the boilers are operable. A new boiler house, planned for construction within a few years, will require a construction permit from the Texas Air Control Board (TACB). It will be located between Zones 11 and 12 and will serve both zones. It will burn natural gas. Nitrogen oxides are the major pollutant of concern from burning natural gas. Nitrogen oxide emissions are a function of combustion temperature and combustion product cooling rate. Emission levels vary considerably with the type and size of the unit and with operating conditions. Generally, older boilers will not have the combustion air controls found in new boilers. Consequently the new boilers are expected to have lower emission rates than those currently in operation. Stack testing of emissions from the current boilers is not required by Texas air regulations, and no testing has been conducted on the Pantex boiler stacks. Calculations based on fuel consumption indicate the emissions for 1985 were 16 tons of nitrogen oxides and 4 tons of carbon monoxide (Laseter, 1986a). Calculated ambient concentrations from boiler operations are well below any applicable NAAQS (DOE, 1983).

3.1.2.2 Burning Grounds

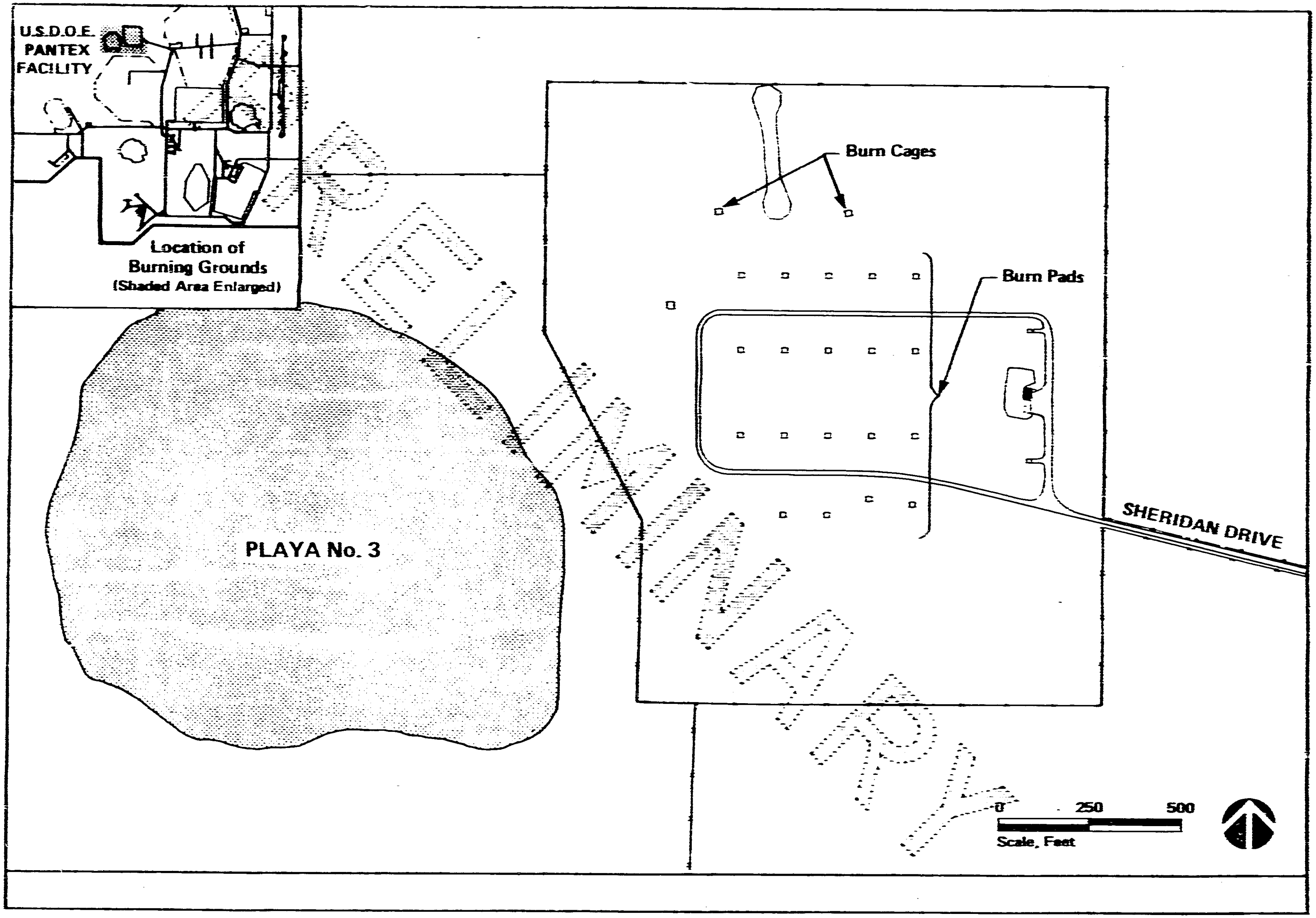
The burning grounds, located in the northwest section of the facility, contain several burning pads and racks for waste explosives, two burn cages, and three evaporation pans (Figure 3-2). Materials and solvents potentially contaminated with high explosives (HE) are incinerated in the burn cages or evaporated from the pans, respectively.

Burning Pads and Racks

Permission for open-air burning of waste high-explosive material has been granted by the Texas Air Control Board (Bradford, 1976). Waste HE pieces are arrayed on burning pads at the burning grounds with straw that is used to sustain the fire. Most of the HE material is burned in 2 to 5 minutes, but smoke may last for 15 to 30 minutes. Two types of high explosives, Baratol and Boracitol, do not burn completely during normal burning operations. To sustain the burning, the remains from the first burn of these explosives would be piled on old railroad ties, and the ties set afire. The ties burned for 2 to 3 hours, and the Baratol or Boracitol burned and/or smoldered for several days (Macdonell and Dewart, 1982).

During 1985, an estimated 77,000 kilograms (170,000 pounds) of waste high explosives were burned. The amounts and types of such materials to be burned each year will depend on the specific programs in operation during the year. For the period 1981 through 1985, the amount of high explosives burned annually averaged an estimated 103,000 kilograms (227,000 pounds) (Laseter, 1982a, 1983, 1984, 1985, 1986a).

Potential emissions and airborne concentrations from the burning of high explosives have been evaluated for the five most prominent explosives burned during 1981: LX-10, PBX-9502, Baratol, Comp B-3, and Cyclotol (Macdonell and Dewart, 1982). The results indicate potential emissions of hydrogen cyanide (HCN), hydrogen chloride (HCl), hydrogen fluoride (HF), and barium oxide.



LOCATION OF BURNING GROUNDS

FIGURE 3-2

Hydrogen fluoride may be emitted from the burning of certain plastic-bonded explosives. Pantex administrative controls limit the amount of certain HF-producing explosives that may be burned at one time (Laseter, 1982b). These limits are based on calculations for six wind direction segments, and are intended to avoid exceedance of the Texas HF emission standard at the property line in any of the segments.

When certain weapons are retired, the high-explosive components must be separated from the surrounding metal liner or parts. The burning racks are designed to separate the metal liner from the high explosives as the high explosives burn. Before separation, a very small amount of the liner may vaporize, releasing uranium oxide to the atmosphere. Burns are restricted to a maximum of 500 grams of uranium in the metal components per burn. The metal parts are recovered after the burn. Field measurements of uranium emitted during HE burns indicate that less than 0.2 microcurie is released per year (Laseter, 1982c). Uranium oxide is hazardous as an airborne toxic metal as well as a source of radiation. Additional uranium oxide may be released from Firing Site 5, which is described below. Pantex monitors the air concentration of uranium on and around the site (see Section 3.1.3) but reports the results in terms of radioactivity. However, the toxicity of these emissions can be evaluated based on the reported radioactivity levels. Based on the annual average radioactivity level of uranium measured at Pantex, a calculated equivalent uranium mass concentration is 1.07×10^{-7} milligram per cubic meter. This concentration is well below the toxicological exposure limit for uranium of 0.2 milligram per cubic meter for an 8-hour time-weighted average (ACGIH, 1986).

<u>Burning Cages</u>

The burning cages are steel-framed enclosures with steel grating on four sides and the roof. The grating allows unobstructed air flow into the fire and unobstructed emission of combustion products. The cages are cubes the sides of which are approximately 16 feet in length.

Potentially HE-contaminated wastes are loaded into the cages and doused with fuel oil before being ignited. Although open burning of wastes is restricted in Texas, Pantex interprets the Texas grant of authority to burn waste high-explosive material to include essentially all waste from Zones 11 and 12 that could possibly be contaminated with high explosives without regard to the probability of actual high-explosives contamination or the concentration of the high explosives should there be such contamination.

Approximately 6000 pounds of HE-contaminated waste are generated per month. The high explosives constitute less than 1 percent by weight of this waste and are in the form of residual amounts on rags, paper towels, labware, etc. The waste can be broken down as follows (El Dorado Engineering, Inc., 1986):

Waste Class	Percentage
Paper wastes: paper towels, wrapping paper, cardboard	62
Plastics: styrofoam, bubble-pack, labware, syringes	22
Wire: insulated electrical wire and cable	8
Cloth: canvas, nylon (parachutes)	3
Miscellaneous waste: rubber gloves, foam	5

No evaluation has been made of the potential emissions from the open burning of these wastes. However, the wastes are usually burned only twice a week, and the emissions are unlikely to cause ambient air quality standards to be exceeded off-site. Combustion of plastics, nylon, and rubber items, however, may produce some toxic compounds, although their expected concentrations would be quite low.

Evaporation Pans

Waste organic solvents are evaporated to the atmosphere at the burning grounds because the solvents may contain trace amounts of high explosives. The waste solvent mixture is placed in one of three steel tanks, each of which has a surface area of approximately 50 square feet. The rate at which the solvents evaporate varies depending on the weather conditions and characteristics of the particular solvents. When the organic solvents have evaporated, any residual waste high explosives in the tank are burned. Quantities of specific solvent compounds evaporated will vary from year to year with program changes. From 1981 through 1985, the volume of mixed solvents evaporated annually averaged 29,000 liters (7660 gallons) (Laseter, 1982a, 1983, 1984, 1985, 1986a). The types of solvents used have been consistent for several years. Table 3-5 presents the composition of a typical waste solvent mixture. A similar mixture was modeled to evaluate the short-term (24-hour) solvent vapor concentrations. Results of dispersion modeling indicate that concentrations of waste organic solvent vapor do not exceed 1 part per million (ppm) off-site, even during unfavorable weather conditions (Macdonell and Dewart, 1982). No adverse health effects would be expected from exposures to these concentrations. There are no applicable EPA or Texas air standards for these solvents.

Future Contaminated Waste Processor System

An incinerator has been designed for the burning grounds that would replace the open burning in the burning cages and much of the solvent evaporation (El Dorado Engineering, Inc., 1986). The incinerator would burn all the HE-contaminated wastes currently being burned, plus additional classified wastes such as publications, printed material, and miscellaneous devices that are currently being buried on-site. Although the incinerator will have a cyclone and a baghouse to remove particulates from the exhaust gas, the present plans do not include a fume scrubber. A scrubber will be required if solvents composed of, or containing, significant concentrations of chlorine are to be burned legally in a permitted hazardous waste incinerator. Since the process generating the waste toluene and methyl ethyl ketone (MEK) may contain as much as 5 percent chlorinated compounds, these solvents will not be incinerated. The toluene will be recovered in an evaporative still, but the MEK will continue to be evaporated at the burning grounds. With the startup of the incinerator, total emissions of toxic compounds from the burning grounds are expected to decrease due to the controlled high-temperature burning (1600-1800°F) and the particulate controls on the exhaust.

TABLE 3-5

TYPICAL WASTE SOLVENT MIXTURE FOR FUTURE INCINERATOR

Material	Qty gal/yr	% by vol.	Formula	Qty lbs/yr	% by wt
Toluene	3,416	35	$C_6H_5CH_3$	24,700	34.8
Acetone	2,017	21	CH_3COCH_3	13,300	18.7
Water	1,750	18	H_2O	14,600	20.6
Tetrahydrofuran	1,306	13	$OCH_2CH_2CH_2CH_2$	8,700	12.3
Methanol	590	6	CH_3OH	3,900	5.5
Dimethylformamide	418	4	$HCON(CH_3)2$	3,300	4.7
Methyl Ethyl Ketone	225	2	$C_2H_5COCH_3$	1,500	2.1
Ethanol	111	11	C_2H_5OH	700	1.0
Others	46	<0.5	--	300	0.4
Annual Total	9,879	100	--	71,000	100
Benzene	Trace		C_6H_6	Trace	
Cyclohexane	Trace		C_6H_{12}	Trace	
Dichloroethane	Trace		CH_2ClCH_2Cl	Trace	
Ethyl acetate	Trace		$CH_3COOC_2H_5$	Trace	
Methyl Isobutyl Ketone	Trace		$CH_3COCH_2CH(CH_3)_2$	Trace	
Pyridine	Trace		$CH<(CHCH0_2>N$	Trace	
Cyclohexanone	Trace		$C_6H_{10}O$	Trace	

Source: El Dorado Engineering, 1986

3.1.2.3 Firing Sites

The test firing sites are located in the northern section of the Pantex Facility (see Figure 2-4). High-explosive test firings are performed for quality assurance testing of weapons explosives and components. The types and amounts of high explosives tested will vary with program requirements, but 1000 to 2000 pounds per year is a typical amount, with most test shots using less than 10 pounds (Macdonell and Dewart, 1982). The primary detonation products are water vapor, carbon dioxide, nitrogen or nitrogen oxides, and carbon particulates. Small amounts of other compounds may also be emitted, including fluorinated compounds. Airborne concentrations of these compounds have been estimated at less than 1 part per billion (ppb) for the closest plant boundary and the main operations area (Macdonell and Dewart, 1982). Estimates of peak concentrations indicate that no ambient air standard or occupational exposure limits would be exceeded.

Some of the test shots at Firing Site 5 included uranium metal parts. Although these test firings were as frequent as several times a week during the 1970s, during the past few years there has been, on average, only one shot per year involving depleted uranium. These test firings determined the hydrodynamic behavior of simulated weapon components in combination with the high explosives. Uranium depleted in the isotope uranium-235, which leaves mostly uranium-238, was used as the heavy metal to simulate the shock properties of the plutonium components. The explosion released approximately 5 percent of the uranium as fine particles, which were dispersed downwind from the firing site. The largest particles settled near the firing site, but the settled particles may have become resuspended during dry and windy conditions. Measurements of the uranium concentration in the smoke plume indicated that concentrations at the property line were less than 57 nanograms per cubic meter for a 40-minute sample (Buhl et al., 1982). Since the test shots occur infrequently over the course of a year, their impact on the annual concentration is low, and the annual concentrations are well below the uranium mass equivalent concentration of the DCG value of approximately 300 nanograms per cubic meter (Stern, 1986). Estimated emission rates for uranium-238 from test firings, burning operations, and the resuspension of particulates have been on the order of 10 to 20 microcuries per year for the period 1981 through 1985 (Laseter, 1982a, 1983, 1984, 1985, 1986a).

At the Total Containment Test Fire Facility of Firing Site 23, small explosive devices containing beryllium and depleted uranium are tested in a containment chamber. The facility consists of a control bunker, the test fire containment chamber, and a particulate filtering system. The chamber prevents the dispersal of the uranium and beryllium to the atmosphere by containing the explosive blast and resulting dust. Only a few test shots (four to eight) are planned for any one year. The filtering system consists of pressure reducing valves, a prefilter, and two high-efficiency particulate air (HEPA) filters. Immediately after the test shot, the high pressure is allowed to bleed off through the filters. When the pressure is reduced, the valves are adjusted to permit a steady release of the explosion's gases at low pressure to the filters. The next day, a fan exhaust sweeps clean air through the chambers and through the filters. During the venting period, ambient air particulate samples are collected around the test chamber. The samples from past tests were analyzed for beryllium and uranium, and the results were at or below the detection limit of the analytical method.

3.1.2.4 Tritium Emissions

Small quantities of tritium are released occasionally when shipping drums are opened. Residual tritium is present sometimes in air in packaging drums, and it inadvertently enters the atmosphere. A second source of tritium is the quality assurance section of the plant, where components containing tritium are tested. According to measurements made by Pantex personnel, estimated releases of tritium from 1981 through 1985 range from 0.1 to 120 millicuries per year (Laseter, 1982a, 1983, 1984, 1985, 1986a).

3.1.2.5 Radiation Exposure Calculations

An estimation of the overall impact to the public from routine activities is made each year by modeling the radioactivity release rates with local meteorological data. Based on the specific operations conducted during a year, estimates are made at Pantex of the types and total amounts of radioactive material dispersed annually. Estimated releases for 1985 included 10 microcuries of depleted uranium and 0.12 curie of tritium (Laseter, 1986a). These releases are considered ground-level releases since the materials were released from buildings without stacks or from the firing sites. Average wind speeds and directional frequencies for each of 16 compass directions are determined from the National Weather Service data from Amarillo for the corresponding year. Population estimates are based on figures presented in the 1980 Census of Population and Housing for each city, town, and county within an 80-kilometer (50-mile) radius of Pantex.

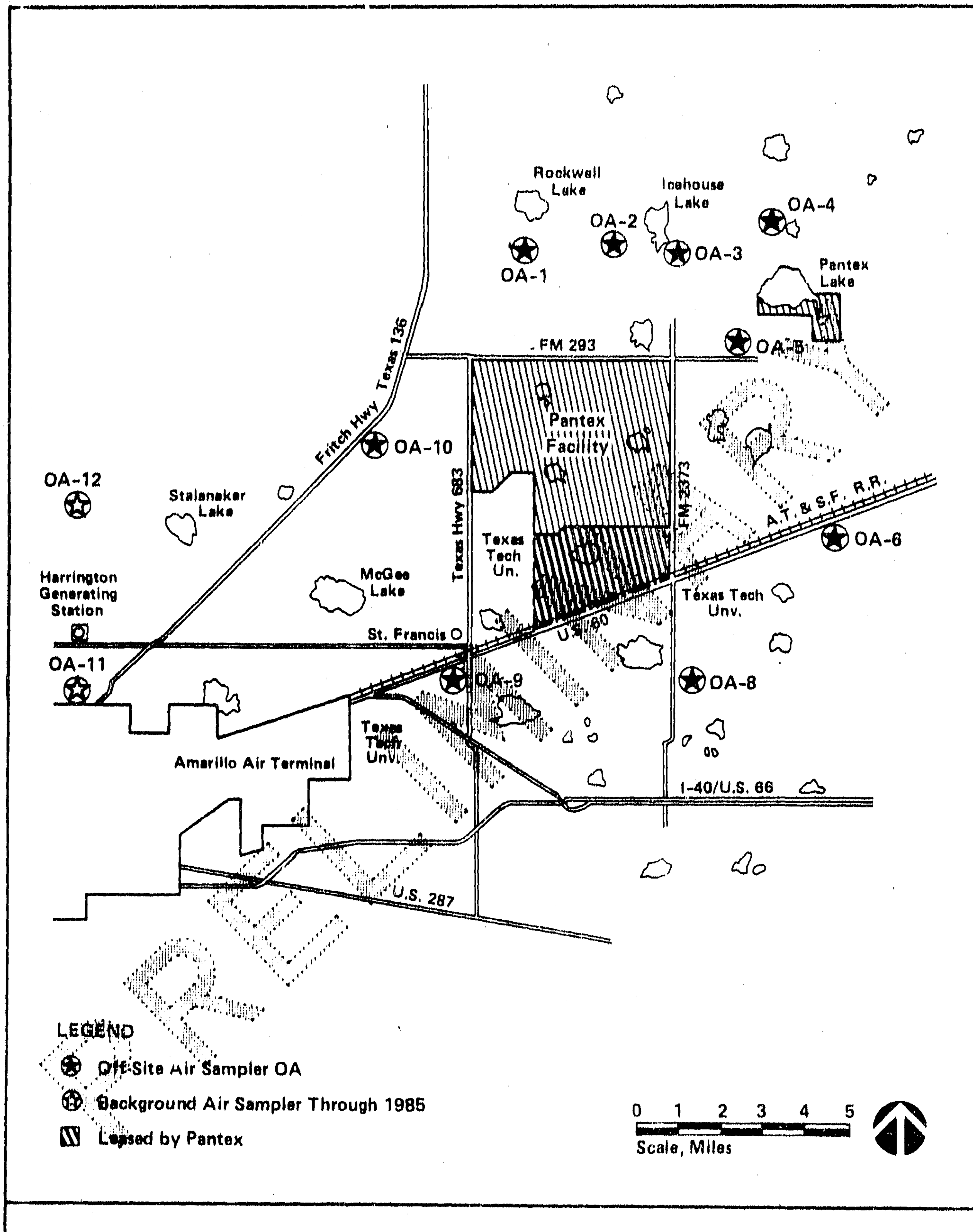
Through 1985, calculations of airborne concentrations of releases from Pantex were performed with the Climatological Dispersion Model (CDM) developed by the EPA. However, for demonstrating compliance with the NESHAP dose limit (40 CFR 61), the EPA requires the use of the computer code AIRDOS-EPA. At the time of the Survey, Pantex personnel were making arrangements to obtain the AIRDOS-EPA model.

Airborne releases of radioactivity are evaluated by calculating the doses received by the public. The doses from the air pathway of exposure and any other applicable routes of exposure are integrated to determine a total dose estimate. These doses are then compared with applicable EPA and DOE standards. The process of dose assessment at Pantex is described in Section 4.3.

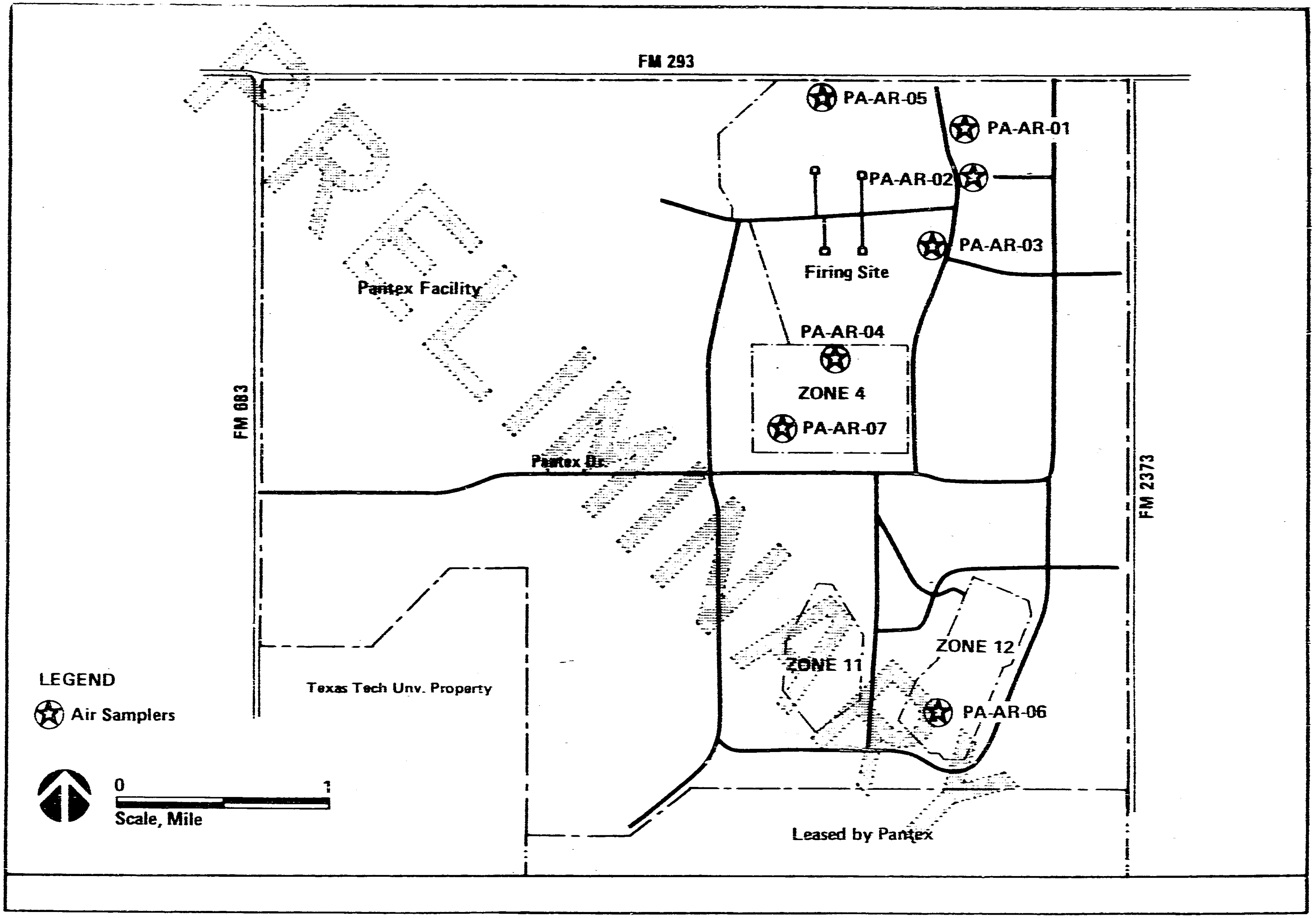
3.1.3 Environmental Monitoring Program

Air samples are collected at 16 locations around the Pantex Facility. Seven sampling stations are within the site boundaries and nine are located around the facility on approximately a 5-mile radius. Figure 3-3 shows the off-site air sampling locations, and Figure 3-4 shows the on-site sampling locations. Additionally, background samples are collected at the U.S. Department of Agriculture (USDA) Bushland Research Station, which is about 20 kilometers (12 miles) west of central Amarillo, and at two locations west and southwest of Pantex near Lakeside Drive between Pantex and Harrington Station through 1985.

Except for the background stations, each location contains a high-volume (Hi-Vol) and a low-volume (Lo-Vol) air sampler. The Bushland Research Station has only a Hi-Vol sampler. Through 1985, only Lo-Vol samples were collected at the other two background locations near Harrington Station. These two stations are no longer operating. The Hi-Vol samplers operate at a sampling rate of approximately



OFF-SITE AIR SAMPLING LOCATIONS FIGURE 3-3



ON-SITE AIR SAMPLING LOCATIONS

FIGURE 3-4

1.1 cubic meters per minute (40 cubic feet per minute). The nominal air flow in the Lo-Vols is 0.0425 cubic meter per minute (1.5 cubic feet per minute). In the Hi-Vol, particles are collected on an 8- by 10-inch filter. The filters are collected weekly, but they are combined into a bimonthly sample with other filters from the same sampling station. These samples are then sent to a commercial laboratory for total uranium and plutonium-239 analysis. Each Hi-Vol has an electronic flow controller that adjusts the power to the motor to compensate for restricted air flow due to loading on the filter and for changes in ambient air temperature and pressure. However, there are no meters or gauges on the electronic controller to indicate actual sampling rate, nor are there any other devices for tracking sampling time or sampling rate. During the survey, 6 of the 18 samplers stopped operating during a 3-day period of heavy rain.

The Lo-Vol samplers employ a particulate filter and a silica gel column in the sampling line. The silica gel is for collection of ambient tritiated water vapor (HTO). The silica gel, acting as a desiccant, removes water vapor from the air stream. Any tritiated vapor present is captured with the water vapor and recovered for analysis. Silica gel columns are exchanged weekly with the air filters. Silica gel samples are analyzed by an outside laboratory, Controls for Environmental Programs (CEP), in Santa Fe, New Mexico, to determine tritium content. The 47-millimeter particulate filters are analyzed at Pantex for gross alpha and gross beta activity. The RADeCO sampling pumps, model HD28B, contain a flow meter, a vacuum gauge, a pump pressure head gauge, and an elapsed-time meter. No information is collected from these gauges or the timer when the samples are changed.

Table 3-6 presents a summary of the 1985 results for airborne uranium, plutonium-239, and tritium. The data indicate that there are no significant differences between on-site and off-site air concentrations. Measured concentrations of plutonium, uranium, and tritium have been consistently well below the DOE off-site DCG values, which are listed in the footnotes to the table.

3.1.4 Findings

3.1.4.1 Category I

There are no Category I findings for air.

TABLE 3-6

SUMMARY OF PANTEX ATMOSPHERIC MONITORING DATA FOR 1985

Offsite Sample Location	No. of Samples	Plutonium - 239	Total Uranium	Tritium
		Average uCi/ml (10^{-17})	Average uCi/ml (10^{-16})	Average uCi/ml (10^{-12})
OA-AR-01	6	0.20 ± 0.16	0.27 ± 0.19	<0.30 ± 4.58
OA-AR-02	6	0.21 ± 0.15	0.27 ± 0.19	0.48 ± 5.16
OA-AR-03	5	0.57 ± 0.27	0.22 ± 0.21	1.19 ± 4.13
OA-AR-04	6	0.09 ± 0.08	0.37 ± 0.20	<0.30 ± 5.34
OA-AR-05	6	0.91 ± 0.32	0.23 ± 0.19	0.5 ± 5.24
OA-AR-06	6	0.38 ± 0.24	0.31 ± 0.16	<0.30 ± 4.18
OA-AR-08	6	0.62 ± 0.32	0.37 ± 0.21	<0.30 ± 4.95
OA-AR-09	6	0.26 ± 0.23	0.61 ± 0.23	<0.30 ± 4.31
OA-AR-10	6	0.06 ± 0.09	0.46 ± 0.21	0.05 ± 4.42
On-site Locations				
PA-AR-01	6	0.24 ± 0.22	0.48 ± 0.22	<0.30 ± 4.10
PA-AR-02	6	0.13 ± 0.12	0.37 ± 0.19	<0.30 ± 4.24
PA-AR-03	6	0.25 ± 0.17	0.59 ± 0.21	<0.30 ± 4.38
PA-AR-04	6	0.32 ± 0.20	0.43 ± 0.21	<0.30 ± 4.10
PA-AR-05	6	0.35 ± 0.20	0.31 ± 0.17	0.07 ± 4.27
PA-AR-06	6	0.15 ± 0.19	0.30 ± 0.18	0.27 ± 4.49
PA-AR-07	6	0.05 ± 0.08	0.25 ± 0.18	<0.30 ± 4.38
Control Locations				
OA-AR-11	17	--	--	<0.30 ± 2.98
OA-AR-12	18	--	--	0.84 ± 2.88
OA-AR-13	6	0.00 ± 0.02	0.58 ± 0.23	--

Minimum Detectable Limits = 1×10^{-17} uCi/ml for Plutonium - 239, 5×10^{-18} uCi/ml for Uranium, and 3×10^{-13} uCi/ml for Tritium.
Derived Concentration Guide for members of the public = 2×10^{-14} uCi/ml for Plutonium, 1×10^{-13} uCi/ml for Uranium, and 2×10^{-7} uCi/ml for Tritium.
Radioactivity Concentration Guide for controlled areas = 2×10^{-12} uCi/ml for Plutonium, 7×10^{-11} uCi/ml for Uranium, and 5×10^{-6} uCi/ml for Tritium.

Reported errors are counting errors at the 95% confidence level.

Source: Laseter, 1986a.

3.1.4.2 Category II

There are no Category II findings for air.

3.1.4.3 Category III

1) Potential for toxic air pollutant contamination of grazing lands and cattle - Emissions of hydrogen fluoride from burning operations may be harmful to cattle grazing on and near the northern portion of the plant property. The high explosives and the HE-contaminated waste burned at the burning grounds may emit small quantities of hydrogen fluoride and possibly hydrogen cyanide and barium oxide. These toxic compounds may be deposited on, or absorbed into, the pasture grass or soil downwind from the burning grounds and then eaten by cattle. If deposited on the soil, the compounds may migrate through the soil to the roots of the plants and then be absorbed into the edible part of the plant. Fluorides in particular can cause softening of the bones and teeth in cattle. Since the prevailing wind is from the south through the southwest, the majority of the smoke plumes will be blown toward the north through northeast. A grazing field begins just north of the burning grounds, approximately 300 feet from the burning cages and 700 feet from the burning pads.

The amounts and types of toxic pollutants formed from the burning of high-explosives will depend on the types of high explosives. Hydrogen fluoride and other fluoride compounds may be formed when high explosives formed with a plastic binder--i.e., the PBX and LX types--are burned. Hydrogen cyanide may be formed from the burning of some of the PBX mixtures as well, and burning Baratol may produce barium oxide (Macdonell and Dewart, 1982). The amount of each type of high explosive burned in 1 year depends on the programs being conducted. Records are maintained for estimates of the total amount of high explosives burned per week, but none are kept on the amount of each type of high explosive burned. Although the toxic pollutants constitute a small percentage of the possible emissions from the burning of high explosives, they may accumulate in the pasture grass at significant concentrations over the length of the growing season or over several years.

Texas air regulations limit the concentrations of fluorides in the air and in cattle forage. Ambient air concentrations of fluorides (measured as hydrogen fluoride) are limited to 6 ppb average over a 3-hour period at the property line of the emitters (Texas Administrative Code, Title 31, Chapter 113). This standard is designed to ensure that vegetation is not exposed to air concentrations that could lead to accumulations of fluorides that would be toxic to the vegetation or to cattle that eat the vegetation. Calculations were made by Pantex for the maximum amount of high explosives that could be burned and still meet the property line limit of 6 ppb. Maximum quantities were determined for each HE type commonly burned and for six wind sectors. Based on observations of burning practices and smoke plumes during the Survey, the calculations appear to be conservative; that is, the burn quantities are smaller than necessary to ensure that the emission limit is not exceeded. However, no documentation for the calculations was available for review during the Survey; hence the suitability of the calculations could not be confirmed. Additionally, there appears to be some confusion over the time limit that is to be applied to the maximum amounts of high explosives burned. The memorandum listing the limits implies a mass limit per each 3-hour period (to coincide with the regulation), while burning ground personnel thought the burn limits were per hour, and the person who calculated the limits thought they were per day. In terms of actual operations, these interpretations may be significant, since most burning takes place over a few hours on any one day, and the emission limit is for a 3-hour average. The confusion over the burn limits creates the potential for exceeding the Texas emission limit at the property line. Regardless of the assumptions behind, and the confusion over, the HE burn limitations, cattle are grazed within the site boundary and near the burning operations while the HE burn limits are based on achieving the required conditions at the site boundary.

The second part of the Texas regulations on fluoride emissions limits the concentration of fluorides in forage to

- o An average of 40 ppm from 12 consecutive monthly samples
- o An average of 60 ppm from 3 consecutive monthly samples
- o An average of 80 ppm from 2 consecutive monthly samples

Although Pantex collects and analyzes the vegetation samples, there are no on-site samples collected directly downwind from the burning grounds, and those samples that are collected are not analyzed for fluorides. During the sampling and analysis phase of the Survey, the forage and grass in the grazing areas will be sampled for fluorides to provide information on the concentration of inorganic fluorides in forage. Since the burning of the high explosives may have produced a buildup of barium and cyanides in the soil and forage over the years, the forage will be analyzed for these ions as well to ensure that it is not toxic to cattle.

3.1.4.4 Category IV

1) Air monitoring data are of unknown accuracy - Reported airborne concentrations of plutonium, uranium, tritium, gross alpha, and gross beta are of unknown accuracy and, because of the lack of documentation, are not defensible. Since the monitoring data are not used to calculate off-site concentrations of radioactivity and exposures of the general public, the lack of data on accuracy does not affect the assessment of environmental risk from Pantex operations. However, the air data presented in the annual reports may be in error due to the inattention to sampling accuracy. The problem of unknown accuracy is not considered so serious that it would lead to concentrations exceeding the Radioactivity Concentration Guides for controlled areas or the DCG values for members of the public for air.

The weekly ambient air samples are collected without any documentation of sampling time and sample flow rate from which the sampled air volume is determined. The Hi-Vol sampling equipment does not provide any indication of flow rate or elapsed sampling time. These samplers are prone to stoppage due to power failures during bad weather and to worn-out motor brushes. There is no preventive maintenance program that would reduce the number of samples affected by motor brush wearout. Although the samplers are equipped with an electronics module for regulating the sampler air flow to a constant rate as the filter becomes loaded with dust, the flow rate is checked only when there is an obvious problem with the electronics; it is not checked or calibrated when a motor is replaced, or on any regular schedule. Therefore, neither the flow rate nor the sampling time can be guaranteed for any Hi-Vol sample, and the resulting sample volume and sampled contaminant concentration are of unknown accuracy.

Although the low-volume samplers are equipped with both a flow indicator and an elapsed-time meter, no data are recorded when samples are changed. The low-volume samplers do not have the reliability problem that the Hi-Vol samplers have, but the assumption of a constant sampling rate and time for each sample is a bad practice when the actual data are so readily obtainable.

Additionally, the air drawn through the low-volume sample collectors inside the sampling shelter is not representative of ambient conditions. The small louvers on the side of the shelter allow an exchange of air for cooling the equipment, but they do not guarantee a representative flow of air through the shelter, especially in low-wind conditions. Instead of sampling ambient air, the low-volume samplers are probably recirculating a major portion of the air inside the shelter since both sample intake and exhaust are inside the shelter. Thus, the tritium measurements are probably not representative of true ambient concentrations. Additionally, a large proportion of the dust particles collected on the filter may come from resuspended dirt from the bottom of the shelters. Each shelter has approximately a quarter inch of dirt in it. Filter analyses for alpha and beta probably reflect the radioactivity in the shelter dirt rather than in the ambient air.

2) <u>Pantex has no air sampling program quality control</u> - There are no quality control checks on the air sampling program to provide basic data on the precision and accuracy of the sampling methods. Although the laboratories performing the filter analyses can provide such information on the mass analyses for the filters, the information is not sufficient for determining the quality of the complete sampling program. Typically, Hi-Vol sampling programs collect duplicate samples at one location every few days for determining precision. Accuracy is assessed by checking the flow rate of some samplers with a different calibration device than the one used for routine calibrations. This flow-rate check is normally conducted quarterly by a person or agency other than the one responsible for the operation of the sampling program.

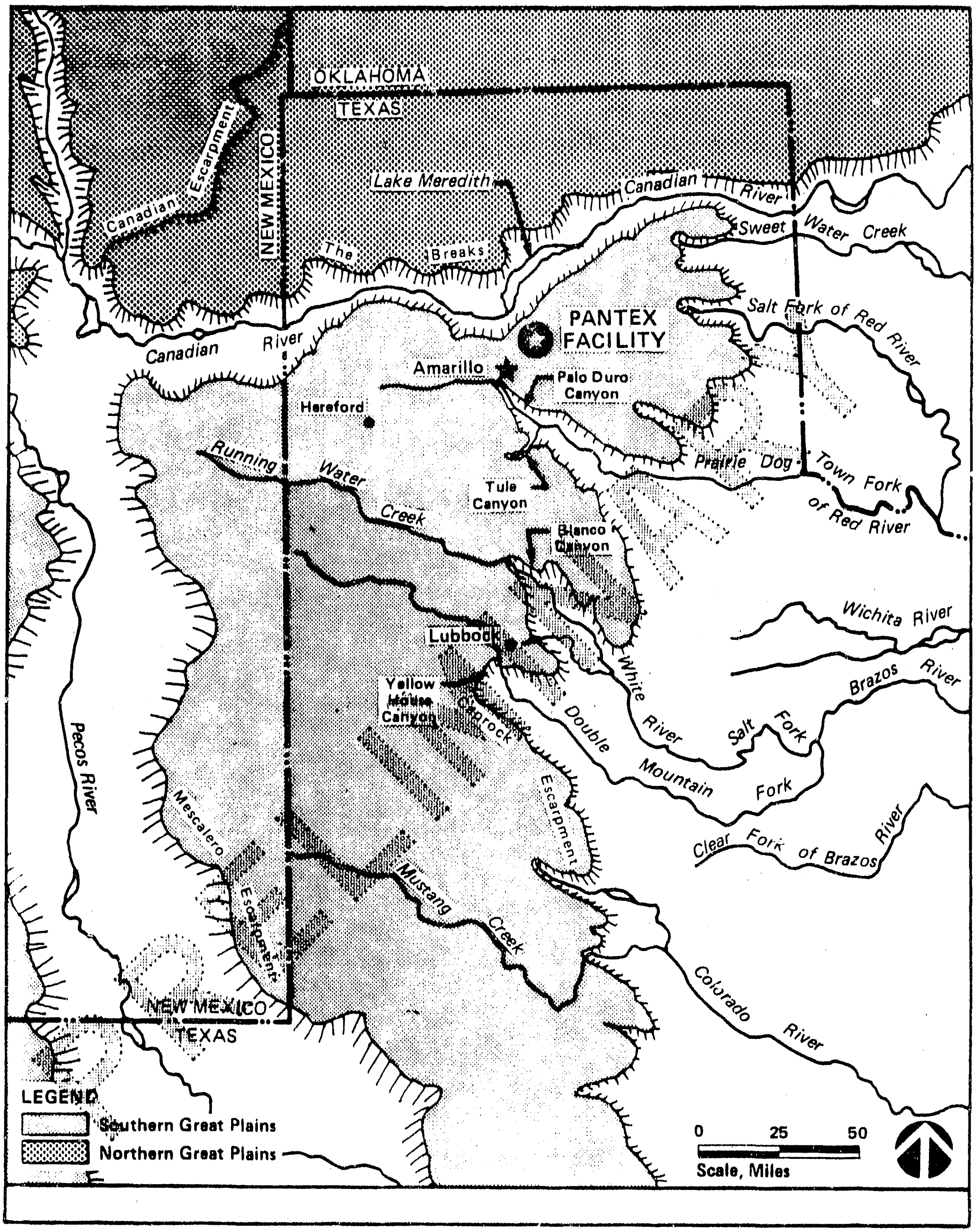
3) <u>Pantex does not comply with the Texas requirement for monitoring of fluorides</u> - The section on measuring and monitoring under the Texas air regulations for fluoride (Texas Administrative Code, Title 31, Section 113.9(b)(2)) requires the owner or operator of a source of fluoride compounds to ". . . conduct such sampling and exercise such control as is necessary to assure that the emissions that are made do not exceed [6 ppb per 3 hours] . . . and that the emissions from the property do not exceed [3.5 ppb per 3 hours] more than three times during any 12-month period." Although Pantex collects airborne particulate samples downwind from the burning grounds, these samples are not analyzed for fluoride. Consequently, there are no data available on fluoride concentrations (or any other toxic compounds except uranium and plutonium) by which to assess the impact of the burning ground emissions on the nearby pasture or the cattle that graze there (see related finding in Section 3.1.4.3).

3.2 Soil

3.2.1 Background Environmental Information

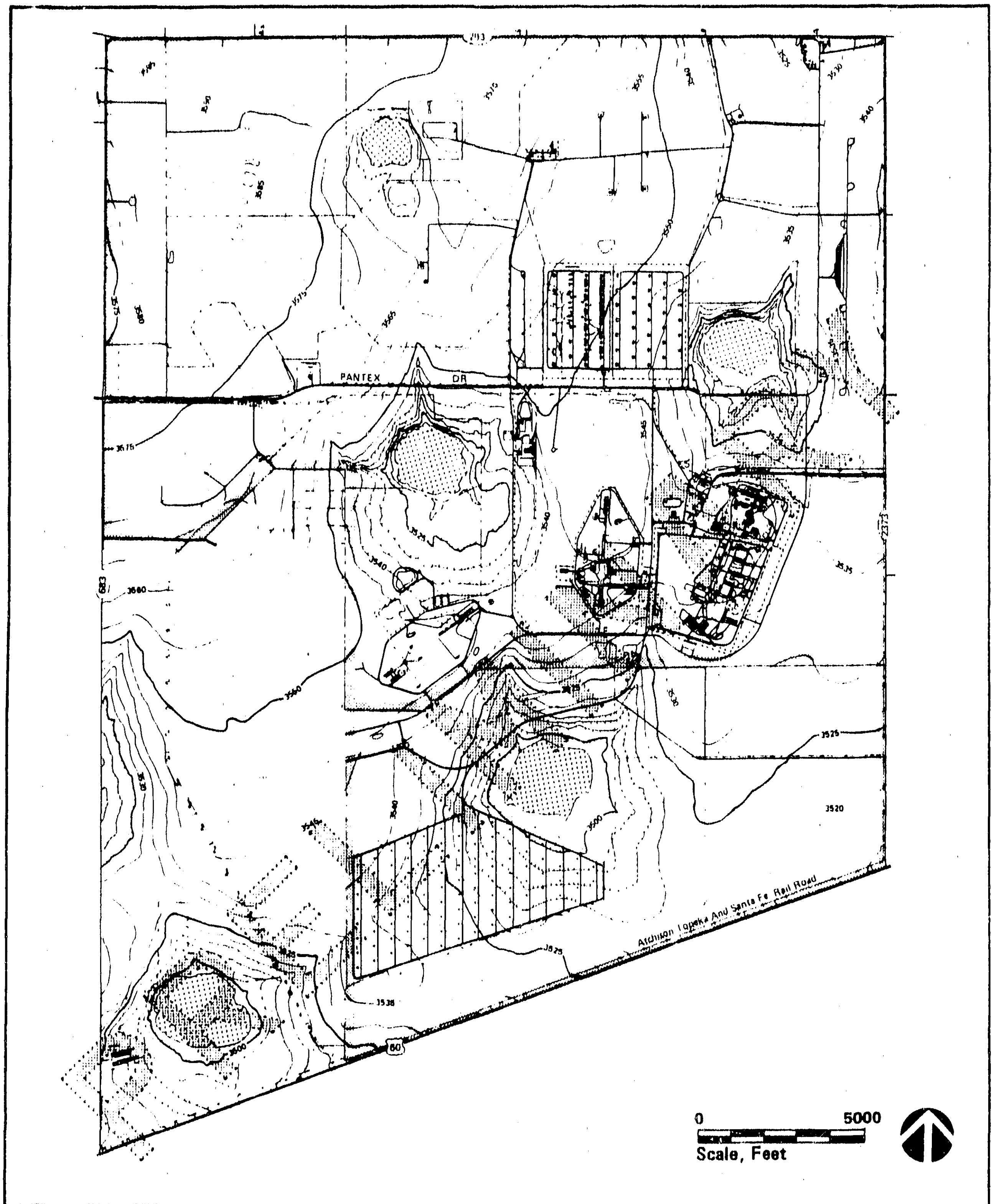
The Pantex Facility is located in Carson County, Texas, on the Southern High Plains. The High Plains, which includes most of the Texas Panhandle, is part of the Great Plains, the largest, most uniform, and most fertile mass of land in North America. It is a nearly featureless strip about 200 to 500 miles wide paralleling the eastern side of the Rocky Mountains. The upland surface of the High Plains is a nearly level to gently sloping plain which is irregularly pitted by many depressions or "playas" (natural dry land lakes). In Carson County, most of the High Plains consists of uniform, deep, moderately fine textured, fertile soils. The remainder consists of soils formed in the bottoms of playas and of scattered, calcareous soils. Figure 3-5 shows the physical features of the region. The elevation of the Pantex Facility is approximately 3550 feet. The ground surface at the facility is quite level, with slopes varying from a 10-foot drop in 4000 feet to a 10-foot drop in 500 feet near each of the playa basins (Figure 3-6). The entire area gradually slopes downward to the southeast.

The finely textured, easily eroded soils of the Pullman series predominate at the Pantex Facility (Figure 3-7). This series consists of dark grayish-brown, deep, loamy, and very slowly permeable soils that have dark-brown clay subsoil. Pullman soils formed in fine-textured, calcareous sediments that probably originated from loess or other windblown material. They have little or no relief except where they surround intermittent lakes or playas. Their permeability ranges from 0.05 to 0.5 inch per hour. Also in evidence at Pantex are soils of the Randall and Ulysses series and small patches of Lofton series soils. The Randall series consists of dark-grey, very poorly drained, clayey soils in depressions or low playa bottoms. These soils are deep and generally consist of massive, noncalcareous clay. They formed from sediment washed from the surface of the surrounding soils within the individual playa watershed. Randall soils have a permeability from 0.05 to 0.3 inch per hour. The Ulysses series consists of well-drained, youthful soils that are calcareous and loamy. These grayish-brown soils formed mainly in loessal High Plains deposits. Their permeability ranges from 0.5 to 0.9 inch per hour. The Los Alamos National Laboratory (LANL) performed some soil (surface and subsurface)



PHYSIOGRAPHIC FEATURES OF REGION SURROUNDING PANTEX FACILITY

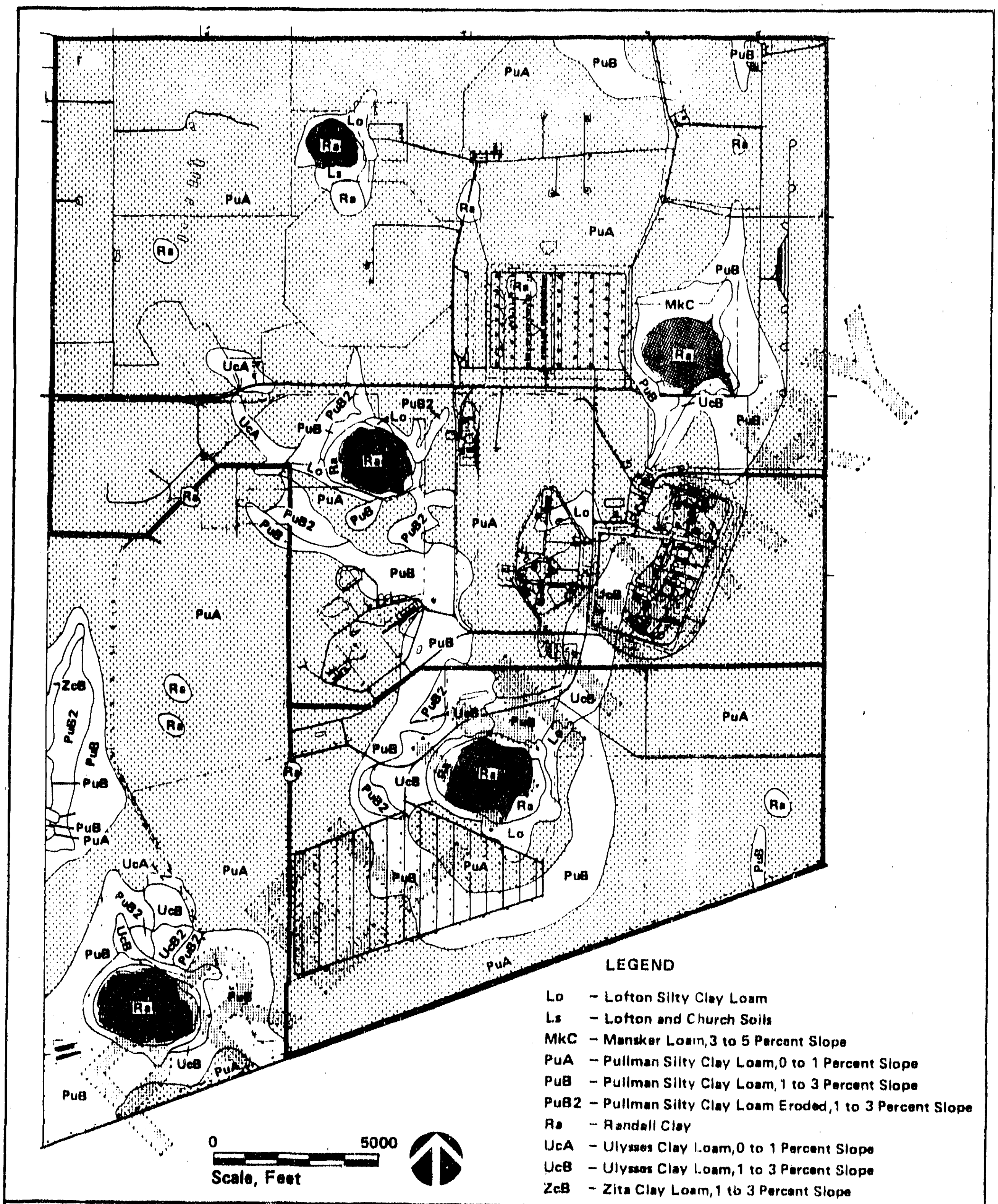
FIGURE 3-5



Source: USGS Topographic Quardrangle Maps

TOPOGRAPHIC MAP OF PANTEX FACILITY AND VICINITY

FIGURE 3-6



Source: USDA 1962

SOIL ASSOCIATION MAP OF PANTEX FACILITY AND VICINITY

FIGURE 3-7

and vegetation sampling in 1981 in preparation for an Environmental Impact Statement (LANL, 1982). Soil was sampled at five perimeter and eight off-site locations (see Figure 3-8). Table 3-7 shows that regional (beween 11 and 35 miles from Pantex), off-site (within 11 miles of Pantex), and Pantex perimeter soil sampling locations have average total uranium concentrations of 2.3, 2.7, and 3.1 ppm, respectively. The standard deviations of the values are such that there is little difference between the numbers and that they can be considered equivalent to background values for total uranium in soils. Plutonium concentrations in the soil at the perimeter are similar to those off-site and regionally.

The LANL sampled vegetation in six gardens near Pantex; one location on-site; and nine gardens in and around Claude, Texas, (see Figure 3-9) about 18 to 20 miles southeast of Pantex. The Claude samples were used as controls (unaffected by Pantex operation). Results of the sampling show that the concentrations of tritium and uranium at and near the Pantex perimeter do not differ significantly from those at Claude. Plutonium is at or below detection levels for all gardens.

3.2.2 General Description of Pollution Sources and Controls

This section concerns those areas that have, or may have, radioactive contamination. Soils contaminated with nonradioactive materials are discussed in Section 4.5.

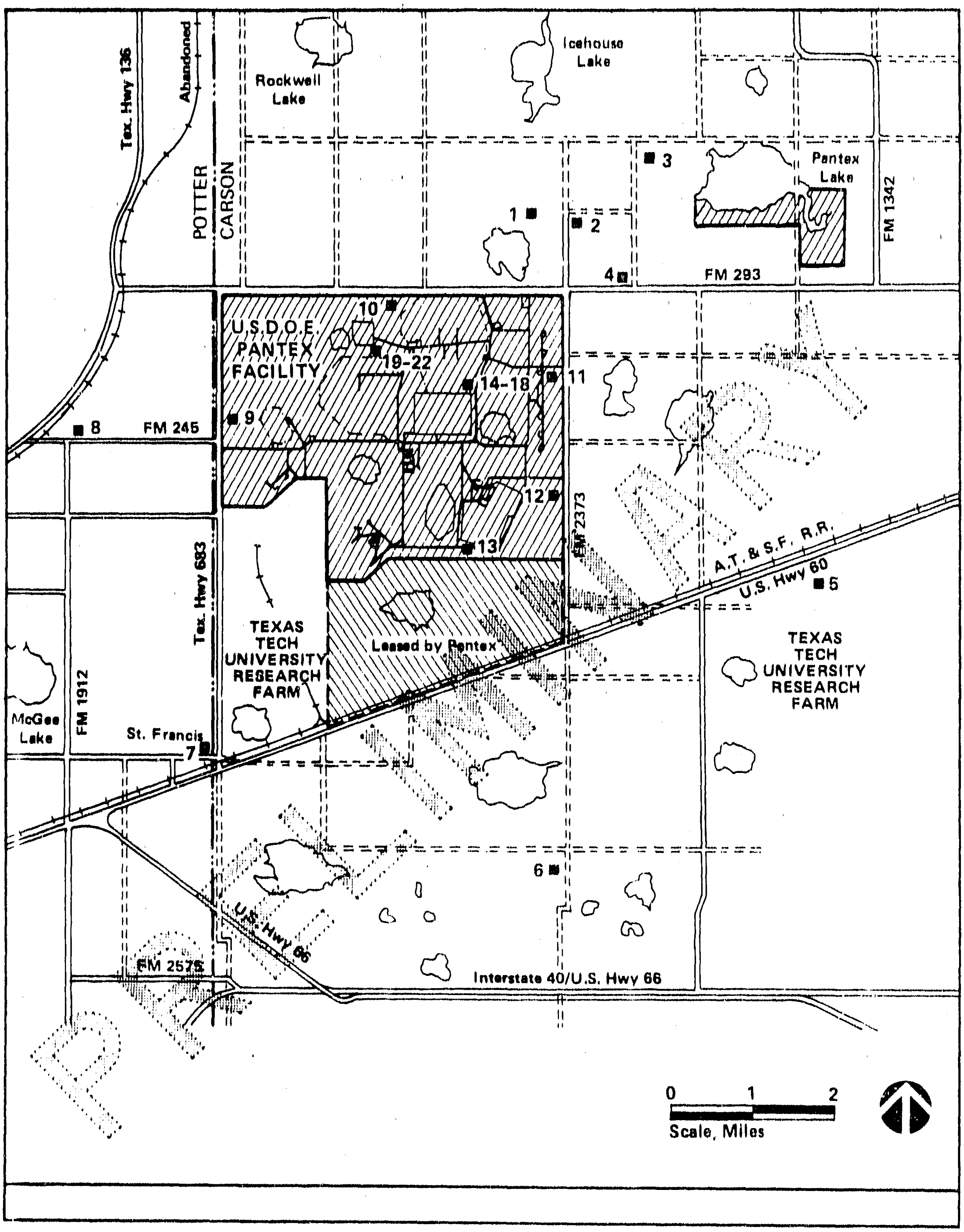
The activities at Pantex that have the potential for resulting in radioactive contamination of soils can be divided into two groups: historical and current. Historical activities include

- Storage of radioactive wastes onsite
- Testing of an igloo containment
- Test firing of high explosives containing radioactivity

Current practices include

- Disposal by burning of high explosives containing depleted uranium

- Test firing of high explosives containing radioactivity



LOS ALAMOS NATIONAL LABORATORY
SOIL SAMPLING LOCATIONS
IN AND AROUND PANTEX

FIGURE 3-8

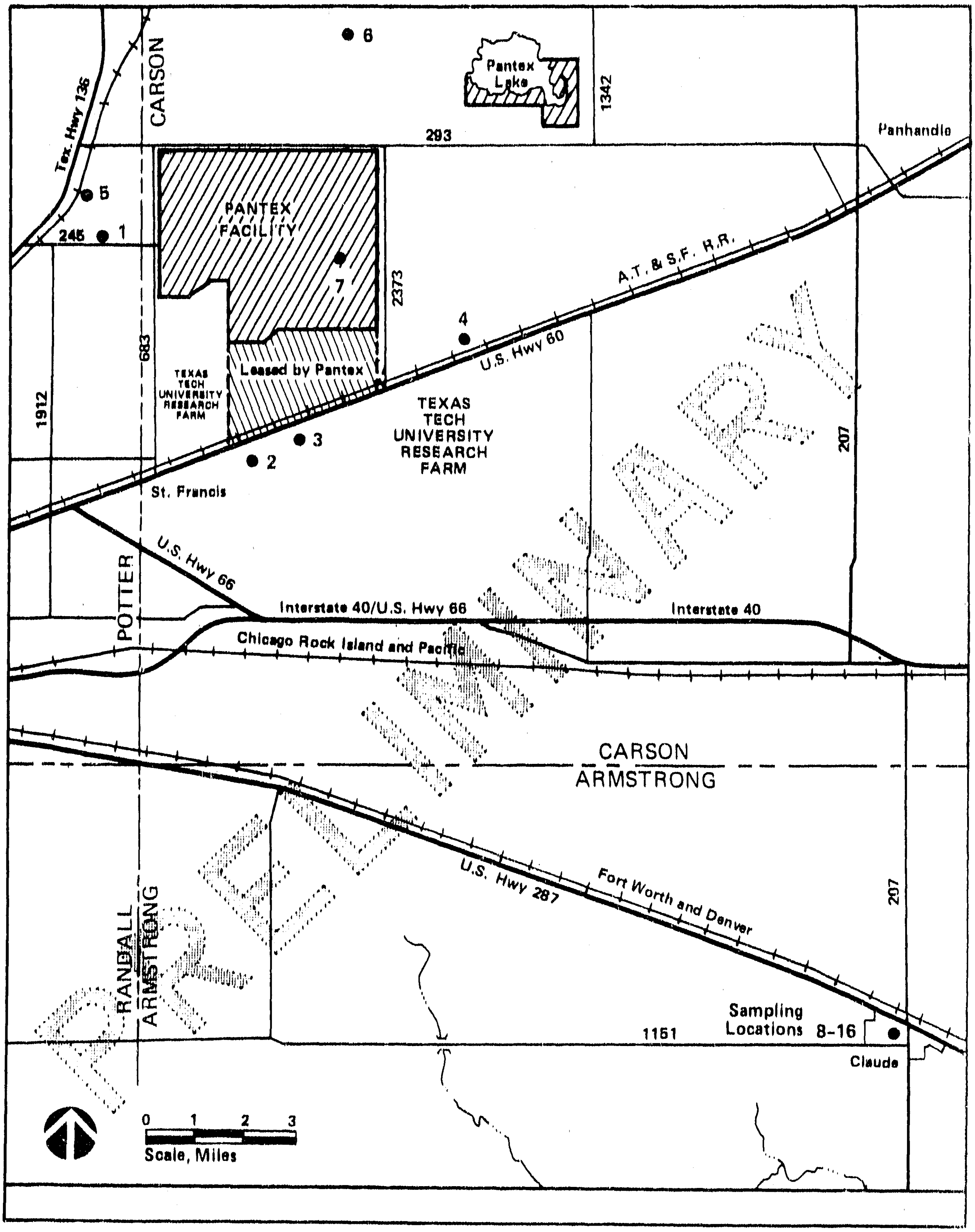
TABLE 3-7

RESULTS OF SURFACE SOIL SAMPLES TAKEN AT PANTEX ($X \pm S$)

Location	Total Uranium (ppm)	Ratio $^{235}U/^{238}U$ x 100	^{238}Pu pCi/g	239-240Pu (pCi/g)
Regional Samples[a] (n = 8)				
Maximum	3.4 ± 0.3	0.68 ± 0.03	0.005 ± 0.001	0.026 ± 0.005
Minimum	1.2 ± 0.3	0.80 ± 0.04	0.001 ± 0.001	0.000 ± 0.000
Average (x ± s)	2.3 ± 0.7	0.73 ± 0.05	0.002 ± 0.001	0.008 ± 0.009
Off-site				
1	2.8 ± 0.3	0.71 ± 0.04	-0.002 ± 0.001	0.005 ± 0.002
2	3.1 ± 0.3	NA	0.002 ± 0.002	0.006 ± 0.003
3	2.8 ± 0.3	0.66 ± 0.03	0.006 ± 0.002	0.007 ± 0.002
4	2.8 ± 0.3	0.73 ± 0.04	0.001 ± 0.002	0.002 ± 0.003
5	3.0 ± 0.3	0.73 ± 0.04	-0.0008 ± 0.0003	0.027 ± 0.005
6	2.4 ± 0.2	0.70 ± 0.03	-0.002 ± 0.001	0.010 ± 0.003
7	2.2 ± 0.2	0.79 ± 0.04	0.002 ± 0.002	0.040 ± 0.006
8	2.8 ± 0.3	0.68 ± 0.03	0.002 ± 0.002	0.024 ± 0.005
Maximum	3.1 ± 0.3	0.66 ± 0.03	0.006 ± 0.002	0.040 ± 0.006
Minimum	2.2 ± 0.2	0.79 ± 0.04	-0.002 ± 0.002	0.002 ± 0.003
Average (x ± s)	2.74 ± 0.30	0.71 ± 0.04	0.0010 ± 0.0027	0.015 ± 0.014
Perimeter				
9	2.9 ± 0.3	0.75 ± 0.04	0.001 ± 0.001	0.002 ± 0.002
10	3.3 ± 0.3	0.68 ± 0.03	0.001 ± 0.001	0.012 ± 0.003
11	2.9 ± 0.3	0.68 ± 0.03	0.001 ± 0.002	0.021 ± 0.005
12	3.5 ± 0.4	0.74 ± 0.04	0.010 ± 0.005	0.028 ± 0.009
13	3.0 ± 0.3	0.75 ± 0.04	0.003 ± 0.002	0.004 ± 0.003
Maximum	3.5 + 0.4	0.68 ± 0.03	0.010 + 0.005	0.028 + 0.009
Minimum	2.9 ± 0.3	0.75 ± 0.04	0.001 ± 0.001	0.002 ± 0.002
Average (x ± s)	3.12 ± 0.27	0.72 ± 0.04	0.0032 ± 0.0039	0.013 ± 0.011

Source: LANL, 1982.

a. W. D. Purtymun, N. M. Becker, and M. Maes, "Supplementary Documentation for an Environmental Impact Statement Regarding the Pantex Plant: Geohydrologic Investigations," Los Alamos National Laboratory report LA-9445-PNTX-H (1982).



LOS ALAMOS NATIONAL LABORATORY
VEGETATION SAMPLING LOCATIONS
IN AND AROUND PANTEX

FIGURE 3-9

3.2.2.1 Storage of Radioactive Wastes

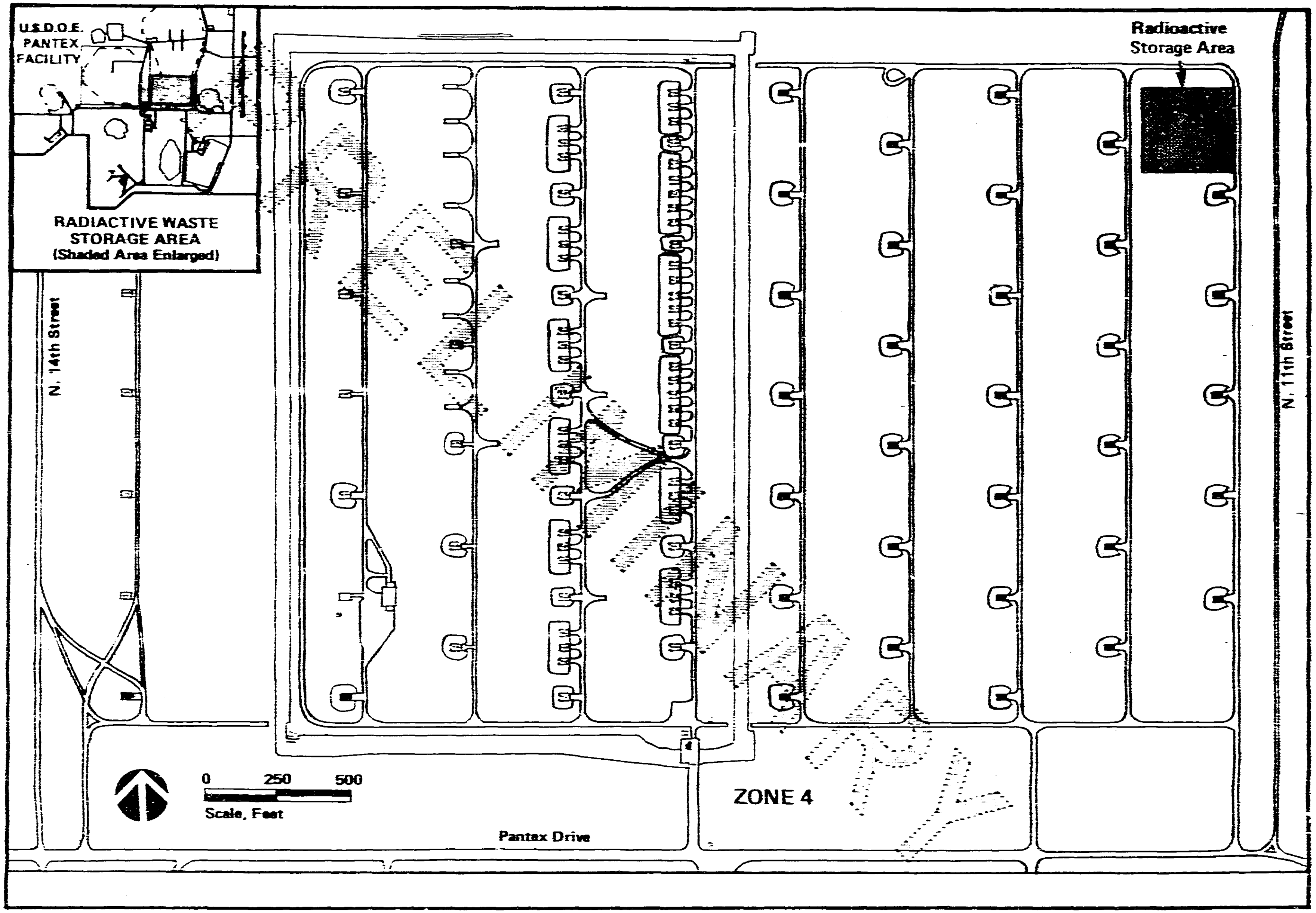
From the early 1960s until 1980, a fenced area measuring about 300 by 400 feet in the northeast corner of Zone 4 (Figure 3-10) was used for the storage of radioactive waste. Decontamination of the area was begun in 1981 and completed in mid-1986. The wastes, including contaminated soil, were shipped to and disposed of at the Nevada Test Site.

This area was used to store residue from hydrodynamic test shots, low-level waste from the production line operations at Pantex, and small quantities of so-called nuclear weapon accident residue (NWAR). The storage receptacles included an earthen trench and hollow concrete cylinders embedded vertically flush with ground level.

The trench, 165 feet long, 15 feet wide, and 16 feet deep, was located in the southwest section of the disposal area and oriented east to west. Containers of NWAR were deposited in the west end, loose firing site debris in the plastic-lined middle section, and containers of firing site debris in the east end of the trench. The NWAR containers were large metal receptacles with a capacity of about 300 cubic feet each. They were coated with fiberglass before being placed in the trench. Dirt, gravel, and low-level waste (LLW) made up the debris dumped into the middle section of the trench. After the dumping, that section was backfilled with dirt. The debris containers buried in the eastern end were fiberglass-coated plywood boxes of 2-cubic-foot capacity.

The hollow concrete cylinders, 7 feet in inside diameter and 20 feet deep, were buried in two rows on the west side of the disposal area. They were located north of the trench and in a north-south direction. The LLW, NWAR, and firing site debris, in a mix of containers, were placed on pallets and lowered into the cylinders, and the cylinders were identified as to their contents.

In late 1979, the Amarillo Area Office made a decision to retrieve all radioactive waste staged below ground at Pantex and dispose of it at an approved DOE burial ground. The decontamination of this site consisted of the removal of the radioactive waste buried, as well as any soil that may have been contaminated by the buried material. The radioactive wastes and contaminated soil were shipped to the Nevada Test Site.



LOCATION OF RADIOACTIVE WASTE STORAGE AREA

FIGURE 3-10

3.2.2.2 Test of an Igloo Containment

In 1958, a bunker located at Firing Site 15 (FS-15) (Figure 3-11) was involved in several tests to determine the containment capabilities of the bunker design. One test involved the use of high explosives containing a trace amount of strontium-89 (a short-lived isotope) heavily contaminated with strontium-90 (a long-lived isotope), the object being to facilitate determination of the dispersal of debris. Results of the testing indicated that the surface area surrounding FS-15 can be contaminated with strontium-90, but the magnitude and extent of such contamination is not known.

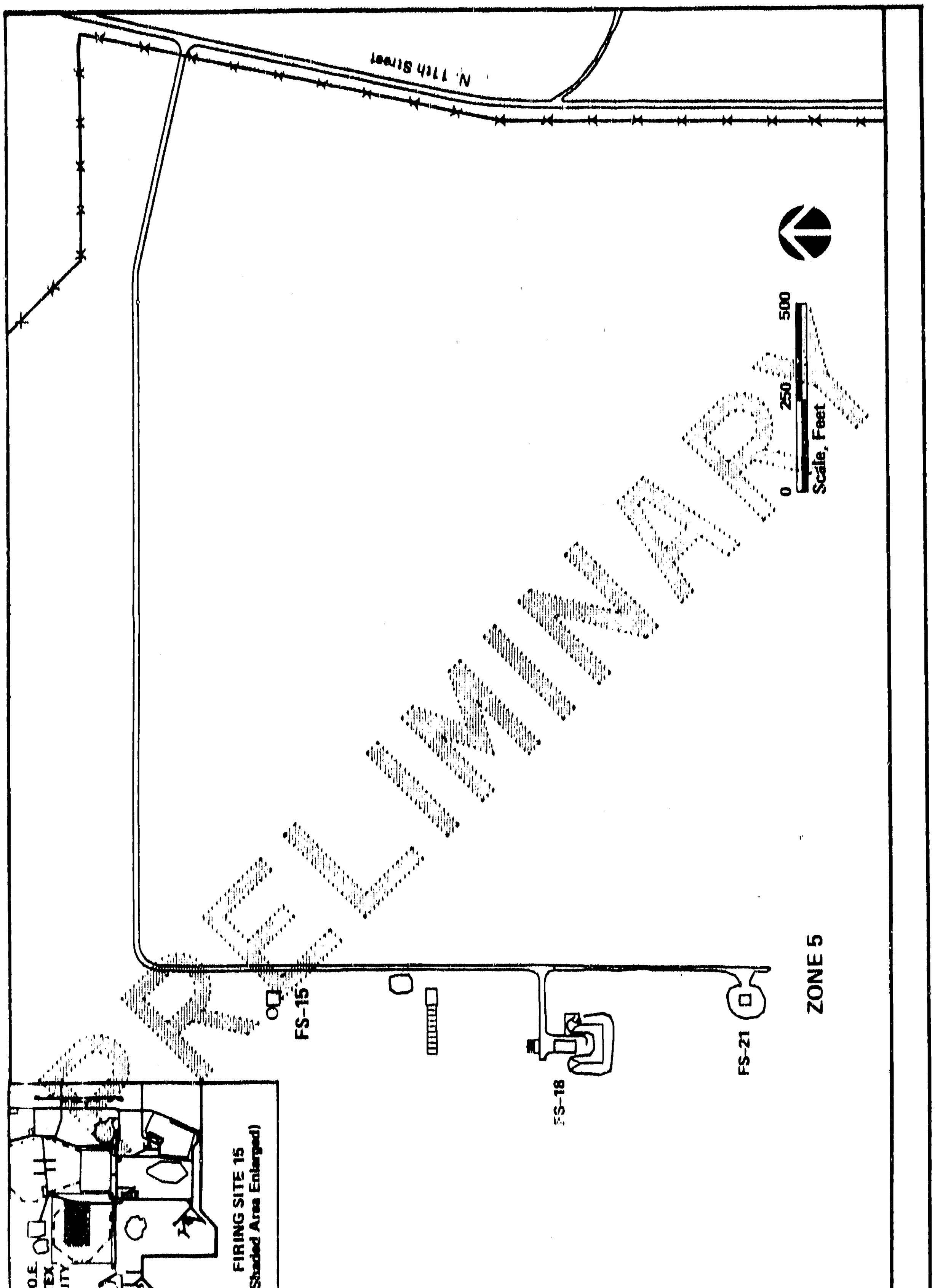
3.2.2.3 Test Firing of High Explosives Containing Radioactivity in the Open

Since 1953, firing sites have been used for tests of the hydrodynamic behavior of simulated weapon components in combination with high explosives. Tests have been conducted at FS-4, 5, and 10 (see Figure 3-12). Depleted uranium (natural uranium depleted in uranium-235) was used as the heavy metal to simulate the shock properties of the plutonium components. Some of this uranium was vaporized in the test and dissipated in the smoke cloud. The rest was dispersed around the test fire site as fragments or small particles and dust. After each test firing, the fragments left on the ground around the test fire site were picked up and buried.

Although uranium-238 has a low specific activity, it has a long radiological half-life (4.5 billion years). This oxide is a heavy, finely divided solid that can become attached to soil particles. After a test firing, it is mixed into the soil, where it remains unless it is resuspended in dust or transported by surface water. Since uranium oxide is relatively insoluble in water, there is little uptake in plants.

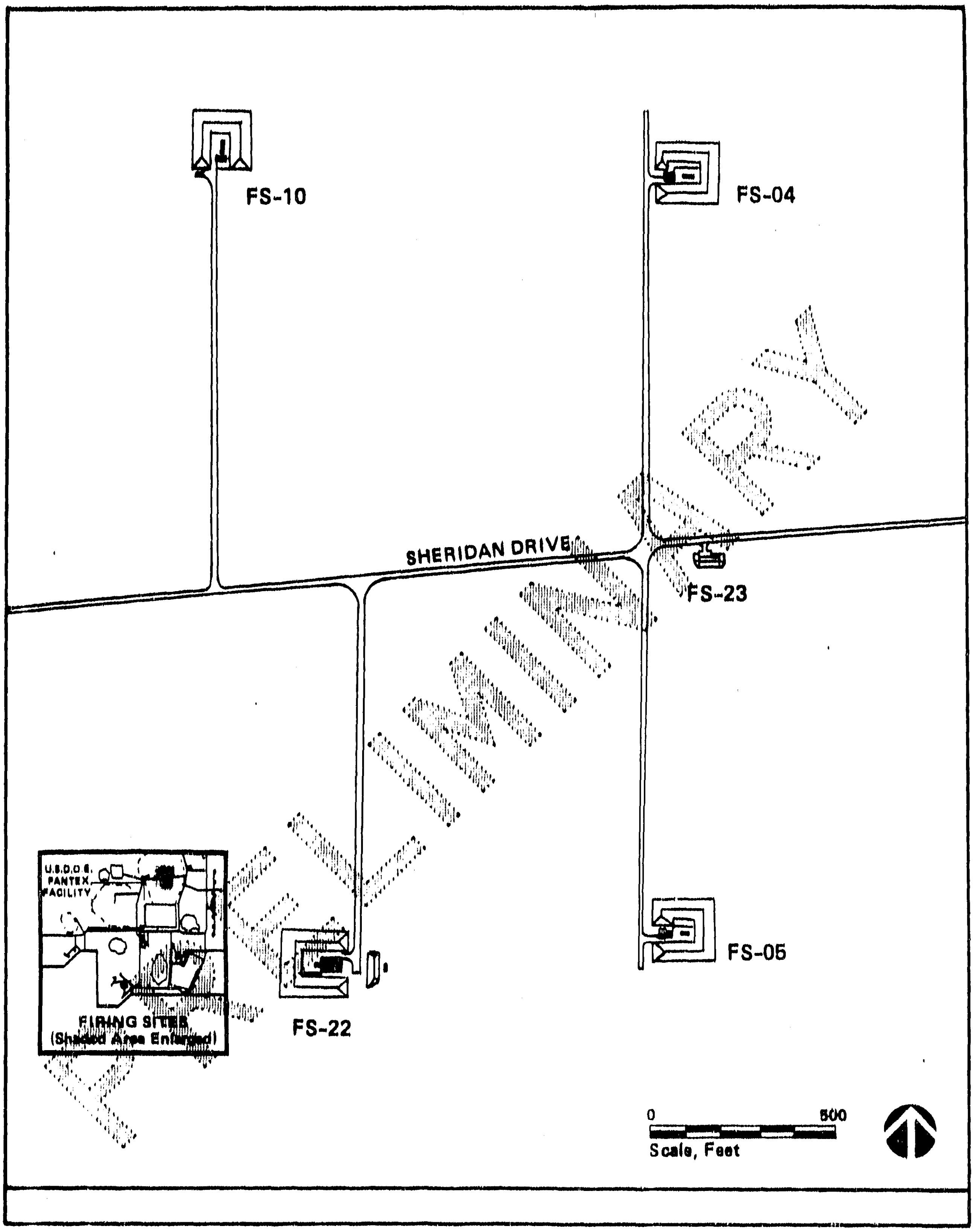
Firing Site 5 was the prime location of test shots of combined high explosives and depleted uranium. As a result of the test shots, the ground of FS-5 is more contaminated with depleted uranium than is that of FS-4 or FS-10 (see Section 3.2.3). At FS-10, however, thorium in addition to depleted uranium was involved in test shots. Therefore, thorium contamination may be present at FS-10.

Table 3-8 presents the weight of depleted uranium involved in test shots in the open at Pantex from 1963 to 1986. It has been estimated that 83 percent of the



LOCATION OF FIRING SITE 15

FIGURE 3-11



LOCATIONS OF FIRING SITES 4, 5, 10, AND 23 FIGURE 3-12

TABLE 3-8

ANNUAL AMOUNT OF DEPLETED URANIUM USED IN HYDRODYNAMIC TEST FIRE SHOTS AT PANTEX FACILITY FS-4, 5 AND 10

Year	Kilograms of Depleted Uranium
1963	112
1964	123
1965	316
1966	303
1967	206
1968	210
1969	2,418
1970	3,589
1971	3,379
1972	2,421
1973	832
1974	896
1975	626
1976	416
1977	138
1978	419
1979	75
1981	4
1982	8
1983	4
1984	0
1985	4
1986	4

Source: DOE, 1983, and personal communication with W. Laseter, 1987 uranium is recovered while another 12 percent remains at the site (ERDA, 1976). As can be seen in Table 3-8, few test shots involving depleted uranium have occurred in the open since 1984. In that no further shots of this nature are planned, soil contamination is not expected to increase.

3.2.2.4 Disposal of Radioactivity-Contaminated High Explosives by Burning

High explosives bonded to pieces containing depleted uranium are burned at the burning grounds around Pad 12 (see Figure 3-2). The burning, started in 1981, removes the high explosives from the uranium. Each composite of high explosive and depleted uranium is placed on a burning rack (a metal form used to elevate the piece above the ground). The high explosive is then burned, allowing the depleted uranium piece to fall to the ground. After that piece has cooled, it is retrieved and packaged for shipment to the Nevada Test Site. During the burn, some depleted uranium drops to the ground as very fine particles. As a result, the ground is contaminated with depleted uranium. Measured concentrations at the burning grounds range from 5.7 to 35 x 10^{-7} microcuries per gram, or up to seven times higher than off-site concentrations. The contamination could be removed by resuspension of the soil (see Section 3.2.3).

3.2.2.5 Test Firing of High Explosives at Firing Site 23

Since 1983, the hydrodynamic test fire shots have been conducted in the Total Containment Test Facility (TCTF) at FS-23, also referred to as the Silver Bullet (see Figure 3-12). The TCTF was built to totally contain the explosion of test shots containing beryllium and depleted uranium. During the post-test decontamination of the total containment chamber, the contaminated residue from the shot is taken from the facility manually and transferred to boxes for ultimate disposal. During this transfer, contaminated material can be spilled onto the ground.

3.2.3 Environmental Monitoring Program

The Pantex Facility has been measuring the concentration of radionuclides on-site since 1957 and off-site since 1962. Beryllium in soil has been measured since 1983. In addition to soil, Pantex monitors the concentration of radionuclides in vegetation. Analysis of soil samples provides a measure of the degree of soil contamination. Vegetation sampling, however, provides a better measure of potential exposure to humans by the food pathways. Table 3-9 presents a summary

TABLE 3-9

SUMMARY OF SOIL AND VEGETATION ENVIRONMENTAL MONITORING PROGRAM

Type of Sample	Number of Sample Locations	Sampling Frequency
	SOIL	
Onsite		
Beryllium	19	Monthly
Plutonium-239	19	Monthly
Total uranium	19	Monthly
Offsite		
Plutonium-239	32	Monthly
Total uranium	32	Monthly
	VEGETATION	
Onsite		
Tritium	5	Monthly
Total uranium	5	Monthly
Offsite		
Tritium	17	Quarterly
Total uranium	17	Quarterly

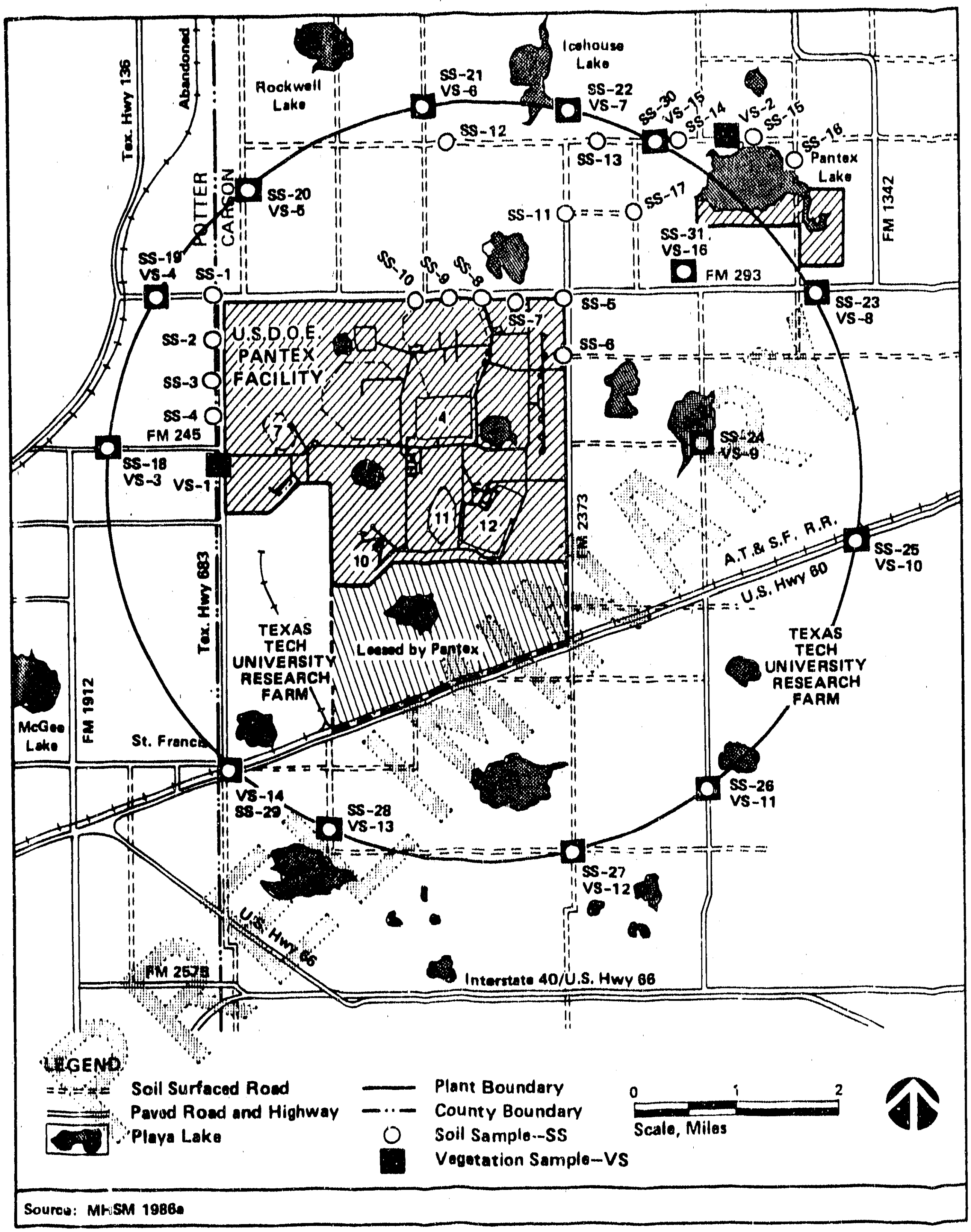
Source: MHSM, 1986a.

of the current soil and vegetation monitoring program. Pantex samples 51 locations on- and off-site for plutonium-239 and total uranium and 19 locations on-site for beryllium. Vegetation is sampled in 22 locations on- and off-site for tritium and total uranium. Figure 3-13 illustrates all of the sampling locations except the one at the Bushlands Research Farm, approximately 20 miles west of Amarillo. Figure 3-14 and 3-15 illustrate the on-site sampling locations.

Beryllium measurements in soil began in 1983. All measurements for all sampling locations have been below either the detection limit (0.05 microgram per gram) or the background level (0.1 microgram per gram). From 1978 to 1985, plutonium measurements were at or below the detection limit (2×10^{-8} microcurie per gram). For vegetation, the tritium measurements are near the detection limit (2×10^{-7} microcurie per gram).

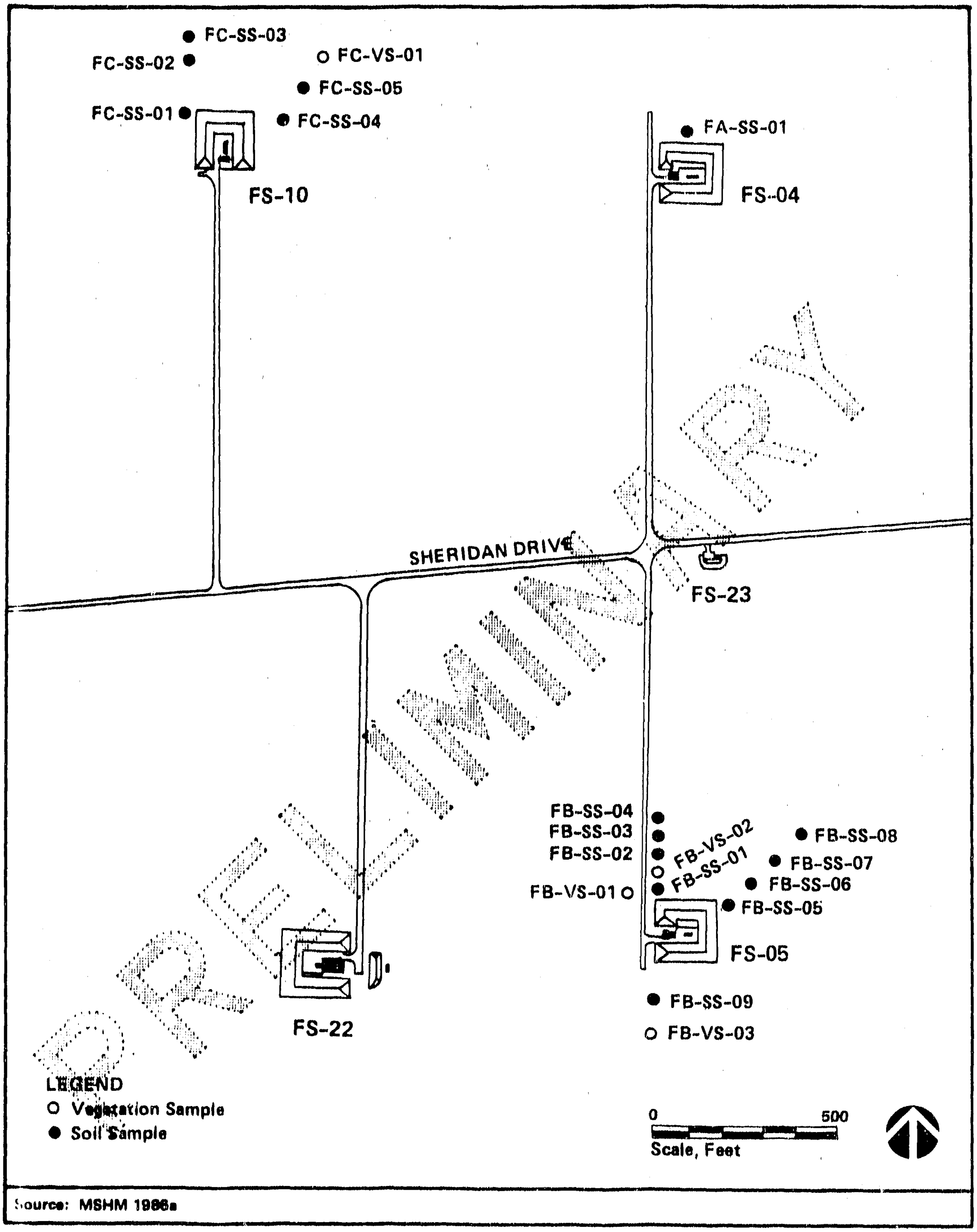
Tables 3-10 and 3-11 present the results of the monitoring program for total uranium in soil and vegetation, respectively, for the 8-year period. Other measurements are not shown since they are either at or below the background level or detection limit. The data from Table 3-10 show that elevated levels (above background) of total uranium in the soil are found near the firing sites and burning grounds. Total uranium activity levels in the soil have ranged from 1.2 to 7.3 times the average background (off-site) levels at the burning grounds, 3.0 to 43 times the background levels at FS-4, 8.8 to 122 times background at FS-5, and 2.2 to 5.8 times background at FS-10. The standard of the Formerly Utilized Sites Remedial Action Program (FUSRAP), which is the DOE guideline of residual radioactivity for decontaminating sites such as these is 420×10^{-7} microcuries per gram of uranium-238.* The corresponding Pantex firing site soil concentrations have ranged from 5.7 to 26×10^{-7} microcuries per gram at the burning grounds, 47 to 153×10^{-7} microcuries per gram at FS-4, 36 to 563×10^{-7} microcuries per gram at FS-5, and 6.0 to 25×10^{-7} microcuries per gram at FS-10. Similarly, higher, but less pronounced levels of total uranium were found in vegetation at the burning grounds and firing sites. Contamination in vegetation above background levels is not as great as that reported for soil, because uranium is not readily absorbed into the vegetation.

* This value derives from the adjustment of two others: the uranium-238 concentration limit for soil of 75 picocuries per gram (ORO, 1983) and the DOE equivalent whole-body dose limit of 100 millirem per year.



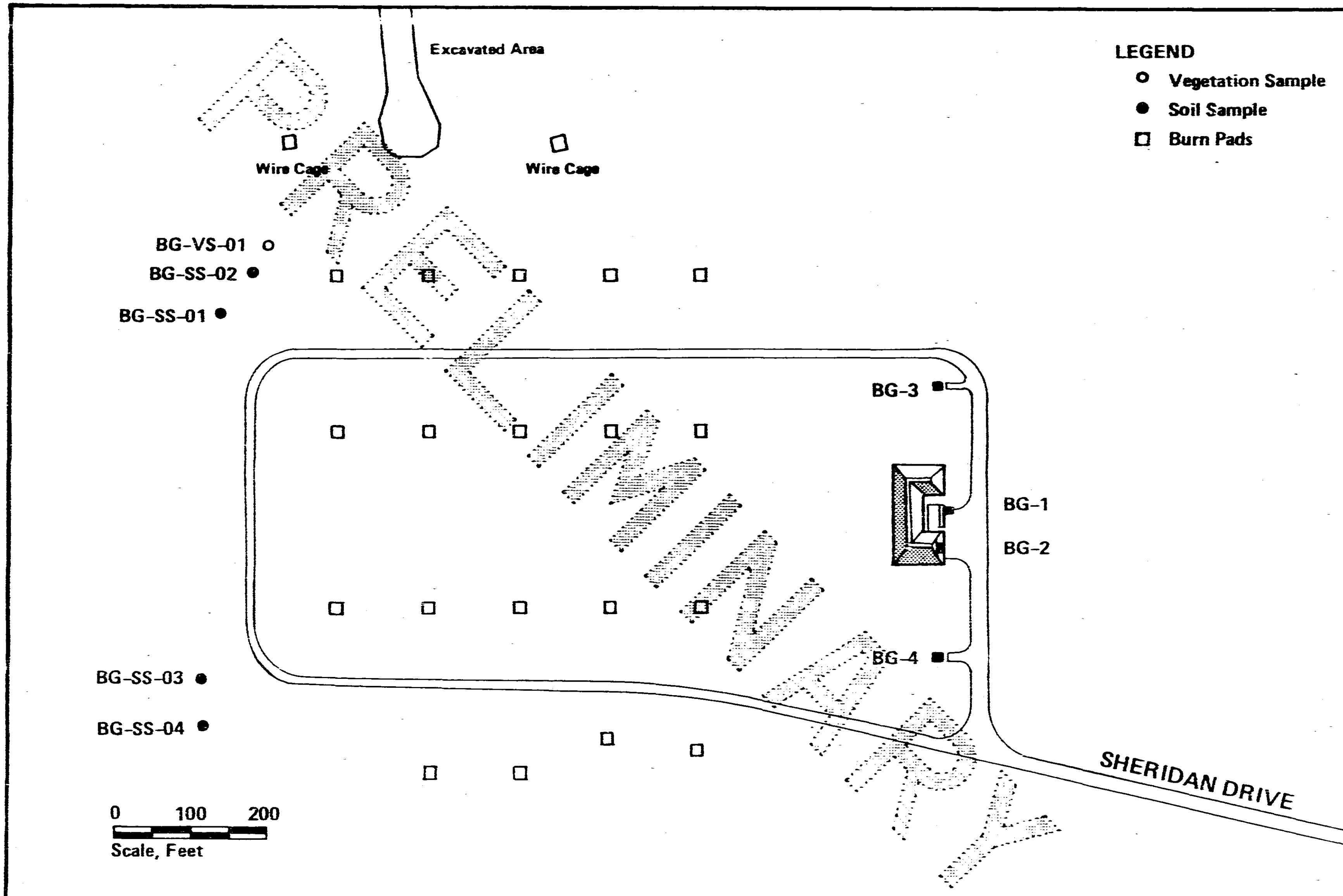
PANTEX SOIL AND VEGETATION SAMPLING LOCATIONS

FIGURE 3-13



FIRING SITE SOIL AND VEGETATION SAMPLING LOCATIONS

FIGURE 3-14



Source: MHSM 1986a

BURNING GROUNDS SOIL AND VEGETATION SAMPLING LOCATIONS

FIGURE 3-15

TABLE 3-10

TOTAL URANIUM IN SOIL AT PANTEX FACILITY
(10^{-7} µCi/g)

Location	Year							
	1978	1979	1980	1981	1982	1983	1984	1985
SS-01	4.80	3.84	5.22	3.78	16.62	23.09	7.22	4.43
SS-02	3.70	3.71	5.24	2.72	16.75	22.55	5.47	4.03
SS-03	2.90	3.38	4.58	3.48	14.96	20.64	5.60	3.34
SS-04	2.90	3.17	5.00	4.10	15.82	23.18	5.99	4.48
SS-05	3.80	3.89	4.56	3.74	14.61	20.09	5.59	3.38
SS-06	3.20	14.08	5.72	3.91	13.74	19.27	7.22	6.16
SS-07	2.80	3.37	4.17	5.12	16.15	18.65	6.05	5.25
SS-08	3.70	2.73	5.82	4.62	16.28	20.18	6.11	3.67
SS-09	3.50	5.38	4.50	4.14	13.65	20.64	6.30	6.45
SS-10	3.00	3.54	6.02	3.68	17.44	19.36	6.42	5.57
SS-11	3.40	3.28	4.84	3.68	14.46	21.09	6.29	3.85
SS-12	3.90	3.60	5.03	3.39	12.10	18.36	7.23	4.00
SS-13	3.70	2.92	5.19	3.12	13.35	19.82	5.00	3.49
SS-14	3.60	2.30	3.87	3.03	17.01	18.91	5.86	6.35
SS-15	3.70	2.41	4.89	4.63	13.80	18.10	6.18	4.66
SS-16	3.40	2.88	4.82	3.28	10.66	17.55	4.93	3.16
SS-17	3.50	2.97	5.63	4.37	14.31	18.40	6.92	6.47
SS-18	3.40	3.15	6.35	4.68	16.68	18.84	5.50	3.89
SS-19	3.90	2.57	4.70	3.96	16.53	16.50	4.13	4.73
SS-20	4.00	3.12	10.29	4.03	17.36	16.91	5.41	5.19
SS-21	4.10	3.10	4.65	4.21	16.64	17.50	6.59	5.68
SS-22	4.20	3.87	5.67	5.03	16.56	19.55	5.14	4.57
SS-23	3.30	2.39	3.88	4.95	17.14	20.05	6.99	5.65
SS-24	3.20	2.94	4.23	4.96	13.48	16.91	7.04	6.18
SS-25	3.30	4.15	4.68	3.94	17.01	21.30	6.68	5.02
SS-26	3.40	3.65	3.84	7.12	13.04	19.00	6.22	3.11
SS-27	3.20	2.48	3.44	3.63	10.55	15.90	6.75	3.38
SS-28	3.20	3.25	3.63	3.01	13.12	17.73	5.08	4.51
SS-29	2.90	2.93	6.35	4.25	14.29	16.76	5.55	4.42
SS-30	3.80	2.69	4.42	4.07	20.09	18.91	6.04	4.66
SS-31	3.60	3.58	5.20	4.28	17.66	20.00	9.27	4.32
BU-SS-01					30.20	19.11	5.99	4.21
Average of off-site	3.52	3.59	5.05	4.09	15.69	19.21	6.15	4.63

Source: MSHM, 1986a.

Note: Refer to previous figures for sampling locations.

TABLE 3-10 (cont'd)

TOTAL URANIUM IN SOIL AT PANTEX FACILITY (10^{-7} µCi/g)

Location	Year							
	1978	1979	1980	1981	1982	1983	1984	1985
ON-SITE Burning Ground								
BG-SS-01	25.60	4.97	11.83	16.93	28.31	35.25	12.80	5.67
BG-SS-02	7.30	7.64	6.95	5.23	22.38	22.27	12.13	4.84
BG-SS-03	4.80	4.21	6.63	6.82	22.95	24.25	9.37	5.56
BG-SS-04	5.20	5.85	6.54	3.73	19.32	23.50	7.67	4.64
FS-4 FA-SS-01	152.80	141.03	54.55	28.09	47.11	95.00	234.26	148.36
FS-5								
FB-SS-01	241.50	17.62	214.50	36.06	159.04	223.64	85.21	225.45
FB-SS-02	35.70	16.62	51.45	22.22	71.69	95.58	159.25	78.49
FB-SS-03	45.40	9.45	15.91	18.52	49.59	62.25	25.04	42.08
FB-SS-04	33.70	10.28	15.21	9.34	46.05	46.33	26.47	41.43
FB-SS-05	31.50	20.46	37.18	13.00	52.56	64.75	103.30	66.15
FB-SS-06	42.30	20.13	16.59	12.83	36.85	55.17	29.51	563.14
FB-SS-07	44.90	15.51	11.15	12.32	27.88	106.75	17.50	16.10
FB-SS-08	38.10	38.50	14.36	8.62	28.41	33.82	11.55	13.50
FB-SS-09	14.60	45.71	70.35	26.16	111.83	212.73	482.75	324.33
FS-10								
FC-SS-01	8.10	5.63	10.24	12.84	37.19	36.25	25.86	9.04
FC-SS-02	4.30	6.03	10.66	7.12	32.15	37.08	15.18	6.25
FC-SS-03	5.30	4.67	8.16	6.69	29.38	28.85	11.21	4.85
FC-SS-04	6.10	7.22	14.75	16.37	49.75	63.17	35.53	25.30
FC-SS-05	4.60	7.78	7.59	8.74	23.75	29.40	10.29	8.13
Ratio of On-site to Off-site								
Burning Ground	7.28	2.13	2.34	4.14	1.80	1.83	2.08	1.22
FS-4	43.46	39.29	10.81	6.86	3.00	4.94	38.10	32.02
FS-5	68.68	12.73	42.51	8.81	10.14	11.64	78.51	121.55
FS-10	2.30	2.17	2.92	4.00	3.17	3.29	5.78	5.46

Source: MSHM, 1986a.

TABLE 3-11

TOTAL URANIUM IN VEGETATION AT PANTEX (10^{-7} µCi/g)

Location	Year							
	1978	1979	1980	1981	1982	1983	1984	1985
VS-01	0.20	1.34	1.32	0.41	3.90	1.41	1.15	1.08
VS-02	0.20	1.69	1.77	0.97	1.63	3.09	1.03	1.13
VS-03	0.20	1.67	0.91	1.47	0.58	1.71	2.79	0.74
VS-04	0.10	2.17	0.81	0.92	0.97	1.31	0.82	0.67
VS-05	0.20	2.00	1.06	0.48	2.04	2.62	0.25	1.90
VS-06	0.30	1.35	1.05	0.60	1.59	2.09	0.63	0.99
VS-07	0.20	1.73	1.23	0.88	1.09	1.06	0.88	1.18
VS-08	0.10	2.05	0.81	0.52	1.18	2.81	0.68	0.79
VS-09	0.50	1.75	0.88	1.37	1.49	2.40	1.41	1.12
VS-10	0.10	1.87	1.15	2.47	2.19	1.97	0.47	2.11
VS-11	0.30	1.60	1.26	0.22	1.12	1.10	0.18	1.21
VS-12	0.20	1.16	1.12	0.68	2.34	2.05	0.69	1.05
VS-13	0.20	2.01	1.30	0.60	2.18	2.55	0.44	0.66
VS-14	0.10	1.55	0.80	0.77	1.54	1.54	0.02	0.61
VS-15	0.60	2.11	0.94	1.44	1.94	3.44	1.44	0.77
VS-16	0.20	1.54	1.21	2.99	2.10	3.29	0.96	1.13
BU-VS-01					15.20	2.05	0.47	1.97
Average of Off-site	0.23	1.72	1.10	1.05	2.53	2.15	0.84	1.12
ON-SITE Burning Ground B-6-01	0.40	2.21	1.55	0.90	1.74	2.13	2.27	1.99
FS-5								
FB-VS-01	0.40	9.11	5.82	3.27	17.11	19.26	31.50	28.86
FB-VS-02	0.80	15.14	8.32	8.38	15.21	19.28	41.46	32.74
FB-VS-03	1.00	16.00	3.45	7.11	4.07	6.22	66.98	87.54
FS-10 FC-VS-01	0.20	1.83	2.93	2.42	2.53	4.29	1.94	2.18
Ratio of On-site to Off-site								
Burning Ground	1.78	1.28	1.41	0.86	0.69	0.99	2.70	1.77
FS-5	4.44	9.28	7.56	7.99	6.75	8.98	79.57	77.87
FS-10	0.89	1.06	2.66	2.31	1.00	2.00	2.30	1.94

Source: MSHM, 1986a.

3.2.4 Findings

3.2.4.1 Category I

There are no Category I findings for soil.

3.2.4.2 Category II

There are no Category II findings for soil.

3.2.4.3 Category III

1. At Firing Sites 4, 5, and 10, the surface soil has depleted uranium as a result of past test fire shots. The surface contamination could lead to broader dispersal of the residual contamination through wind resuspension. It could also be moved by surface water runoff to a diversion ditch which channels runoff from these firing sites to the sewage treatment plant which then discharges to Playa 1. The contamination could accumulate in the playa and be available for uptake by vegetation and by animals using the playa. Pantex has been monitoring the amount of soil contamination around firing sites FS-4, FS-5, and FS-10. Monthly soil samples are taken at one location near FS-4, nine locations near FS-5, and five locations near FS-10 (see Figure 3-14). Annual total uranium activity levels in the soil at the firing sites have ranged from 3.0 to 43 times background levels at FS-4, 8.8 to 122 times background at FS-5, and 2.2 to 5.5 times background at FS-10. The corresponding concentrations have ranged from 5.7 to 26 x 10^{-7} microcuries per gram at the burning grounds, 47 to 153 x 10^{-7} microcuries per gram at FS-4, 36 to 563 x 10^{-7} microcuries per gram at FS-5, and 6.0 to 25 x 10^{-7} microcuries per gram at FS-10. For comparison purposes, the maximum uranium concentration at FS-5 would have exceeded DOE FUSRAP guidelines if this site were in the program.

This finding does not contribute significantly to the off-site atmospheric concentration of depleted uranium, and therefore the maximum individual dose. Any increase due to resuspension and surface water runoff is expected to be well below the DOE dose limits for members of the public. During the sampling and analysis phase of the Survey, the playa water and sediment will be sampled to determine if movement via surface water runoff has occurred.

2. The surface soil at the burning grounds is contaminated with depleted uranium. Since 1981, high explosives and depleted uranium have been separated by burning at the burning grounds.

The composite of high explosive and depleted uranium is placed on a burning rack (metal table used to elevate the piece above the ground). The high explosive is then ignited and the depleted uranium allowed to fall to the ground. As a result of this burning operaton, some depleted uranium falls to the ground as fine particulates and cannot be retrieved. The area surrounding Pad 12 is monitored for soil contamination monthly; the samples are taken at four locations (see Figure 3-15). Pantex sampling identifys elevated levels (above background) of total uranium in the soil at the burning grounds. Total uranium activity levels in the soil at the burning grounds have ranged from 1.2 to 7.3 times background levels. The corresponding uranium, concentrations have ranged from 5.7 to 26 x 10^{-7} microcuries per gram, which are well below the DOE FUSRAP guideline of 420 x 10^{-7} microcuries per gram.

The surface contamination could lead to broader dispersal of the residual contamination through wind resuspension. It could also be moved by surface water runoff into Playa 3. The contamination could accumulate in the playa and be available for uptake by vegetation and by cattle using the playa. As stated above, this finding does not contribute significantly to the off-site atmospheric concentration of depleted uranium, and therefore the maximum individual dose. During the sampling and analysis phase of the Survey, water and sediment samples will be taken from playa 3 to determine if movement via surface water runoff has occurred.

3. The soil of the Total Containment Test Facility at (Firing Site Number 23) is potentially contaminated with depleted uranium and beryllium as a result of ongoing test fire shots. Firing Site 23 was built to totally contain the explosion of a test shot involving beryllium and depleted uranium. It was first operated in 1983. The potential for soil contamination arises from the procedures for post-test decontamination of the total containment chamber. The contaminated residue from the shot is taken manually from the facility and transferred to boxes for ultimate disposal. During this transfer, contaminants can spill onto the ground.

Discussions with facility personnel have revealed that normal health physics procedures are used to clean up any minor spills that occur during the cleanup of the TCTF.

If there is such a spill, the surface contamination could lead to broader dispersal of the residual contamination through wind resuspension. It could also be moved by surface water runoff into playa waters. The contamination could accumulate in the playa and be available for uptake by vegetation and by waterfowl and cattle using the playa. As stated above, this would not contribute significantly to the off-site atmospheric concentration of depleted uranium, and therefore the maximum individual dose. During the sampling and analysis phase of the Survey, sampling will be performed at FS-23 in an attempt to determine if the soil around the site is contaminated, and to establish the level and extent of the contamination.

4. <u>The soil at Firing Site 15 has potential strontium-90 contamination from tests of the bunker there in 1958.</u> A tracer of strontium-89, which was potentially heavily contaminated with strontium-90, was used for the test. The level and extent of the remaining contamination are not known. During the sampling and analysis phase of the Survey, sampling will be performed at FS-15 in an attempt to determine if contamination does exist around this site, and if so to establish the level and extent of the contamination.

3.2.4.4 <u>Category IV:</u>

There are no Category IV findings for soil.

3.3 Surface Water

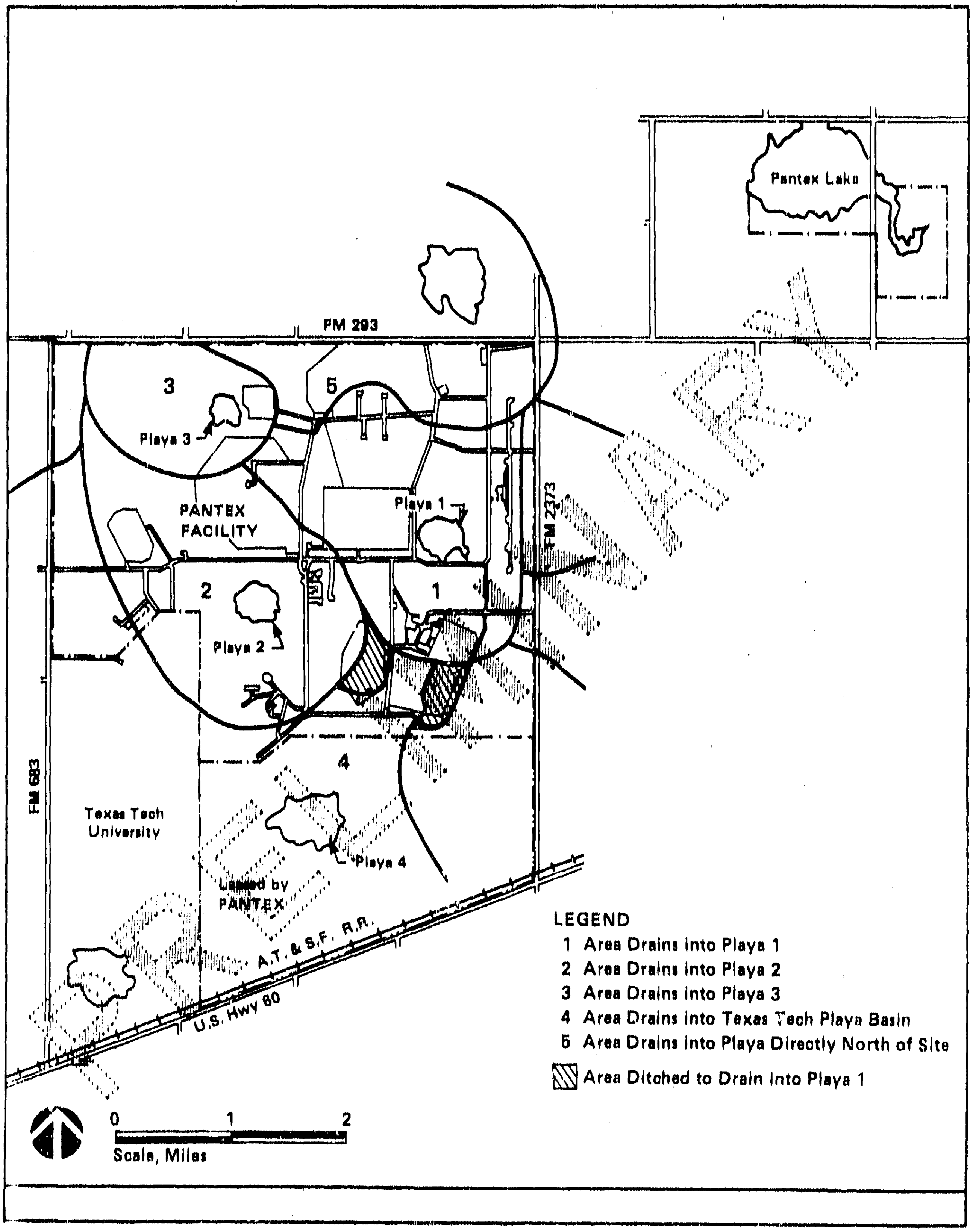
3.3.1 Background Environmental Information

The major surface water streams in the vicinity of Pantex include the Canadian River and the Salt Fork of the Red River (see Figure 3-5). However, due to the localized drainage and lack of connection to these major surface watercourses in the region, the water quality of these watercourses should be unaffected by Pantex activities.

A unique feature of the site is the localized, closed-basin natural drainage that does not feed into streams and rivers. The waters from infrequent rainfalls flows a short distance across the flat terrain to natural depressions called playas, where they form ephemeral lakes that eventually evaporate because of the low humidity. The playas in the vicinity of Pantex are on the Central Flyway for migratory birds, and some of the playas are used by migratory water fowl during their north and south migrations.

Several playas on- and off-site receive drainage from the Pantex site (see Figure 3-16). Discharge from Pantex constitutes the major source of water for Playa 1. Historically, the effluent from the Pantex sanitary wastewater treatment plant was pumped through a 2.9-mile force main to a playa northeast of the site called Pantex Lake. Although the DOE owns the land on which Pantex Lake is situated, a large area along the south side of the lake (beyond the land owned by DOE), and upon which the lake sometimes impinges, is owned by others.

Discharges into Playas 1 and 2, and the quality of the water in them, are regulated by a permit issued by the State of Texas. A copy of the state permit, number 02296, issued to Pantex in 1980, is included as Appendix D. The state permit, which is in effect indefinitely, limits the biochemical oxygen demand (BOD) of the sanitary wastewater discharge to Playa 1 to a 30-day average of 50 milligrams per liter and an instantaneous maximum of 150 milligrams per liter. The industrial effluents from Zones 11 and 12 are also limited to an instantaneous maximum chemical oxygen demand (COD) of 300 milligrams per liter and to an instantaneous



PLAYA LAKES AND DRAINAGE AREAS FIGURE 3-16 pH in the range from 6.0 to 9.0. Other specific numerical limits are placed on the permeability and seepage rate through the playa bottom and on the irrigation application rate. Seepage is limited to a maximum of 0.1 foot per year (1×10^{-7} centimeters per second), and irrigation rates are not to exceed 5.3 feet per year.

Precipitation at the Pantex site averages 19.67 inches per year, with 75 percent of this occurring between April and September, usually as thunderstorms (ERDA, 1976). However, the annual precipitation does vary widely from year to year (e.g. from 9.56 inches in 1970 to 39.75 inches in 1923). The humidity averages are also rather low, often going below 20 percent. The low humidity and consistently high average wind speed results in a high evaporation rate. Precipitation does not readily penetrate into the ground due to the soil types (see Section 3.2.1).

3.3.2 General Description of Pollution Sources and Controls

The Pantex facility obtains its water from four deep wells on the site that draw from the Ogallala aquifer. Approximately 1.5 million gallons of water per day are distributed throughout the facility (Table 3-12). The water leaves the zones as sanitary and industrial wastewaters. The only other source of surface water flow is stormwater runoff. These waters are discharged to the onsite playas or the wastewater treatment plant as described below.

3.3.2.1 Industrial Wastewaters

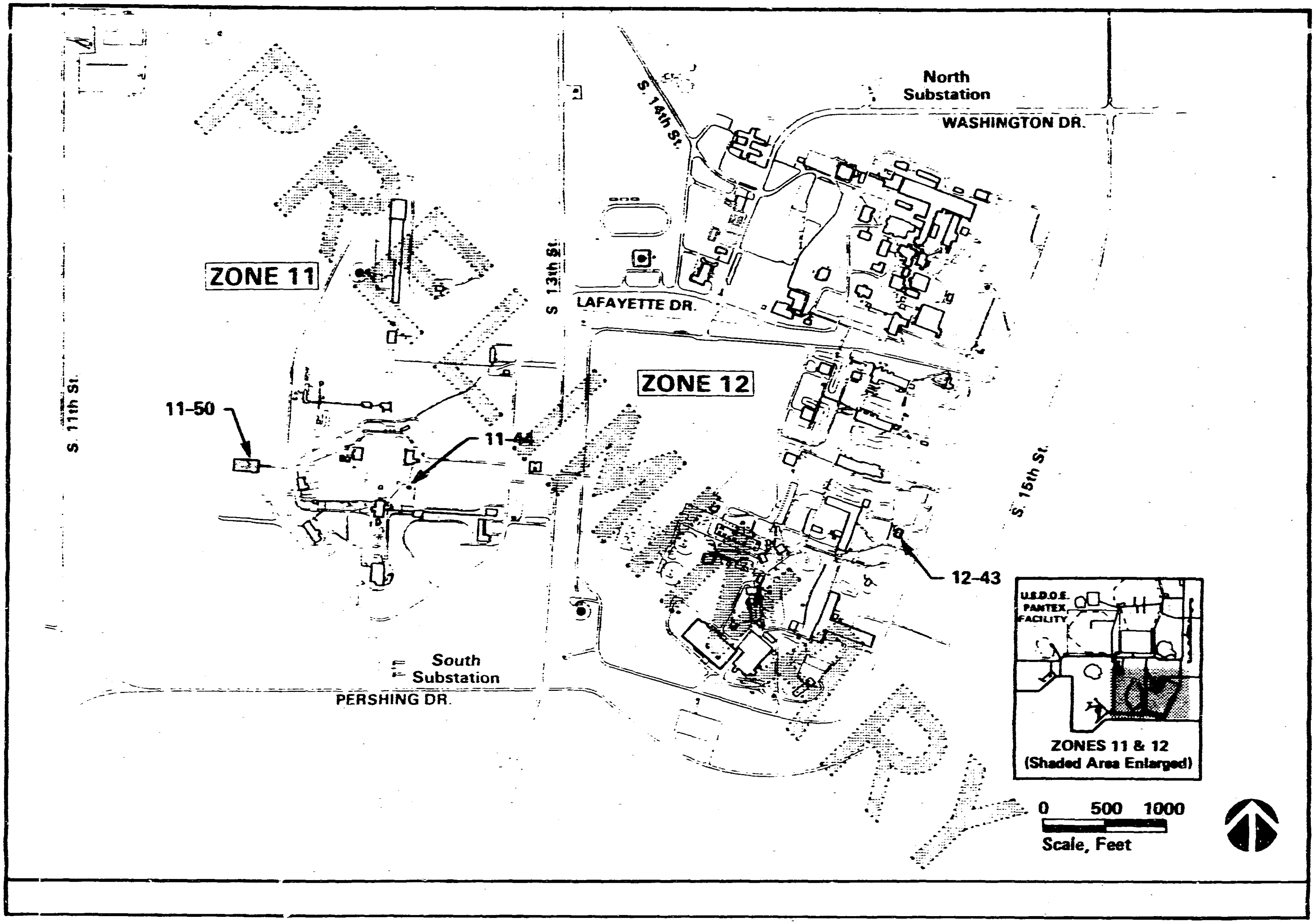
The industrial wastewaters are primarily noncontact cooling waters, but they include some contact cooling waters used in the machining of high explosives. The HE wastewaters are partially treated by settling and filtration in buildings 12-43, 11-44, and 11-50 (see Figure 3-17). The HE wastewaters going to 12-43 and 11-44 typically exit the HE machining buildings in covered concrete flumes at ground level. They are then raised by lift pumps and flow to the filter buildings. At building 12-43 this flow is through a pair of outdoor, elevated, metal flumes, while at building 11-44 the flow goes directly into the filter building via a pair of vented pipes. The HE filter units are within the same building (11-50) as the machining operation, and the wastewater channels, sumps, and pumps are located in the building's floor.

TABLE 3-12

WATER USAGE AT PANTEX
(gal./min.)

Zone	Domestic (Sanitary)	Industrial	Total
10	0.08	0	0.08
11	6.07	185.9	191.97
12	81.71	597.06	678.77
16	7.56	200	207.56
Total, gpm	95.42	982.96	1,078.38
Total, 10^6 gal/day	0.137	1.415	1.553

SOURCE: Appendix E



LOCATIONS OF WASTEWATER FILTRATION UNITS

FIGURE 3-17

A special arrangement has been established for handling HE wastewaters that are trinitrotoluene (TNT) contaminated. The wastewaters are being generated by an operation in building 12-64, bay 17. This wastewater is pumped to a tanker truck parked outside the ramp adjacent to the bay. When full, the tanker truck is driven to building 11-44 and its contents discharged into the influent channel feeding the HE treatment units.

A pair of activated-carbon columns connected in series have been installed within bay 17 to pretreat this wastewater by removing dissolved TNT prior to its discharge into the tanker truck. The carbon columns are designed to reduce the dissolved TNT from 100 milligrams per liter in the raw flow to less than 50 micrograms per liter in the finished flow. The intermediate flow between columns is monitored so that the carbon can be replaced when TNT breakthrough occurs in the first column. Because the TNT breaking through the first column will be captured by the second, the TNT residual in the effluent from the second will be low. This arrangement is believed by Pantex personnel to be adequate to serve indefinitely as the pretreatment technique for this TNT-contaminated wastewater.

Another pretreatment unit is a Hypalon-lined, granular-lime-filled lagoon situated east of building 11-14 and called the acid pond or Hypalon pond. This pond received wastewaters generated in building 11-36 through a 1000-foot-long, 1.5-inch-diameter underground Polyvinyl chloride (PVC) pipeline fed by pumps set in an outdoor sump west of building 11-36. The pond received waste sulphuric, nitric, and/or hydrochloric acid solutions generated in building 11-36 during HE synthesis operations. These solutions were largely neutralized by the granular lime in the pond. The pond also has an overflow pipe leading to an open ditch that also receives the effluent from building 11-44. The ditch drains to Playa 1. Pantex personnel indicate that the pond rarely overflows, as the liquid input is usually so small that it is entirely balanced by evaporation. However, the Survey team did observe the pond overflowing during the Survey. The Survey was conducted during a period of heavy rains.

During the Survey team's visit, the equipment in the HE synthesis building (11-36) was being used for treating an inventory of hexavalent chromium wastewater and sludge. This waste was generated in the plating shop in building 12-68 when other equipment normally handling it failed (see Section 4.1 for a related discussion.) Treating it in building 11-36 (by reduction to Cr(+3) and precipitation as the hydroxide) proved to be difficult, labor-intensive and has been discontinued. The treated wastewater from this operation was discharged to the Hypalon pond in Zone 11. Building 12-68 plating bath liquid waste is to be packaged in 55-gallon drums for storage until a package treatment plant is constructed. A package treatment plant was being installed at the time of the Survey at the northeast corner of building 12-68 to pretreat this Cr(+6) waste on a permanent basis. This prefabricated treatment plant uses the reduction/precipitation process train, and it is specifically designed for chromate reduction. The effluent will be discharged into the sanitary sewer system.

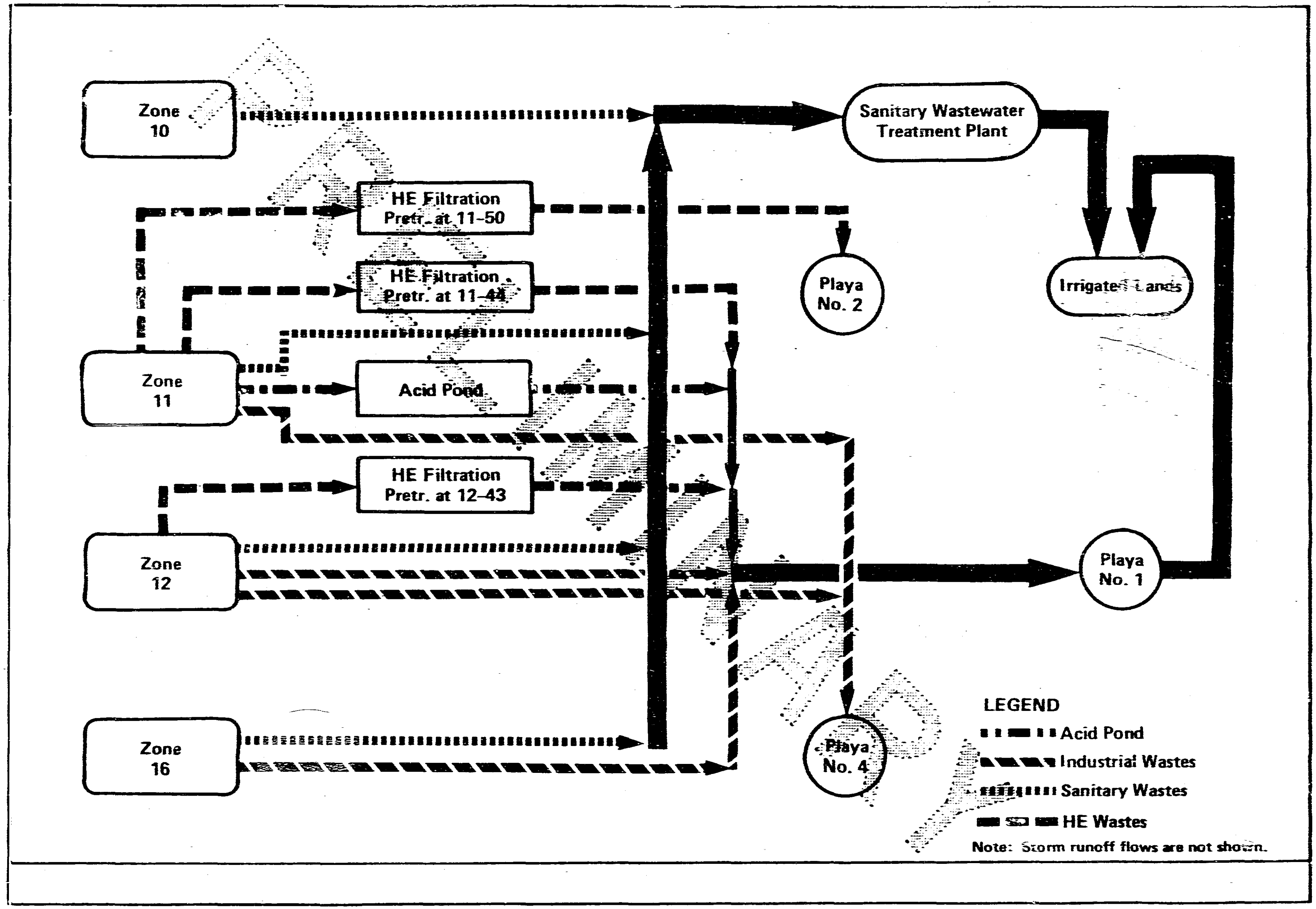
The majority of industrial flows are eventually discharged to open ditches, which also receive all stormwater runoff. The ditches carry these waters to the playas with no further treatment. Drainage areas for runoff to the various playas are shown in Figure 3-16.

3.3.2.2 Sanitary Wastewaters

The sanitary wastewater collection system encompasses only the major currently active areas of the Pantex Facility, namely Zones 10, 11, 12, and 16. There are also a few small septic tank/leaching field installations at isolated locations in active but dispersed areas such as Zones 4 and 5, the test fire sites, and burning grounds.

Small amounts of partially treated industrial wastewaters that are not compatible with the microorganisms of the sanitary wastewater treatment and disposal processes are discharged into the sanitary wastewater collection system. The latter include photographic wastes from building 11-29, plating wastes from buildings 12-68 and 11-29, vehicle washwaters from Zone 16, and boiler feedwater de-ionizer backwashes from building 12-4.

The specific sources of the various industrial and sanitary wastewater flows are detailed in Appendix D of this report. They are also summarized in Table 3-12 by zone. Figure 3-18 presents a diagram of flow paths for the different effluents



SCHEMATIC DIAGRAM OF SANITARY AND INDUSTRIAL WASTEWATER FLOWS AT PANTEX FACILITY

FIGURE 3-18

from each zone. Zone 10 discharges only to the sanitary wastewater treatment plants. Sanitary wastes from Zones 11, 12, and 16 also discharge to the sanitary treatment plant. High-explosive waste from Zone 11 is discharged to 11-44 which flows to Playa 1; the only exception is building 11-50 HE waste, which is treated in the building and flows to Playa 2. Building 11-36 discharges a portion of its wastewater to the acid pond in Zone 11. Zone 12 discharges HE waste to building 12-43, and industrial wastewater to Playas 1 and 4. Zone 16 industrial wastewaters are discharged to Playa 1.

The trunk line sewer now serving Zone 10 also extends several miles farther to the southwest to the Texas Tech University (TTU) campus and Amarillo International Airport (formerly Amarillo Air Force Base). Flows in this line now go only as far Playa 4 on the TTU property south of Zone 10. The waters from this playa are used by TTU for irrigation on their property. However, legal agreements from past years include a clause obligating Pantex to treat this wastewater from TTU and/or the Airport for a set fee on demand. Thus, the trunk sewer line crossing the Pantex site from southwest to northeast, as well as both the existing and new wastewater treatment plants, are sized to handle this proportionately large additional flow that may be imposed upon it in the future.

The sewer system is in poor physical condition and oversized for the present flows (Leedshill-Herkenhoff, Inc., 1985). Physical defects include cracked and broken pipes and joints, sags, blockages, and excessive sediment deposits. The ability of a sewer to flush solids along with the liquid is a function of the velocity of the liquid flow, which is in turn a function of the quantity (e.g., volume/time) of flow and the pipe's size and slope. Because the size and slope are fixed at the time of installation, a drastic decrease in flow quantities can lead to low flow velocities and the increased deposition of solids in the sewer. The deposition may result in blockages which can cause abnormally high stress on the pipes at times of high flow. The sewer system was originally designed for the larger flows from the World War II Army Ammunition Plant; the present flows are much smaller. This decrease, along with age, is responsible for the present poor physical condition of the sewer system.

At the time of the Survey, sanitary wastewaters were carried to a wastewater treatment plant in the extreme northeast corner of the site (Zone 13 on Figure 2-4). This plant consists of a bar screen, a measuring flume, a pair of primary settling tanks, a pump station, pairs of trickling filters and secondary settling tanks, a chlorination building, an anaerobic digester, and open sludge drying beds. However, most of the equipment is in an advanced state of disrepair, and the wastewater essentially flows through the plant with no effective treatment. Until approximately 1970, the effluent from the treatment plant was pumped to Pantex Lake. Currently, it is pumped into an irrigation header from which it is spread on fields on the Pantex site during most of the year. At other times, effluent flows to Playa 1 on the Pantex site.

A new sanitary wastewater treatment plant was under construction and nearly completed at the time of the Survey. In addition, the facility intends to repair that portion of the sewer system that is used now (Leedshill-Herkenhoff, Inc., 1985). The new plant is on the south side of Pantex Drive, south of Playa 1 and north of Zone 12 (see Figure 2-4). It consists of a bar screen, measuring flume, a lagoon with concrete-lined side slopes and a Hypalon-membrane-lined floor, a chlorine contact tank, an irrigation water pumping station, and a chlorinator building. The irrigation header leads to essentially the same area that is now being irrigated from the old plant. Similarly, excess wastewater will overflow to Playa 1. The lagoon is intended mainly as a storage/equalization unit preceding land application.

3.3.2.3 Stormwater Runoff

Pantex stormwater runoff drains to five playas located on, or directly adjacent to Pantex property (see Figure 3-16). Playa 1 drains Zone 12, a portion of Zone 11, Zone 4, and the firing sites directly north of Zone 4. Zone 12 activities include chemical research and development work, HE machining, fabrication of weapons, and maintenance shop operations. In Zone 12, stormwater drainage runs across the surface to open, unlined drainage ditches which lead to Playa 1. The Zone 4 weapons staging area is adjacent to Playa 1. The playa receives direct surface runoff through a short pipe system below a roadway which lies between the two facilities. Surface runoff from firing sites located in the northern portion of Pantex is collected by a diversion channel. The diversion channel transports stormwater runoff to the sanitary treatment plant and to Playa 1. The channel was constructed to assure that surface runoff from the firing sites remained on-site.

Playa 2 receives surface runoff from the northwest portion of Zone 11, Zone 16, Zone 8, and Zone 10. Zone 16 operations involve maintenance for railway and road vehicles. Zone 8 is an historic inert material storage area. Zone 10 is used for disposal of construction rubble and solid waste. The Playa 2 drainage area encompasses several areas where historic activities have resulted in soil contamination from spills and releases (see Section 4.5.1 for a discussion of these sources).

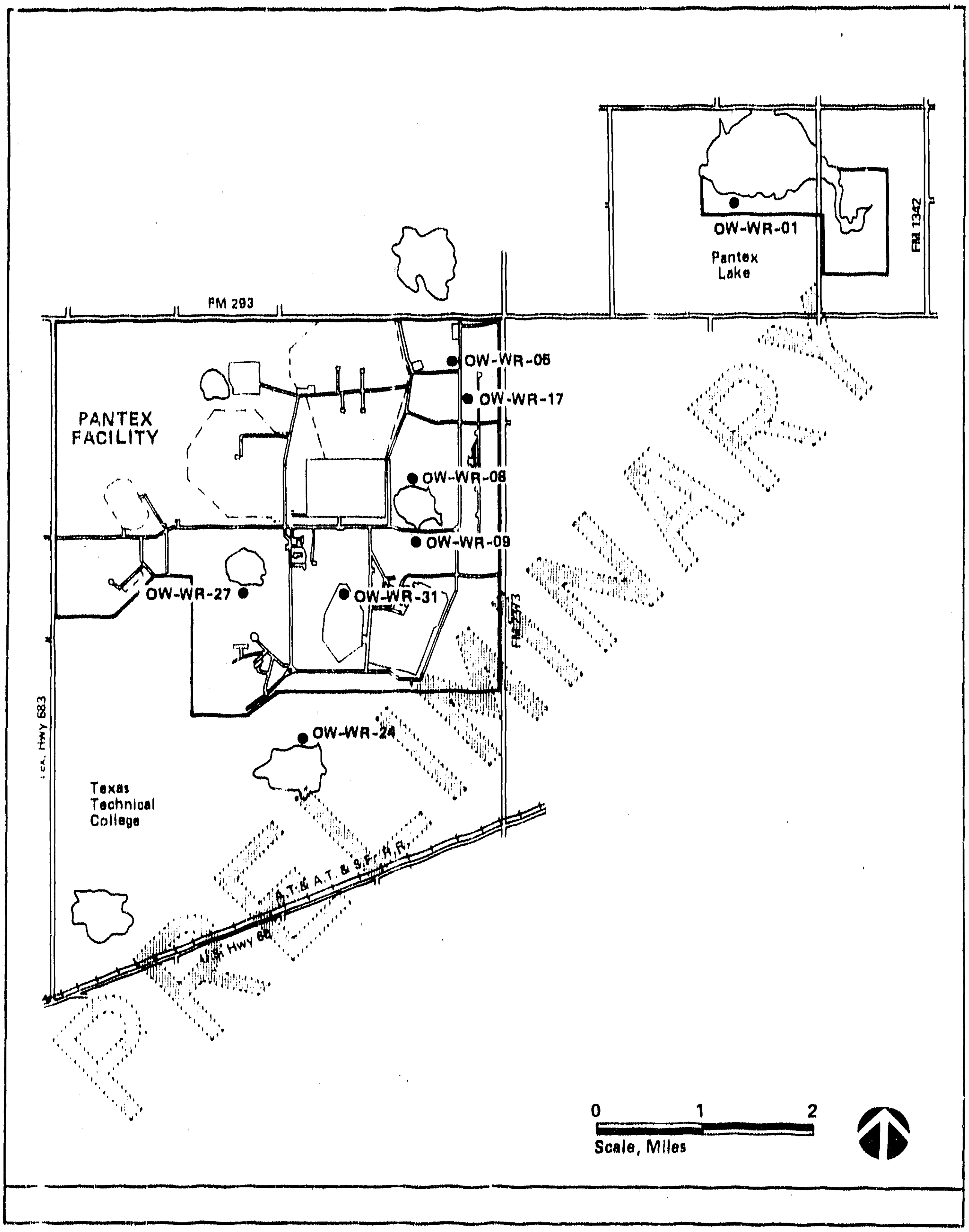
Playa 3 drains the burning ground and the area in the northwest portion of the Pantex facility. An unlined evaporation pit was used for the disposal of waste HE-contaminated solvents during the period 1954-1980. In addition, the burning ground operates burn pads, burn cages, and a disposal pit operation which treat or dispose of HE-contaminated wastes. Surface runoff from these areas drain to Playa 3 by direct overland flow.

Playa 4 is located on land leased by Pantex. Surface runoff from a small portion of the southern end of Zones 11 and 12 drain to the playa. Playa 4 receives the majority of its surface water inflow from Zone 3. Zone 3 contains 69 inactive igloos used to store munitions in the 1960s. The land is not cultivated and is used as a security buffer zone.

An unnamed playa north of Pantex receives runoff from an area on the northeast edge of the facility. There are no active Pantex facilities in this area.

3.3.3 Environmental Monitoring Program

Wastewaters and surface waters are currently sampled at eight locations (see Figure 3-19). Pantex analyzes the samples for conventional pollutants, heavy metals, explosives, radionuclides, and pesticides (see Table 3-13). Sampling frequency varies at each of the eight locations but is usually between one and twelve samples per year.



WASTEWATER AND SURFACE WATER SAMPLING LOCATIONS

FIGURE 3-19

TABLE 3-13
PARAMETERS FOR WASTE WATER AND SURFACE WATER ANALYSES

Conventional Pollutants	Heavy Metals	Explosives
Cyanide	Silver	RDX
Fluoride	Barium	HMX
Iron	Cadmium	PETN
Nitrogen-Nitrate	Arsenic	
Biochemical Oxygen	Lead	**Radionuclides**
Demand (5 day	Total Chromium	Tritium
Total Phenols	Copper	Plutonium
Phosphate	Selenium	Radon
Total Suspended Solids	Hexavalent Chromium	Total Uranium
Total Dissolved Solids	Mercury	
Chemical Oxygen	Zinc	
Demand		
pH	**Pesticides**	
Oil and Grease	Endrin	
Hardness	2,4-D	
Sulfate	Lindane	
	2,4,5-TP	
	Methoxychlor	

SOURCE: Laseter 1984, 1985, 1986

The strength of the influent to the wastewater treatment plant for 1985 (Laseter, 1985), as measured by the BOD, was extremely low. It was actually lower than the treated effluent of most wastewater treatment plants. Typical compositions of untreated domestic wastewaters have BODs of 400, 220, and 110 milligrams per liter for strong, medium, and weak concentrations, respectively (Metcalf and Eddy, Inc., 1979). Apparently, the copious amounts of industrial noncontact cooling water discharged to the sanitary sewer system dilute the wastewater to the point that it is very weak.

Examination of the water quality data for Playa 1, which receives the majority of wastewater flows from Pantex operations, shows the concentrations of all contaminants to be quite low. Pantex compares its surface water quality to four sets of limits: the EPA's drinking water regulations, described maximum levels of elements for irrigated waters (Dawson, 1974), Texas Water Development Board Water Quality Levels--Inland Waters, and Texas Water Commission Permit To Dispose of Waste (see Table 3-14). The first three of these criteria are advisory. With the exception of BOD and sulfate levels for irrigation waters, Pantex meets all these limits. The BOD limits are sometimes slightly exceeded. For instance, the 30-day average BOD, which is limited by the state permit to 50 milligrams per liter, varied from 51 to 52.5 for the period December 12, 1985, to February 13, 1986. The sulfate levels for irrigation water, which are not mandatory, are sometimes exceeded. For instance, the limit, 200 milligrams per liter, was exceeded at Station 08 for the monthly samples taken on May 20, August 19, and December 16, 1985. Pantex also analyzes Playas 1, 2, and 4 waters for tritium, plutonium, radon, and total uranium, but sediments in these playas have not been analyzed.

3.3.4 Findings

3.3.4.1 Category I

There are no Category I findings for surface water.

3.3.4.2 Category II

There are no Category II findings for surface water.

TABLE 3-14

WATER QUALITY CRITERIA

Elements or Parameters	EPA Drinking Water Regulations (mg/l)	Desired Maximum Levels of Elements for Irrigation Waters (mg/l)	Texas Water Development Board Water Quality Levels - Inland Waters (mg/l)	Texas Water Commission, Permit To Dispose of Waste, Permit No. 02296
Arsenic (As)	0.05	0.1	0.1	-
Barium (Ba)	1.0	1.0	1.0	-
Cadmium (Cd)	0.010	0.005	0.05	-
Chromium (Total)	0.05	-	0.5	-
Chromium (+6)	-	1.0	-	-
Copper	-	0.2	0.5	-
Cyanide	-	-	-	-
Fluoride	2.2*	10	-	-
Iron	-	5.0	-	-
Lead	0.05	5.0	0.5	-
Mercury	0.002	-	0.005	-
Nitrate (as N)	10	-	-	-
Phenol	-	-	-	-
Phosphate	-	-	-	-
Silver	0.05	-	0.05	-
Sulfate	-	200	-	-
Selenium	0.01	0.02	0.05	-
Total Dissolved Solids	-	-	-	-
Suspended Solids	-	-	-	-
Zinc	-	6.0	1.0	-
BOD (5 day)	-	-	-	50, 30-day Avg. 150, Grab
Fecal Coliform	1 ct/100 ml	-	-	-
pH	-	-	-	>6.0 & <9.0
COD		-	-	300, Grab
PESTICIDES				
Endrin	0.0002	-	-	-
Lindane	0.004	-	-	-
Methoxychlor	0.1	-	-	-
Toxaphene	0.005	-	-	-
2,4-D	0.1	-	-	-
2,4,5-TP (Silvex)	0.01	-	-	-

*This value for fluoride is based on on annual average daily air temperature between 12.1 and 24.6 C.

\- = Not Applicable

Source: Laseter, 1985.

3.3.4.3 Category III

1) Playas may have contamination in the water and sediment as a result of current and past operations - The surface waters and sediments in Playas 1, 2, and 4 (particularly Playa 1) may be contaminated with heavy metals, organic wastes, and pesticides, resulting in a potential threat to the migratory birds and other wildlife.

Playas are intermittent or ephemeral lakes with no outlets to streams or rivers and with inflows almost entirely balanced by evaporation losses to the atmosphere. When the water in the playa evaporates, it leaves behind all the dissolved, colloidal, suspended, and floating materials, both natural and anthropogenic, it brought with it. Many of these materials are neither highly volatile nor readily degradable and will continue to accumulate indefinitely in the playa waters and sediments. Adsorption, ion exchange, and other chemical, physical, and biological equilibria will determine the distribution of each material between the bulk liquid and sediment phases. This means that the playas on the Pantex site are natural sinks for many of the contaminants released on the site at any time in the past. Because Playa 1 receives the largest wastewater flows from Pantex operations, it is the most vulnerable to the accumulation of such contaminants. Pantex uses heavy metals, organics, and pesticides in its operations. Electroplating operations use chromium, copper, other heavy metals as well as cyanide, acids, and bases. Photoprocessing of firing site experiments and other activities result in the discharge of silver to the wastewater ditches that enter the playas. These substances have the potential to enter the playas by process wastewater; sanitary discharges; and surface runoff from firing sites, production zones, and inactive waste sites.

In addition, production areas, landfills, and land areas contaminated in the past may all be sources of heavy metal and/or toxic organics that are carried to drainage ditches, possible assisted by storm runoff, and ultimately to the playas receiving Pantex drainage. For example, activities in Zones 16, 12, 11, 10, 6, and 7 have resulted in organic chemical, high explosive, inorganic, or radionuclide releases to soils in the past (Section 4.5.1.3 contains a detailed description of 26 incidents from 1951 through 1986 which result in potential sources of soil contamination).

Heavy metals and pesticides sorb and tend to concentrate on sediments. There is no sediment sampling in Playas 1, 2, and 4, although the playa waters are sampled quarterly. The lack of sampling and analysis of sediments may result in unmonitored accumulation and potential uptake by waterfowl. During the sampling and analysis phase of the Survey, samples of the playa waters and sediments will be collected and analyzed to determine the nature and extent of contamination. Also, flows in the main drainage channels will be analyzed to determine the extent of pollutant transport caused by surface runoff.

2) Effluent treatment plants discharge ditches may contain high explosives, metals, and other organic pollutants that may migrate to the playas, constituting a continuing source of contamination to these water bodies - Any contamination in these ditches could be moved during successive storm events down the ditches and eventually to the playas. The sediments in discharge ditches leading from the HE filter/treatment units may be contaminated with high explosives. High-explosive particulates were clearly visible on the bottom of the discharge channel and ditch leading from HE filter building 12-43. A red plume, later found to be dissolved TNT, was also clearly visible in the discharge ditch from HE filter building 11-44. Such dissolved organic materials have a tendency to bind on soils, inorganic sediments, and vegetation that line these open drainage ditches.

Various organic solvents, binders, and plastic-formulating chemicals are used, along with high explosives, in the buildings discharging wastewaters to the HE filter/treatment units. The machinable explosives used in the largest quantities at Pantex are triamino-tetranitro-benzene (TATB) for newer products and cyclo-tetramethylene-tetranitramine (HMX) for older products. The contact cooling water used during machining is the largest contaminated wastewater flow coming from the HE operations in Zones 11 and 12. The filtration/treatment process is capable--when operating properly--of efficiently removing particulate materials only down to a certain grain size. However, it has little or no capability to remove colloidal or dissolved materials. In addition, effluent from building 11-44 may contain volatiles and semi-volatiles. The major solvents used in HE processing are dimethylformamide (DMF), tetrahydrofuran (THF), acetone, and toluene. Methanol is used in smaller amounts. In addition, discharges to these effluent ditches may constitute a hazardous waste under the Resource Conservation and Recovery Act

(RCRA) because of the organic and HE components of wastewaters (see Section 4.1.5 for related findings). During the sampling and analysis phase of the Survey, the sediments in the discharge ditches will be analyzed to determine if HE or organic contamination can be detected.

3) Wastewater treatment plant sludge may be contaminated - The sludge that has accumulated in the old wastewater treatment plant is possibly contaminated by heavy metals. There is a potential for the sludge to be resuspended and discharged from the treatment plant to Playa 1 and the irrigated fields. In addition, the sludge may be a hazardous waste requiring special handling when the plant is decommissioned.

Chromium, copper, and silver are discharged to the sanitary waste collection system from production operations involving plating and photoprocessing. Some of these metals are likely to reach the wastewater treatment plant. Pretreatment at some of the sources, including silver recovery and chromium reduction/ precipitation, has only been initiated or upgraded in the last 2 to 4 years. Given the changing character of the physical and chemical production processes at Pantex, and the waste handling and disposal practices of the past, it is probable that various heavy metals were discharged to the treatment plant. In addition pesticides, semi-volatile compounds, and HE used in past operations may have been discharged to the wastewater treatment plant inadvertently or as a result of overland runoff directly to the treatment plant. The sludge scraper mechanisms in the primary and secondary settling tanks have been inoperative for the last 12 to 15 years, and during that time only one effort has been made to remove the accumulation of sludge from the settling tanks. During the sampling and analysis phase of the Survey, the sludge will be analyzed to determine the presence of heavy metals and whether or not the sludge will constitute a hazardous waste.

3.3.4.4 Category IV

1) Potential for poor performance of Pantex wastewater treatment plant - The influent waters in the existing and the new wastewater treatment plant may contain heavy metals (e.g., chromium, lead, copper, and silver) resulting from plating and photoprocessing operations. These materials may adversely affect

treatment plant performance. Heavy metals, even in small concentrations, are toxic to treatment plant microorganisms. If the microorganisms are killed off, the organic wastes will not be degraded and partially treated effluent will be discharged. The wastewaters from the plating and photoprocessing operations (in buildings 12-68 and 11-29, for example) are discharged to the sanitary sewer system. Some of these wastewaters are pretreated; others are untreated. The wastewaters are presently transported to the old wastewater treatment plant; however they soon will be transported to the new plant. Because chromium, lead, copper, and silver are discharged from the above production operations to the sanitary waste lines, some of these materials are likely to reach the wastewater treatment plants.

In addition, extreme variations in influent pH, down to 2, were found in the treatment plant records. Pantex personnel explained that the acid slugs are believed to have come from regeneration of the cationic deionizers at the old Zone 12 boiler house with concentrated sulphuric acid. This regeneration cycle is automatically triggered by metal ion breakthrough and occurs several times a day. Such acid slugs can also impair the effectiveness of the biological treatment process by killing the microorganisms.

3.4 Groundwater

3.4.1 Background Environmental Information

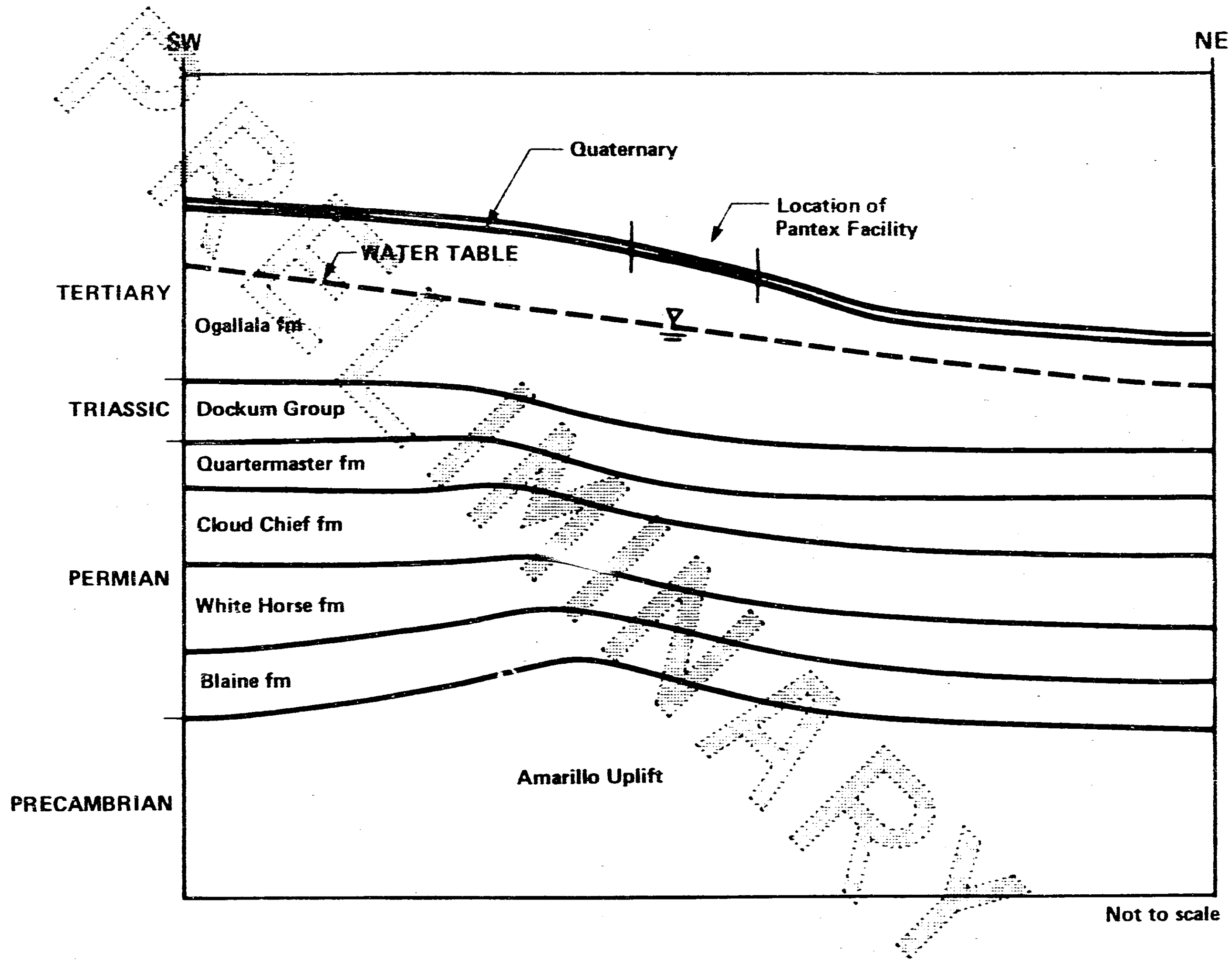
The Pantex Facility overlies one of the most extensive and productive aquifers in the United States, the Ogallala. For this reason, any potential for groundwater contamination is a major concern and a sensitive regional issue. Groundwater also represents a principal migration pathway should contamination reach the aquifer.

3.4.1.1 Regional Geology

The Pantex Facility is located in the southern part of the Great Plains Physiographic Province, in the transition zone between the North Central Plains and the Llano Estacado (Staked Plains). This Southern High Plains region, which includes parts of eastern New Mexico and western Texas, is characterized by a rather flat surface formed by Tertiary gravel deposits derived from the Rocky Mountains. The topography of the plant site features a flat upland with numerous playa basins. To the north, the Canadian River has eroded an escarpment which exposes the geologic section (see Figures 3-5 and 3-6).

The ages of the geological formations that underly the plant site are, in ascending order, the Permian, the Triassic, the Tertiary, and the Quaternary. A typical cross-section of these formations is provided as Figure 3-20. The oldest sediments occurring in the area form the Blaine Formation of Permian age. These sediments consist of shales, siltstones, gypsum, and dolomite. Overlying the Blaine Formation are, in ascending order, the Permian sediments of the White Horse Sandstone, the Cloud Chief Gypsum, and the Quartermaster Formation. These formations are composed primarily of red to reddish-brown siltstone and sandstone with some shale and gypsum.

Unconformably overlying the Permian System is the Triassic-age Dockum Group. This unit is subdivided into the Tecovas and Trujillo Formations. The Tecovas Formation consists of shale, siltstone, and sand, and the Trujillo Formation consists of conglomerate, sandstone, and shale. These formations are relatively thin (less than 100-feet thick underlying the Pantex Facility), and they are absent to the east of Pantex.



CONCEPTUAL GEOLOGIC CROSS-SECTION OF PANTEX FACILITY

FIGURE 3-20

The upper surface of the Southern High Plains is formed by the Ogallala Formation of Pliocene age. The source of the Ogallala sediments was predominantly the mountainous regions to the west. Materials eroded in the mountains were transported by streams that flowed eastward and southeastward. These braided streams deposited a thick blanket of sands, gravels, silts, and clays across the plains. The Ogallala Formation is thickest where it filled old valleys cut into the Triassic surface; its thickness ranges up to 900 feet. Since Tertiary time (1.6 million years ago), the Canadian River to the north and the Pecos River to the west have cut through the Ogallala into the underlying older rocks, so that the Ogallala Formation is now isolated geologically and hydrologically from the Rocky Mountains. For this reason, the Ogallala no longer receives recharge from the mountains.

Quaternary deposits in the vicinity of the Pantex Facility consist of windblown sands, playa lake sediments, and drainage channel deposits. These deposits are generally thin and discontinuous and consist of fine sands, silt, and clay. Caliche layers (calcium carbonate concretions) occur in the Quarternary and Tertiary deposits.

Two structural features that affected the depositional patterns were the Amarillo uplift, which occurs north of the Pantex Facility, and an associated minor uplift, which occurs on the southern flank of the Amarillo uplift. While the influence of these two structural highs was largely muted by Permian and Triassic deposits, the thickness of the Ogallala Formation is related to the underlying structure. The Ogallala thickens to the north and northeast of the Pantex Facility as it extends off the flank of the minor uplift.

3.4.1.2 Hydrogeology

The principal groundwater source in the vicinity of Pantex is the sands and gravels of the Ogallala Formation. Since this unit is hydraulically connected with other geologic units of Tertiary and Quaternary age, it is referred to by the general name of the High Plains Aquifer. The High Plains Aquifer underlies about 174,000 square miles in parts of eight states and is the principal source of groundwater used for municipal, irrigation, domestic, and stock watering purposes throughout the Great Plains (Gutentag et al., 1984).

The High Plains Aquifer is generally under unconfined or water table conditions, although, locally, slight artesian pressure may occur where water is confined beneath clay and silt lenses. The fairly impermeable sediments of the Triassic or Permian rocks form the lower boundary of the aquifer. The saturated thickness varies greatly because of the variable topography of the upper surface of the Triassic and Permian formations. Within the immediate vicinity of the Pantex Facility, the saturated thickness increases from southwest to northeast and exceeds 300 feet at the Pantex well field in the northeast corner of the site. The saturated thickness has been decreasing throughout the region owing to high pumpage rates, primarily for irrigation, and low recharge rates. Recharge to the aquifer is derived from precipitation on the surface and from streams and playas. Since evapotranspiration greatly exceeds precipitation, the amount of rainfall available to infiltrate is very low. Streams and playas provide an intermittant source of recharge and it is possible that a few high-flow events per decade or century may be a principal source of recharge to the aquifer (Gutentag et al., 1984). Researchers have estimated recharge rates for the High Plains Aquifer in Texas at 0.06 to 0.50 inch per year (Theis, 1937; White et al., 1946; TDWR, 1981). In any case, recharge is substantially less than current consumption, as shown by the steady declines in the water table. Declines in the Pantex area have averaged 1.8 feet per year based on measured levels from 1942 to 1980 (Purtymun and Becker, 1982). At the current time, depth to the water table at Pantex is about 400 feet. Projections of water consumption in the area indicate continued declines in the future.

Groundwater is known to occur in the Ogallala above the water table where it is perched by layers or lenses of impermeable rock. Two test wells on Pantex property are completed in perched-water zones, and some of the domestic wells and windmills in the area may also tap perched zones. The perched-water zones are generally localized and would not be a reliable long-term supply for irrigation, municipal, or industrial uses, because of their limited extent and relatively low yield.

The hydrologic properties of the High Plains Aquifer have been extensively tested and show considerable variation in different localities. The average hydraulic conductivity value in Texas is 60 feet per day (2.1 x 10^{-2} centimeters per second).

Based on average values of hydraulic gradient and aquifer characteristics, the velocity of water moving through the aquifer is only about 1 foot per day (Gutentag et al., 1984). Similar data on hydraulic properties of perched zones are not available. However, it is reasonable to assume that the hydraulic conductivity would be similar, since the formation materials are the same. Values for the hydraulic gradient in perched zones have not been determined.

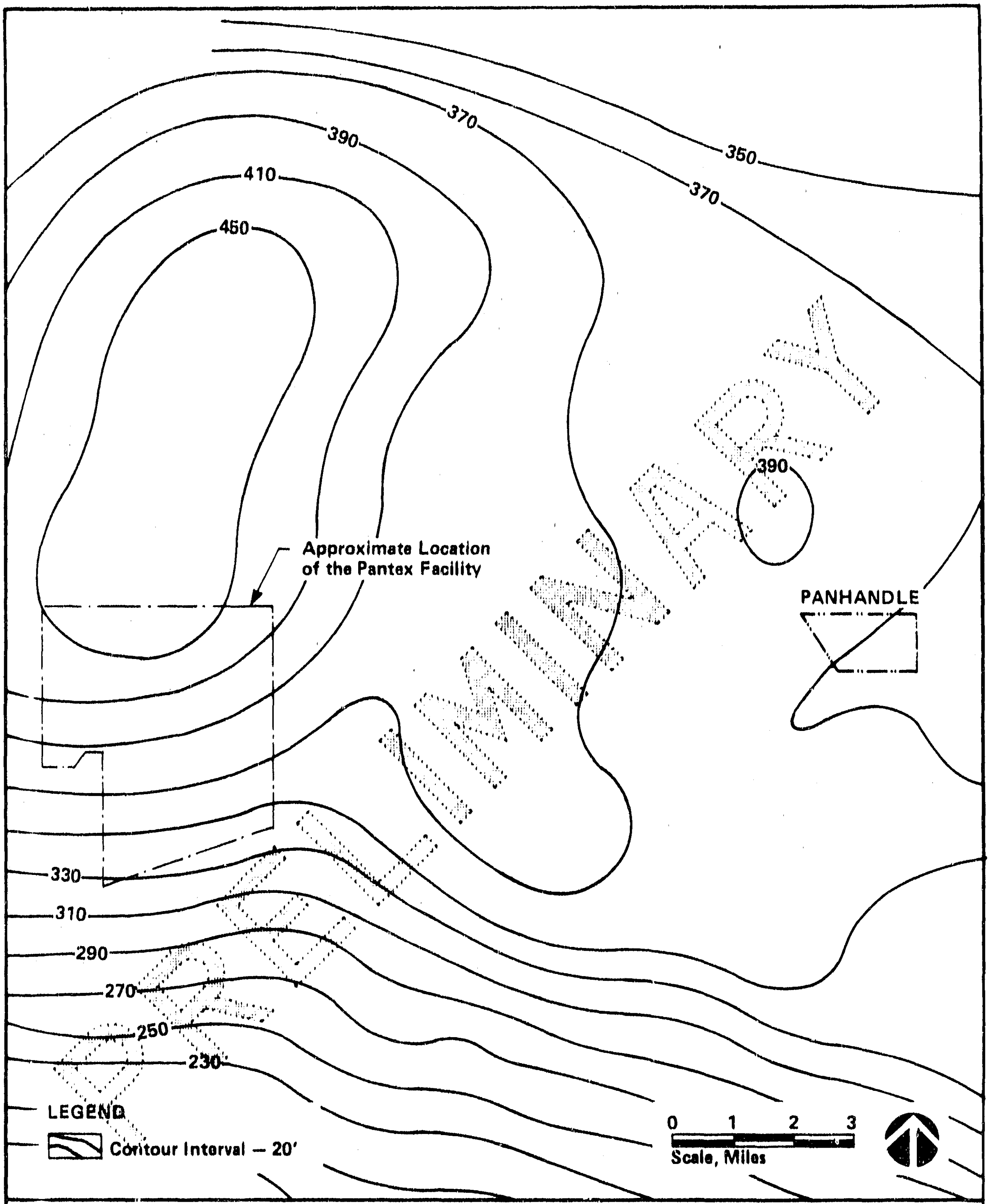
In the area of the Pantex Facility, groundwater is used for municipal, domestic, irrigation, livestock, and industrial purposes. The City of Amarillo draws part of its supply from an extensive well field to the north of the facility. Pumping in this well field has substantially affected groundwater elevation contours in the area, as shown in Figure 3-21. Production from this field for the years 1975 through 1980 ranged from 3.2 to 5.6 billion gallons per year.

There are also 50 wells (Figure 3-22) located within 1 mile of the Pantex Facility boundaries. These include 20 domestic supply wells, 16 irrigation wells, 4 municipal wells, and 10 windmills. Windmills typically supply water for livestock. According to site personnel, irrigation and municipal wells are usually completed in the main aquifier, while windmills and domestic wells are often completed in perched-water zones above the main aquifer.

On-site water supplies are drawn from four production wells in the northeast portion of the property. A fifth well was completed in 1986 and was scheduled to be on line by the end of the year. The number of wells operating at any given time depends on demand. Wells are used on a rotating schedule to minimize local aquifer impact. Average annual pumpage for the period 1971 to 1980 was 387 million gallons.

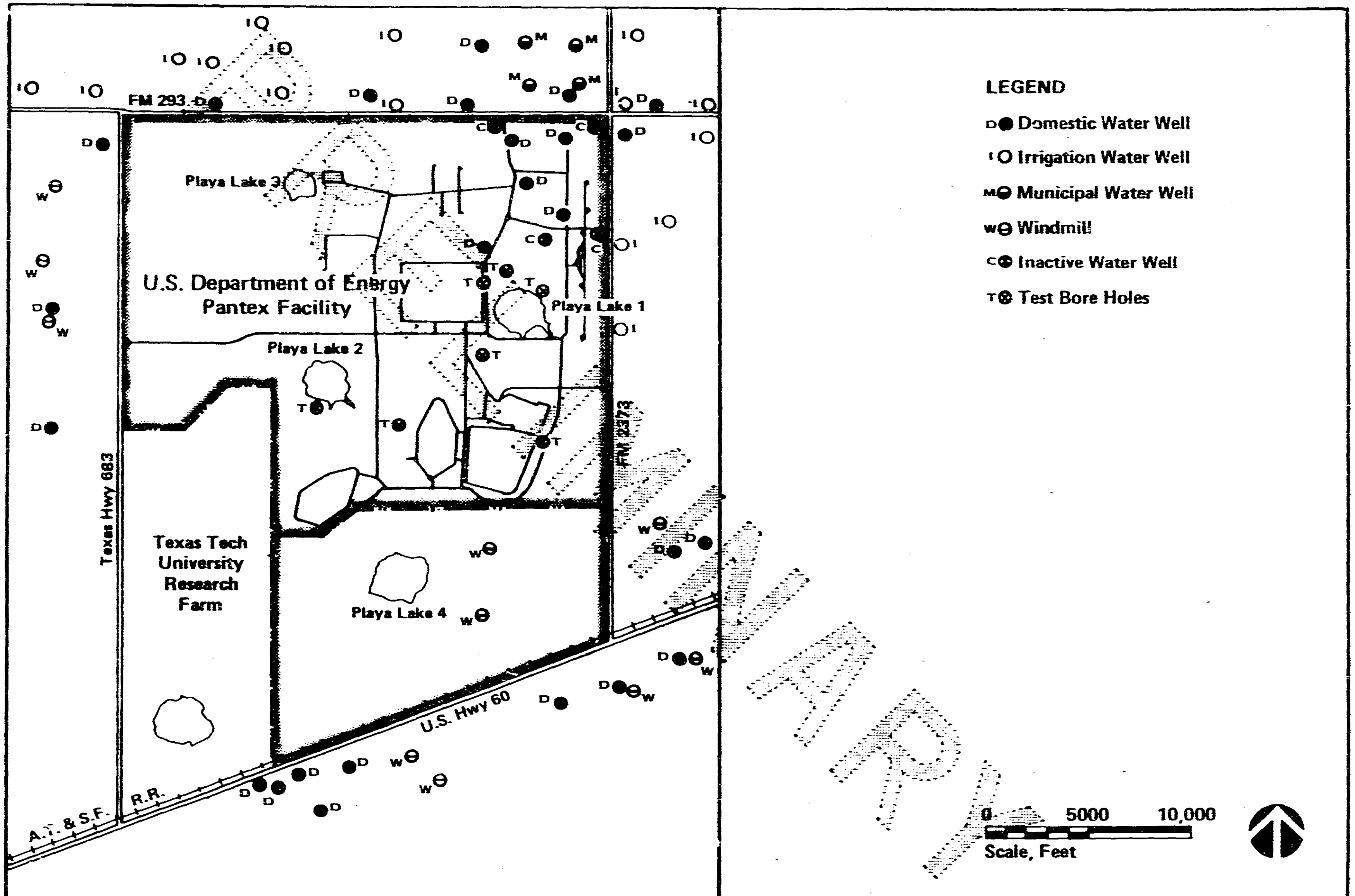
3.4.2 General Description of Pollution Sources and Controls

Potential sources of groundwater pollution at Pantex include various releases of contaminants over time to other media. These releases could have an impact on groundwater. The major potential sources of groundwater contamination are as follows:



Source: Taylor, H.D. 1979, Texas Department of Water Resources Report #228 "Carson County"

APPROXIMATE DEPTH TO WATER IN OGALLALA AQUIFER, CARSON COUNTY, 1977 FIGURE 3-21



Source: Pantex Drawing BO-OL-32

WELLS WITHIN 1 MILE OF PANTEX FACILITY

FIGURE 3-22

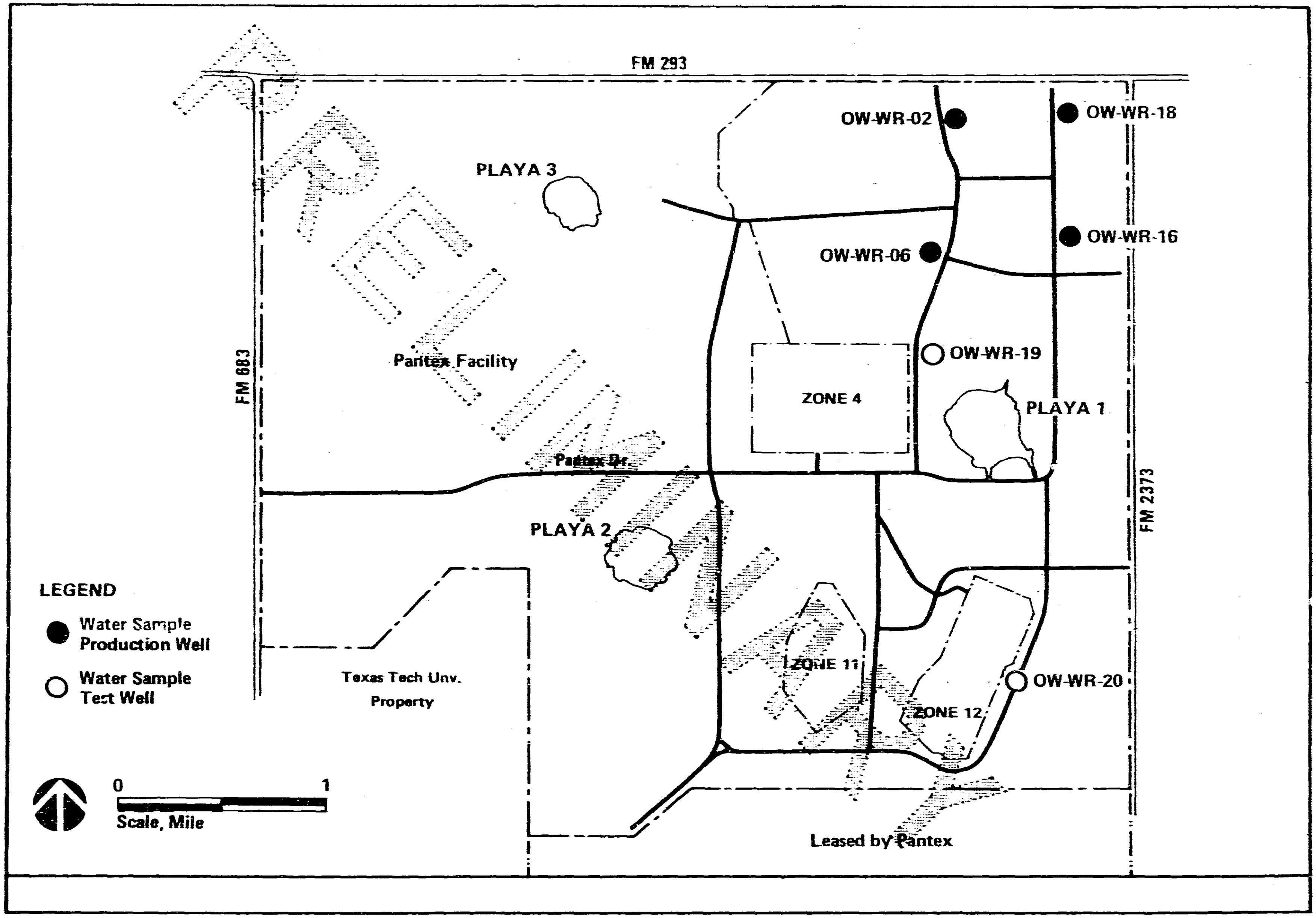
1. Historic disposal of wastewater in Playa 1 (Figure 2-4) which may have infiltrated into the subsurface. Playa 1 has received sanitary and industrial effluents, as well as surface runoff, for more than 40 years. Regionally, infiltration from the surface and potential recharge to the aquifer are extremely limited, but the continuous source of water provided by this playa may have enhanced the potential for vertical migration of any contamination present. Section 3.3.2 contains a discussion of the discharges that Playa 1 has received.

2. Historic disposal of solvents in an unlined pit at the burning grounds. Solvents and waste oils possibly contaminated with high explosives were placed in unlined pits to evaporate. The residue was burned at times. The pit was used from 1954 to 1980. Previous sampling (Becker et al., 1986) has identified acetone at a depth of 43 feet adjacent to the pits. Section 4.5.1 contains a detailed discussion of the use of the pit and an estimate of the amount of material diposed.

3. Accidental spills of fuels and chemicals. Although vertical migration of water through the unsaturated zone (between the ground surface and the water table) in the region appears to be very slow, theoretical calculations of the vertical transport of spilled fuels and chemicals suggest that vertical migration of these substances may be more rapid (Rea, 1986a).

3.4.3 Environmental Monitoring Program and Data

The current groundwater monitoring program at Pantex involves the sampling of seven wells, including four on-site production wells, two on-site test wells, and one off-site irrigation well. The locations of the on-site wells are shown in Figure 3-23. The off-site irrigation well is located at the USDA's Bushland Agricultural Research Station, approximately 20 miles west of Amarillo. The well at Bushland Station was chosen as an upgradient location primarily because of the ease of access at another Federal facility. Although this well is a considerable distance from Pantex, it does represent background conditions in the aquifer. It is not an ideal upgradient location, since it is also upgradient of any effects on the



ON-SITE WELL SAMPLING LOCATIONS

FIGURE 3-23

aquifer from sources in Amarillo. The production wells are completed in the Ogallala aquifer at depths ranging from 649 to 837 feet. The test wells are completed in perched-water zones at depths of 300 and 350 feet. Judging from the water chemistry (Purtymun and Becker, 1982), it would appear that the test wells are completed in two separate perched zones. In addition to the wells that are currently part of the monitoring program, a number of other wells exist on-site. Four of the original water supply wells that were installed in 1942 remain in place. They are no longer used because of deterioration of the screens and casings, and these four wells were scheduled to be grouted closed at the time of the Survey. A new supply well was installed in the northeast portion of the site and was expected to be on line in November 1986. In addition, two test wells drilled as part of the assessment study to locate the new production well have been completed as monitoring wells. These test wells are both completed in the Ogallala aquifer and are expected to be included in the environmental monitoring program in the future. Both test wells have screened intervals from 488 to 518 feet and a bentonite seal from 420 to 430 feet. The design is based on an expected static water level of 450 feet.

None of the wells currently used in the monitoring program were constructed for the express purpose of collecting environmental samples. All production wells have steel casings and screens with long intervals open to the aquifer to maximize production. It is reasonable to assume, given its age and intended use, that the irrigation well at Bushland Station is of similar construction. Construction details are incomplete for the two test wells, although it is known that they were both completed to 350 feet.

Sampling Frequency and Monitored Parameters

Samples are collected from wells monthly. Only two production wells are sampled during the monthly round, since that is the number that operate at any given time. The sampling of wells has been conducted since at least 1976. The samples are submitted to the laboratory and analyzed for the constituents shown in Table 3-15. This list includes most of the parameters specified by the primary and secondary drinking water standards, as well as explosives and radioactive parameters. Testing for organic solvents is not currently included in the monitoring program, but future plans call for an expansion of the program to include these parameters (Laseter, 1986b).

TABLE 3-15

GROUNDWATER ANALYSES

Silver	Phosphate
Arsenic	Sulfate
Barium	Selenium
Cadmium	Total Settleable Solids
Total Chromium	Total Dissolved Solids
Hexavalent Chromium	Zinc
Copper	pH
Cyanide	Oil & Grease
Fluoride	Hardness
Iron	RDX
Mercury	HMX
Nitrate	PETN
Lead	Endrin
Phenols	Lindane
	Methoxychlor
	2,4 - D
	2,4,5 - TP (Silvex)
Tritium	
Plutonium - 239	
Total Uranium	
Radium - 226	
Radium - 228	

Source: Environmental Monitoring Report for Pantex Plant Covering 1985, May 1986.

Sampling Procedures

The field technician follows a written procedure that has been developed by Pantex personnel for well sampling. Samples are collected with a bucket from a discharge pipe on the production wells and then transferred to bottles. The two test wells are sampled with an aluminum bail. The well sampling procedure has been recently updated, but further changes would be required to comply fully with EPA recommendations (EPA, 1986). These recommendations are discussed in Section 3.4.4.4.

Groundwater Monitoring Results

The results of laboratory analyses of groundwater samples are reported annually in the Environmental Monitoring Reports. According to a review of these reports for the period 1976-1985, monitoring has not revealed any contamination of the groundwater from the monitored wells. All contaminants that are tested are either below the limits of detection for the test procedure or are within the range of background values and do not exceed any regulatory limits. Background values are based on samples from the Bushland Agricultural Research Station.

3.4.4 Findings

3.4.4.1 Category I

There are no Category I findings for groundwater.

3.4.4.2 Category II

There are no Category II findings for groundwater.

3.4.4.3 Category III

1) Potential for undetected groundwater contamination - There is a potential for undetected groundwater contamination in the perched-water zones and possibly the Ogallala aquifer at Pantex. This potential would be the result of migration of

wastewater from the playas, particularly Playa 1, and the solvent evaporation area. If such migration has occurred, it maybe undetected as the current environmental monitoring program involves sampling a limited number of wells that were not located or constructed for the purpose of sample collection. Playa 1 is of particular concern since it has received discharges of wastewater for more than 40 years, is a continuous source of water to the subsurface and provides a driving force for the migration of contamination. As shown in Figure 3-23, the only well that is close to the playa is Test Well 1 (OW-WR-19), which is completed in a perched-water zone. There is not enough information to determine the gradient in the perched zone and, therefore, it is not possible to determine if that well is in a downgradient direction. The solvent evaporation area represents another potential source of contamination (see related finding in Section 4.5.2.3). Once again, existing wells are not located near this potential source and thus any migration may go undetected.

In addition to problems related to well locations and construction, the laboratory analyses incorporated in the monitoring program do not focus on a number of potential contaminants, including organic solvents. The monitoring program is being revised to address the need for additional analyses. Organic solvents (i.e., acetone, toluene, and MEK) and inorganic constituents could affect perched water zones that supply nearby domestic water wells. Current environmental monitoring does not adequately test groundwater for the migration of organic or inorganic contaminants from sources on-site. During the sampling and analysis phase of the Survey, water samples from existing on-site wells will be analyzed to determine whether any contamination has reached the High Plains Aquifer. Additional samples will be taken from the perched-water zone near Playa 1 to ascertain whether any contaminants have reached that zone.

3.4.4.4 Category IV

1) Sampling procedures are deficient in several areas - Procedural deficiencies can affect the reliability of the monitoring data and are therefore of some concern. These deficiencies include:

    1. Lack of adequate well purging before the sampling of test wells - This may result in inaccurate measurement of volatile contaminants.

2. Failure to decontaminate sampling equipment between samples - This may result in cross-contamination of the wells.

3. Failure to measure water levels in accessible wells - This may result in inadequate purging of the well.

4. Lack of locks on some wells - This may result in foreign material entering the well.

Sampling procedures are currently being revised by Pantex personnel and Pantex plans to address the majority of the deficiencies. However, well purging may remain a problem because site personnel do not have appropriate pumping equipment. The bailing equipment currently used for sampling is not practical for the purging of a well over 300 feet deep.

4.0 NON-MEDIA-SPECIFIC FINDINGS

This section discusses findings and observations pertaining to waste management, toxic and chemical materials, radiation, quality assurance, and inactive waste sites and releases. These discussions do not include a background environmental information section because the areas addressed are not necessarily tied to one medium as was the case with the discussions in Section 3.0. The discussions include an environmental monitoring program section where appropriate and where information was available.

4.1 Waste Management

4.1.1 General Description of Pollution Sources and Controls—Hazardous Waste

Pantex waste management activities include the generation, handling, and disposal of hazardous, mixed (i.e., containing both hazardous and radioactive components), radioactive, and nonhazardous/nonradioactive waste. Each of these waste types is discussed separately in the following sections.

4.1.1.1 Hazardous Waste Generation

The Pantex RCRA Parts A and B Permit documentation states that the facility typically generates the following classes of hazardous waste.

- o Explosive solid waste
- o Explosive contaminated solid waste
- o Explosive contaminated spent-solvent waste
- o Mercury contaminated vacuum pump oil
- o Beryllium residue

In addition, Pantex has generated the following wastes:

- o Solvents used in degreasing (recycled by the Safety Kleen Corporation of Amarillo, Texas)
- o Chromium contaminated soil from spill clean-up (sixty-nine 55-gallon drums at the time of the Survey)

Table 4-1 depicts the estimated annual quantity of each category of hazardous waste generated as reported in the RCRA Part B Permit documentation. The quantities are estimates subject to the variation of individual weapons program needs and have varied significantly in the past.

Explosive solid wastes are fragments, shavings, or chips of pure explosives that are considered waste. These are primarily generated by machining operations in which explosives are turned and shaped on a lathe producing scrap explosive particles. Scrap or reject parts of pressed high explosives from dismantlement operations are also considered explosive solid waste.

The wastes from machining operations are sluiced by water to a flume which goes to an HE filter building (11-44, 12-43, or 11-50). There the HE is separated in a hopper, emptied to a red transport container, and then taken to the burning grounds for disposal on burn pads. Waste HE from weapons component tear-down is also collected and taken to the burning grounds via special vehicle. The waste is arranged on a burn pad and remotely ignited so that an intense combustion process consumes the scrap material.

Explosive contaminated solid waste is composed of items such as mops, paper towels, filters, and rags which are used in manufacturing, inspection, sythesis, assembly, or disassembly operations and which come in contact with high explosives and may be contaminated by it. The items are collected in yellow colored explosive waste cans in individual work rooms or bays, consolidated into yellow waste carts, and unloaded to an explosives truck that makes regular (two or three times per week) pick-ups at plant facilities. The waste is taken to the burning grounds where it is disposed of by combustion in a burn cage.

TABLE 4-1

ANNUAL PANTEX HAZARDOUS WASTE GENERATION

Waste Category	Estimated Annual Quantity
Explosive Solid Waste	136,000 lbs.
Explosive Contaminated Solid Waste	160,000 lbs.
Explosive Contaminated Spent Solvent Waste	13,500 gallons
Mercury Contaminated Vacuum Pump Oil	1,375 gallons
Beryllium Residue	< 1 pound

Source: Pantex RCRA Part B

Explosive contaminated solvent waste is generated from the formulation and synthesis of high explosives. The formulation of high explosives uses a number of hazardous solvents including acetone and ethyl acetate. The formulation process results in a wastewater that is contaminated with HE and solvents. Much of the HE is filtered out of the formulation mixture, but some of this material is released in the solvent and water carrier solution. HE synthesis occurs in building 11-36. Chemicals used in the synthesis process include toluene, methanol, methylethylketone and tetrahydrofuran. Waste solvent contaminated with HE is pumped to a 1000-gallon trailer and then taken to the burning grounds for disposal.

Since 1980, Pantex waste solvents have been disposed of in three evaporation pans in the burning grounds. The liquid is pumped to one of the three open tanks (3000 gallons each) for evaporation of the solvent fraction of the waste prior to ignition to burn the HE portion of the waste. In addition to the HE-contaminated solvents from 11-36, HE-contaminated solvents from small labs and other operations are disposed of via the burn pans.

Non-HE-contaminated solvents were disposed of at the burn pad (Survey observation). The waste solvent generated in the building 12-9 chemistry lab is composed of acetone, toluene, acetonitrile, and methanol not contaminated with HE, and the adhesive lab in the same building generates waste freon. These waste solvents are disposed of in the burning ground pans. Pantex considers all solvent waste generated within a portion of Zone 12 to be HE-contaminated. The administrative designation was imposed for safety considerations. However, some operations that generate waste are known to be free of HE. For example, the chemistry laboratory, building 11-17, separates not only HE-contaminated from non-HE-contaminated wastes but separates chlorinated from nonchlorinated solvents as well. However, these solvents are taken to building 11-36, where they are mixed with HE-contaminated solvents for transport to the burning grounds.

Pantex generates waste-mercury-contaminated pump oil from the mercury vacuum pumps in the gas laboratories in buildings 12-21 and 12-59. The mercury pump oil is placed in drums marked as containing mercury waste. The drums are staged in building 12-21A and 12-94 until filled. They are then taken to pad 11-7N for storage until disposal. In October 1986, Pantex shipped 17 drums (55 gallons each) of mercury waste to GSX, Incorporated, in Greenbriar, Tennessee. This was the last shipment as of the time the Survey team left the site.

Pantex generates used solvents in parts degreasing. These solvents include freon, trichloroethylene, and others. Building 16-1 (the Maintenance Shop) is the largest generator of waste solvent. The Safety Kleen Corporation has been retained to remove and recycle this solvent waste.

Pantex operates a large plating operation in building 12-68. The plating operation has generated an acidic chromium waste stream in the past. Pantex personnel have stopped the discharge of the chromium waste stream until such time as a new chromium treatment system, under construction at the time of the Survey, becomes operational. A spill of approximately 500 gallons of liquid chromium waste occurred at building 12-68 on October 22, 1986 (see Section 4.5.1.4 for further details). The spill resulted in a cleanup campaign which generated 69 drums (55 gallons each) of chromium-contaminated soils at the time of the Survey. The cleanup continued after the Survey team left the site. Pantex has treated soil from the chromium spill cleanup in building 11-36, as discussed in Section 3.3.2.1. The chromium was subjected to a chemical reduction process to convert the hazardous hexavalent chromium to the less hazardous trivalent form. Some waste chromium was stored at the 11-36 solvent storage pad within stainless-steel trays to prevent the discharge of any leakage. Neither treatment building 11-36 nor storage pad 11-36 have been identified as the location of a hazardous waste management activity in the RCRA Part A notification. The remainder of the chromium spill cleanup material is staged on pad 11-7N until it can be removed by the off-site hazardous waste disposal contractor. The remaining soils are now stored on pad 11-7N awaiting disposal by the Rollins Environmental Services Corporation of Deer Park, Texas, the current site hazardous waste disposal contractor.

The hypalon-lined pond in Zone 11 receives effluent from HE synthesis building 11-36. The pond contained lime that was used to neutralize acidic wastes that had been discharged from building 11-36.

The Pantex laboratories generate waste chemical jars through periodic inventory and disposal of out-of-date chemicals. These are collected and stored on pad 11-7N prior to pickup by the site hazardous waste contractor.

4.1.1.2 Additional Waste Streams

Six other hazardous waste streams in addition to those reported in the Part B Permit documentation have been generated at Pantex. These include 4,4'-methylene bis 2-chloraniline (MOCA) waste, waste oil contaminated with solvents, photoprocessing wastes potentially containing hazardous quantities of silver, xylene (a hazardous solvent constituent of scintillation vials) waste, and waste paint and paint thinner streams. Each of these are discussed below.

MOCA waste

The Adiprene process in building 12-16, the plastics shop, uses MOCA in the epoxy forming process. A thermal reactor is used to heat granular MOCA to a thick liquid so it can be added to the Adiprene plastics process. MOCA waste is generated when heated MOCA is discharged from its heating unit to a cup but is not mixed to form the epoxy. The waste MOCA is placed in a 20-gallon waste can, which is marked as containing hazardous waste. The cup can hold approximately 4 fluid ounces of raw MOCA but typically contains less than an ounce when disposed of. The cups of MOCA are disposed of in a 20-gallon waste drum, which is marked as containing a hazardous material. Approximately four times per year the waste MOCA can is emptied into the general trash dumpster behind building 12-16. The contents of the dumpster are disposed of in the Pantex sanitary landfill. The practice of disposing of the waste in the sanitary landfill was stopped as soon as it was brought to the attention of plant management.

Photoprocessing waste

Small quantities of hazardous waste are entering the Pantex sanitary treatment system and wastewater treatment system. For example, building 11-29 photographic lab operations result in the disposal of small amounts of unrecovered silver and mercury to the drains from photographic and circuit board processes. Silver and mercury are toxic heavy metals.

Waste paint and solvents

Spray painting building 12-41 contains a large water spray paint booth. The water from this spray booth operation is discharged to a ditch behind the building. Building 12-41 personnel stated that the disposal of the laquer thinner, acetone, and xylene to the 500-gallon paint spray booth water bath occurred occasionally. The thinner, acetone, xylene and wastewater have been disposed to the ditch.

Solvent-contaminated waste oil

Waste organic solvents are mixed with waste oil. For example, building 12-68 waste freon is disposed of in waste oil drums. Approximately six drums of solvent-contaminated waste oil are generated per year from this operation. This practice mixes a hazardous waste with a nonhazardous waste and makes the disposal of waste oil, which is not otherwise contaminated, more difficult and costly.

Xylene waste

Waste scintillation vials from scintillation counting operation in building 12-42 were disposed of in the general trash. The scintillation vials contain a xylene-based scintillation fluid. Vials that contained no radioactive constituents were placed in the general trash dumpster behind building 12-42 for disposal in the landfill. Xylene is a listed hazardous waste and is an ignitable material with a flash point of less than 60°C (140°F). This practice was stopped as soon as it was brought to the attention of plant management.

Mercury waste

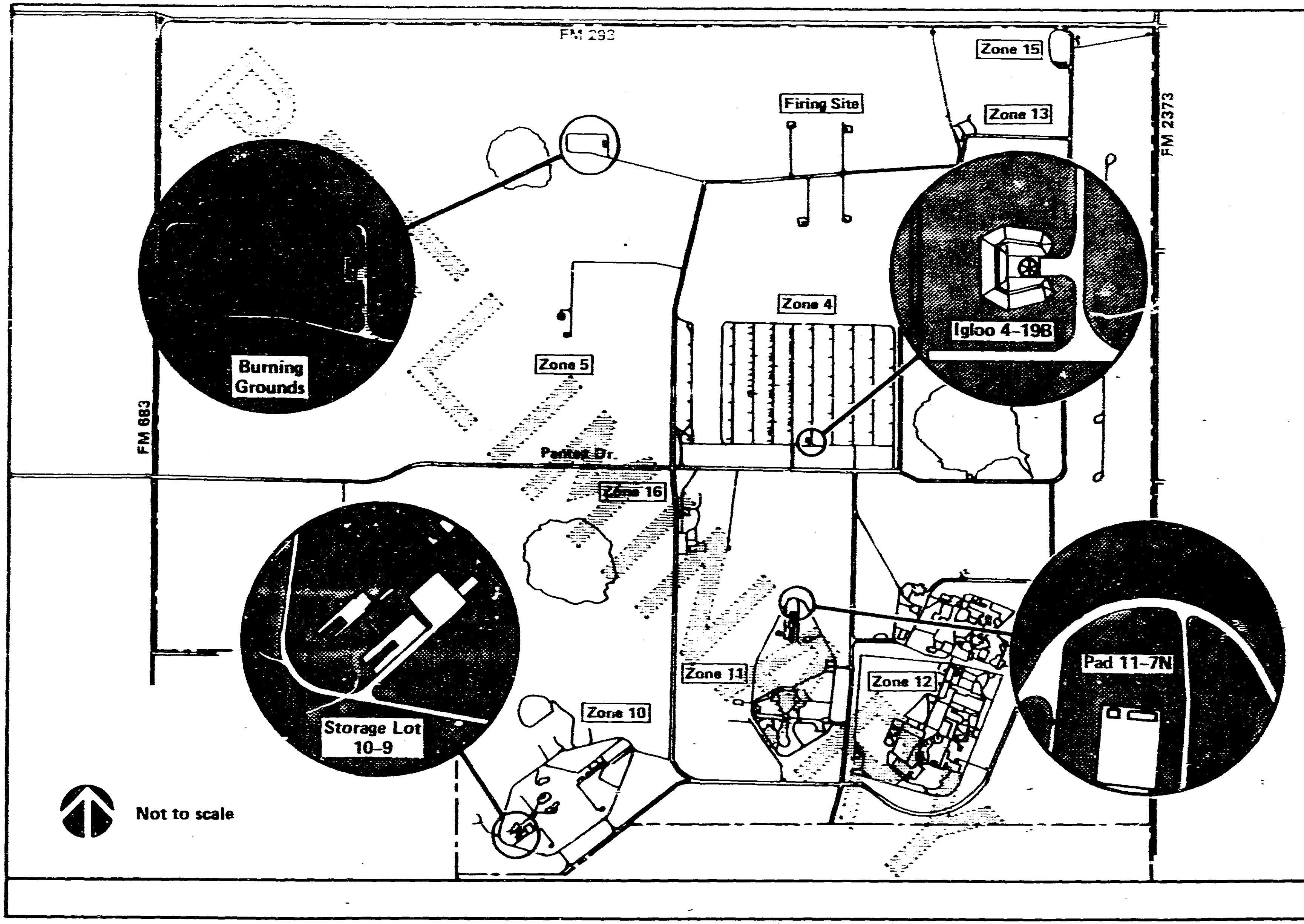
A small amount of sludge (approximately 4 ounces per week) from the circuit board operation in building 11-29 has been dispos d of in the general trash. The sludge contains small amounts of mercury. The building 12-94 chemistry lab contains glass racks that use mercury in a pressurized environment. The stopcocks that occasionally contain minute amounts of mercury are cleaned with paper towels soaked in toluene. The paper towels are disposed of in general waste trash cans.

4.1.1.3 Hazardous Waste Facilities

The Resource Conservation and Recovery Act (RCRA) Part A Permit notification (DOE, 1985) identified three container storage facilities; an open, controlled incineration area; and a number of inactive facilities (Figure 4-1). The three container storage facilities are building 4-19B, one-half of a munitions igloo that used to store hazardous, mixed, and radioactive wastes; the building 11-7 north pad, an open hazardous waste storage area; and the building 10-9 storage lot, which is used to store empty 55-gallon drums that once held solvents, acids, and other materials. The open, controlled incineration area (i.e., the burning grounds) consists of 15 earthen pads upon which explosives are remotely ignited and allowed to burn; three metal troughs that hold solvents for evaporation and subsequent ignition; and two burn cages for mops, paper, paper towels, gloves, and plastics from contaminated areas.

In addition to those facilities included in the Part A Permit documentation, two burning grounds facilities handle wastes that may be hazardous: a landfill at the north edge, and the burning racks. The landfill is used to dispose of ash resulting from burning grounds activities. There are burning racks at the burning grounds where weapons components containing radioactivity and HE are separated. The burning rocks are used to dispose of the HE portion of a component that contains HE bonded to depleted uranium (see discussion in Section 3.2.2.4).

The inactive facilities listed in the Part A application are an earthen basin at the burning ground formerly used to dispose of solvents, the former scrap HE ignition area, a PCB storage area, and an area at the northeast corner of the sanitary landfill that is used to stage hazardous waste items from the sanitary landfill. The items in this latter group include gloveboxes and equipment that may contain MOCA. The MOCA-contaminated equipment was buried in the sanitary landfill in the 1970s prior to the designation of MOCA as a hazardous waste and was exhumed in mid-1986 for off-site disposal.



HAZARDOUS WASTE STORAGE AND DISPOSAL AREAS

FIGURE 4-1

High explosive filter building 11-44 has been used to treat a pink/red wastewater from TNT operation in Zone 12. The wastewater results from weapons disassembly that occurs in Zone 12. The pink/red water is pumped into a 2500-gallon tanker and is transported to the building 11-44 influent trench for processing. At one point during the Survey, a large section of the building 11-44 effluent ditch waters were pink/red-colored. The source of the color was the discharge of the TNT wastewater to building 11-44 earlier in the day. Pantex personnel indicated that they intend to change procedures and treat the pink/red water by a charcoal filter operation rather than continue to use filter building 11-44.

In addition to the HE wastewater, the laboratory sink drains of some Pantex buildings are connected to the HE filter buildings. For example, the laboratory in building 11-7 is connected to filter building 11-44. Laboratories in the building separate out most of solvent wastes into waste cans, but some chemical wastes have been disposed of in the sink drains. The practice could result in hazardous wastes entering the HE filter buildings and thereby mixing with waste otherwise contaminated only with HE.

4.1.2 General Description of Pollution Sources and Controls—Mixed Waste

Liquid scintillation vials and the beryllium-contaminated debris are the only mixed wastes at the Pantex facility. Scintillation counting is used for monitoring worker exposure to radiation, for environmental monitoring, and for determining the level of radiation emitted from various weapons parts. Scintillation vials typically contain xylene (a listed hazardous waste) or other ignitable solvents in combination with alpha- or beta-emitting radionuclides. The waste scintillation vials are generated in buildings 12-2 and 12-42. Small quantities of mixed wastes generated in building 12-2 (approximately 5 gallons per year) are solidified in a cement grout mixture prior to disposal. The cemented waste is being stored in building 4-19B until an approved DOE mixed waste disposal location is identified. The scintillation vials generated in building 12-42 are segregated into those that contain radionuclides (i.e., mixed waste) and those that do not (i.e., hazardous waste). Pantex personnel could not estimate an annual quantity of mixed waste generated from building 12-42 because of the great variability in program requirements. The mixed waste is staged in igloo 4-19B until an approved facility begins accepting it.

The handling of the scintillation vials that are considered hazardous waste was discussed in Section 4.1.1.

The Total Containment Test Facility (TCTF) waste consists of sandbags, wood, and plastics from the test, as well as booties and protective clothing used in the clean-up of the TCTF. The debris is contaminated with depleted uranium and beryllium. Pantex has not tested the TCTF debris but has administratively classified the waste as mixed. This waste has been transported to the Nevada Test Site (NTS) in the past, but such shipments ended in February 1986 upon notification from the NTS of a prohibition on the acceptance of mixed wastes. The waste is staged in plywood boxes in igloo 4-19B until an acceptable DOE mixed-waste disposal location is identified.

Pantex manages the disposal of joint test assembly (JTA) debris. The JTA program involves the evaluation of weapons that have been deployed in simulated tests. The weapons arrive at Pantex in a damaged state. After appropriate weapons component evaluation tests have been performed, the debris is packaged for shipment to NTS. The debris may contain hazardous constituents with the weapons parts, resulting in a mixed waste.

4.1.3 General Description of Pollution Sources and Controls—Radioactive Waste

Pantex generates only low-level radioactive waste. No high-level or transuranic waste is generated, nor does Pantex generate any waste that has been designated as a by-product waste. Pantex is now generating approximately 1500 cubic feet per year (Pantex Waste Management Site Plan, 1985) of low-level waste (LLW) from weapons assembly areas, weapons breakdown areas, test fire sites, and the burning grounds burning racks. The radioactive waste consists of contaminated vacuum cleaners and hoses, kimwipes, filters, gloves, aprons, and swipes. These wastes are packaged into 55-gallon drums and sent to the NTS. Building 4-19B is used to stage radioactive wastes until they can be transported to the NTS.

Pantex generates depleted uranium at the burning grounds from the separation of depleted uranium (uranium-238) from HE components by high-temperature combustion. The depleted uranium is packaged and stored in building 4-19B to await recycling at the DOE Rocky Flats facility. In addition, in the past, test fire shots of depleted-uranium components resulted in contamination of some test fire areas with depleted uranium (see Section 3.2 for related information). The larger particles of uranium are collected after each shot, packaged, and stored in building 4-19B prior to NTS shipment.

4.1.4 General Description of Pollution Sources and Controls—Nonhazardous, Nonradioactive Waste

Nonhazardous wastes generated at the Pantex facility consist of the nonchemical and non-HE solid wastes that are generated during plant operations. These wastes consist of ordinary garbage, waste paper, trash, cafeteria food discards, construction debris, and scrap. According to 1984 and 1985 Annual Waste Summaries, approximately 50,000 cubic yards of nonhazardous solid wastes are generated each year. These wastes are generally disposed of in the on-site sanitary and construction landfills. Scrap materials may be staged at the plant Scrap and Salvage Yard (at building 10-9) for subsequent sale (Figure 4-1).

Solid Waste Collection

Solid wastes are screened to separate HE and radioactive waste from the solid waste at the point of generation. All nonhazardous wastes are deposited into green or gray dumpsters for transport to the sanitary landfill. (HE or HE-contaminated wastes are deposited within yellow dumpsters for transport to the burning grounds.) When the green or gray dumpsters are picked up, the contents are immediately dumped into the transfer truck and compacted for subsequent transport to and disposal in the sanitary landfill. There is no apparent opportunity for wastes improperly disposed of to be retrieved once they are in the dumpster.

Within the Materials Access Area (MAA) of Zone 12, formal procedures are used to screen the solid wastes prior to transport to the landfill. The MAA solid wastes are bagged and placed in orange carts. At the time of pickup, the solid waste transfer truck places an empty dumpster at the building doorway. Under the supervision of plant security personnel, the orange carts are brought to the doorway, at which a large metal detector is also stationed. Bags of trash are removed from the carts and passed through the metal detector. In addition, the bags are screened by a hand-held radiation detector. Trash bags that do not set off either the metal or radiation detector are deposited directly into the dumpster. Bags that set off a metal detection alarm are set aside for manual inspection prior to disposl in the dumpster. These procedures were observed at building 12-26 during the Environmental Survey. The screening process was performed in assembly-line fashion; trash bags were passed quickly through a metal detector, then passed to one of two individuals, depending upon the metal detector response. If there was no response from the detector, the bag was passed directly to the person standing by the dumpster, who then disposed of the bag. If the metal detector alarm sounded, then the bag was passed to a supervisor, who quickly checked the bag contents. In no instance were any of the bags opened to find the cause of either the radiation or the metal detector alarms.

Sanitary and Construction Landfills

According to State of Texas Operational Standards for Solid Waste Land Disposal Sites (Title 25, Subchapter F), an attendant shall be on duty to direct unloading of solid waste, and site access shall be controlled. Also, portable fences or other suitable means are to be used to confine windblown materials to the smallest practical area. All solid wates received in a Type I site shall be compacted and covered daily, except for areas designated to receive only brush and construction debris.

The Pantex sanitary landfill is located immediately to the north of Zone 10 (see Figure 2-4). According to dimensions in the plant engineering drawings (Drawing Number DO-0121-1), the landf'll occupies an approximately 32-acre, rectangular tract oriented in a northeast-southwest direction. An access road enters from the south side at the approximate midpoint. Although the landfill is bordered with chainlink fencing, the access road is not secured. A sign at the entrance provides information about the types of materials that may and may not be disposed of there. Only the front-end loader operator is present at the landfill. Approximately 17 acres northeast of the access road are filled-in, closed portions of the landfill. The operating portion is on the remaining 15 acres southwest of the access road. In the late 1970s, chemical wastes were buried on the far north-northeastern end of the landfill. These wastes included MOCA, Sil-Gard, and dodecenyl succine-anhydride. These wastes have been exhumed and are presently staged at that end of the landfill pending selection of an offsite disposal contractor. Some trash was also observed being blown across this end of the landfill.

Two deliveries to the sanitary landfill were observed during the Survey, the first load was dumped at midday and the second at late afternoon. At the time the second load was dumped, the first load had not yet been covered but had only been pushed into the open landfill pit. However, cover material was applied immediately upon the dumping of the second load.

The construction landfill is located immediately to the north of the sanitary landfill. Access is gained via a road along the northeastern side of the sanitary landfill (see Figure 2-4). The construction landfill is intended for use by onsite construction subcontractors for the disposal of inert construction-related materials. Materials reported to be disposed of there include brick, concrete, steel, sheetrock, paper, wire, glass, and plastic. As with the sanitary landfill, the construction landfill in not secured against unauthorized access, and only a sign at the entrance indicates the types of materials that may be disposed of. The construction subcontractors haul their own wastes to the landfill as required, and therefore may dump their loads without supervision. During the Survey, a crushed drum labeled hydrofluoric acid was observed at the construction landfill, suggesting that improper disposal practices could be occurring there.

The sanitary and construction landfills are inspected irregularly by plant environmental health personnel. The last documented inspection was in February 1984. The inspection consisted of a checklist of 10 required and 12 recommended items regarding operational practices (e.g., "daily cover applied . . . yes or no"). The inspection form includes the inspectors' comments and suggestions, but there is no indication that follow-up on these items has occurred. For example, the February 1984 inspection checklist for the construction landfill indicates that access is not limited and litter control is not provided, and it suggests the use of a large movable sign to designate proper dumping areas. Observations during the survey indicate that there has been no change with regard to these items.

Scrap and Salvage Yard

The Pantex Scrap and Salvage Yard is to the south of the landfills in Zone 10. This yard is operated by the Central Stores Department for both the procurement and disposition of excess or surplus properties, as well as for the disposition of saleable scrap materials.

Scrap materials are accumulated on the plant site in large, gray boxes, or they may be delivered directly to the scrap yard at building 10-9. Plant policy is to ensure that any material that may possibly be released to the public be free of explosive or radioactive contaminants. Therefore, safety certification is required before scrap materials can be transported to or accepted at the scrap yard. Additional checks by security, fire, and waste management departments may also be required.

At the time of the Survey, the scrap yard was storing empty 55-gallon drums and lead-acid batteries for salvage sale. Before drums are accepted at building 10-9, they are required to be labeled empty, meaning they have less than 1 inch of contents remaining. When sufficient numbers of drums are accumulated, they are picked up by the buyer. The buyer is selected by a bidding process, during which the buyer must identify any relevant state and EPA permit and registration numbers. When the drums are picked up by the buyer, the transfer is documented solely by the shipping order prepared by Central Stores. No further documentation is obtained from the buyer regarding final disposition of the drums. Under the current drums sale contract, the facility anticipates the sale of approximately 600 drums during the period May 15, 1985, through May 15, 1987. No information on the sale of lead-acid batteries was available at the time of the Survey.

During the Survey, approximately 200 drums were observed to be stored in the salvage yard. These drums were stacked on their sides, three or four high, along the south side of the salvage yard. Dark stains were observed on the ground adjacent to the drums, suggesting that the drums may not have been sufficiently emptied at the time of receipt and that the contents may have spilled or leaked upon the ground. Also, storage pad 10-7 adjacent to Building 10-9 is considered a general-use area by the facility, and is not controlled by Central Stores procedures. Items observed in this outdoor area included old transformers and 55-gallon drums.

4.1.5 Findings

4.1.5.1 Category I

There are no Category I findings for waste management.

4.1.5.2 Category II

1) A listed hazardous waste is treated at a non-RCRA facility - Pink/red water from TNT operations, a listed RCRA hazardous waste, has been treated in HE filter building 11-44. Building 11-44 has not been identified as a hazardous waste treatment facility in Pantex notifications to Texas and does not have interim status under RCRA. The operation of an RCRA facility without interim status contravenes RCRA requirements and may result in an enforcement action.

Filter building 11-44 has been used to treat wastewaters containing TNT from weapons dismantlement operations occurring in Zone 12. The pink/red water from these Zone 12 activities is pumped to a tanker truck, transported to building 11-44 and discharged to the influent of the building. The Environmental Survey team discovered the practice when pink water was seen moving in the building 11-44 discharge ditch. Pink/red water from TNT operations is a hazardous waste listed in 40 CFR 261.32 as EPA Hazardous Waste No. K047. The operations that generate the waste occur intermittantly at Pantex. Pantex officials stated that measures would be taken to ensure that this waste would no longer be treated in building 11-44. A carbon filtration system will be used at the weapons dismantlement location to treat the wastewater from the operation.

2) Influent and effluent wastewater has not been tested to determine if it constitutes a hazardous waste - The influent to HE filter operations in buildings 11-44, 12-43, and 11-50 has not been tested for all hazardous waste characteristics. The influent and effluent wastewaters have not been tested for corrosivity, reactivity, ignitability, and toxicity to document whether the filter buildings are facilities that require RCRA compliance. Pantex could be required to notify the state of the existence of these facilities and comply with requirements for RCRA hazardous waste treatment and disposal facilities if the influent and effluent

wastewaters were found to be hazardous. Buildings 11-44 and 12-43 are filter operations that receive wastewater from various buildings engaged in HE machining operations, primarily in Zones 11 and 12. Building 11-44 also has received wastewaters contaminated with TNT via tank truck. Building 11-50 has a filtering operation that receives wastes only from HE machining in that building. The high explosives used in the machining processes include HMX, TATB, and other sensitive and nonsensitive explosives. The HE is machined on lathes using water as a cooling or lubricating medium. The water carries the waste HE to the filter building, where the wastewater is filtered. Most of the HE is removed from the waste in the filtration process, but grains of HE are visible in the effluent exiting the filter buildings and in drainage ditches that carry the effluent to the playas. Particulate HE is visible in the ditches up to 300 feet from the filter building 12-43 outfall (see related finding in Section 3.3.4.3) . Soluble constituents of the waste stream may be carried farther along the drainage ditches than the large particulate HE. The effluent ditches are unlined, and they usually contain a continuous water flow that either reaches Playa 1 (for buildings 12-43 and 11-44) or Playa 2 (for building 11-50) or evaporates before reaching the playa.

The filter operations would meet the regulatory definition of hazardous waste treatment under RCRA if the influent wastewater were a hazardous waste and the facility did not remove the hazardous characteristic prior to discharge. In addition to the potential for the filter buildings being a RCRA treatment facility, the presence of hazardous wastes in the drainage ditches or the playas would signify that these features were hazardous waste land disposal units if the filter building effluent were hazardous. The RCRA requires such units be double-lined, have a groundwater monitoring program, and obtain a RCRA Permit. The RCRA contains an exemption for discharges subject to regulations under Section 402 of the Clean Water Act, but the exemptions are not applicable to Pantex. Pantex does not have a National Pollutant Discharge Elimination System (NPDES) permit under Section 402 of the Clean Water Act and cannot make use of exemptions based on NPDES permits. During the Sampling and Analysis Phase of the Survey, the wastewater at buildings 12-43, 11-44, and 11-50 will be analyzed to determine if the influent and effluent wastewater constituents are hazardous wastes.

3) <u>Hazardous wastes may be released from buildings 12-17 and 12-19 to soils near the buildings</u> -The disposal of potentially hazardous waste to drainage ditches near buildings 12-17 and 12-19 can be interpreted by regulators as land disposal of hazardous waste without a permit. These waste streams are not accurately identified and their management as hazardous waste is not fully explained in Pantex RCRA documentation.

HE synthesis and formulation operations in buildings 12-17 and 12-19 involve a number of solvents (e.g., acetone) in a mixture to process PETN. The wastewaters from the processing are discharged to an effluent ditch adjacent to the buildings. The wastewater contains some HE not removed by filtration as well as acetone and water. The concentration of acetone in the wastewater is typically 30 gallons per 200-300 gallons of water. The wastewater is transported in unlined ditches for most of its journey to Playa 1. The evaporation rate of the Pantex area usually causes the wastewater to evaporate before reaching Playa 1. Unlike the HE filter buildings, wastewater is discharged only during synthesis operations, so there is no constant drive force to transport solvent waste into the soil column. Pantex personnel report that there are plans to use a portable liquid dumpster to receive the solvent wastewater mixture from building 12-17 processing in the future. The dumpster will transport the solvent and HE-contaminated wastewater to the burning grounds evaporation pans for disposal.

Building 12-19 engages in HE formulation operations somewhat similar to those of building 12-17, but uses ethyl acetate and methyl isobutyl ketone as the primary solvents. These solvents are listed as nonhalogenated solvent wastes under RCRA (F003). They are mixed with water and HE in the filtered waste stream, which is discharged to unlined ditches that terminate at Playa 1.

During the Sampling and Analysis Phase of the Survey, the wastewaters from buildings 12-17 and 12-19 will be analyzed to detect the presence or absence of acetone and other solvents in the wastewaters and sediments of the drainage ditches from the buildings and to test for other hazardous characteristics.

4) <u>A surface impoundment in Zone 11 may contain a hazardous sludge and thus be subject to the RCRA</u> - The hypalon-lined acid neutralization pond in Zone 11 may contain a sludge that is a hazardous waste. The pond receives effluent from building 11-36, which is the largest generator of hazardous waste on-site. Building 11-36 synthesizes HE for Pantex application and has processed hexavalent chromium (a hazardous material) to trivalent chromium. The wastewater from the chemical reduction of chromium is discharged to the pond. There is a potential for small amounts of hexavalent chromium to be discharged to the pond. During the Sampling and Analysis Phase of the Survey, the sludge will be analyzed for toxicity to determine whether it constitutes a hazardous waste.

4.1.5.3 Category III

1) <u>Hazardous waste may be deposited in the burning grounds landfill</u> - There is a potential for hazardous waste in the ash resulting from the burning of HE-contaminated hazardous waste to be deposited into the burning grounds landfill. Since these pits are below the caliche layer, these wastes could constitute a potential source of contaminants to underlying perched-water zones.

The ash deposited in the landfill has been tested by the currently required Extraction Procedure (EP) Toxicity Test. However, the EP Toxicity Test is not capable of detecting organics as is the Toxicity Concentration Leaching Procedure (TCLP). The ash in the landfill has not been tested by the TCLP to determine if hazardous organic residues remain.

Materials such as high explosives, HE-contaminated parts, plastics, paper contaminated with HE, solvents, and metals have been burned at the burning grounds. The ash from such burns is collected and placed in pits along the north side of the burning grounds. Approximately seven closely spaced pits have been filled, and one newly opened pit is now receiving ash. The pits are approximately 100 feet long, 20 feet wide, and 15 feet deep. The burning grounds landfill has been in operation for over 20 years, and the pits have been excavated and filled from west to east during that time.

There are no records pertaining to the measures used to control materials deposited in the burning grounds landfill in the early years of its operation. The ash may contain solvents, metals, or chemical compounds contained in waste materials burned at the burn cage or burn pads. The chemicals in the ash can be transported lower in the soil column by precipitation. The Pantex soil column contains a caliche layer that acts to retard downward migration of water. However, during the Survey the new ash pits were observed to have broken through the caliche layer. The construction of older pits may have also broken through a caliche layer. The soil directly above the burning grounds landfill did not contain standing water after a heavy rainfall, but adjacent surface soils did show standing water. The visual evidence indicates a potential for downward migration of water through the burning grounds pits.

During the Sampling and Analysis Phase of the Survey, the ash in older pits of the burning grounds landfill will be analyzed using the TCLP to determine if organic residuals are contained in the ash.

2) <u>Soils in the salvage yard may be contaminated</u> - Contents of drums stored in the salvage yard may have spilled or leaked and contaminated the adjacent soils.

Empty drums are received at the salvage yard for storage pending sale. These drums are supposed to be empty (i.e., containing less than 1 inch of contents) when received at the salvage yard. They are stored on their sides, stacked three or four high along a row within the salvage yard fence line on the southwest side. An estimated 200 drums (previous contents unknown) were observed stored in this manner during the Survey. The salvage yard is unpaved. Stained soil was observed between the row of drums and the fence line, suggesting that drums may not have been sufficiently emptied at the time of receipt and that spills or leaks may have occurred during storage. During the Sampling and Analysis Phase of the Survey, soil samples will be collected from the stained area to determine the types of materials that may have been released and if subsurface migration has occurred.

3) <u>Paint spray booth discharge may have resulted in contamination of the soils behind building 12-41</u> - Solvents and lead-based paints used in the operation of the building 12-41 paint spray booth may have resulted in contamination of the soils behind the building.

The building 12-41 paint shop is the largest of three painting operations at Pantex. The paint shop uses laquer thinner and lead-based paints. The paint spray booth has a water curtain device that recirculates water to a 500 gallon tank. The tank is discharged through a pipe to a ditch behind the building approximately once per month. The Survey team was told that 10 gallons of cleaning solvent (consisting of methyl ethyl ketone, acetone, xylene) were also occasionally dumped into the water tank for discharge to the ditch. There is no available information pertaining to the areal extent of the contamination in the ditch.

During the Sampling and Analysis Phase of the Survey, the soils at the discharge pipe outfall will be analyzed to determine if the soil in the ditch is contaminated as a result of this operation.

4) Hazardous wastes may be released to soils - Hazardous waste drums are stored in a manner that presents the potential for uncontrolled release to the soils.

The drums of concern are used for satellite storage and are to be removed when filled. They are stored on unpaved areas outdoors without shelter, documented inspections, or a record of the times they were stored. Some of the drums (e.g., those at building 11-20) were rusted and in need of inspection. The Survey team observed that seven 55-gallon drums, contents unknown, on the ground at building 11-20, two drums of used vacuum pump oil on the ground at building 12-24E, one drum of contaminated acetone at building 11-38, and a drum of freon at building 16-1 were stored in this manner (see related information pertaining to past spills in Sections 4.5.1.4 and 4.5.2).

5) There is a potential for the release of hazardous waste to the soils at the sanitary landfill - During the Survey, MOCA-contaminated wastes exhumed from the sanitary landfill were staged on the surface at the northeast end of the landfill. Extended storage of the waste (in excess of 90 days) at that location may result in future releases and an RCRA compliance concern. The material is covered with plastic and at the time of the Survey did not appear to have released any waste to the soil.

The MOCA-contaminated waste consists of two gloveboxes, a mixing kettle, and three drums of MOCA. The waste was stored on the ground and covered with a plastic tarp. The tarp was not completely secured and could be dislodged by a strong wind. The storage area was not diked and was near a dry drainage ditch. Pantex personnel advised the Survey team that they planned to remove the waste shortly and had discussed the removal with their hazardous waste contractor, Rollins Environmental Services of Deer Park, Texas.

4.1.5.4 Category IV

1) The waste segregation system is generally ineffective - Hazardous, radioactive, mixed, and general trash waste streams are mixed and improperly handled.

The Survey team found evidence of general trash and hazardous waste in containers marked radioactive waste, non-HE-contaminated solvents treated in units intended for HE-contaminated solvents, general trash in HE-contaminated waste streams, waste paper in metals-only waste streams, and hazardous materials in the general trash. For example, waste drums designated by color as HE-contaminated waste were being used as the only kind of waste drum in the Inert Machining Shop in building 11-20, an area containing no HE. A purple waste can in building 12-42 marked and color-coded as containing radioactive waste was used to accumulate nonradioactive scintillation vials containing an ignitable hazardous waste. This purple waste can with the hazardous waste was disposed of in the general trash dumpster whose waste is disposed of in the Pantex sanitary landfill. An empty drum that was labeled as having contained hydrogen fluoride (hydrogen fluoride is potentially an acidic hazardous waste) was disposed of at the Pantex construction landfill. Sludge from a building 11-29 photographic process involving the use of small amounts of mercuric chloride (a potential hazardous waste) is disposed of in the general trash. This general lack of effective waste segregation is the source of several environmental problems included in Categories II and III.

2) Mercury waste is improperly handled - Small amounts of mercury waste may be deposited in the general trash by the cleaning of glass stopcocks with kimwipes in the Chemistry Laboratory of building 12-94. In addition, sludge from a building 11-29 photographic process involving the use of small amounts of mercuric chloride

generates a sludge that is disposed of in the general trash. The Pantex landfill is not designated a hazardous waste facility and is not to accept hazardous waste.

3) <u>Hazardous waste is deposited in the sanitary landfill</u> - Two listed hazardous wastes, MOCA and xylene-based scintillation fluids, have been inadvertently deposited in the Pantex sanitary landfill. Pantex personnel stopped both the practices upon notification from the Environmental Survey that such activities were occurring.

MOCA is used in building 12-16, the plastics shop, as a hardening agent in adiprene plastics formulation. The cups of hardened liquid MOCA are disposed to a 20-gallon waste drum which is marked as containing a hazardous material. However, the waste drum is emptied into the trash dumpster behind building 12-16, which in turn is emptied into the Pantex sanitary landfill. Pantex generates approximately four 20-gallon drums of such waste per year.

The Pantex radiation monitoring program operates a liquid scintillation counting station in building 12-42. Scintillation cocktails are prepared using xylene-based scintillation fluids. Radiation counting swipes that may contain radioactive contamination are placed in the vials to determine the radioactive count rate. The vials are placed in purple waste cans marked as containing radioactive waste. Approximately 40-50 percent of the disposed scintillation vials contain only the xylene-based cocktail with no detectable radiation. The building 12-42 counting operation generates approximately one 30-gallon waste can of scintillation vials per week at peak workload periods. The vials without radioactivity are disposed in the general trash dumpster.

A radiation monitoring program conducted in building 12-2 operates a scintillation counter which has resulted in the generation of waste scintillation fluids and vials. Waste scintillation fluids that contain radiation are solidified in a hardening media and are currently being held until suitable disposal is available. In the recent past, xylene-based scintillation vials without radioactive contamination were placed in the dumpster for building 12-2 and disposed of in the Pantex sanitary landfill. The quantity of material involved could not be accurately determined, but it is likely to be less than 10 gallons per year.

4) The construction landfill is operated without sufficient controls or supervision - Construction subcontractors are responsible for hauling their own wastes as necessary. Therefore, they may deliver wastes at unscheduled times when operators are not present. A drum marked "hydrofluoric acid" was observed at the construction landfill during the Survey, suggesting that improper disposal may have occurred. Furthermore, there are no fences there, nor are there signs directing the subcontractor to the correct dumping areas.

5) Mixed waste has been shipped to the Nevada Test Site - Pantex has shipped low-level radioactive waste containing trace amounts of beryllium dust (an acutely hazardous waste) to the NTS for disposal.

Specific weapons components containing radioactivity and beryllium are tested in the TCTF. The TCTF is a large tank that contains the emissions from the test detonation of weapons components. The test is conducted with sandbags and wooden structures to position the component and absorb the explosive forces developed in the TCTF. The test generates sand, wood, metal, protective clothing used in the cleanup of the TCTF, and other debris that is radioactively contaminated and contains beryllium dust. Each test generates approximately 616 cubic feet of waste material. The most recent shipment of such mixed radioactive and hazardous waste to the NTS was in February 1986; eleven boxes (112 cubic feet each) were transported. The NTS waste management procedures in effect at the time of the shipment prohibited the storage or disposal of hazardous mixed radioactive waste unless the prohibition was specifically exempted by approval of the DOE Nevada Operations Office manager. There is no evidence that this was done, yet the waste was accepted. At the time of the DOE Survey, Pantex had stored approximately 392 cubic feet of mixed waste from a TCTF test shot in January 1986. The waste was being held until a suitable DOE disposal site became available. Pantex is no longer shipping mixed waste from the TCTF to the NTS.

6) Inspections of the sanitary and construction landfills are brief and infrequent - The most recent documented inspection of the two landfills occurred in February 1984. This consisted of a yes-no checklist of 22 items, but there were no indications in the records that follow up on the inspector's observations had occurred. Observations during the Survey indicated that there has been no follow-up on the observations and suggestions made during the inspection.

7) There is a potential for the release of mercury-contaminated pump oil - The location of the drain in the mechanical room adjacent to the Glass Laboratory in building 12-94 can result in mercury-contaminated pump oil entering the drain from pump oil draining operations. The drain is connected to the sanitary sewer system, and thus the mercury could contaminate the wastewater system. The lack of a barrier around the drain provides access to the wastewater system for any mercury that may be released.

8) Characterization of waste evaporated at the burning grounds is inaccurate - The Pantex RCRA Parts A and B Permit documentation contains an inaccurate characterization of waste disposal at the burning grounds, resulting in a compliance concern. Failure to report treatment of non-HE-contaminated solvents may be interpreted as a violation of Texas Administrative Code, Title 31, Chapter 335, and Federal RCRA regulations 40 CFR 270.13 and 40 CFR 270.14 dealing with identification of wastes treated at RCRA units.

The evaporation of non-HE-contaminated waste solvent in the burning ground evaporation pans could be interpreted as an improper activity under the RCRA because the waste analysis did not identify non-HE-contaminated solvents as being among the wastes disposed of at the burning grounds. Existing Pantex documentation (i.e., the RCRA Part A and B Permit applications) identified the evaporated waste solvent as being solely HE-contaminated. Pantex disposes of all solvent wastes from areas identified as HE areas as HE-contaminated waste for safety considerations. Some Pantex operations such as the laboratories at Buildings 12-9 and 11-17 segregate solvent waste into HE contaminated and non-HE contaminated waste containers. However, these containers are opened and mixed with HE-contaminated solvents later in the waste solvent collection and disposal process (i.e., 11-17 wastes are mixed at Building 11-36 prior to transport to the burning ground for disposal in the evaporation pans).

9) A hazardous waste drum was unlabeled - A drum of mercury-contaminated hazardous waste found in building 12-21A was not properly identified as containing hazardous waste. Personnel in the area were aware of its contents. However, the drum should be marked as containing hazardous waste to avoid improper handling of that waste. Pantex waste management personnel stated that the drum had been properly marked by the end of the Survey.

4.2 Toxic and Chemical Materials

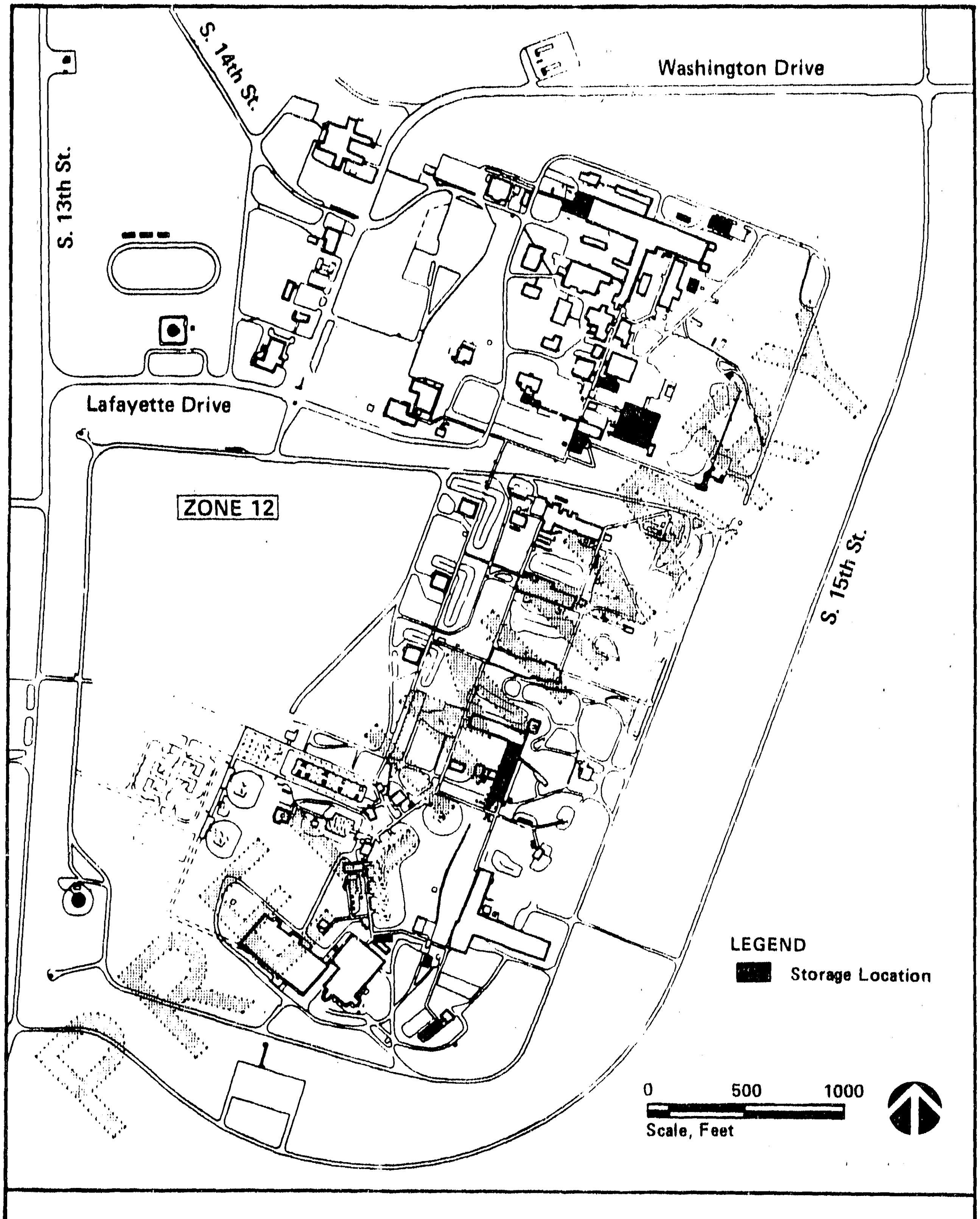
4.2.1 General Description of Pollution Sources and Controls

Most chemicals used at the Pantex Facility are purchased through a system developed by the General Stores Department. General Stores is responsible for the procurement, initial storage, and distribution of materials. The Pantex Facility handles a number of toxic and hazardous materials such as solvents, pesticides, and herbicides using the General Stores system. Shipments of chemicals are delivered directly to General Stores. Production and testing departments request quantities of specific chemicals to be delivered to their buildings as the need for the chemicals arises. The chemicals are placed in secondary storage sites that are under the management of the various end user departments on the site. Figure 4-2 shows the locations of the main and secondary storage sites.

4.2.1.1 Toxics Management

General Stores has initial control over the purchase, storage and distribution of chemicals. A computerized inventory system tracks the quantities of chemicals and materials in the General Stores Department. Any chemical purchase requisition is first approved by the Industrial Health Department to ensure that Material Safety Data Sheets (MSDS) are available that show proper procedures for handling of the chemicals, and that protective equipment is available. Sign off by the Industrial Health Department is required before the chemical order is processed. All Pantex personnel have been trained in the availability and use of MSDS. Upon receipt of a chemical at the General Stores Department, a hazardous chemical warning label is applied to the product container. The Pantex label is similar to the one used by the National Fire Protection Association that identifies the degree of health hazard, flammability, reactivity, and special handling for a chemical. Flammable solvents and gases are stored in building 12-67.

Chemicals distributed to the requesting department are stored on concrete pads near the building in which they will be used. Drums of oils and solvents are stored on these pads and users dispense working quantities of the fluids for the individual operations as needed. Most pads have racks in place to support the drum



MAJOR CHEMICAL STORAGE FACILITIES AND IMPORTANT SATELLITE STORAGE LOCATIONS

FIGURE 4-2

horizontally while dispensing the chemicals. Ground straps are available for flammable chemicals. Most of concrete pads have no curbs to prevent runoff of any spillage to the surrounding soil. Some pads have covers to shade the drums from exposure to direct sunlight. The size of the storage pads varies with the number and amounts of chemicals used for each facility. Most of these concrete pads are approximately 8 x 12 feet with four to six drums on horizontal racks and two to ten spare drums stored vertically on the concrete.

During the Survey, the chemical storage area near building 11-36 was inspected. This was the largest chemical storage area with the exception of the General Stores receiving depot at building 12-67. At building 11-36, two 50-foot, parallel concrete pads were connected by a 10-foot crosswalk at the ends. The storage area was roofed with open sides. Eight 55-gallon drums of toluene were placed in two steel pans that had been constructed to contain spills or leaks. Twenty drums of acetone were on the concrete pad with no spill containing curbing or pans.

Exposure of these drums to direct sunlight resulted in vapor pressure buildup within the drums. Popping of the drum lids was observed during the Survey as the vapor pressure changed within the drums. Four drums were tilted from the vertical as the tops and bottoms of the drum lids bowed due to the increased pressure. No electrical ground straps were connected to any of these drums.

4.2.1.2 Polychlorinated Biphenyls (PCBs)

Pantex maintenance personnel sampled all PCB transformers and switches during 1980 and again in 1981. Sun Ohio Company was contracted to replace all transformer fluids whose PCB concentrations were greater than 50 ppm. Concentrations below 50 ppm are not regulated. Twenty-five transformers were drained, flushed, and refilled with non-PCB fluids in 1984. No equipment using PCBs is currently operational at Pantex.

PCB switchgear located on a concrete transformer pad at 11-14A dripped approximately 40 gallons of Pyranol (a PCB fluid) into the soil adjacent to the transformer pad in 1975, and it was not cleaned up until 1986. In October 1986, prior to the Environmental Survey, the transformer at this location was removed and disposed of by Rollins Environmental Services at Deer Park, Texas. Contaminated soil surrounding the pad in the spill area was packed in drums and disposed of by this contractor. Disposition of the transformer, PCB fluids, and contaminated soil was at approved facilities in accordance with TSCA regulations.

Soil samples were collected and analyzed by Pantex after the contaminated soil had been removed. At the most distant sampling point from the spill, the PCB concentration was greater than 2.8 percent (>28,000 ppm). Pantex personnel notified the Survey team that more soil will be removed and tested until EPA cleanup criteria are satisfied.

A PCB transformer leak occurred at the main electrical substation in 1978. A small quantity of PCB fluid (Pantex uncertain of the exact quantity) was spilled (Johnson, MS 1987b). The PCB spill was cleaned up with rags. All contaminated material, including the gloves, was disposed of at an EPA-authorized TSCA landfill (i.e., Wescon, Inc., Grandview, Idaho). All PCB transformers in that area have since been drained of PCB, flushed and refilled with non-PCB fluids as part of the 1984 campaign to remove PCB fluids from Pantex.

4.2.1.3 Pesticides

Pesticides and herbicides are applied at the Pantex plant site by plant personnel. Those staff members who apply these compounds are certified annually by the Texas Department of Agriculture as licensed applicators of these chemicals.

Since 1985, the pesticide inventory has been stored under lock and key in building 12-51. Dry materials are stored off the floors to avoid absorbing moisture and liquid containers showed no evidence of leaking. Table 4-2 lists the pesticides and herbicides in the inventory in 1986 and their approximate quantity. A sink with a shutoff valve to the drain is used to mix stock solutions of these chemicals for application. The shutoff valve is used to prevent spillage from flowing from the building to the waste system. Directions for safe and proper mixing of these chemicals are posted. An exhaust fan is provided to vent any accumulated fumes from the building before personnel entry. A sign posted at the lock on the door directs personnel to activate the exhaust fan and allow adequate time for venting the storage shed before entry.

TABLE 4-2

PANTEX PESTICIDE-HERBICIDE INVENTORY, BLDG. 12-5*

Item	Quantity
Hyvar X	10 each drums
Oust Weed Killer	3 lbs.
Isotox insect spray	15 gal.
parathion	4 qts.
Vapona	8 gal. approx.
2-4-D Mulch & Activator N.F.	11 gal.
B-1	9 qts.
Bolt spray	3 each cans
Spectracide	3 each cans
Lindane	18 qts.
Lindane Concentrate	4 gal.
Diazinon A.G. 500 tree spray	1 gal.
Sevimol 4 A.G.	5 qts.
Hiyield Toxaphene	6 qts.
Tersan fungus	6 bags
Purina rat poison	3 gal.
De-Con rat poison	3 boxes
Dowpon M	8 10 lb. boxes
General spray	9 pints
Aqua-Kill	30 gal. drum
Gold Crest C-100 chlordane	17 05 gal. cans
Chlordane	20 gal.
Orthenex	39 pints
Malathion	23 5 gal. cans
2-4-D & diesel mix	35 gal.
2-4-D (raw)	40 gal.
Banvel Herbicide	10 gal
Weed Out 2-4-D Amine	30 gal

*Inventory September, 1986 by Pantex Maintenance Personnel

A curbed cement floor with shutoff valve to a surface drain is located behind the chemical storage shed. Stock solutions are diluted for application in "water buffalo" tanks that are used for applications. In the event of a spill in mixing, the shutoff valve prevents flow to surface drains. The curbing for this containment area was installed in 1986.

4.2.1.4 Asbestos

Most buildings at Pantex date from the 1940s and 1950s. Therefore, many Pantex buildings contain asbestos. Covered walks between buildings used "cemesto" (a cement/asbestos building material) for side walls, and many pipe runs are covered with asbestos insulation. Remodeling, replacement, and maintenance of the buildings results in a continual stream of asbestos waste.

Pantex has procedures for the removal, handling, and disposal of asbestos. Contractors performing these functions must use the Pantex procedures to handle, remove, and dispose of the asbestos containing materials. An extensive asbestos removal program was in progress at the time of the Survey. Pantex had engaged a contractor to remove asbestos piping in exterior and exposed interior locations. The program was expected to span a number of years. The Industrial Health Section monitors asbestos removal operations by contractors. Asbestos materials are shipped to permitted landfills for ultimate disposal, and records of disposed material are maintained by the Waste Management Engineering Section. Historic disposal of asbestos in on-site landfills is addressed in Section 4.5. Pantex does not have an asbestos inventory program that marks asbestos containing building material or pipes.

Building 10-2 was decommissioned in the 1960s. A few years ago, the DOE contracted building salvage work to a private firm. This company did not follow the asbestos removal procedures. Asbestos insulation was stripped from the pipes and discarded on the floor. The building has been abandoned and served as a refuge for grazing cattle on land used by Texas Tech. The building is open, since doors and windows were removed in the decommissioning process; hence, the asbestos is exposed to the elements and can be transported by winds away from the structure.

4.2.1.5 Oil and Hazardous Substances Storage Tanks

Storage tanks are used at Pantex predominantly for the storage of fuels to power emergency generators, as well as for automotive fuels, lubricants, and fluids. A significantly smaller portion of the tanks are used for storage of process- or operations-related hazardous substances such as acids and solvents.

Underground Tanks

Forty-seven on-site storage tanks are installed underground. Pursuant to recent RCRA Subtitle I regulations (40 CFR 280), the facility submitted a "Notification for Underground Storage Tanks" to the EPA and the Texas Water Commission (TWC) in March 1986. A summary of the underground tanks as reported in the notification is shown in Table 4-3. The presence of all reported tanks was verified during the Environmental Survey, although the following discrepancies from the notification form were noted: tank 4 at building 11-16 and tank 45 at building 12-76 are in fact aboveground tanks, and tank number 41, reported as located at building 4-31, is actually located at building 4-147. These discrepancies are noted on Table 4-3.

As shown in Table 4-3, 43 of the 47 underground tanks were reported to contain petroleum products or derivatives--i.e., gasoline, diesel fuel, transmission fluid, and antifreeze. Two were reported to contain toluene and dimethylformamide (DMF), and two were reported as empty but formerly containing acetone and methanol.

The environmental concerns associated with storage tanks stem from the potential for releases of harmful quantities of oil or hazardous substances as a result of leaks, spills, or tank failure. Harmful quantities of hazardous substances are not specifically defined by the Texas contingency plan. However, a harmful (therefore reportable) quantity of oil or petroleum products is defined, in the State of Texas Oil and Hazardous Substances Spill Contingency Plan, as any quantity that is spilled on water or 210 gallons or more spilled on land. The Pantex Survey team selected a tank capacity of 210 gallons for use as an approximate demarcation for tanks from which harmful quantities of oil or other substances (according to the Texas

TABLE 4-3

SUMMARY OF TANK DESCRIPTIONS FROM UST NOTIFICATION FORM

Tank	Location	Age	Capacity	Construction	Contents	REMARKS
1	4-52P	23	110	Steel	Gasoline	
2	FS-1	10	55	Steel	Gasoline	
3	11-1	21	110	Steel	Gasoline	
4	11-16	5	54	Steel	Diesel	Above Ground
5	12-3P	5	100	Steel	Diesel	
6	12-4	13	18,000	Steel	Diesel	
7	12-5B	10	30	Steel	Diesel	
8	12-17	11	55	Steel	Gasoline	
9	12-17E	16	3,000	Steel	Diesel	
10	12-19	16	55	Steel	Gasoline	
11	12-20	15	110	Steel	Diesel	
12	12-21E	9	55	Steel	Gasoline	
13	12-21S	13	110	Steel	Diesel	
14	12-24E	5	110	FRP	Gasoline	
15	12-26E	5	110	FRP	Gasoline	
16	12-35	34	7,500	Steel	Used Oil	
17	12-35	10	10,000	Steel	Diesel	
18	12-35	13	10,000	Steel	Gasoline	
19	12-35	13	10,000	Steel	Gasoline	
20	12-35	33	6,400	Steel	Diesel	
21	12-36	10	55	Steel	Gasoline	
22	12-37	11	1,038	Steel	Diesel	
23	12-39	15	180	Steel	Gasoline	
24	12-62	14	110	Steel	Diesel	
25	12-64E	13	55	Steel	Diesel	
26	12-75E	7	1,000	Steel	Diesel	
27	12-84	2	300	Steel	Diesel	
28	12-91	6	110	Steel	Diesel	
29	16-1	6	4,000	FRP	Diesel	
30	16-1	6	1,000	FRP	Used Oil	
31	16-1	6	10,000	FRP	Gasoline	
32	16-1	6	12,000	FRP	Diesel	
33	16-1	6	550	FRP	Motor Oil	
34	16-1	6	550	FRP	Motor Oil	
35	16-1	6	250	Steel	Anti-freeze	
36	16-1	6	250	Steel	Transmission Fluid	
37	16-10	6	550	FRP	Diesel	
38	12-98	2	560	Steel	Diesel	
39	12-84A	2	660	Steel	Diesel	
40	12-99	2	560	Steel	Diesel	
41	4-31	1	2,500	Steel	Diesel	Actually located @ 4-147
42	15-25	13	300	Steel	Diesel	
43	15-24	13	300	Steel	Diesel	
44	15-23	13	300	Steel	Diesel	
45	12-76	11	650,000	Steel	Diesel	Above Ground
46	11-36	8	500	Steel	Empty	Formerly contained acetone
47	11-36	8	500	Steel	Empyt	Formerly contained methanol
48	11-36	8	1,000	Steel	Toluene	
49	11-36	8	1,000	Steel	Dimethylformamide	

Age = Years
Capacity = Gallons
FRP = Fiber Reinforced Plastic
Source: Compiled from U.S. DOE Pantex Plant Notification for Underground Storage Tanks, March 1986.

contingency plan) could potentially be released. Of the 47 reported underground tanks at the Pantex facility, 30 have capacities in excess of 210 gallons.

In addition to tank capacity, the potential for a harmful quantity release may also be related to such factors as, tank age, material of construction, corrosion protection, and compatibility with contents. Using 10 years as an arbitrarily selected example of age-related release potential, the tanks with capacities in excess of 210 gallons can be grouped as follows: 10 tanks are from 13 to 34 years old, and 20 are from 1 to 10 years old. The 10 tanks over 10 years old and their locations and contents are shown in Table 4-4. Of the 17 tanks below 210 gallons capacity, 9 are from 11 to 23 years old, and 8 are from 5 to 10 years old. According to the Underground Storge Tank (UST) notification form, little is known about any corrosion protection methods associated with these tanks.

In addition to the tanks reported to the EPA and the TWC in March 1986, there are eight empty, steel, underground tanks that are intended for the collection of wastewasters from the emergency decontamination deluge system at various points on the facility. The tanks are of 20,000-gallon capacity each, and are located at buildings 12-2, 12-44, 12-85, 12-96, and 12-98. RCRA standards for both permitted and interim status facilities (40 CFR 264.190 and 40 CFR 265.190, respectively) indicate that tanks and sumps serving as part of a secondary containment system for the collection or containment of releases of hazardous wastes are exempted from the containment and release detection requirements (40 CFR 264.193 and 40 CFR 265.193). Due to uncertainties over the eventual RCRA Subtitle I requirements for tanks containing or proposed to contain radioactive waste, however, the facility filed a supplementary notification for the eight deluge tanks in April 1988, per guidance from the DOE Office of Environment, Safety, and Health.

All of the reported underground storage tank (and most aboveground storage tank) locations were visited during the Survey to examine their setting and associated piping.

There are four underground solvent tanks at the north side of building 11-36. Two are empty 500-gallon tanks that had previously held acetone and trichloroethylene (contrary to the notification form which indicated acetone and methanol). The

TABLE 4-4

UNDERGROUND TANKS OVER 210 GALLONS AND OVER 10 YEARS OLD

Tank	Location	Capacity	Age	Construction	Contents	REMARKS
6	12-4	18,000	13	Steel	Diesel	
9	12-17E	3,000	16	Steel	Diesel	
16	12-35	7,500	34	Steel	Used Oil	
18	12-35	10,000	13	Steel	Gasoline	
19	12-35	10,000	13	Steel	Gasoline	
20	12-35	6,400	33	Steel	Diesel	
22	12-37	1,038	11	Steel	Diesel	
42	15-25	300	13	Steel	Diesel	
43	15-24	300	13	Steel	Diesel	
44	15-23	300	13	Steel	Diesel	

Age = Years
Capacity = Gallons
Source: Compiled from U.S. DOE Pantex Plant Notification for Underground Storage Tanks, March 1986.

other two are 1000-gallon tanks, containing approximately 200 gallons of DMF and 500 gallons of toluene. According to building 11-36 personnel, trichloroethylene has not been used in 10 years, nor has acetone in 3 or 4 years. However, toulene and DMF are still used at building 11-36, and according to building personnel there is enough remaining in those tanks to last approximately 2 and 6 months, respectively.

A piping system from the four solvent tanks and its pump control switches were observed to be weathered and not well-marked. The piping and switches were labeled and marked with the names of the materials they individually were to convey, which included methanol, toluene, hexane, ethanol, and DMF. According to building personnel, these pipes had never been used to convey tank contents into the building.

Stains were observed on the ground around the fill pipe of a small underground diesel fuel tank (number 11) outside of building 12-20, perhaps resulting from spillage during filling. Similar ground stains were evident around the fill pipe of underground tank 9 at building 12-17E.

The underground tank 40 at building 12-99 was observed to have tire tracks in the mud adjacent to the fill pipe, indicating that it may have been, or possibly could be, struck by a vehicle.

The underground tank 5 was reported to be immediately east of office building 12-3 in what is now a parking lot. The tank could not be found in this area, and plant personnel had no knowledge of the tank having been removed or covered over. The tank was later discovered within the Materials Access Area (MAA) fence line along the east-west roadway south of building 12-3.

The underground tank 41 at building 4-31 could not be located. However, plant personnel believe that the tank was incorrectly reported on the UST Notification form as being at that location, and that it is actually at building 4-147. The tank was installed in March 1985, and pictures of the installation show a synthetic liner and sand backfill being installed around the tank. A pipe shown to be placed vertically alongside the middle of the tank is presumably for venting or monitoring purposes. This was the only underground tank on-site at which secondary containment was known to have been installed.

Leaks and spills from underground storage tanks have occurred in the past at Pantex. Subsurface spills of approximately 2000 gallons occurred in the vehicle maintenance areas of building 12-35 and 16-1 in 1984 and 1985, respectively, due to breaks in piping between the tanks and pumps.

Although tank leaks can be detected by inventory control methods, the fuel inventory records at Pantex were not set up for leak detection purposes. They were, however, instrumental in identifying the loss of gasoline at building 16-1.

Fuel inventory balances for both gasoline and diesel fuel at buildings 12-35 and 16-1 are routinely kept for accounting purposes. The fuel balance is kept for both areas combined, not individually. Therefore, the gasoline records reflect the combined balances of one tank at building 16-1 and two tanks at building 12-35. Inventory records showed noticeable fuel loss in January 1984. However, it could not be attributed to either area. It was not until March 1984, that the leak was confirmed at building 16-1 by the detection of strong odors at the pump housing.

Aboveground Tanks

In addition to the 47 reported underground storage tanks, there are several aboveground tanks at Pantex. Aboveground tanks observed during the Survey included the following:

- Self-contained generator fuel tanks - 10 (including guard towers)
- Fuel day tanks - 3
- Brine tanks - 3
- Natural gas tank - 1
- Diesel fuel storage tank - 1 (650,000 gallon tank at 12-76)
- Acid tanks - 4
- Liquid nitrogen tanks - 8
- Carbon dioxide tank - 1
- Contractor equipment fuel tanks - 14

The actual numbers of aboveground tanks may differ slightly from the above (e.g., contractor fuel tanks), since the focus of this portion of the Survey was on the underground tanks and on the larger fuel and chemical aboveground tanks. However, the general mix of materials stored in aboveground tanks as listed above is believed to be representative of the facility.

At the east of building 11-36 was a large aboveground tank containing oleum, which was described by building personnel as having not been used in about 5 years. Approximately 3000 gallons of oleum remain in the tank pending location of a buyer prior to removal. The tank is badly weathered and is in need of painting. The dike surrounding the tank has severely eroded, substantially filling in the containment area.

Adjacent to the oleum tank were two aboveground steel tanks labeled nitric acid and hydrochloric acid. These tanks were also badly weathered and had visible corrosion. The nitric acid tank was described as having never been used but an unknown quantity of hydrochloric acid remained in the other tank. The berm around the base of these tanks was badly worn down.

Three aboveground pressurized tanks, two horizontal and one spherical, were present on the north side of building 12-25. All three tanks were in need of painting and appropriate markings. Although the tanks had stamped metal plates describing them as containing liquid oxygen, lines running from the tanks to the building were marked liquid nitrogen.

The aboveground sulfuric acid tank south of building 12-4 is newly installed and appears to be in satisfactory condition and to have ample spill containment. However, there are no markings to indicate the tank contents despite the fact that the design drawings dated January 1985 indicate that "DANGER ACID" is to be stencilled in 6-inch red letters on the tank side.

There have been significant leaks from Pantex aboveground tanks in the past. A large surface spill of oleum reportedly occurred at building 11-36 in 1978 or 1979. Approximately 1500 gallons of sulfuric acid were spilled on the surface at building 12-4 after severe hail storm damage in 1984.

Pantex uses the inventory control method to detect diesel fuel leaks. The difficulty in detecting diesel fuel leaks by the inventory method is compounded at Pantex due to the large size (650,000 gallons) of tank 12-76. Control charts are maintained for the fuel balances. Due to the large diesel fuel inventory, the control chart is plotted in increments of 0.1 percent, with upper and lower control limits set at plus or minus 0.4 percent. While this may be suitable for tracking inventories for accounting purposes, this aggregate method is not sufficiently sensitive for timely leak detection. Using the October 1986, diesel stock balance of 480,000 gallons, a 0.1 percent shortage on paper would be viewed as within acceptable limits. However, it could indicate a possible loss of 480 gallons, which would be an exceedance of the Texas Oil and Hazardous Substances Spill Contingency Plan definition of a harmful-quantity release. The actual October 1986, diesel fuel balance indicated a 4200-gallon shortage relative to measured quantities.

The Preventive Maintenance Office maintains records of maintenance procedures, and schedules the upcoming Preventive Maintenance (PM) tasks to be performed each month at Pantex. Standing work orders are maintained in the files, indicating the tasks to be performed, the frequency at which the activity is to be performed, and the crafts that will perform the work. Current standing work orders pertaining to the storage tanks include:

o An annual, passive, 5-day leak check of 25 generator fuel tanks

o Annual and monthly checks of the building 12-25 nitrogen tank electrical components and pressure relief valves

o Semiannual inspection of the eight decontamination deluge receiving tanks

No other tank-related standing work orders were identified in the PM files during the Survey. The Property Location Custodian at a particular building or shop is responsible for equipment assigned to that location and may request or cancel PM work orders. For example, the building 11-36 oleum tank was removed from the PM schedule in March 1984 by the building personnel, presumably because it was taken out of service. Notations in the PM files state that the tank was "eaten with acid and will not hold pressure." However, this tank remains on-site more than 2 years later, containing approximately 3000 gallons of acid.

A Spill Prevention, Control, and Countermeasure (SPCC) Plan for aboveground tanks was not available at the time of the Environmental Survey. An SPCC plan is required under 40 CFR 112 for facilities that have the potential to release oil or hazardous substances into the navigable waters of the United States. Although it can be argued that the Pantex site is not linked to navigable waters, the preparation of an SPCC plan is generally regarded as a prudent practice. In addition, the Texas Spill Contigency Plan reinforces this practice by stating that even with oil spills less than 210 gallons on land, it is a "violation of the Texas Water Code to cause pollution."

The facility has addressed the issue of hazardous substance releases through various internal operating procedures and standards, including

- o Safety Standard 344, "Chemical Spillage and Unplanned Releases Control"
- o Safety Standard 314, "Notification, Investigation, and Reporting of Occurrences"
- o Internal Operating Procedure 1318, "Hazardous Materials Accidental Spillage"

These documents establish in general terms the initial responses and divisions of responsibilities in the event of accidental releases, but do not address the preventive or technical aspects of spill control. Elements of a complete SPCC plan (40 CFR 112) include

- o Descriptions of past spills, corrective actions, and measures to prevent recurrence
- o Predictions of direction, rate of flow, and total quantities that could be discharged from equipment with spill or failure potential (i.e., tanks)

- o Discussion of appropriate containment measures to prevent releases from reaching waterways

- o Discussion of conformance with guidelines for facility drainage, secondary containment of bulk storage structures, and facility transfer operations

These elements are not addressed by the aforementioned Pantex safety standards and operating procedures.

4.2.2 Findings

4.2.2.1 Category I

There are no Category I findings for toxic and chemical materials.

4.2.2.2 Category II

There are no Category II findings for toxic and chemical materials.

4.2.2.3 Category III

1) Substances may be released from stored product drums - The potential for discharge of product solvents into the environment exists at the outdoor chemical storage near building 11-36 because of inadequate storage procedures.

Acetone, toluene and benzene drums were stored in the area near building 11-36 without adequate protection from direct sunlight. Twenty drums of acetone were placed in the open and rainwater accumulated on the lids such that corrosion of the drums is possible. Exposure of these drums to direct sunlight resulted in vapor pressure buildup within the drums. At the time the area was inspected, popping of the drum lids was observed as the vapor pressure increased within the drums. Four drums had tilted from vertical alignment as the tops and bottoms of the drum lids bowed due to the increased pressure. In addition, no electrical grounding straps were connected to these drums. These conditions present a potential for failure of the drums due to excess pressure and corrosion. Pantex placed grounding straps on the drums upon learning of this deficiency. A spill of solvents in this area would contaminate soil surrounding the pad.

2) Soil may be contaminated by PCBs near Pad 11-14A - PCB-contaminated soils may exist in the area near transformer pad 11-14A and may cause excessive exposure to the personnel working in this area.

Soil surrounding the concrete transformer pad 11-14A was contaminated with PCBs when a transformer leaked in 1975. Forty gallons of Pyranol ran into the soil. Cleanup of the contaminated soil began in October 1986. Thirty-six 55-gallon drums of soil were removed from the eastern end of the transformer pad. Pantex personnel collected soil samples from the pit from which the PCB-contaminated soil had been removed. Laboratory results were 2.8 percent PCBs at a point most distant from the pad, suggesting the possibility that the area of contamination is larger than expected. This is a high PCB concentration for subsurface soils that have been cleaned up and sheds doubt on the validity of the measurement. During the Sampling and Analysis Phase of the Survey, additional soil samples will be collected to establish if cleanup operations were sufficient to reduce PCB levels to background levels.

3) There is the potential for undetected releases of petroleum products or hazardous substances from virtually all on-site oil and hazardous substance storage tanks - The large quantity of contaminants available for release from the tanks creates the potential for significant environmental impact. The potential for undetected releases is due to several interrelated factors observed during the Environmental Survey. These factors include

- o More than half of the underground tanks are 10 years old or older (see Table 4-4). Little is known of corrosion protection methods used on these tanks or of their general conditions.

- o There are no formal or accurate mechanisms for detecting leaks from the storage tanks. Although the General Stores fuel balance control charts can be used to identify possible leaks, the inventory system as presently set up tracks only a limited number of tanks and cannot be used to verify leaks in a timely manner. Diesel fuel records indicated a 4000-gallon shortage in October 1986, but it was not possible to determine from that alone whether the shortage was due to leakage or possible measurement error.

- Preventive maintenance procedures do not incorporate consideration of the various safety, environmental, engineering, and emergency aspects of oil and chemical storage. The decision for requesting or canceling PM work orders is made by the Property Location Custodian at each building or shop. Routine preventive maintenance procedures such as painting and corrosion prevention do not appear to be uniformly applied to the aboveground storage tanks.

- A formal SPCC plan, which would permit coordinated implementation of tank inspection, maintenance, and spill prevention procedures, has not been prepared for the facility.

- Stains on the ground around tank fill pipes at buildings 12-17E and 12-20 indicate possibly inadequate fuel handling procedures and/or fill controls.

During the Sampling and Analyses Phase of the Survey, soil sampling around several of the tanks of highest concern will be analyzed to determine if any releases have occurred. These tanks and the rationale for sampling them includes

- Building 11-36 solvent tanks and oleum tank: apparent condition and contents

- Building 12-4 diesel tank: size and age

- Building 12-17E diesel tank: age and stains on ground

- 12-76 diesel tank: size and October 1986 fuel balance shortage

4) <u>Soils may be contaminated by herbicides or pesticides</u> - Past practice and facilities at building 12-51 may have contaminated the soil behind this building with high levels of pesticides or herbicides.

Building 12-51 is a storage shed for pesticides and herbicides used at the Pantex Facility. Stock concentrations of these materials were prepared inside the storage shed. The stock solutions were mixed in sprayers behind this shed on a concrete pad. Any spillage would lead directly to the surrounding soil because no containment curb was in place. A curb was installed in late 1986. During the Sampling and Analysis Phase of the Survey, samples will be collected from the drainage ditch behind building 12-51 and the adjacent soil to determine if pesticides or herbicides are present.

5) Exposure to airborne asbestos is possible - Loose asbestos in building 10-2 represents a potential health risk exposure for personnel who perform yard work in the area or personnel who would decommission the remaining structure. Asbestos pipe insulation was removed from heating pipes and discarded onto the floor in building 10-2. This building has not been used for site operations since at least 1981, and cattle use the structure as a refuge. Since the doors and windows have been removed, the asbestos is exposed to the wind and thus may become airborne.

6) Chemicals may be released to soils at storage locations - Chemical spills at storage pads can contaminate surrounding soil because containment facilities are not in place. Chemical solvents and waste material are stored on concrete pads adjacent to the buildings in which they are used. Chemicals are dispersed from drums as needed for the operations in the adjacent building. No curbing exists at these pads to contain spillage that might occur. Any material spilled would flow to surrounding soils. For example, the oil storage room in building 12-68 contains a large number of lubricating and cutting oils used in the machine shop. The cement floor of the storage room is curbed but two grated flapper valves in the exterior wall conduct spillage from the room to the asphalt paved area outside. Material would flow across the asphalt surface to the adjacent soil.

4.2.2.4 Category IV

1) Use of grounding straps is ineffective - Safety, health, and environmental contamination risks exist when combustible materials are used without electrostatic ground straps. Solvent drums are stored on the storage pads adjacent to operating facilities. Pantex personnel restock their operating supplies of these

chemicals as needed by filling safety cans from drums stored at the concrete storage pads. Ground straps are available to prevent electrostatic discharges when refilling operating stock supplies of these solvents. When the storage facilities were inspected initially, the ground straps were not connected at a significant percentage of storage pads (11-14, 11-20, 11-36, and 12-24). These conditions were corrected when this observation was mentioned to the Pantex staff. All grounds were connected when the solvent storage areas were checked a second time.

2) Tank locations are not well marked - At the time of the Survey, tank locations were not well marked or protected, thus creating the potential for damage to fill pipes and consequential leakage. Tire tracks were observed immediately adjacent to the fill pipe of underground tank 40 at building 12-99.

3) Tank contents are not marked on tanks - Tanks throughout the facility were not adequately marked as to their contents, thus not providing appropriate hazard class information to spill response personnel in event of release. For example, the building 12-4 sulfuric acid tank had no markings, and the building 12-75 nitrogen tanks were labelled oxygen.

4) Storage drums are not labeled - Unlabeled drums or drums with labels in poor condition may result in improper use or disposal of the contents. In addition, lack of labels may impede a response during an emergency. Pantex standard operating procedure 326.2 requires that all chemicals brought on-site be labeled with a hazardous warning label. Heavy rains that occurred just before the Survey washed the rating codes off the labels, and many labels fell off the drums. Users are responsible for maintaining these labels while the drums are in use. Labels identify the contents of these drums and aid in ensuring proper handling and disposal practices for these chemicals.

4.3 Radiation

4.3.1 Background Environmental Information

The background radiation in the vicinity of the Pantex Facility is both natural and man-made. Specific sources include cosmic radiation, natural radioactive materials in the soil, and fallout from past atmospheric weapons detonations. The average annual effective dose equivalent* to humans from natural background radiation in the United States is 189 millirem per year. The components of this dose are detailed in Table 4-5, the data in which were derived by the approach recommended by the International Commission for Radiological Protection (ICRP) in ICRP Reports 26 and 30, which are the latest internationally accepted guidance for radiation protection. About one-half of the annual effective dose equivalent (EDE) is attributable to the inhalation of radon-222 and its decay products. Previously accepted estimates of background doses did not include the radon contribution and were set at about 100 millirem per year.

The U.S. Department of Energy (DOE) establishes the radiation guidelines for DOE facilities. Radiation standards for the protection of the public in the vicinity of the Pantex Facility are given in DOE Order 5480.1A. These standards are based on recommendations of the ICRP and the National Council on Radiation Protection and Measurements (NCRP).

In 1985, DOE Order 5480.1A was revised to incorporate recommendations and internal dose models contained in ICRP Reports 26 and 30 (ICRP, 1977, 1978). Also included in the revised Order are annual limits set by the U.S. Environmental Protection Agency (EPA) in 40 CFR 61 on atmospheric pathway radiation doses received by the general public from normal DOE operations. The limits, as stipulated in 5480.1A are an EDE* of 100 millirem for all pathways except natural background and medical exposures, a dose equivalent (from 40 CFR 61) of 25 millirem for the whole body, and a dose equivalent of 75 millirem for any individual organ.

* The effective dose equivalent is the sum of the products of the dose delivered to individual organs and specific "weighting factors" expressed as the fraction of the risk to the entire body attributable to that organ. It takes into account the distribution of, and organ sensitivity to, various radionuclides, and thus is particularly useful for the comparison of organ doses.

TABLE 4-5

AVERAGE ANNUAL EFFECTIVE DOSE EQUIVALENT TO HUMANS FROM NATURAL BACKGROUND RADIATION

Organ	Annual Effective Dose Equivalent (millirem)
Gonads	24
Breast	14
Lung (Total)	100
Red Bone Marrow	13
Bone Surfaces	6
Thyroid	3
Other	29
Total	189

Source: FR 1986

Associated with the revised DOE Order were the replacement of DOE Concentration Guides (CGs) with Derived Concentration Guides (DCGs). The DCGs are based on an off-site EDE limit of 100 millirem per year. (The CGs were based on a limit of the off-site annual dose equivalent to 500 millirem.) DCGs take into account only the drinking of water and inhalation of air. They represent the concentration of a specific radionuclide in either air or water that would result in an EDE of 100 millirem per year to an individual.

4.3.2 General Description of Pollution Sources and Controls

This section concerns the dose model and a comparison of the dose assessment of the Pantex radiological effluent releases with applicable standards and guidelines. The discussions of radioactive sources and controls for air (Section 3.1.2), soil (Section 3.2.2), surface water (Section 3.3.2), and groundwater (Section 3.4.2) were included in earlier portions of this report. The dose assessment focused on atmospheric releases attributable to operations of Pantex. Liquid releases were excluded, since Pantex does not identify any off-site releases of radioactivity in liquids.

4.3.2.1 Dose Assessment for Releases to the Atmosphere

The general public can be exposed to atmospheric releases of radiation through inhalation of, and direct contact with, the contents of a plume. Individuals can also inhale contaminated particulates deposited on the soil surrounding the facility, and they can consume, directly or indirectly, radioactive particulates deposited on plants or assimilated by them from the soil. Indirect consumption might involve drinking milk or eating meat from a cow that has eaten grass grown in contaminated soil.

Pantex uses estimates of released radioactivity (see Section 3.1.2) and a computer code called CDM (see Section 3.1.3) to calculate the atmospheric concentrations at selected points off-site. Concentrations of tritium and depleted uranium, the only two radionuclides released to the atmosphere from Pantex, are compared to the DCGs, and the concentrations then converted to doses through the use of dose conversation factors published by the DOE (Vaughn, 1985).

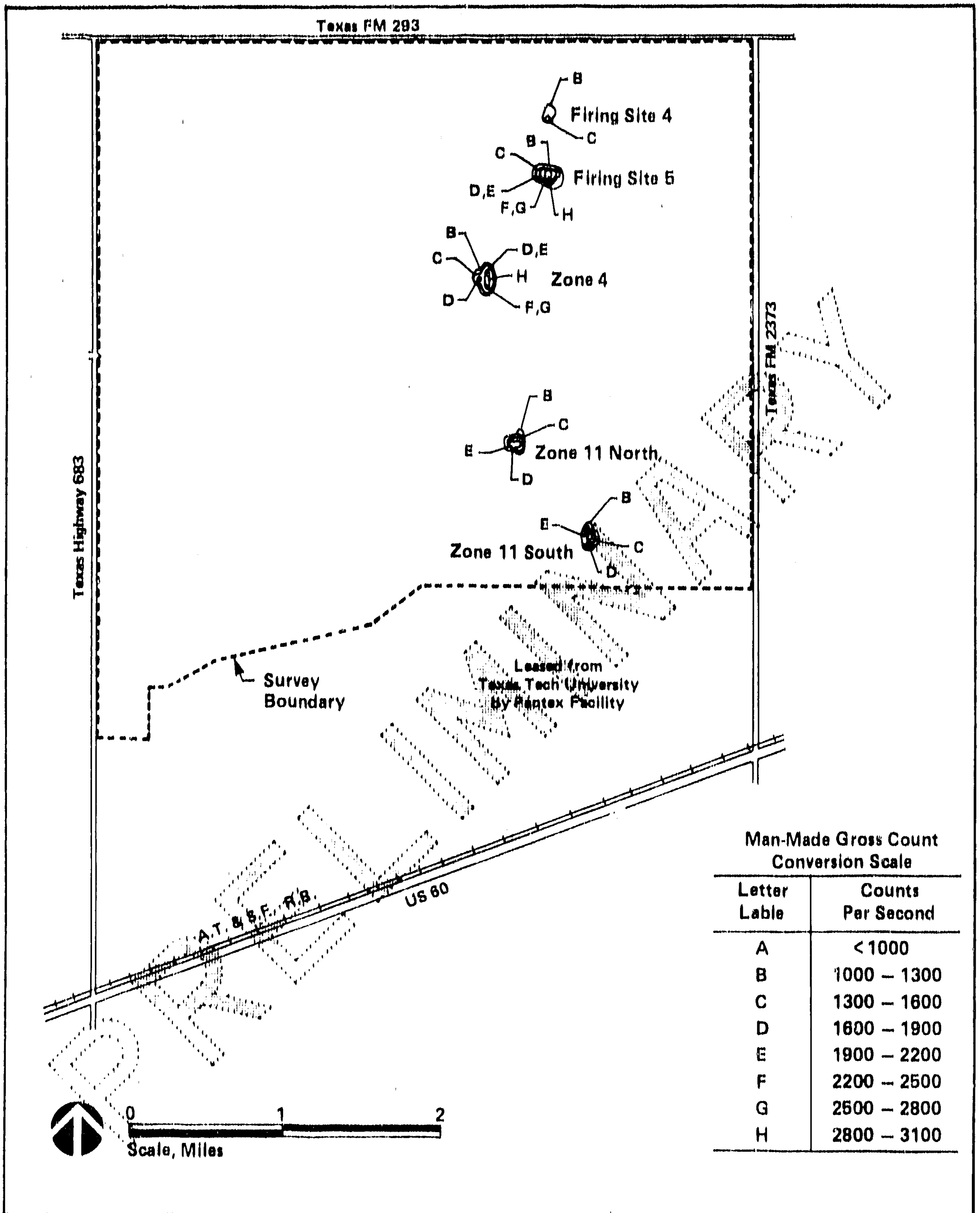
The maximum tritium concentration is 1.7×10^{-15} microcuries per milliliter at the site boundary. This value is 9×10^{-7} percent of the DCG for tritium, which is 2×10^{-7} microcuries per milliliter. As for depleted uranium, the maximum concentration at the site boundary is 1.9×10^{-19} microcuries per milliliter, that is, 1.9×10^{-4} percent of the DCG, which is 1×10^{-13} microcuries per milliliter. The calculations show that the whole-body dose of tritium and the maximum organ (the kidney is used because it is the critical organ for depleted uranium) dose of depleted uranium received by the maximally exposed individual at the site boundary are 8.1×10^{-7} and 4.2×10^{-5} millirem per year, respectively. These doses are based on calculations for different locations on the site boundary--south for tritium and north for depleted uranium--and for different organs--a whole-body dose from tritium and maximum organ (kidney) dose from depleted uranium. These calculations reflect the highest possible doses to an individual for each radionuclide. The dose assessment calculations indicate that the maximum individual exposure to these radionuclides at Pantex would not exceed the limits stipulated in 40 CFR 61.

4.3.2.2 Dose Assessment for Exposure to Direct Radiation

Direct radiation is defined as exposure to gamma photons, X-rays, and beta particles emanating from radioactive materials outside the body. There are two sources of direct radiation on-site:

1. Contaminated soil
2. Radiation from plutonium stored on-site

Figure 4-3 presents the results of an aerial survey in October 1979 showing the levels of direct radiation in the soil (EG&G, 1979). As can be seen in the figure, the higher-level areas coincide with those identified in Section 3.2 as contaminated soil areas: Firing Site 4, up to 1600 counts per second, and Firing Site 5, up to 3000 counts per second: and the corner of Zone 4, which was used as the radioactive waste storage area, up to 3000 counts per second.



Man-Made Gross Count Conversion Scale

Letter Lable	Counts Per Second
A	< 1000
B	1000 – 1300
C	1300 – 1600
D	1600 – 1900
E	1900 – 2200
F	2200 – 2500
G	2500 – 2800
H	2800 – 3100

Source: EG&G 1981

RADIOACTIVITY EXPOSURE RATE FOR PANTEX FACILITY FIGURE 4-3

The State of Texas Department of Health has monitored the levels of direct radiation emanating from the Pantex Facility. Table 4-6 presents the results for the period 1982 to 1985. The off-site average of results is about 10.3 microrads per hour which compares well with the reported background level of direct radiation (terrestrial and cosmic radiation) for Amarillo, Texas, of 87 millirem per year, or 9.9 microrads per hour (EPA, 1981). Therefore, there is no direct radiation originating on-site that exceeds background levels at or beyond the site boundary. Figure 4-4 shows the location of the State of Texas sampling locations. In 1985, the Pantex Facility has also measured direct radiation. The data from both the monitoring networks (see Table 4-7) show that the direct radiation off-site is at background levels. A comparison shows that the results obtained by the Pantex network are about 30 percent higher than those of the State of Texas network for the same off-site locations. For one on-site location, the value reported by Pantex is about 150 percent higher than that reported by the state. However, the off-site locations as measured by Pantex are also at background levels.

4.3.2.3 Summary of Exposures

As discussed above, the DOE imposes a limit other than that of 40 CFR 61 on radiation exposure of the general public. This limit is the 100 millirem per year EDE for all pathways attributable to normal operations of the DOE facility (Vaughn, 1985). The atmospheric inhalation dose was the only exposure pathway reported in the monitoring report. Pathways that could contribute to total exposure but were not discussed include direct radiation and direct or indirect uptake of radioactivity through ingestion of plants. It is impossible to calculate the EDE for all pathways for Pantex because information was not reported for pathways other than air. However, the reported doses from the atmospheric pathway are the most significant source of dose and are greater than five orders of magnitude below the EDE limit of 100 millirem per year.

4.3.3 Findings

4.3.3.1 Category I

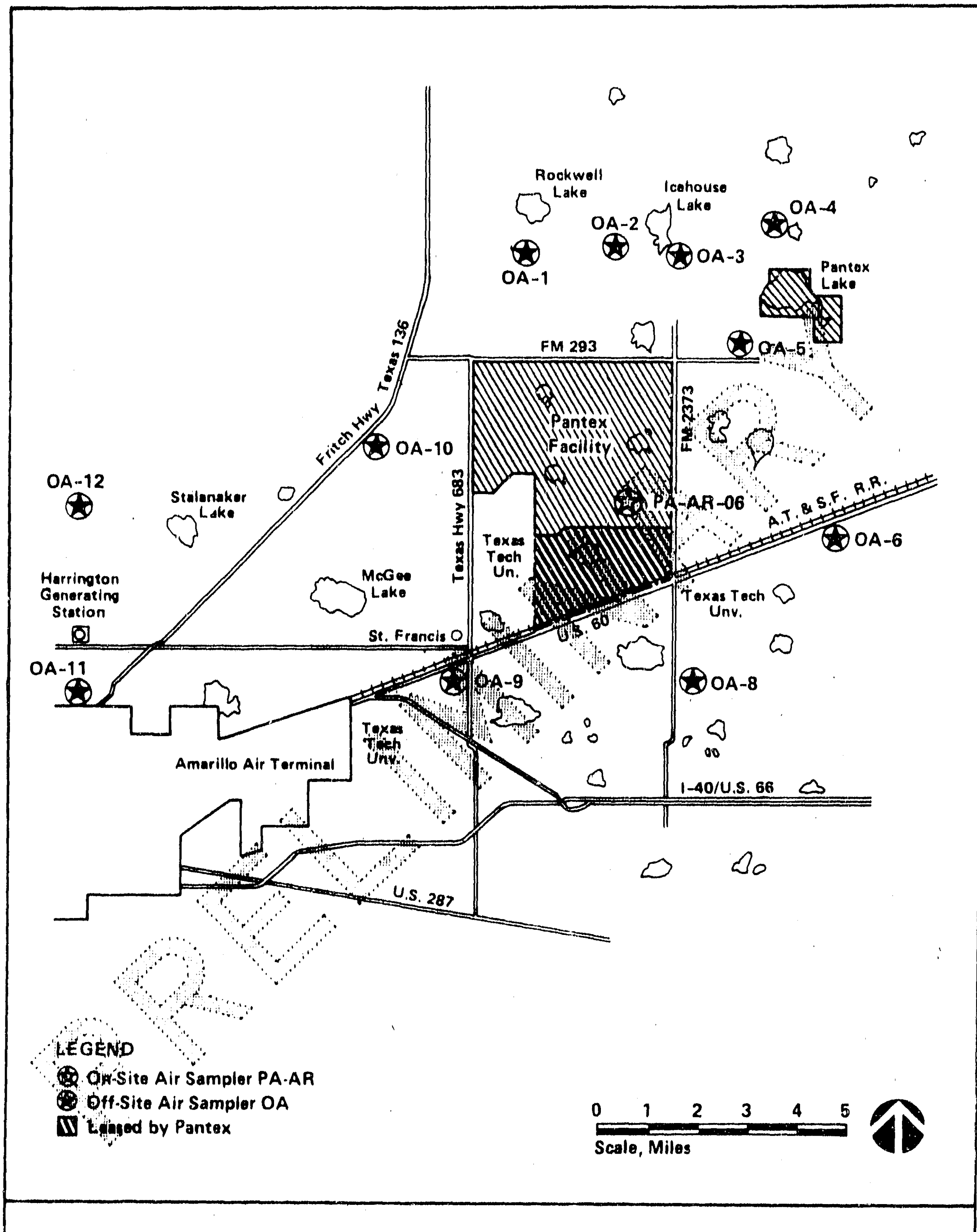
There are no Category I findings for radiation.

TABLE 4-6
THERMOLUMINESCENCE DOSIMETER RESULTS
STATE OF TEXAS DEPARTMENT OF HEALTH (microR/hour)

	1982			1983		
	Average	Minimum	Maximum	Average	Minimum	Maximum
OFFSITE						
OA-AR-01	9.7	8.7	10.7	9.7	7.6	11.1
OA-AR-02	10.1	9.2	10.5	7.5	3.0	10.2
OA-AR-03	9.6	8.8	11.2	8.0	2.9	11.0
OA-AR-04	9.6	8.0	10.9	7.6	2.7	11.2
OA-AR-05	9.4	8.5	11.6	9.3	7.9	10.8
OA-AR-06	10.1	9.2	11.3	8.0	3.4	11.6
OA-AR-08	8.8	7.9	10.3	7.2	2.4	10.9
OA-AR-09	7.8	7.8	8.0	6.5	2.7	9.8
OA-AR-10	8.6	8.3	9.6	8.7	2.7	14.1
Average Offsite	9.3			8.1		
ONSITE						
PA-AR-06	19.6	19.6	19.6	11.9	5.7	22.6
Zone 6	17.7	17.7	17.7		-	-

	1984			1985		
	Average	Minimum	Maximum	Average	Minimum	Maximum
OFFSITE						
OA-AR-01	8.0	6.9	9.0	9.7	9.0	11.7
OA-AR-02	7.8	5.8	10.2	10.0	8.0	12.9
OA-AR-03	7.1	5.7	8.9	9.9	8.4	13.6
OA-AR-04	7.6	6.0	9.2	10.3	8.9	13.6
OA-AR-05	7.2	5.6	8.5	10.4	8.5	13.4
OA-AR-06	7.9	5.5	9.2	10.9	9.2	13.6
OA-AR-08	6.9	4.2	8.5	10.1	8.5	13.9
OA-AR-09	7.7	6.7	8.7	9.9	8.5	13.2
OA-AR-10	7.3	6.3	8.5	10.1	8.5	13.4
Average Offsite	7.5				8.6	
ONSITE						
PA-AR-06	16.7	7.1	25.4	21.9	19.6	25.8

	1982-1985		
	Average	Minimum	Maximum
OFFSITE			
OA-AR-01	9.2	6.9	11.7
OA-AR-02	8.8	3.0	12.9
OA-AR-03	8.6	2.9	13.6
OA-AR-04	8.8	2.7	13.6
OA-AR-05	9.2	5.6	13.4
OA-AR-06	9.1	3.4	13.6
OA-AR-08	8.2	2.4	13.9
OA-AR-09	8.0	2.7	13.2
OA-AR-10	8.7	2.7	14.1
Average Offsite	8.7		
ONSITE			
PA-AR-06	16.7	5.7	25.8



LOCATION OF DIRECT RADIATION SAMPLING SITES

FIGURE 4-4

TABLE 4-7
COMPARISON OF 1985 DIRECT RADIATION MEASUREMENTS
(microR/hour)

	Department of Health State of Texas			Pantex Facility			Ratio of Pantex to State Average Values
	Average	Minimum	Maximum	Average	Minimum	Maximum	
OFFSITE							
0A-AR-01	9.7	9.0	11.7	12.6	12.1	13.3	1.29
OA-AR-02	10.0	8.0	12.9	12.3	12.9	13.8	1.23
OA-AR-03	9.9	8.4	13.6	13.6	12.9	14.2	1.37
OA-AR-04	10.3	8.9	13.6	13.0	12.7	13.2	1.27
OA-AR-05	10.4	8.5	13.4	13.7	13.3	14.1	1.32
OA-AR-06	10.9	9.2	13.6	13.4	13.3	13.8	1.23
OA-AR-08	10.1	8.5	13.9	12.7	12.5	13.1	1.26
OA-AR-09	9.9	9.2	13.2	13.2	12.6	14.2	1.33
OA-AR-10	10.1	8.5	13.4	13.7	13.3	14.1	1.35
OA-AR-13		8.5		14.7	14.1	15.9	
Average Offsite	10.3	8.5		13.3			1.29
ONSITE							
PA-AR-06	21.9	19.6	25.8	54.4	41.5	65.1	2.48

4.3.3.2 Category II

There are no Category II findings for radiation.

4.3.3.3 Category III

There are no Category III findings for radiation.

4.3.3.4 Category IV

1) The proper radiation dose computer code was not used - The AIRDOSE-EPA computer code was not used for dose calculations as required by the DOE (Vaughan, 1985). Use of that code, however, would not greatly affect the magnitude of the reported doses in relationship to the DOE guidelines, since the reported doses are orders of magnitude below the existing limits. It has been reported that after preparation of the 1986 Environmental Monitoring Report, Pantex did use the AIRDOSE-EPA code for a comparison. The doses obtained differed by less than a factor of 10 from those reported in the 1985 or 1986 Environmental Monitoring Reports (Laseter, 1987).

2) There is a discrepancy of about 30 percent between the direct radiation measurements reported by Pantex and the State of Texas - This discrepancy brings into question whether Pantex and Texas measurement devices are colocated. A small difference in placement of TLDs from ground level (i.e., as little as ½ meter) can resolve a significant difference in radiation measurements such as those between Pantex and Texas. It may also reflect a disparity in sampling procedures or unintentional sampling bias. Pantex results are about 30 percent higher than those of the state. At one location the Pantex results are 150 percent higher.

4.4 Quality Assurance

The Survey team reviewed the procedures used to collect and analyze environmental samples to evaluate the quality of these measurements. Two aspects of quality assurance are considered in this section: quality control and quality assessment.

Quality control (QC) is a system of inspections, testing, and remedial actions applied to an analytical process so that by inspecting a small portion of the analyses an estimate can be made of its quality. This is achieved by evaluating the precision of repetitive measurements of samples and may include splits, spikes, surrogates and reference materials.

Quality assessment (QA) is a system of activities that provides assurance that the overall quality control job is done effectively. The system involves a continuing evaluation of the adequacy and effectiveness of the overall quality control program and is supported by a quality assurance program or plan that addresses the fundamental concepts of a laboratory quality control. An adequate quality assurance program should include the following:

- o Chain of custody
- o Technical competence of staff
- o Suitable facilities and equipment
- o Good laboratory practices
- o Good measurement practices
- o Standard operating procedures
- o Protocols for specific purposes
- o Inspection
- o Documentation
- o Training

The Survey team compared these elements with actual laboratory operations at Pantex.

4.4.1 General Description of Sampling and Data Handling Procedures

Pantex has two laboratories that conduct environmental analyses on-site. The Environmental Health Laboratory analyzes water and wastewater samples for pH, biochemical oxygen demand (BOD), and chemical oxygen demand (COD). The Chemistry Department of the Development Division analyzes water and soil samples for organic and inorganic determinations. Radiation measurements are contracted to a private laboratory, Controls for Environmental Pollution, in Santa Fe, New Mexico. Bacteriological determinations of fecal coliforms in wastewaters are conducted by the Amarillo Bi-City County Health Department of the City of Amarillo, which is a state-supported and state-certified facility.

The DOE Survey team reviewed the Quality Assurance (QA) procedures that were written for the two Pantex laboratories: the Industrial Health laboratory and the Chemistry section of the Development Department. The review process compared the written documents for these facilities with the essential elements of a QA program listed above. Both laboratories were inspected to verify that actual analytical chemical operations were conducted in accordance with the QA Plans.

A written copy of the QA Plan for the contract laboratory that supplied the radiological measurements of all Pantex samples was reviewed during the survey. (A summary of the CEPQA plan is available in the Environmental Monitoring Report for Pantex Facility Covering 1985 MHSMP-86-17.) No DOE Survey team member visited the CEP laboratory to review actual laboratory operations. Pantex personnel had visited and evaluated the CEP laboratory before awarding the service contract.

No attempt was made to evaluate the Amarillo Bi-City County Health Department QA program since this facility is state-supported and certified. This laboratory analyzes wastewater samples from Pantex for fecal coliforms only.

Both laboratories at Pantex address most of the above elements in their QA plans. Procedures are in place in both the Development Department Chemistry Laboratory and the Industrial Health Laboratory to train and certify technicians and analysts. Training both on- and off-site for all technical and professional staff is encouraged. Analytical procedures for each analysis were in place, and the procedures were readily available to the analysts. Laboratory supervisors review and approve environmental analyses. The Quality Coordinator monitors laboratory operations to ensure that the QA Plan is followed. All laboratory data are recorded in hardbound notebooks, in ink, with results of quality control measures included for each sample batch. The analyst signs and dates each entry. Supervisors review and approve entries on a regular basis. Except as mentioned below, laboratory facilities and equipment were of the type and quality specified in the EPA analytical procedures. The following descriptions present information on the specific procedures for the analyses of the different environmental media.

Surface water samples are analyzed for inorganic and organic parameters at Pantex laboratories. The inorganic parameters include the metals and ions listed in Table 4-8 and are analyzed at the Development Division Laboratory. Oil and grease, and phenol are organic determinations made at the Development Division Laboratory.

Additional analyses conducted by the Development Division Chemistry Laboratory include endrin, lindane, methoxychlor, 2,4-D, and 2,4,5-TP. These determinations are made using gas chromatography methods approved by the EPA.

Table 4-8 lists the reference methods for analyses performing analyses in the Development Department Chemistry Laboratory. (Analytical procedures marked by reference 1 or 2 are established reference protocols and are acceptable for NPDES monitoring reports.) The analytical procedures listed for cyanide (CN), hexavalent chromium (Cr^{+6}), nitrogen (N), phenolics (PHEN), and phosphate (PO4) are Mason & Hanger methods. These methods have not been demonstrated as acceptable substitutes for NPDES or Standard Methods protocols, but these parameters are not required for any operating permits from the EPA or the Texas Water Commission.

TABLE 4-8
PANTEX DEVELOPMENT DIVISION ANALYTICAL PROCEDURES

TEST	APPROVED METHOD
AG	Standard Method 303A/303B
ARSN	Standard Method 303E
BA	Standard Method 304
CD	Standard Method 303A/303B/304
CN	SOP 6-5172
CRTO	Standard Method 303A/303B/304
CR + 6	SOP 6-5172
CU	Standard Method 304
ENDR	Standard Method 509A/EPA 608
F	Standard Method 413B
FE	Standard Method 303B/304
HARD	Standard Method 314B
HMX	Water 2 Procedure
LIND	Standard Method 509A/EPA 608
MOCL	Standard Method 509A/EPA 608
MN	Standard Method 304
N	SOP 6-5172
O/G	Standard Method 503A
PB	Standard Method 303A/303B/304
PETN	Water 1 Procedure
PH	Standard Method 423
PHEN	SOP 6-5172
PO4	SOP 6-5172
RDX	Water 2 Procedure
SE	Standard Method 303E/304
SO4	Standard Method 426A
TDS	Standard Method 209A
TSS	Standard Method 209F
ZN	Standard Method 303A/303B/304
24D	Standard Method 509A/EPA 608
245T	Standard Method 509A/EPA 608

Wastewater samples are analyzed for the explosives RDX, HMX, and PETN using high-performance liquid chromatography. These procedures were developed at this facility. Quality control measures that include instrument calibrations, determinations of blanks, duplicates, and spikes are incorporated into each batch of sample analyses.

Radiological analyses are contracted to a private laboratory off-site, Controls for Environmental Pollution Laboratories (CEP Laboratories) in Santa Fe, NM. A QA program is in place that is designed to meet U.S. Nuclear Regulatory Commission (NRC) specifications in Regulatory Guide 4.15. Analyses include gross alpha and beta, total uranium, plutonium, tritium, and radium.

BOD, COD, and pH measurements are performed in the Industrial Health Laboratory. EPA methods of analyses are used for the assays. Commercial standards are used to calibrate the analytical instruments. EPA-approved QC procedures are included with each determination.

There are several deficiencies in field sampling. Sample pH was not measured before setting up BOD tests on wastewater samples. In addition, the procedures lacked preservatives and chain-of-custody forms. Finally, no acid preservatives were available to preserve samples at the collection point. Sample chests and ice to cool samples in transport from the collection point to the laboratory were not available. Samples normally are collected throughout the day at a number of sample points and sit in the transport vehicle until delivered at the laboratory.

Chain-of-custody forms do not accompany samples through the Development Division Chemistry Laboratory. The sample collector delivers water samples to the laboratory, where they are recorded in a log book and locked in a sample storage cabinet. There is no documentation or receipt of transfer from the collector to the laboratory personnel.

Samples analyzed in the Industrial Health Laboratory are collected and analyzed by the same person. Sample information concerning sample number, sampling time, and sampling date are recorded in a field notebook. Analytical data are recorded in laboratory notebooks.

sensitive and the population could be significantly reduced as a result of the sample acidity. During the BOD test the bacteria feed on the organic materials in the sample and use oxygen present in the sample test bottle. Should acid test conditions exist, the bacteria used may be killed off such that no reduction of the oxygen placed in the test bottle (along with bacteria and a known volume of sample) occurs.

The BOD test procedure states specifically that the sample pH must be adjusted to a neutral value before initiating the process. This step was not taken and represents a significant deviation from the established protocol.

2) <u>Sample preservation</u> - Quality assurance procedures for proper preservation of environmental samples have not been implemented. Pantex personnel reviewed their sample collection and preservation protocols as part of an audit conducted by Albuquerque Operations Office during 1986. Deficiencies were noted and were in the process of being corrected during the Survey. These deficiencies include not icing BOD samples at collection and not fixing metal samples with nitric acid when collected. EPA sample preservation protocols require maintaining a temperature of 4°C from collection until analyses are started. Nitric acid should be added to the sample bottle when the sample is collected.

The changes to the Pantex procedures include the addition of chemical preservatives and QA measures. Implementation of these measures requires the purchase of preservatives and sampling equipment, which were ordered but had not been received at the time of the Survey. Written procedures for sample collection, preservation, and quality control were being drafted.

4.5 Inactive Waste Sites and Releases

4.5.1 General Description of Pollution Sources

Most of the liquid and solid wastes generated by operations at Pantex over the period 1942-1980 were disposed of on the facility rather than at off-site locations. This section provides a discussion of the waste sites used in the past and of instances of accidental releases or spills involving chemical substances.

The background information reviewed prior to the Survey site visit included the Phase 1 Installation Assessment Report (DOE, 1986) prepared under the Comprehensive Environmental Assessment and Response Program (CEARP), which is administered by the DOE Albuquerque Operations Office (ALO) in response to DOE Order 5480.14. One of the purposes of this Phase 1 Report was to identify all potential sites that are subject to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and to gather sufficient information to evaluate whether the sites required further action. As such, this report provided a substantial data base to the DOE Environmental Survey effort, particularly considering that the original records of waste management practices at Pantex are no longer available. In the Phase 1 Report, the site relied largely on the recollections of employees, covering the span of the plant's operation by both the Department of Defense (DOD) and the DOE, to identify past waste sites and releases. Although actual documents or logs of the types and quantities of waste disposed of no longer exist, some information was obtained during the Survey from a review of sequences of historical photographs. The general descriptions that follow contain the best information available to date pertaining to these waste sites. It is important to note that Phase 2 activities under CEARP are planned for many of the waste and spill sites discussed in this section.

The inactive sites associated with all identified DOE operations on DOE-owned or DOE-leased property all Pantex were visited during this Survey. The inactive waste sites on the Pantex Facility have been grouped into the following general categories:

Category	Number of Sites	Subsection
Liquid waste disposal sites	10	4.5.1.1
Solid waste disposal sites	23	4.5.1.2
Spills and releases	26	4.5.1.3
Suspect areas based on historical photographs	2	4.5.1.4
Total	61	

The following sections provide a description of the sites within each of these categories. Previous studies were conducted at some of the sites; therefore, pertinent information from these studies also has been included. Section 4.5.1.5, Potential Inactive Waste Sites Resulting from DOD Operations, is provided to complete the inventory of sites associated with the Pantex facility, even though such sites are not related to DOE operations.

4.5.1.1 Liquid Waste Disposal Sites

This subsection addresses areas that at one time regularly received a liquid waste stream. The types of contaminants in the liquid waste vary, hence they are presented site-specifically. Historically, the final disposition of liquid wastes at the Pantex facility included the following:

- Percolation/evaporation pit
- Solar evaporation ponds
- Subsurface leaching beds
- Playas (discussed in Sections 3.3 and 3.4)

Percolation/Evaporation Pit

From 1954 to 1980, liquid waste was disposed of at the west side of the burning grounds, where waste oils and solvents contaminated with high explosives generated by HE processing were transported, discharged, and allowed to percolate and evaporate in an unlined waste pit. Other flammable liquids used on the facility may also have been disposed of in this pit (DOE, 1986). In 1980, the practice of placing waste oils and solvents in the unlined pit changed and the facility began using metal evaporation pans instead (see related discussion in Section 4.1.1). The location of this area is shown in Figure 4-5. The pit dimensions were reportedly 20 x 20 x 3 feet (MHSM, 1985). Periodically, the liquid waste in the pit was burned or the residue from percolation and evaporation of the liquids was burned. The only specific information available on the amount of waste disposed of in this pit is a record that it received approximately 3000 gallons of toluene during 1978 (MHSM, 1979).

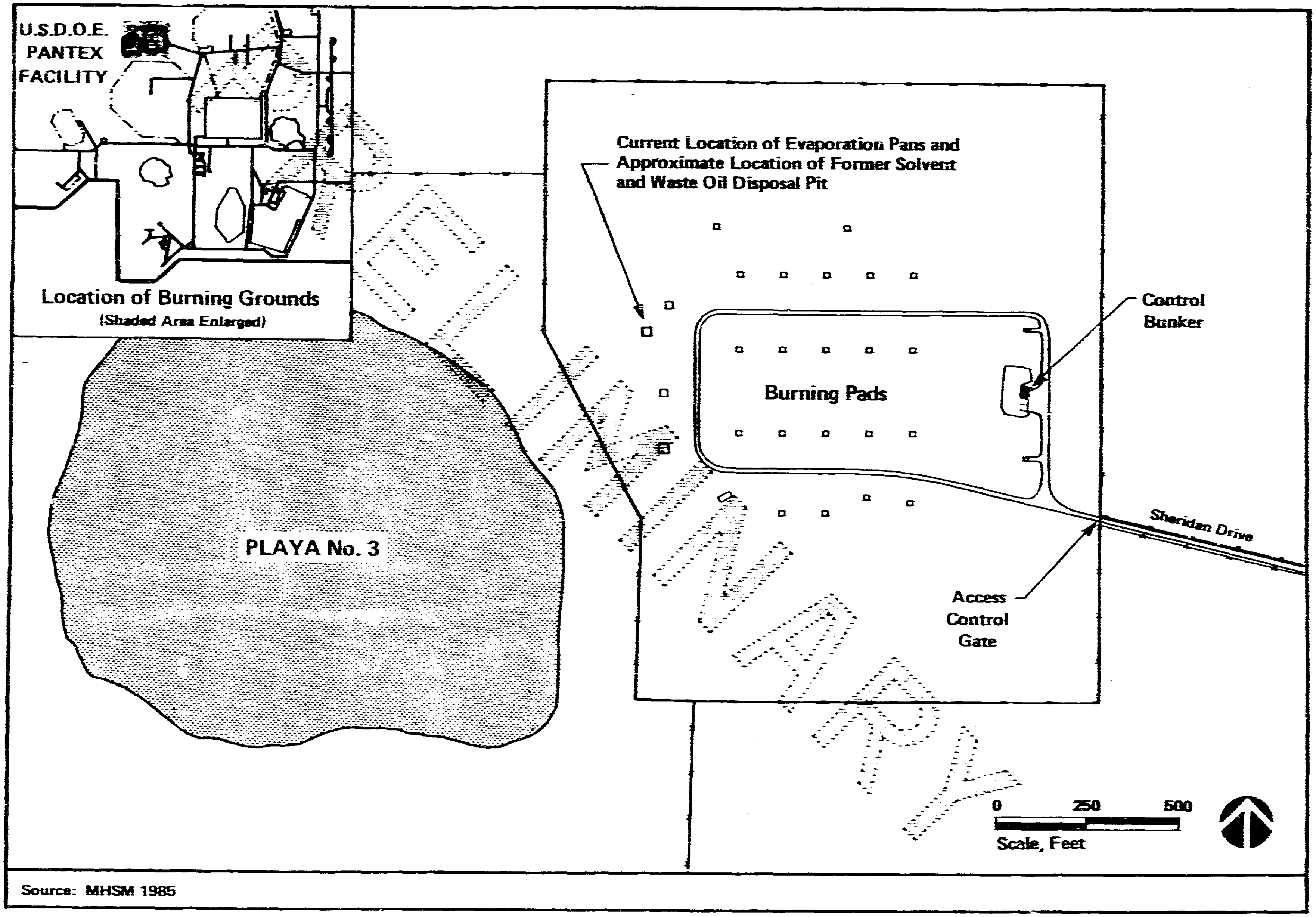
Other solvents reportedly used at Pantex during this period and potentially disposed of in this waste pit include the following (MHSM, 1979, 1980):

Acetone	Benzene
Ethyl acetate	Trichloroethylene
Methyl ethyl ketone	Tetrachloroethane
Methyl isobutyl ketone	Chloroform
Tetrahydrofuran	Carbon tetrachloride
Dimethylformamide	Methylene chloride

With the lack of precise records to determine the quantity of waste disposed of in the pit, an estimated volume was calculated based on reports of the annual quantity of waste solvents generated during the years 1981 through 1984. These reports indicate that the volume of explosive-contaminated, spent chemicals ranged from 3500 to 13,500 gallons annually (MHSM, 1981, 1982, 1983, 1984a). Assuming that this range is indicative of the operations over the life of the plant, then the total waste disposed of in the unlined pit over its 26-year period of use may range from 90,000 to 350,000 gallons.

A study (Purtymun et al., 1982) was performed by Los Alamos National Laboratory (LANL) in support of an environmental impact statement (EIS) involving Pantex that included soil sampling and analyses in the vicinity of the former solvent/oil disposal pit. Test holes were drilled at three locations. Their total depths and distance relative to the solvent disposal pit are given below.

LANL Designation	Total Depth (ft)	Distance and Direction from Solvent Pit
TH-27	23	150 ft southwest
TH-28	28	110 ft west
TH-29	48	10 ft southwest



APPROXIMATE LOCATION OF FORMER SOLVENT AND WASTE OIL DISPOSAL PIT AT BURNING GROUNDS

FIGURE 4-5

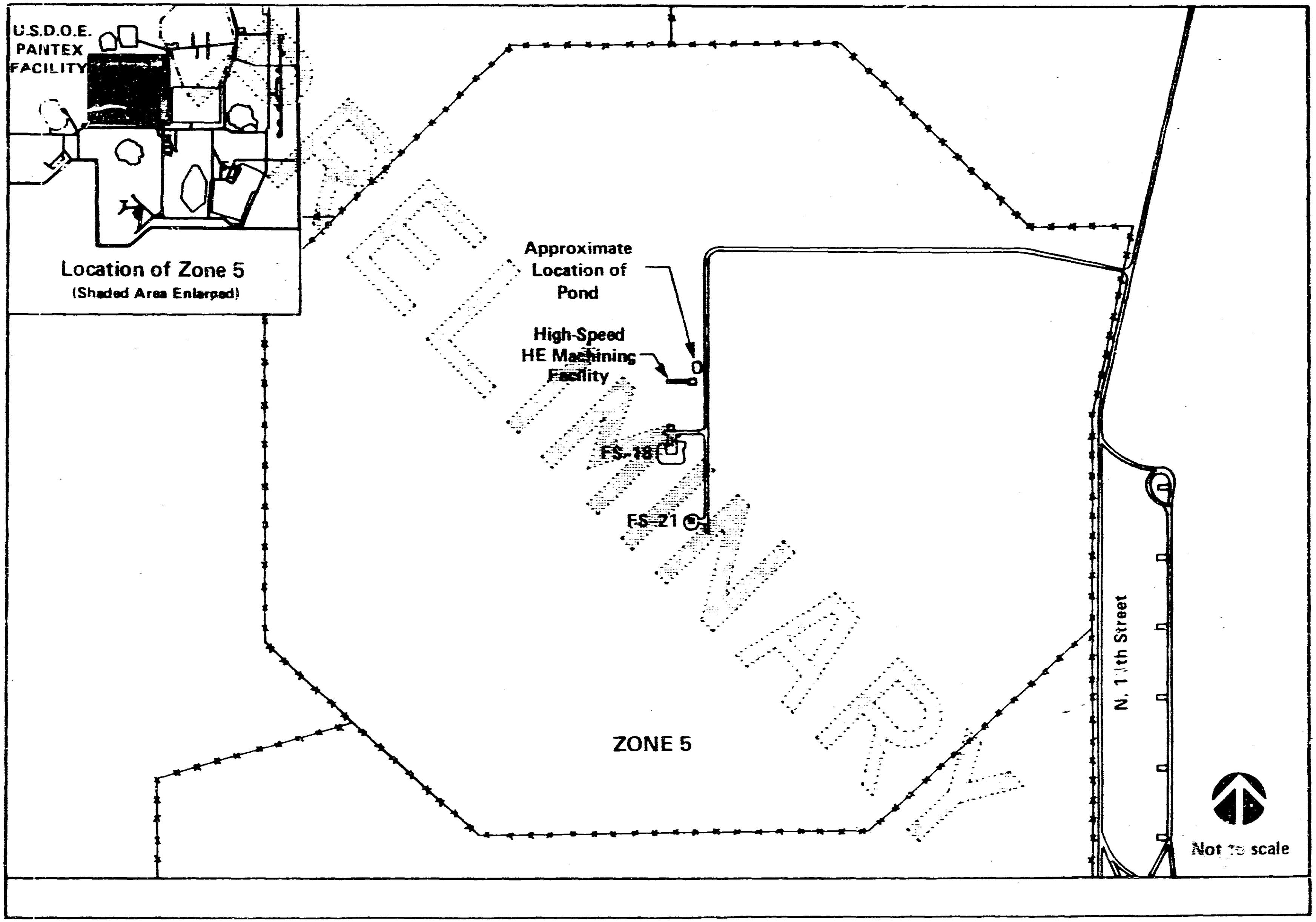
Samples were collected from the test hole cuttings at distinct intervals: land surface to 3 feet and then at 5-foot intervals to the bottom of the hole. Analyses performed on each sample were for the following parameters: toluene, DMF-methanol, tetrahydrofuran, and acetone. The results of these analyses indicated that acetone was present in TH-29 below the caliche layer in the silty clays at depths of 13 to 43 feet and at concentrations ranging from 1 to 10 ppm. In the deepest sample collected, 43 to 48 feet, acetone was not found above the detection limit of 1 ppm.

Solar Evaporation Ponds

Two inactive solar evaporation ponds have been used at the Pantex facility. One pond is in Zone 5 located adjacent to a building formerly used as a high-speed HE machining facility (Figure 4-6). The cooling water from this operation was filtered and routed into the small, hypalon-lined pond adjacent to the building and allowed to evaporate. The waste stream was small in volume, but apparently not analyzed to determine its constituents. The pond dimensions are approximately 24 x 36 x 8 feet (Johnson, 1987a).

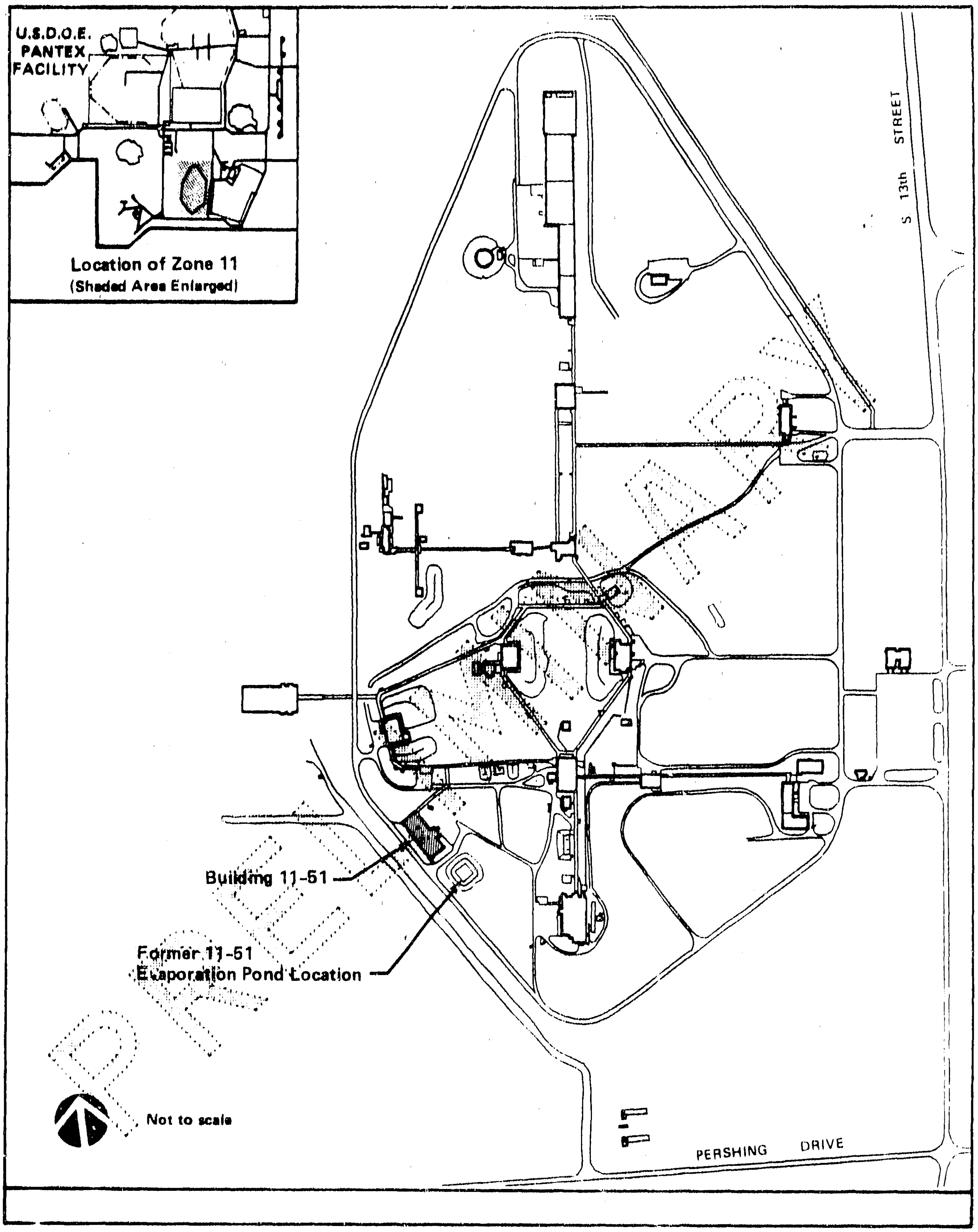
A second inactive solar evaporation pond formerly existed in Zone 11, as shown in Figure 4-7. This hypalon-lined pond was designed to receive liquid waste from sinks and drains exiting from building 11-51, a chemistry laboratory. According to Pantex personnel, this effluent would be expected to contain trace quantities of metal ions, high explosives, and organic solvents. The results of an analysis of the pond water provided by Pantex personnel are given in Table 4-9. These results confirm the presence of metals, HMX, and RDX in the effluent. The pond was in the shape of a square, with each side having a length of about 94 feet; the bottom was about 50 feet on each side and the total depth was about 10 feet. The pond emptied into a surface drainage ditch, which emptied into a playa south of Zone 11. The building effluent was rerouted into the sanitary sewer at the time of pond closure (Johnson, 1987a).

The building 11-51 pond was backfilled with soil at the time of the Survey. Based on the date of the Safety Assessment Document for that building (Kahler, 1979), the pond was used between 1979 and 1986. As discussed in Section 4.5.1.4, this pond was also used as a location to neutralize soil contaminated with sulfuric acid (Hayes, 1984).



APPROXIMATE LOCATION OF INACTIVE POND IN ZONE 5

FIGURE 4-6



LOCATION OF FORMER 11-51
SOLAR EVAPORATION POND

FIGURE 4-7

TABLE 4-9

ANALYTICAL RESULTS OF AN EFFLUENT SAMPLE FROM THE FORMER 11-51 POND

Analyte	Concentration (mg/l)
Arsenic	<0.01
Barium	0.146
Cadmium	<0.001
Hexavalent chromium	0.018
Chromium (dissolved)	<0.005
Copper	0.041
Cyanide	<0.02
Fluoride	1.63
Iron	<0.01
Lead	<0.01
Mercury	0.0013
Nitrate (as N)	0.029
Phenol	<0.007
Phosphorous	0.10
Selenium	<0.01
Silver	<0.005
Sulfate	22.2
Zinc	0.016
HMX	0.02
PETN	<0.14
RDX	0.06
Methyl alcohol	<10
Acetone	<25
Tetrahydrofuran	<25
Settleable solids	<1.0
Total solids	231
Hardness	156
pH	8.67 (standard units)

Source: Johnson, M.S., 1987a.

Subsurface Leaching Beds

Liquid waste has also been disposed of in subsurface leaching beds or septic systems. Two leaching beds reportedly received contaminated liquids. Figure 4-8 depicts the estimated location of these two disposal sites. One site, located next to building 12-44E, potentially received plutonium-contaminated water from the personnel showers following an accident in 1966. The other, located north of building 12-59, received acidic and solvent waste from the chemistry laboratory. This leachfield apparently was used for a number of years until the mid-1970s when the waste line was disconnected. The specific quantity of waste discharged and its chemical constituents are unknown.

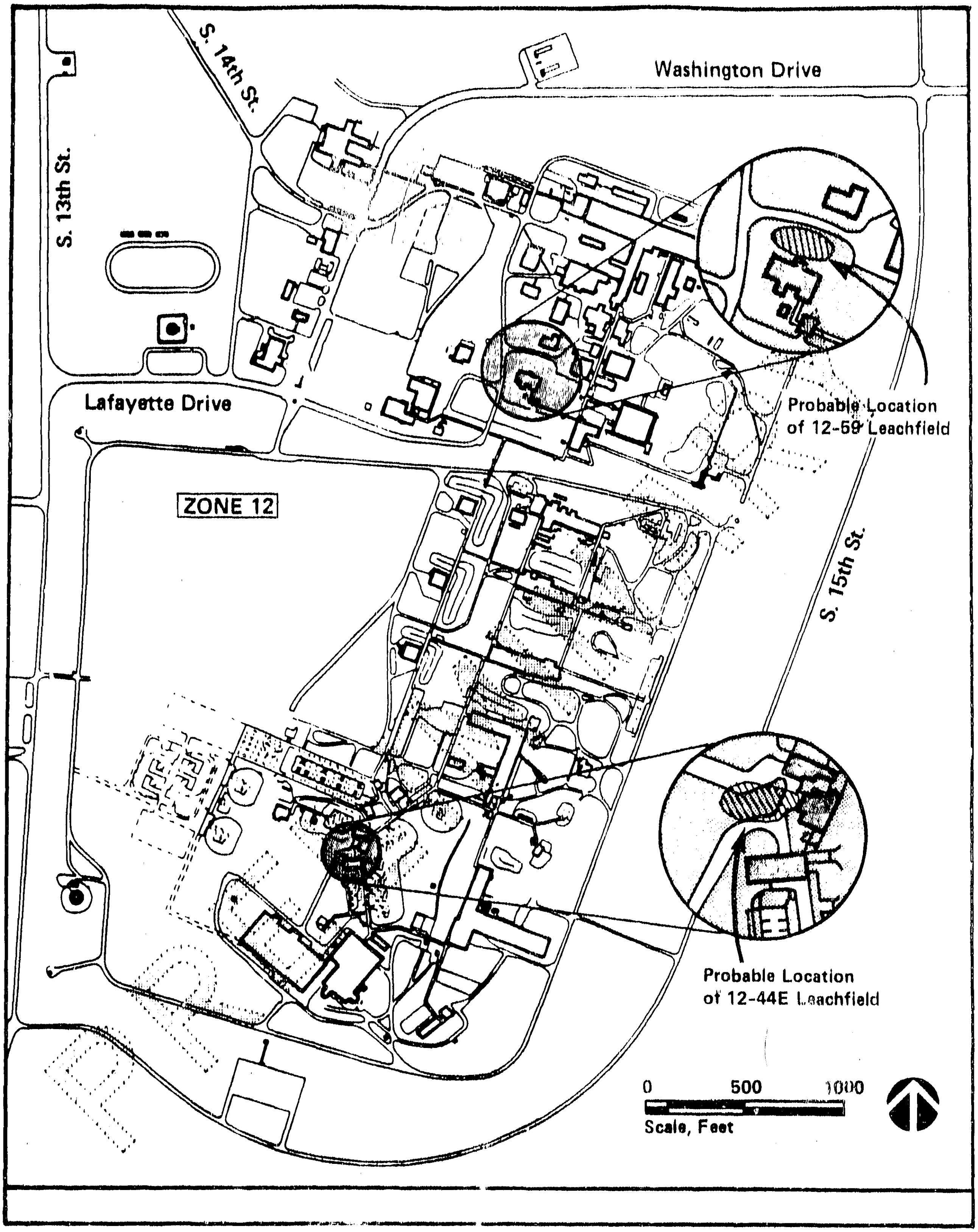
Playas

Playa 1 has traditionally received the largest quantity of facility wastewater, and it continues to receive both treated and untreated waste streams. This active site is discussed in Sections 3.3 and 3.4 as a potential source of pollution. Playas 2 and 4 currently receive liquid discharges from Zone 11, and Pantex Lake, about 4 miles northeast of the facility, formerly received the effluent from the sanitary wastewater treatment plant. They too are discussed in Section 3.3.

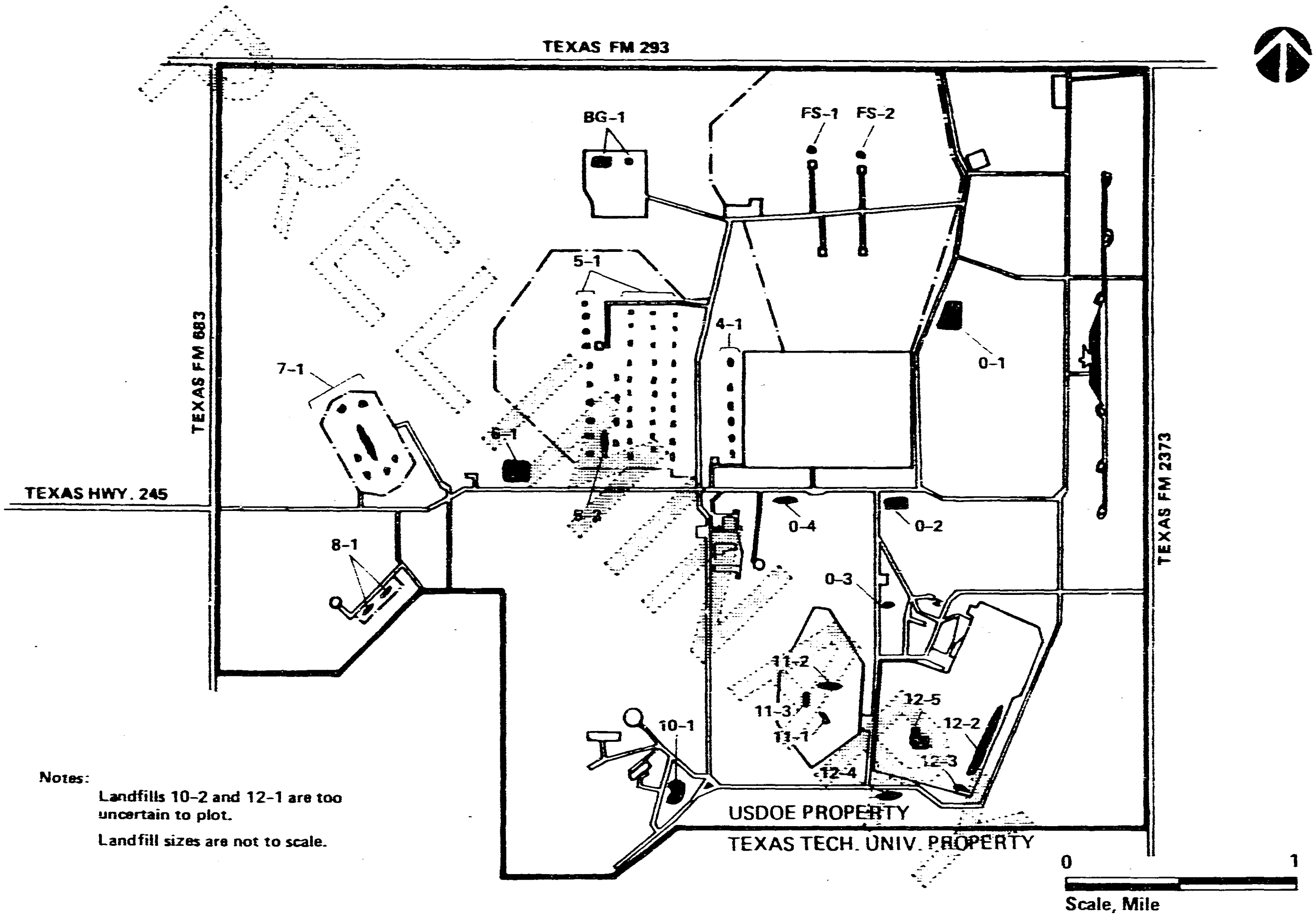
4.5.1.2 Solid Waste Disposal Sites

Virtually all of the sanitary and industrial solid wastes generated at Pantex have been disposed of in landfills located throughout the facility. There are a total of 23 inactive landfills at Pantex; their general locations are listed below and depicted on Figure 4-9.

Location	Number of Landfills
Zone 4	1
Zone 5	2
Zone 6	1
Zone 7	1
Zone 8	1
Zone 10	2
Zone 11	3
Zone 12	5
Burning grounds	1
Firing sites	2
Other areas	4
Total	23



ESTIMATED LOCATIONS OF 12-44E AND 12-59 LEACHFIELDS FIGURE 4-8



APPROXIMATE LOCATIONS OF INACTIVE LANDFILLS

FIGURE 4-9

For the purposes of the Survey, the inactive landfills have been identified by the zone or areas in which each is located, and by a sequential number. For convenience, Table 4-10 provides a list of the Survey's site designations cross-referenced to the site designations given in the Phase 1 Installation Assessment Report prepared under the CEARP.

According to interviews with Pantex personnel and a review of the CEARP Phase 1 effort, the landfills can be distinguished in terms of the reported types of waste placed in each. Generally, the waste can be grouped into six major categories:

1. <u>Sanitary Waste</u>: General trash and garbage, putrescible waste from the cafeteria, and miscellaneous office and paper waste

2. <u>General chemical waste</u>: Plastic wastes, glass, grease/oil trap sludge, empty containers for pesticides, petroleum, solvents, and suspect chemical drums and cans

3. <u>Construction debris</u>

   a. <u>Inert debris</u>: Assorted waste, including brick, concrete, structural steel, wood, asphalt, sheetrock, conduit, pipe, wire, glass, and plastics

   b. <u>Inert debris with asbestos</u>: Inert debris plus asbestos asbestos-covered pipe

   c. <u>Inert debris with waste petroleum</u>: Inert debris plus miscellaneous waste petroleum products not otherwise specified

4. <u>Residual ash</u>

   a. <u>High-explosive ash</u>: Ash and metallic waste resulting from the burning or flashing of HE-contaminated materials and the burning of HE wastes

TABLE 4-10

CROSS-REFERENCE OF SITE DESIGNATIONS PANTEX LANDFILLS

Survey's Designation	CEARP Phase I Report Designation
O-1 O-2 O-3 O-4	Landfill 1 Landfill 2 Landfill 7 Landfill 11
4-1	Landfill 21
5-1 5-2	Landfill 20 Landfill 12
6-1	Landfill 13
7-1	Landfill 14 and unnumbered landfills
8-1	Landfill 15
10-1 10-2	Landfill 22 Unconfirmed landfill used by Texas Tech University
11-1 11-2 11-3	Landfill 8 Landfill 9 Landfill 10
12-1 12-2 12-3 12-4 12-5	Original Landfill Landfill 3 Landfill 4 Landfill 5 Landfill 6
BG-1	Landfills 16 & 17
FS-1 FS-2	Landfill 18 Landfill 19*

* Note: The CEARP Phase I Report does not include Landfill 19; however, it is shown on a facility engineering drawing.

Sources: DOE, 1986 and MHSM, 1984b.

b. Miscellaneous ash: Ash resulting from the burning of general combustible waste or residues from the fire that destroyed building 10-7, which contained carbon black

5. Depleted uranium: Firing Site debris possibly containing depleted uranium

6. Other: Unknown miscellaneous trash and debris

The 23 landfill sites at Pantex are listed in Table 4-11 and the general category or categories of waste believed to be in each are designated. More specific information on the types of chemicals possibly placed in these landfills is not available. However, the nature of the operations at Pantex implies that the chemicals may include solvents, such as acetone and methyl ethyl ketone; chlorinated solvents; metals, such as chromium and lead; nitro compounds; paints; and an assortment of pesticide residues from empty containers.

Table 4-9 also provides the depth and an estimate of the total volume of each landfill based on information obtained from the Phase 1 CEARP effort. The Survey team was not able to further substantiate any of these volume estimates because of the lack of historical records.

The data on years of operation raise a question as to the accuracy of estimates of waste accumulation for the various landfills. For example, Landfill O-2 was used for 1 year for disposal of the sanitary and general chemical wastes. Landfill O-1 received the same types of waste, plus construction debris, for 15 years. According to the available information (DOE, 1986), the average annual waste generation rate for each landfill is as follows:

Landfill Designation	Total Volume (yd^3)	Years of Operation	Average Annual Waste Generation Rate (yd^3/yr)
O-1	114,000	15	7,600
O-2	29,000	1	29,000

TABLE 4-11
LIST OF LANDFILLS WITH INFORMATION ON WASTE TYPES, QUANTITY, AND PERIOD OF OPERATION PANTEX FACILITY

Survey's Site Designation	General Waste Categories									Depth of Landfill (ft)	Estimated Volume (yd 3)	Period of Operation	
	Sanitary	General Chemicals	Construction Debris			Residual Ash		Depleted Uranium	Other				
			Inert Debris	Inert Debris w/Asbestos	Inert Debris w/Waste Petroleum	HE	Misc.					Opened	Closed
O-1	X	X		X	X	X	X			18	114,000	1952	3/67
O-2	X	X					X			18	29,400	3/67	8/68
O-3					X					6	100	?	1980
O-4		X			X					6	800	?	8/69
4-1			X							7	10,000	mid 1970's	7/78
5-1			X							Unknown	Unknown	mid 1970's	7/78
5-2					X					6	3,300	?	1972
6-1					X					22	48,900	1/72	5/72
7-1				X	X					12	3,800	2/79	12/79
8-1					X					12	400	2/80	6/80
10-1							X			22	8,800	1963	1963
10-2			X					X	X	Unknown	Unknown	?	1969
11-1				X						20	15,600	?	1977

TABLE 4-11 (continued)
LIST OF LANDFILLS WITH INFORMATION ON WASTE TYPES, QUANTITY, AND PERIOD OF OPERATION
PANTEX FACILITY
PAGE TWO

Survey's Site Designation	General Waste Categories									Depth of Landfill (ft)	Estimated Volume (yd³)	Period of Operation	
	Sanitary	General Chemicals	Construction Debris			Residual Ash		Depleted Uranium	Other				
			Inert Debris	Inert Debris w/Asbestos	Inert Debris w/Waste Petroleum	HE	Misc.					Opened	Closed
11-2			X							4	1 300	?	8/77
11-3			X							6	500	?	11/77
12-1	X	X					X			Unknown	Unknown	1951	1952
12-2				X	X					20	283,000	?	1951
12-3				X	X					12	200	?	1959
12-4					X					6	500	?	1959
12-5					X					10	3,000	?	8/76
BG-1		X	X			X		X		22	9,300	?	5/64
FS-1						X		X		5	200	?	Late 1960's
FS-2						X		X		6	100	—	Unknown

Sources: DOE, 1986; MHSM, 1984b and 1985

The reasons for the apparent difference in rates of waste generation annually are not clear. This example is given solely to acknowledge that the best available information to date is preliminary in nature and thus that further study may be warranted.

Limited documentation was available on the past landfilling practices and controls at Pantex. The inactive landfills were generally excavations rather than above-grade landfills. Open burning of combustible wastes was allowed at the older landfills used for sanitary and general chemical wastes. Many of the construction debris landfills were only open for short periods during specific building demolition projects. Since the drum staging areas reportedly were used during the 1970s, it is reasonable to assume that, prior to that time, drums containing residual liquids were placed in some of the general chemical landfills. The background information does not indicate whether free liquids were allowed in the landfills; this seems less likely, however, because the solvent and waste oil percolation/evaporation pit was available for use. All of the inactive landfills were covered with native soil upon closure, but the depth of cover was not documented. According to Pantex employees, typically 2 to 3 feet of cover material was applied and the original land surface grade was restored.

Of the 23 landfills, only Landfill O-1 has been the subject of additional study in the past. Three test holes were drilled into Landfill O-1. In two, waste was encountered beginning at 2 feet below the surface; the third was apparently between filled areas. Debris from the test holes included tygon tubing, electrical wire, polyurethane foam, kimpacks, plastic strapping, polystyrene, paint cans, rags, glass, lucite, wood scrap, plastic bags, and fragments of insulation, lead, tin, and stainless steel. The bottom of the waste material was reported to be 14 feet below the land surface. As part of the study, PVC pipe was placed in the two test holes that penetrated waste and remains in place, closed with a cap. The total drilled depth of each test hole was approximately 30 feet below land surface (Becker et al., 1986).

4.5.1.3 <u>Spills and Releases</u>

A total of 26 locations where spills or releases occurred or may have occurred were investigated during the Survey. These locations are predominantly in Zones 10, 11, 12, and 16. The past spills and releases have involved organics, acids, inorganics, high explosives, and radioactive materials. The organic materials include the following general types of chemicals:

- Solvents
- Pesticides
- PCBs
- Petroleum hydrocarbons

Table 4-12 provides a record of the 26 incidents in terms of location, quantity, date of use or occurrence, and type of contaminant suspected. As shown on this table, 13 spills involved organic chemicals; 4, acids; 8, inorganic materials; 4, high explosives; and 1, a radionuclide. Five spills involved more than one major category of contaminants. Each of these spills or releases could have contaminated soil or, based on their location, sediments in the ditches leading to the playas. The spill locations in which further investigations have been performed or cleanup measures completed are discussed in more detail in this subsection.

<u>Investigation of Gasoline Leaks</u>

Of the 26 spill locations, the 2 locations of gasoline leaks were investigated further during 1986. The locations were the vehicle maintenance facility (building 16-1) and a garage in Zone 12 (building 12-35). In 1984, an estimated 1750 gallons of gasoline were released at building 16-1. According to the CEARP Phase 1 Report (DOE, 1986), two leaks occurred at the garage, one in 1974 or 1975 and the second in 1985, with a total estimated volume of 2000 gallons released. Another report states that leaks may have occurred almost continuously since 1956 at building 12-35 (Becker et al., 1986).

TABLE 4-12
LIST OF PAST SPILLS OR RELEASES WITH QUANTITY AND TYPE OF CONTAMINANT SUSPECTED
PANTEX FACILITY

Name	Location	Date of Occurrence	Quantity	TYPE OF CONTAMINANT SUSPECTED								
				Organics				Acids	Inorganics	High Explosives	Radioactive	Unknown
				Solvents	Pesticides	PCB	Petroleum Hydrocarbon					
Gasoline Leak	Bldg 16-1	1984	1,750 gallons				X					
Gasoline Leak	Bldg 12-35	Uncertain	Uncertain				X					
Electroplating Waste Tank Leak	Bldg 12-68	October 22, 1986	4,500 pounds					X	X			
Boiler House Acid Spill	Bldg 12-4	1984 (2 spills)	4,400 gallons					Sulfuric				
PCB Spill	Main Electrical Substation	1978 or 1979	Unknown			X						
Transformer Leak	Bldg 11-14A	1960's 1977	30 gallons 3 gallons			X						
Drum Salvage/ Staging Area	Bldgs 10-7 & 10-9	1970-1981	Residue from 350-600 drums annually	X								X
Drum Storage Area	Pads 11-12 & 11-13	1976	Unknown	Toluene, Acetone, DMF								X
Temporary Burning Ground	Betw. Zones 6 & 7	1951-1954, 1959 or 1960	Unknown	X						X		
Zone 6 Firing Site	NA	1968	Unknown						Beryllium	X		
Fire Training Center Pits	Bldg 16-8	Unknown	Unknown	X		X	X					
Battery Storage Area	Bldg 12-81	1986	Unknown					X	X			
Storage Tank Area	Bldg 11-36	Unknown	Unknown	X								

TABLE 4-12 (continued)
LIST OF PAST SPILLS OR RELEASES WITH QUANTITY AND TYPE OF SUSPECTED CONTAMINANT
PANTEX FACILITY
Page Two

Name	Location	Date of Occurrence	Quantity	TYPE OF CONTAMINANT SUSPECTED								
				Organics				Acids	Inorganics	High Explosives	Radioactive	Unknown
				Solvents	Pesticides	PCB	Petroleum Hydrocarbon					
Storage Tank Area	Bldg 11-36	1978 or 1979	100 gallons					110% oleum				
11-36 Excavation	Bldg. 11-36	Nov. 1986	Unknown						Copper Sulfate			
Air Compressor Lubricant Blowdown	Bldg. 11-41E	Nov. 1986	Unknown				X					
Pesticide Mixing Area	Bldg 12-51	In Use	Unknown		X							
TNT Release from 12-64 Tank Trailer	Ditch near Bldg. 11-44	Nov. 1986	Unknown							100 ppm TNT		
Sanitary WWTP	NA	1950's	Unknown						Mercury			
Zone 5 Bunker	NA	1956	Unknown							X	Sr-90	
Diesel Fuel leak	Bldg 15-24	1985	400 gallons				X					
Boiler House	Zone 10	Pre-1970's	Unknown						Mercury			
Boiler House	Zone 11	Pre-1970's	Unknown						Mercury			
Boiler House	Zone 12	In Use	6 quarts						Mercury			X
Boneyard	East of Bldg 12-5	1957-1968	Unknown			X						
Garage Drain - DDT Spill	Bldg 12-35	Late 1960's	100 gallons		DDT							

Sources: DOE, 1986; Johnson, M.S., 1987a and 1987b.

A limited subsurface investigation was performed at both of these locations. Two holes with total depths of 30 and 37.5 feet were drilled at building 16-1. Analysis of subsurface soil samples taken from these holes showed that gasoline levels were below the detection limit (the detection limit was not given). However, field lower explosive limit (LEL) measurements as determined by a portable explosimeter were elevated between a depth of 20 and 30 feet. The study concluded that there is gasoline beneath the 16-1 facility, even though the two holes drilled did not penetrate contaminated soil (Becker et al., 1986).

One hole was drilled in the presumed vicinity of the building 12-35 spill to a depth of 45 feet. Analysis results of soil samples collected from this hole indicated that gasoline was present from 14 to 45 feet in the parts-per-thousand range. LEL measurements taken during the drilling operation were higher than 20 percent for some of the samples collected. The study concluded that gasoline is moving downward in the spill area and is more than 45 feet deep, but that the total depth is unknown. The gasoline spill problems are continuing to be studied under the CEARP.

Specific cleanup measures have taken place at the sites of four of the spills:

- o Electroplating waste tank leak - building 12-68
- o Boiler house acid spill - building 12-4
- o PCB spill - main electrical substation
- o Transformer leak - building 11-14A (see Section 4.2)

Three cleanup actions are discussed in more detail below. The recent work involving removal of PCB-contaminated soil at the transformer station near building 11-14 is discussed in Section 4.2.

<u>Remediation of Electroplating Waste Tank Leak - Building 12-68</u>

On October 22, 1986, a leak was discovered in a plastic-lined metal tank at the northeast corner of building 12-68. That leak resulted in the release of approximately 4500 pounds of waste chemicals. The tank was used to evaporate the liquid waste from an electroplating process and also contained an Oakite 32 cleaning solution. Pantex personnel constructed an earthern dike to contain the liquid waste and performed an analysis of the liquid. The results of the analysis indicated that the waste contained lead at 16 ppm. The CERCLA-reportable quantity for lead is 1 pound; therefore, Pantex notified the EPA of the release (MHSM, 1986b).

Pantex initiated cleanup measures that involved soil excavation at the site of the release. According to Pantex personnel (Johnson, 1987a), the supernatant from the tank flowed approximately 50 feet east of the leaking tank, then turned south for approximately 150 feet. Maximum depth of soil removal was at the turning point from east to south. About 12 inches of soil were removed from this location. The depth of removal was tapered up to about 4 inches near the leaking tank and at the south end of the spill. Analysis of the removed soil showed chromium content in the range of 3.0 ppm (under the tank) to less than 1.0 ppm, and lead content in the range of 2.0 to 3.6 ppm. The area was backfilled with clean soil. The background soil sample was also analyzed and found to have concentrations of chromium at less than 1.0 ppm and lead at 2.0 ppm.

An attempt was made to treat the soil by reducing the hexavalent chromium to the trivalent state. These efforts proved costly and inefficient (see discussion of hexavalent chromium processing in Section 3.3.2.1); consequently, the contaminated soil was placed in drums for disposal off-site. Approximately 700 drums of contaminated soil were collected and the facility is negotiating a subcontract for removal and final disposal. As of January 30, 1987, Pantex personnel expected that Lone Mountain, Oklahoma, would receive the waste for disposal (Johnson, 1987b).

<u>Remediation of Boiler House Acid Spill - Building 12-4</u>

Two sulfuric acid spills occurred in 1984 at the building 12-4 boiler house involving the acid delivery system. Approximately 1500 gallons spilled originally; then, during the work to repair the system, an estimated 2900 gallons were released. Contaminated soil was collected, placed in the hypalon-lined pond adjacent to building 11-51, and neutralized with lime (Hayes, 1984). Since the 11-51 pond was closed and backfilled by 1986; it is possible that this contaminated soil remained in the pond.

Remediation of PCB Spill - Main Electrical Substation

In 1978, electrical capacitors at the main electrical substation exploded as a result of a strike by lightning (see related discussion in Section 4.2.1.2). The capacitors contained PCB-contaminated oil. The explosions occurred inside a metal cabinet on a concrete pad. The spilled oil was cleaned up using rags and oil-sorb within this confined area. Judging from the location of the spill, no surface soil was involved. The cleanup materials and the capacitors were shipped to Wescon, Inc., Grandview, Idaho, for disposal (Johnson, 1987b; DOE, 1986).

A few of the other spill locations were reportedly subject to some degree of cleanup activity, but documentation on the nature of such activity is not available. All of the sites of former spills were reviewed by the Survey team. Those areas judged to pose a threat or potential threat to the environment are discussed in more detail in Sections 4.5.2.3 and 4.5.2.4.

4.5.1.4 Suspect Areas Based on Historical Photographs

During the Survey, aerial photographs were reviewed that covered the complete period of operations on the Pantex activity. The specific dates of the historical photographs reviewed are 1941, 1953, 1967, 1978, and 1985. Based on this evaluation, two areas of distinctive ground scarring over time were identified.

One area, located in Zone 11 next to building 11-25, can be seen in photographs dating back to 1953. In three parallel depressions in this area, the color of the surface soil or vegetation is distinctively different from that of the surrounding area. Pantex personnel who were interviewed had no information on what may have occurred in this area.

A second area is northeast of Zone 4. The area is circular and supports little, if any, vegetation. Pantex personnel stated that this area was once the location of a transmission line pole where herbicides were applied. Both of these areas are further addressed in Section 4.5.2.3.

4.5.1.5 Potential Inactive Waste Sites Resulting from DOD Operations

As described in Section 2.0, the DOE acquired the Pantex facility after the DOD had used the plant to assemble conventional munitions. From 1942 to 1949, the DOD operated the facility. In 1949, the land was sold to Texas Technology University (TTU), but in 1951, portions of the facility were reclaimed for use by the Atomic Energy Commission (AEC), the predecessor agency to the DOE.

Potential waste sites that were created by these earlier defense operations were identified during Phase 1 of the CEARP. Ten of these potential waste sites are on property that is not owned by the DOE. The DOE-ALO directed that these sites were not to be included in the five-phase CEARP effort (Rea, 1986b). Instead, DOE personnel informed DOD representatives of these potential inactive waste sites and assisted U.S. Army Corps of Engineers (COE) personnel in two reconnaissances of these areas, one in March 1986 and the second in April 1986 (McMenamin, 1986a; Johnson, 1986). The sites are on property owned by the TTU, of which some parcels are leased by the DOE and used as a buffer zone. The 10 sites are as follows:

- Approximately 100 abandoned and essentially empty igloos or ordnance storage bunkers

- Two abandoned building foundations (operations conducted in the buildings are unknown)

- Large landfill with exposed debris on the edge of Playa 4

- Ordnance burning ground with melted fuses and small debris exposed

- Trash burning ground

- Stable area building foundations and possible abandoned septic systems or drainfields

- Small landfill in an area currently under cultivation

- Abandoned pistol range backstop

- Zone 9 TNT drying beds

- Zone 9 potential asbestos contamination

All but the two sites in Zone 9 are on parcels of land leased from the TTU by the DOE. Further action at these sites, if any is planned, would be performed under the responsibility of the COE-Defense Environmental Restoration Action (DERA) Program (McMenamin, 1986a; Johnson, 1986). At this time, DOE is not planning any additional study of these DOD inactive sites (Estrada, 1986).

4.5.2 Findings

4.5.2.1 Category I

There are no Category I findings associated with Pantex's inactive waste sites or past releases.

4.5.2.2 Category II

There are no Category II findings pertaining to the inactive waste sites or releases at Pantex.

4.5.2.3 Category III

1) Portions of the Pantex facility have surface soils that are potentially contaminated with hazardous or toxic chemicals and are accessible to local farmers - Surface soils at three areas on the Pantex facility are potentially contaminated and are accessible to local farmers who, through permission from the Pantex facility, cultivate the fields in these areas. One area is reportedly the former location of a transmission line pole where 2,4-D was applied as an herbicide. The major concern is that 2,4-D can be contaminated with dioxin, and thus that residual levels of dioxin may still be present. The second area is Landfill O-1 which was found to be inadequately covered. The third area is an abandoned burning ground once used to dispose of HE-contaminated waste. It appears that the

burning ground was not formally closed or cleaned up; therefore, HE residue may remain on the land surface. The following paragraphs provide more detailed information on each of these potential problem areas.

Herbicide Area

Past applications of the herbicide 2,4-D, which potentially can be contaminated with dioxin, occurred in an area open to use by a local farmer for cultivation.

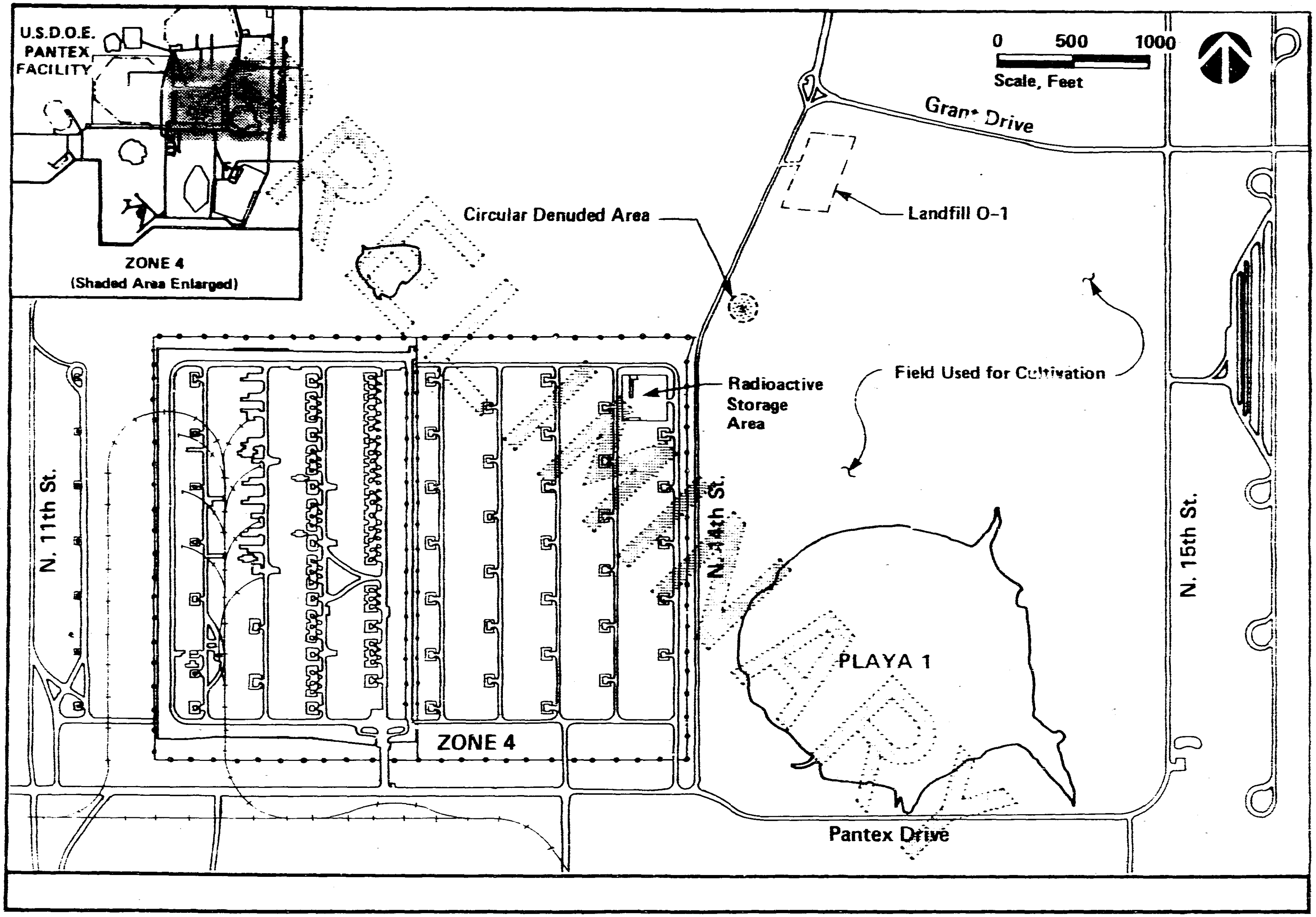
Northeast of Zone 4 and north of Playa 1, there is a circular denuded area on the perimeter of a field under cultivation by a local farmer. The location of this area is given on Figure 4-10. Inquiries revealed that the location approximates that of an old electrical transmission line pole; therefore, information on the weed control program was obtained. According to site personnel (Colvin, 1986), applications made along the transmission line included the following:

- Sta-Kill (5 percent Diuron and 4 percent Bromacil)
- Hyvar X and 2, 4-D diesel mixture (20 pounds of Hyvar X with 2.5 gallons 2,4-D diesel mixture, which is 8 gallons of 2,4-D in 40 gallons of diesel fuel)

The transmission line was removed a number of years ago, and the last application of herbicide was in 1984.

The former pole location remains barren and the circular area is larger than other former pole locations. Since the location is surrounded by a field being actively cultivated, it is possible that the residual herbicide is gradually being spread into a larger area by tilling.

During the Sampling and Analysis Phase of the Survey, soil samples from this area will be collected for analysis to determine the presence and concentration of hazardous or toxic chemical contaminants.



APPROXIMATE LOCATION OF SUSPECTED HERBICIDE CONTAMINATION AREA AND LANDFILL O-1

FIGURE 4-10

Landfill O-1

Since Landfill O-1 is inadequately covered, waste that is potentially hazardous may be exposed on the surface and lead to a problem of contact with farmers cultivating this area.

This landfill was used from 1954 to 1967; it received sanitary waste, waste chemicals, construction debris wastes from all areas of the Pantex facility, and HE-contaminated ash from the burning grounds. Visual observation during the Survey confirmed that the cover placed over this landfill is inadequate and that debris is exposed on the surface. The location of the landfill is shown on Figure 4-10.

The landfill received a wide assortment of waste, some of which may be hazardous and may gradually be exposed on the surface due to the lack of a stable cover. Surface exposure of waste may lead to problems of contact with hazardous contaminants, particularly since access to the fill is unrestricted to the farmers cultivating the land immediately surrounding the landfill. Surface exposure of waste material can also lead to problems with air resuspension and broader dispersal of contaminants; this, however is less likely to be a problem at Landfill O-1, which has a moderate weed and grass growth.

Pantex personnel have developed a preliminary corrective action plan for the landfill which calls for removal of some of the waste material and placement of an earthern cover over the landfill surface (McMenamin, 1986b). The plan is only in its initial preparation stage; consequently, a completion date has not been established. Further work at the site is planned under Phase 2 of the CEARP effort (DOE, 1986).

During the Sampling and Analysis Phase of the Survey, surface soil samples will be collected and analyzed as a means of indicating whether hazardous contaminants are currently exposed. In addition, the PVC pipes placed in the test holes will be checked for accumulated leachate. If present, the liquid will be collected for chemical analyses.

Abandoned Burning Ground

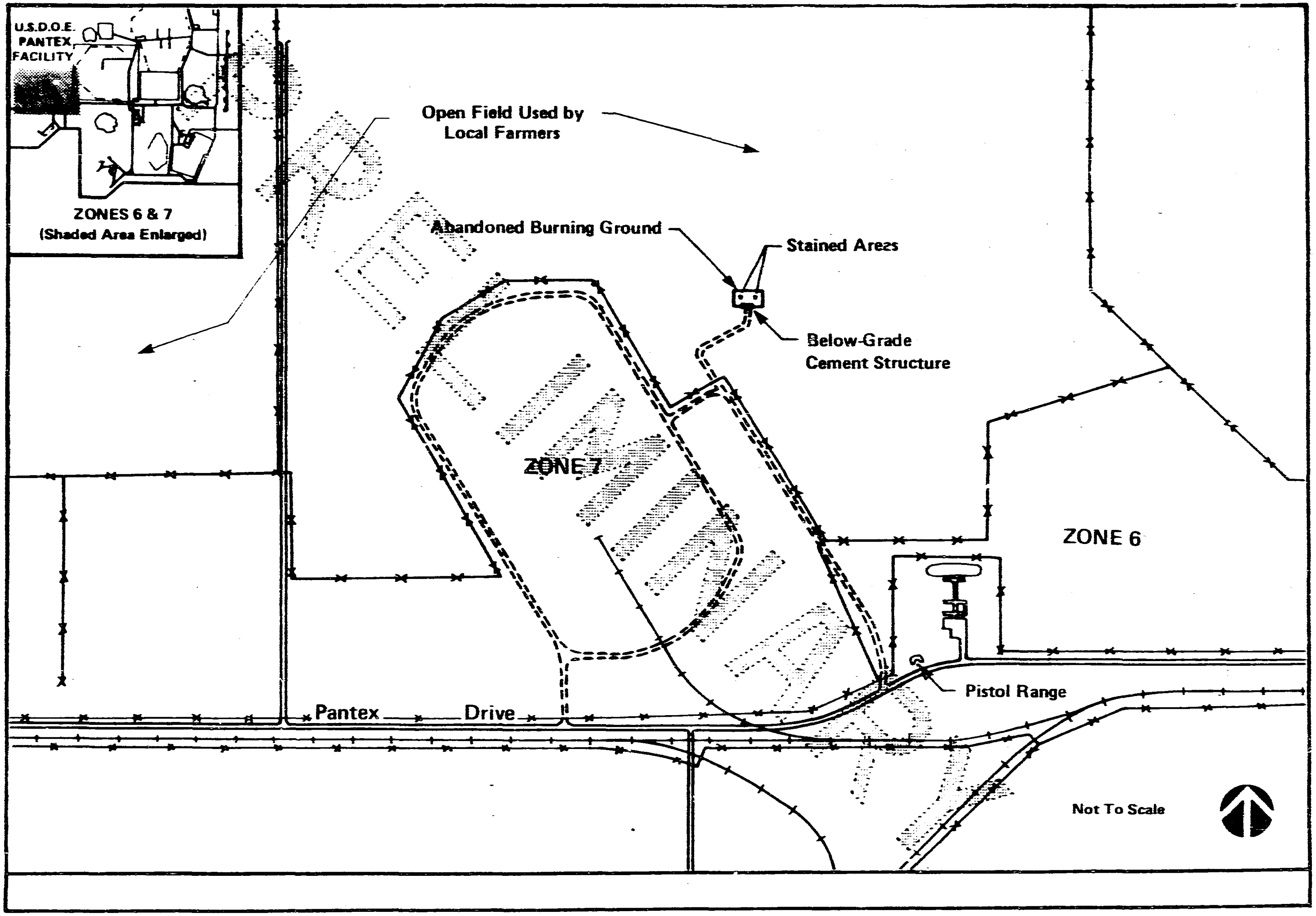
The surface soils at an abandoned burning ground are stained and may be contaminated with TNT, baritol (TNT with barium nitrate), or other high explosives. Local farmers and their cattle have access to this area.

A former burning ground is located between Zones 6 and 7 (Figure 4-11), which was used temporarily from 1951 to 1954 and again in 1959 or 1960, while the main burning grounds were inoperable. TNT, baritol, or any other high explosives used during these periods may have been brought to this burning ground for disposal (DOE, 1986). As is currently practiced, controlled burning of the HE-contaminated waste was the method of disposal. No records were available to delineate the frequency of use or final disposition of the residual ash material accumulated after each burn.

Based on historical aerial photographs reviewed during the Survey, two areas in each northern corner of the burning ground were distinctively scarred. Visual inspection during the Survey found that ground scars remain in similar locations at the burn site. Both of these areas had scattered, rust-colored stains on the surface soils and notably less vegetation than the surrounding area. It appears that the burning ground had been abandoned with no formal closure or cleanup measures performed, and contaminants may still exist in the surface soils. In addition, numerous dead grasshoppers were observed within the burning ground, but no dead grasshoppers were seen outside the area. Portions of a below-grade cement structure exist at the entrance to the area. The abandoned burning ground is located within a portion of the facility accessible to local farmers.

During the Sampling and Analysis Phase of the Survey, surface soil samples at the abandoned burning ground will be collected for analysis to address the possibility of residual hazardous contaminants on the ground surface.

2) Chemical contaminants have migrated vertically downward into subsurface soils at three locations on the Pantex facility and potentially may contaminate perched zones of groundwater, which, according to Pantex personnel, are used in the area as a source of drinking water, for domestic purposes, and for livestock watering - Past liquid waste disposal practices and the occurrence of spills or leaks at two fuel storage locations have resulted in the contamination of subsurface



SKETCH OF ABANDONED BURNING GROUND

FIGURE 4-11

soils. HE-contaminated solvents and waste oils were placed in a pit at the burning grounds and allowed to percolate or evaporate. The pit was 3 feet deep, and one solvent has been identified at a depth of 43 feet. Gasoline leaks have occurred at two fuel storage locations (buildings 16-1 and 12-35) and have also migrated downward in the unsaturated zone, but the total depth of contamination is unknown. The following paragraphs describe these areas more specifically.

Waste Oil and Solvent Percolation/Evaporation Pit

HE-contaminated solvents disposed of in an unlined pit at the burning grounds have migrated vertically downward into the subsurface soils and may migrate farther, possibly reaching zones of perched groundwater.

An evaporation/percolation pit on the west side of the burning grounds (see Figure 4-5) was used for disposal of HE-contaminated solvents and waste oils over the period 1954 to 1980 (see related finding in Section 3.4.4.3). Solvents and waste oils were transported to the burning grounds, poured into the unlined pit, and allowed to evaporate. Periodically, the liquid waste was burned or the residuals from evaporation of the solvents and oils were burned. Virtually any solvent used at the Pantex facility may have been disposed of in this pit.

Solvents reportedly used at the plant include the following (DOE, 1979, 1980):

- Toluene
- Acetone
- Ethyl acetate
- Methyl ethyl ketone
- Methyl isobutyl ketone
- Tetrahydrofuran
- Dimethylformamide
- Benzene
- Trichloroethylene
- Tetrachloroethane
- Chloroform
- Carbon tetrachloride
- Methylene chloride

The total quantity of waste solvents and oils placed in this evaporation/percolation pit is not documented, but based on information made available to the Survey team, it may range from 90,000 to 350,000 gallons. The pit was 20 feet long, 20 feet wide, and 3 feet deep (MHSM, 1985).

As discussed in Section 4.5.1.1, a subsurface soil study was performed in the vicinity of the former solvent/oil disposal pit to determine whether solvents have migrated from the site. At a location 10 feet southwest of the pit, acetone was found in concentrations ranging from 1 to 10 ppm. The depth of contamination extended to 43 feet. Residual contamination below the analytical detection limit used (1 ppm) may exist in these subsurface soils. Also, contaminants may be present below the 48-foot limit of investigation. Furthermore, analytical tests for all of the solvents potentially disposed of in this pit were not performed in the LANL study, nor were tests run for the various types of HE that contaminated the solvents. The possibility that chlorinated solvents and MEK, which tends to move more rapidly than many other solvents, were disposed of in the pit is sufficient evidence that the total depth of vertical migration of contaminants is uncertain.

The former disposal pit is on a portion of the Pantex facility that is secured by a fence; restricted from public access, and worker access controlled. The pit has been filled since 1980, but its location has not been marked or designated in any way. Pantex personnel informed the Survey team that the pit was located immediately south of the bermed area containing the solvent evaporation pans currently in use. Records of the steps taken to close the pit apparently do not exist. The likelihood of continued migration of contaminants with resulting impacts on the local perched groundwater zones has not been adequately addressed. According to site personnel, some zones of perched groundwater serve as a source of drinking water and water for domestic activities in the vicinity of the Pantex facility (Laseter, 1986b). Since the perched water zones are not well understood at Pantex, it is unclear if any located near this source are used in this manner.

During the Sampling and Analysis Phase of the Survey, soil samples will be collected and analyzed to evaluate the depth of downward migration and the related concentrations of the contamination.

Gasoline Leaks

Gasoline has leaked from piping associated with underground storage tanks and resulted in subsurface soil contamination.

Gasoline leaks have occurred at two locations on the Pantex facility, one at the vehicle maintenance facility (building 16-1) and the other at a garage in Zone 12 (building 12-35). In 1984, an estimated 1750 gallons of gasoline were released at building 16-1. For the garage location, the dates of occurrence and the total volume of the spill are uncertain.

A limited subsurface investigation was performed at both of these locations. Field LEL measurements indicated that gasoline is beneath the 16-1 facility, even though the two holes drilled did not penetrate contaminated soil (Becker et al., 1986).

One hole was drilled in the presumed vicinity of the building 12-35 spill area. Analysis of soil samples collected from this hole indicated that gasoline was present at from 14 to 45 feet in the parts-per-thousand range. The study concluded that gasoline is moving downward in the spill area and is greater than 45 feet deep, but that the total depth is unknown (Becker, et al., 1986). The gasoline spill problems are continuing to be studied under the CEARP (Rea, 1986a).

3) Surface soils at six locations on the Pantex facility in areas of controlled access are potentially contaminated with hazardous or toxic chemicals - The six areas of potential surface soil contamination are (1) Pads 11-12 and 11-13, which were formerly used for drum storage; (2) Buildings 10-7 and 10-9, which were formerly used to stage drums for salvaging; (3) the fire training center pits; (4) Landfill 6-1; (5) building 12-41, the former battery storage area; and (6) three parallel stained depressions in Zone 11. These areas are accessible to employees but not to the local farmers. Residual contaminants that are potentially hazardous or toxic may remain in these surface soils. Each of these areas is described in more detail in the following paragraphs.

Drum Storage and Staging Areas

Hazardous contaminants may be present in surface soils next to pads 11-12 and 11-13, which were formerly used as a drum storage area, and in Zone 10, where liquid wastes were once poured onto the ground at a drum staging area.

In Zone 11, pads 11-12 and 11-13 (Figure 4-12) were used in the 1970s to store drums containing various hazardous substances, reportedly predominantly solvents such as toluene, acetone, and DMF (DOE, 1986). Pantex personnel indicate that spills and leaks from these drums may have occurred and run off the pads to the surface soils. In addition, TNT residue may be present in soils in the vicinity of these pads as a result of the former DOD conventional munitions assembly operations. During the Survey, this former drum staging area was visited, and no drums or indications of recent use were evident.

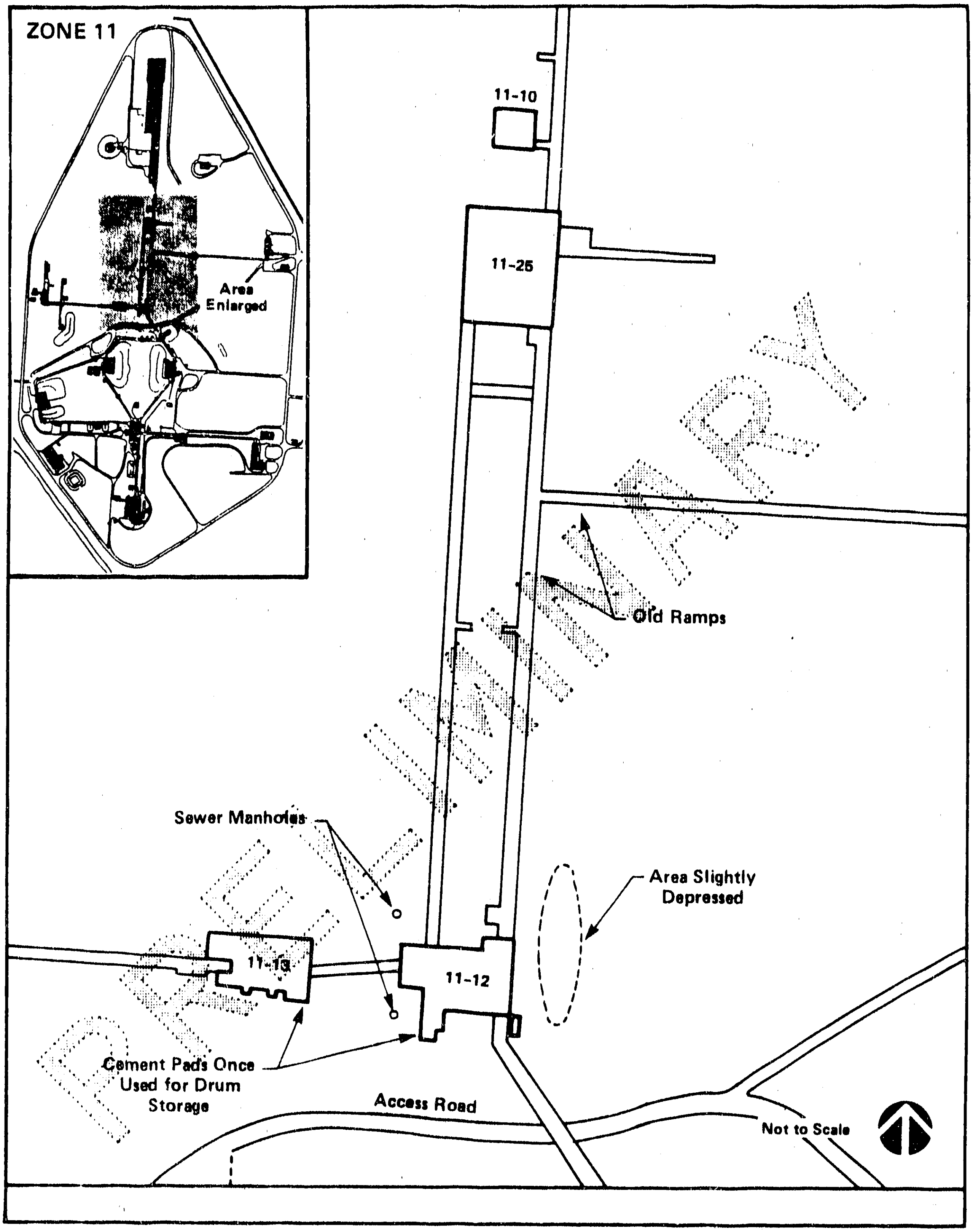
Buildings 10-9 and 10-7 were used from 1970 to 1981 as a staging area for drums and various other containers that were to be salvaged. Apparently, the remaining contents of the containers sent to Zone 10 for salvage were poured onto the ground next to the building foundation. Estimates are that 350 to 600 drums per year were salvaged. The liquid wastes included adhesives, solvents and various other chemicals used on the facility. Carbon black was once stored in building 10-7 and may also be on the ground in the vicinity of this staging area. In addition, Zone 10 was operational when DOD owned the facility, and their practices allowed TNT that did not meet specifications to be discharged to the ground (DOE, 1986).

During the Survey, several barren spots were noted on the land surface, as shown on Figure 4-13. With the assistance of Pantex personnel, the Survey team found pieces of TNT scattered on the ground in the vicinity of building 10-9.

During the Sampling and Analysis Phase of the Survey, surface soil samples will be collected next to pads 11-12 and 12-13 as well as around buildings 10-7 and 10-9 to identify and determine the concentrations of those chemical constituents that may remain in these areas.

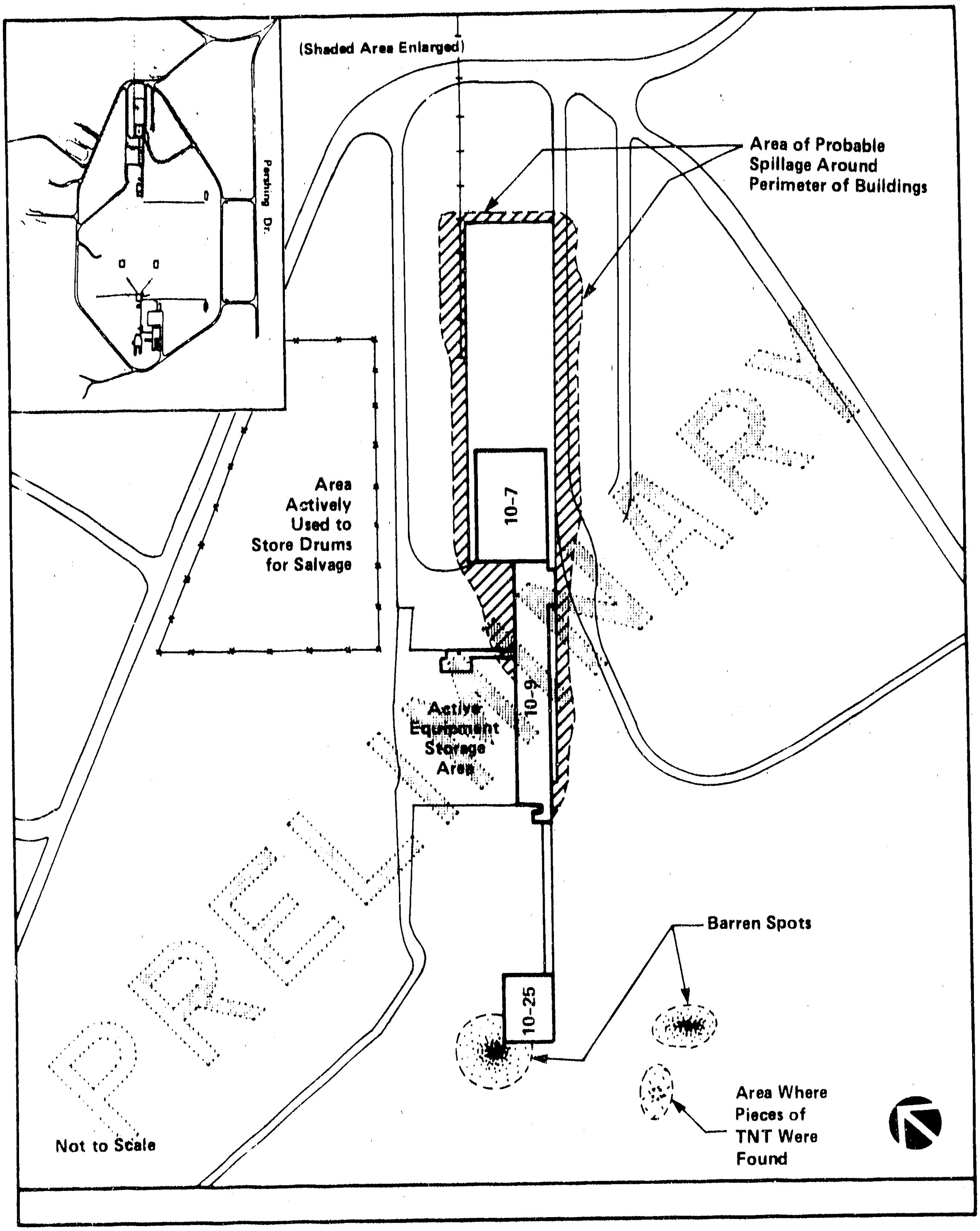
Fire Training Center Pits

Two pits at the fire training center may contain residual solvents and be a source of contamination of surface and subsurface soils.



SKETCH OF FORMER DRUM STORAGE AREA IN ZONE 11

FIGURE 4-12



SKETCH OF FORMER DRUM STAGING
AREA IN ZONE 10

FIGURE 4-13

The pits are located next to building 16-8, the fire training center, and are used in the simulation exercises for the fire protection staff. Soils in and around both pits are stained and covered with a black residue. One pit contained rainwater, hence its depth was not estimated, and the other appeared to be an excavation approximately 1 foot in depth. The substances used in past fire training exercises are not documented but may include oils, solvents, and PCB-contaminated oils; therefore, the possibility exists that the surface and shallow subsurface soils are contaminated. Also, if PCB-contaminated oil underwent combustion, tetra-through heptachlorodibenzo-p-dioxins, and tetra-through heptachlorodibenzofurans could be formed. When stormwater or the fire training exercise water collects in these pits, migration of such contaminants may occur.

During the Sampling and Analysis Phase of the Survey, soil samples from the two pits will be collected for analysis to determine the presence and concentration of hazardous or toxic contaminants.

Landfill 6-1

Landfilled areas in Zone 6 show signs of subsidence, which may allow hazardous contaminants to be exposed on the surface, leading to a problem of possible resuspension of contaminants.

Zone 6 was not used by the DOE for process operations but only for test shots involving beryllium and high explosives. Following these test shots, the remains of the former DOD buildings (thought to be used by the DOD for assembly of fuses) were landfilled. This landfill was designated as Landfill 6-1 for the purposes of the Survey. Personnel interviewed also revealed that a large pit may have once existed in Zone 6 and that it may have received a variety of wastes. No waste records or analytical data have been available to date to further evaluate the types of material possibly buried in Zone 6. However, several areas in the Zone have subsided, leaving cracks or holes that may allow waste to be exposed on the surface. The uncertainty regarding the nature of the waste material placed in the landfill leads to the possibility that hazardous contaminants may be present in the surface soils around the areas of subsidence. If contaminants are present on the surface, they may be transported over a larger area through resuspension.

During the Sampling and Analysis Phase of the Survey, surface soil samples will be collected and analyzed to determine whether hazardous contaminants are present.

Building 12-41 Former Battery Storage Area

The storage of old batteries in an area outside building 12-41 may have resulted in soil contamination.

During the Survey, a storage area for old batteries was identified outside building 12-41 (Figure 4-14). Two gas cylinders and several cardboard containers were located in this area as well. Some but not all of the items were situated on old pallets. The length of time that this area has been used for storage is unknown. Pantex site management directed immediate action to move the stored items to Zone 10, the salvage yard, before the end of the Survey. Spills or leaks from the old battery casings may have occurred in this area, and if so, could have resulted in contamination of the surface soils with acids or metals.

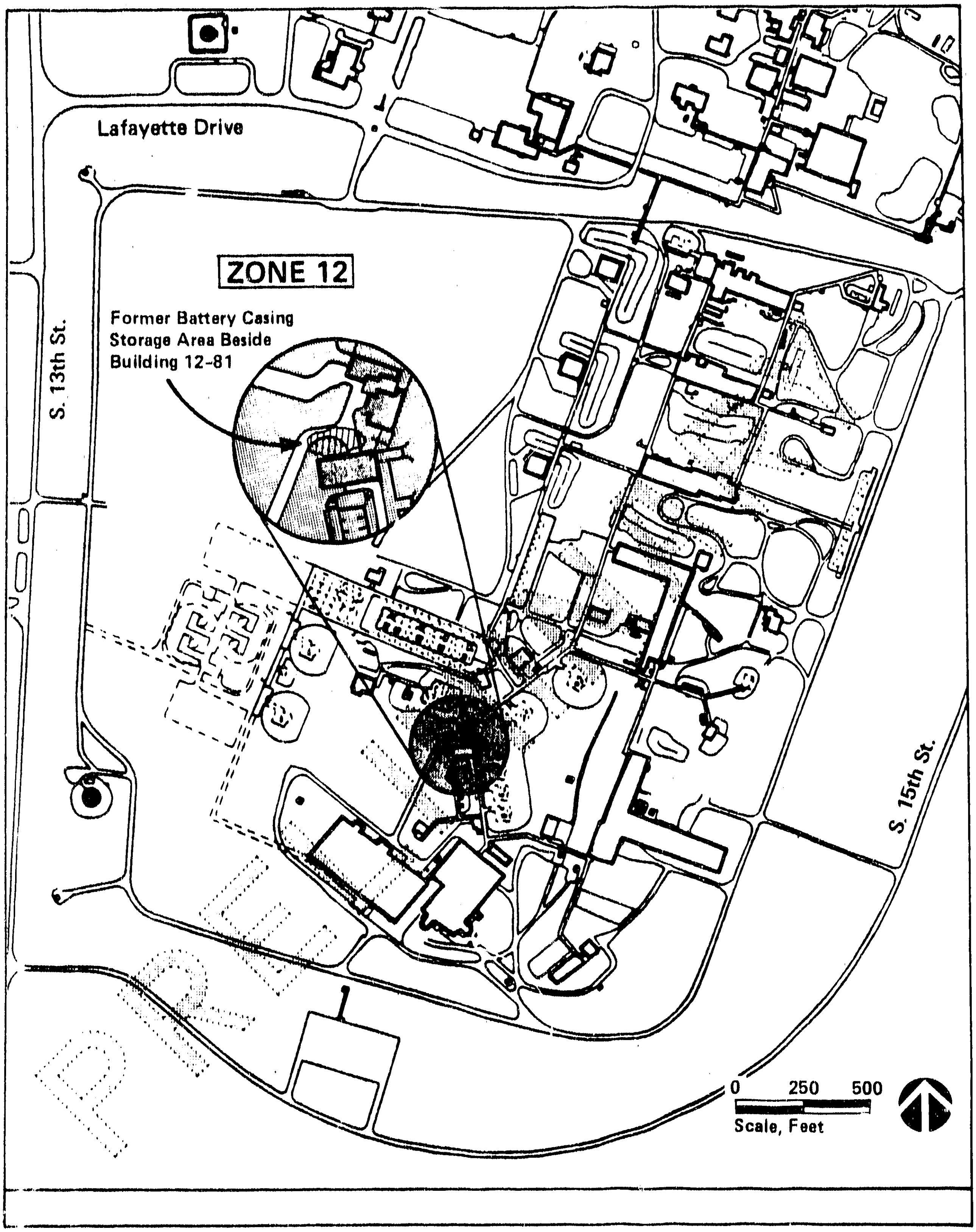
During the Sampling and Analysis Phase of the Survey, surface soils in the former battery casings storage area will be sampled and analyzed to determine the presence and concentration of hazardous chemical constituents.

Three Parallel Depressions in Zone 11

One location on the Pantex facility is a potential site of chemical contamination of the soil based on a distinctively unusual appearance over a long time period, as reflected in historical photographs.

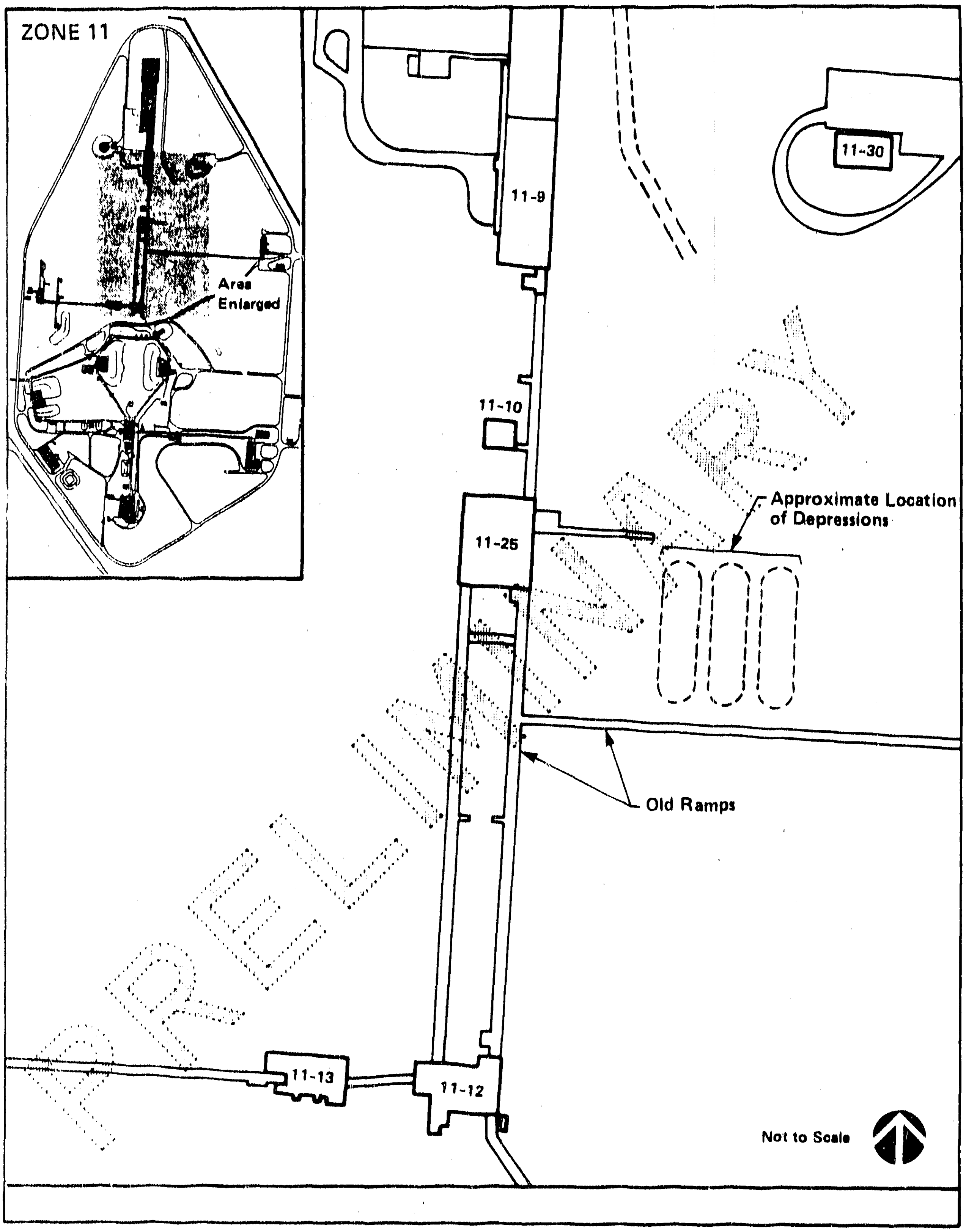
In Zone 11, three brown parallel depressions lie east of building 11-25 (Figure 4-15). These depressions can be seen on historical photographs dating back to 1953. The depressions support a vegetative cover that appears different from that of the surrounding areas. Site personnel who were interviewed have no knowledge of what may have occurred in this area.

During the Sampling and Analysis Phase of the Survey, surface and subsurface soil samples will be collected for analysis to determine the presence and concentrations of contaminants.



LOCATION OF FORMER BATTERY CASING STORAGE AREA

FIGURE 4-14



LOCATION OF SUSPECT AREA IN ZONE 11 FIGURE 4-15

4) The evaporation/percolation pit once used for solvent and waste oil disposal once overflowed, causing vegetation damage and possibly carrying contaminants into Playa 3, a resource for waterfowl and other aquatic animals - The former disposal pit is located on the west side of the burning grounds less than 500 feet upgradient from Playa 3 (see Figure 4-5). Pantex personnel explained that occasionally the liquids in the pit would overflow during a heavy rainfall. The general direction of overland stormwater flow is west toward Playa 3. At times, vegetation along the path of the pit's overflow was stained or killed following these incidents (Pantex personnel, 1986). The pit has not been used since 1980 and has been backfilled with soil. During the Survey, no signs of vegetation stress between the former pit location and the playa were noted.

As discussed in Section 4.5.1.1, the pit contained HE-contaminated solvents and waste oils, and periodic overflows may have transported these contaminants to surface soils and the sediments of Playa 3. Since the HE was in a solvent carrier, it may have reached the playa and eventually settled out along the shoreline sediments.

During the Sampling and Analysis Phase of the Survey, the Playa 3 sediments will be sampled and analyzed to determine whether solvents or HE are present.

5) Surface features of Landfill O-2 may allow for or enhance leachate generation and subsequent contaminant migration to subsurface soils and possibly Playa 1 - Landfill O-2 is slightly depressed, and a stormwater ditch is located either on top of or next to the filled area. The depth of cover on the landfill is not recorded in documents reviewed by the Survey team. The landfill received both sanitary and general chemical waste from the Pantex operations (DOE, 1986), some of which may be considered hazardous. The surface features of the landfill may allow rainwater to percolate into the filled waste areas and thereby increase the generation of leachate that may contain hazardous constituents. Landfill O-2, which has been closed since 1968, is upgradient from Playa 1. Leachate movement, if not predominantly downward, may flow in the direction of this playa.

During the Sampling and Analysis Phase of the Survey, the potential for chemical contaminants to leach out of the landfill and into subsurface soils will be investigated.

6) <u>Of the 23 inactive landfills at Pantex, some may contain hazardous contaminants capable of migrating and contaminating subsurface soils or the vadose zone</u> - Data available to the Survey team indicate that six basic categories of wastes have been placed in various Pantex landfills. These categories and the landfills receiving them are as follows:

Category of Waste	Landfills Receiving Waste
Sanitary	12-1, O-1, O-2
General chemical	12-1, BG-1, O-1, O-2, O-4
Construction debris	4-1, 5-1, 5-2, 6-1, 7-1, 8-1, 10-2 11-1, 11-2, 11-3, 12-2, 12-3, 12-4, 12-5, BG-1, O-1, O-3, O-4
Residual ash	10-1, 12-1, BG-1, FS-1, FS-2, O-1, O-2
Depleted uranium	BG-1, FS-1, FS-2
Other	10-2

It is apparent that construction debris was placed in the largest number of landfills, which might be expected considering Pantex's efforts to decommission numerous buildings formerly used by the DOD. Of the 18 landfills believed to have received construction debris, 4 are thought to have received sanitary waste or general chemical waste. For the remaining 14 landfills, the CEARP records show a distinction in the various construction debris landfills based on waste types, as follows:

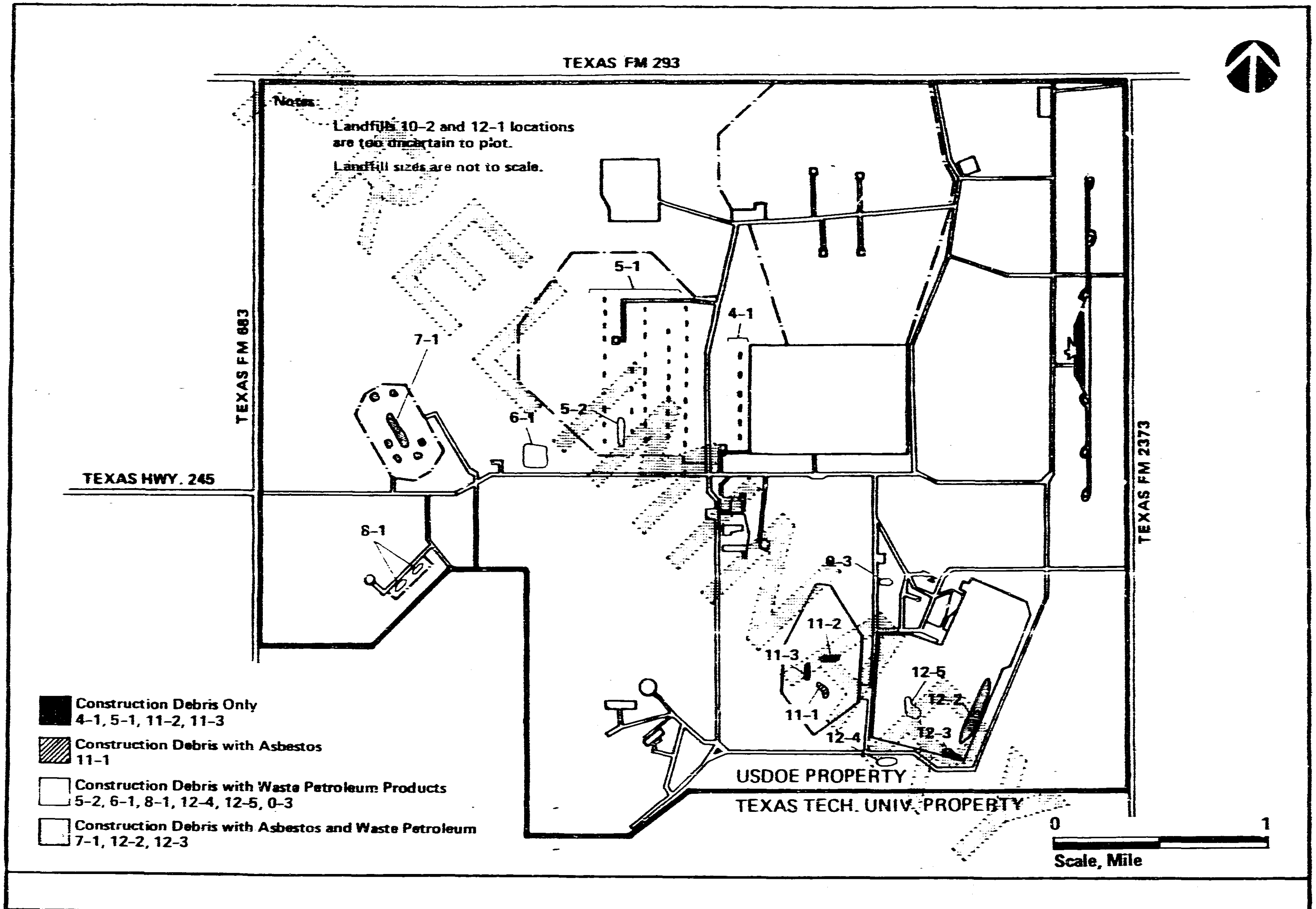
- o Construction debris only: 4 landfills (4-1, 5-1, 11-2, 11-3)
- o Construction debris with asbestos: 1 landfill (11-1)
- o Construction debris with waste petroleum products: 6 landfills (5-2, 6-1, 8-1, 12-4, 12-5, O-3)
- o Construction debris with asbestos and waste petroleum: 3 landfills (7-1, 12-2, 12-3)

If the records are correct, then construction landfills that did not receive waste petroleum products should represent little environmental risk, assuming they have adequate compaction and a final cover. As for those containing waste petroleum, evaluation of their potential impacts is complicated by the absence of data on the quantity or chemical constituents of the wastes. If organic wastes are present and not contained, then contaminant migration is possible. The locations of these 14 landfills are provided on Figure 4-16.

During the Sampling and Analysis Phase of the Survey, these inactive landfills will be sampled. Soil gas samples from each type of construction landfill and from those that received sanitary, general chemical, or HE residual ash will be collected and analyzed for the presence of volatile organic chemicals. Should volatiles be found, an attempt will be made to correlate their presence with the types of waste placed in the landfills. The presence of volatile compounds will be used as an indicator of hazardous or toxic waste disposal.

7) <u>Residual toxic chemicals may be present in an inactive, hypalon-lined pond in Zone 5 that received an uncharacterized waste stream and thus remains as a potential source of waste susceptible to resuspension or migration to subsurface soils</u> - An experimental high-speed HE machining facility once operated in Zone 5, along with a firing site. The cooling water from this operation was filtered and routed into a small, hypalon-lined pond adjacent to the building and allowed to evaporate. The waste stream was small in volume but apparently not analyzed to determine its constituents. Therefore, chemical contaminants may remain in the pond. The pond dimensions are approximately 24 x 36 x 3 feet (Johnson, 1987a). Pantex personnel stated that often the pond was dry, leading to the possibility of wind dispersal of contaminants. During the Survey however, the pond was visited after a storm and it contained liquid. The integrity of the liner is unknown; thus, periodically the pond may be a source of contaminants that may migrate into the subsurface soils.

During the Sampling and Analysis Phase of the Survey, residual sludge samples and liquid samples, if present, will be collected from the pond and analyzed to determine if hazardous constituents are present.



APPROXIMATE LOCATIONS OF INACTIVE CONSTRUCTION DEBRIS LANDFILLS FIGURE 4-16

4.5.2.4 Category IV

1) Documentation on past cleanup activities at Pantex is lacking or insufficient - For most of the older spills, the Survey team found that any cleanup action undertaken was not documented. For instance, when solvents and acids were spilled next to building 11-36, Pantex personnel may have taken limited cleanup measures to provide worker protection, but the area affected and specific actions employed were not recorded. For the most recent spills exceeding the CERCLA reportable quantity, the remediation efforts undertaken were documented.

2) A lubricant for an air compressor in Building 11-41E has been released to surface soils and caused vegetation stress - During the Survey, the discharge point of a small pipe leading from building 11-41 was observed where the fluid released had resulted in an elongated area of darkly stained soil and dead grass. The Survey team observations were related to Pantex site personnel, who began to look for the source of the liquid released. Follow-up information obtained from Pantex after the Survey visit shows that the discharge was blowdown from a building 11-41E air compressor that contained Anderol 500 as a lubricant. The facility began disposing of this blowdown into the sewer and has plans to install a skimmer that will collect the oil, which will then be drummed for disposal (Johnson, 1987b).

3) During the Survey, blue, discolored water was observed in an excavation adjacent to building 11-36 - Follow-up information from Pantex personnel indicates that the discolored water may have been caused by sulfuric acid back-siphoning into a copper potable-water line during repair work and forming copper sulfate. This incident was apparently a one-time occurrence.

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Appendix A

Survey Participants

PANTEX SURVEY PARTICIPANTS
NOVEMBER 3-14, 1986

DOE

Team Leader	R. Aiken
Assistant Team Leader	J. Boda
Operations Office Representative	R. Peterson

TECHNICAL SPECIALISTS

Waste Management/Contractor Coordinator	P. Alexandro, NUS G. Gartseff, NUS
Surface Water	C. Winklehaus, ICF
Air	R. Andes, NUS
Radiation	W. Joyce, NUS
Inactive Waste Sites	J. Clay, NUS
Hydrogeology	W. Murray, NUS
Quality Assurance/TSCA	P. Byrne, NUS
Chemical Materials Storage	G. Gartseff, NUS

Appendix B

Environmental Survey Plan
Pantex Facility

ENVIRONMENTAL SURVEY PLAN

PANTEX FACILITY

NOVEMBER 3-14, 1986

AMARILLO, TEXAS

1.0 INTRODUCTION

The Environmental Survey is a one time baseline inventory of existing environmental problems and environmental risks at DOE operating facilities. It will be conducted in accordance with the principles and procedures contained in the Draft DOE Environmental Manual distributed on May 16, 1986.

The Environmental Survey is an internal management tool to aid the Secretary in identifying current and potential environmental problems in all of DOE's facilities and in prioritizing these problems for appropriate corrective actions.

2.0 SURVEY IMPLEMENTATION

The Environmental Survey will be managed by the Team Leader, Richard Aiken and the Assistant Team Leader, Joseph Boda. Ronald Peterson will serve as the Albuquerque Operations Office representative on the Environmental Survey team. Technical support will be provided by the following NUS Corporation personnel:

Peter Alexandro	NUS Coordinator/RCRA and Radioactive Waste
Patrick Byrne	QA/TSCA
Charles Winklehaus	Surface Water
William Joyce	Radiation
Ralph Andes	Air
Jennifer Scott	CERCLA
William Murray	Hydrogeology
George Gartseff	Solid Waste Management/Underground Tanks

2.1 Pre-Survey Activities

Members of the survey team began reviewing Pantex environmental documentation available at the DOE Office of Environmental Audit and Compliance in July 1986. From that review, a memorandum dated August 15, 1986, was sent to the Albuquerque Operations Office requesting additional information. Messers Aiken, Boda, Alexandro, and Ketchings (Oak Ridge National Laboratory) conducted a pre-survey site visit on September 18 and 19, 1986, to become familiar with the site, to identify any potential environmental problems, and to coordinate plans for the upcoming survey with DOE/AAO and Mason & Hanger-Silas Mason personnel. During the pre-survey visit, the team met with representatives of DOE/AAO, Mason & Hanger-Silas Mason, Sandia National Laboratory (Amarillo), and officials of the U.S. EPA and State regulatory agencies. In addition, the team toured the facility and gathered documents assembled by site personnel in response to the information request memorandum. The bulk of the information being supplied in response to the August 15 memorandum was assembled by the CEARP team in Los Alamos National Laboratory. Additional information was requested and received from AAO and Mason & Hanger-Silas Mason during the pre-survey visit based upon the review of the data sent by Los Alamos. In addition, this summers Weston environmental program assessment should be provided to the survey team. This survey plan is based upon the information received by the survey team as of the middle of October 1986.

2.2 On-Site Activities and Reports

The Environmental Survey of the Pantex Facility will be conducted from November 3 through November 14, 1986. The survey will include the facilities operated by Mason & Hanger-Silas Mason and the Sandia National Laboratory element located on the Pantex site. The Agenda for this survey can be found in the attached survey plan. Modifications to this agenda will be made during the conduct of the survey. All modifications will be coordinated with the site officials designated as survey contacts. The on-site activities of the survey team will consist of interviews and consultations with, among others, environmental, safety, operations, waste management, purchasing, and warehousing personnel; a review of files and documents unavailable prior to the on-site portion of the survey; and process-specific and area-specific tours of the facility.

A closeout briefing will be conducted on Friday, November 14, to describe observations and initial findings of the on-site activities. A Draft Report of the Survey will be prepared within 3 to 4 weeks from the conclusion of the survey. Subsequently, an Interim Report will be prepared by the survey team within 4 weeks of the completion of sample analyses. The Interim Report will have the data from the sample analyses incorporated into the report. The findings from each of the reports from all scheduled surveys will be updated as appropriate and included in the Final Report to the Secretary, DOE, which is scheduled for completion in 1988.

2.3 Sampling and Analysis

Based upon the results of the on-site portion of the survey, the survey team will identify any sampling needs. Sampling and analysis for the Pantex survey will be conducted by a team from the Oak Ridge National Laboratory. Mr. John Murphy will be the Oak Ridge sampling and analysis team leader. The Oak Ridge sampling team will draft a Sampling Plan based upon the sampling needs identified by the survey team.

The Assistant Survey Team Leader, Joseph Boda, will coordinate the review of this Sampling Plan with the Albuquerque Operations Office and EPA's Laboratory at Las Vegas which has quality assurance responsibility for the survey's sampling and analysis efforts. The sampling is projected to start this winter. The sampling will take between 3-5 weeks to complete. Analysis of the samples will be conducted by Oak Ridge following protocols provided in the Survey Manual, supplemented by the Pantex Sampling Plan. Results of the sampling and analysis will be transmitted to the Survey Team Leader for incorporation into the Interim Report.

3.0 AIR

3.1 Issue Identification

The air-related survey activities will involve an assessment of the air emission sources in the facility, the administrative and any emission controls applied to the sources, and the ambient air monitoring systems. The emphasis of the survey will be on operational and procedural practices associated with the emission sources and the emission control equipment, fugitive source of emission, both within and outside the process buildings, and mitigative procedures applied to fugitive emission sources.

The general approach to the survey will include a review of existing air permits, pending applications, and standard operating procedures. Processes and control equipment will be inspected for compliance with DOE ALARA requirements for radionuclide emissions. The survey will also review the nonradiological air contaminants from the different processes in the facility, evaluate any existing controls applied to the air contaminant emissions, and assess the need for additional monitoring or emission controls to characterize or reduce the environmental consequences of the emissions.

The ambient air monitoring system will be evaluated to assess if the existing monitoring program is adequate to characterize environmental impacts of the air emissions from the facility. The activities involved in this part of the survey will include the inspection of the ambient air quality samplers, a review of documentation applicable to the ambient air data acquisition, and an evaluation of the processing procedures used to assure the accuracy of the data. The primary emphasis will be on assessment of the use of these data to characterize the environmental impacts of plant operations and the defensibility of the reported data.

Areas of particular interest will include emissions of the criteria pollutants (e.g., radioactive-bearing particulates, sulfur oxides, nitrogen oxides, hydrocarbons, carbon monoxide and lead) as well as regulated hazardous air pollutants (e.g., beryllium, asbestos, hydrogen fluoride and mercury). The powerhouses, incinerators, and the burning grounds and test firing sites will be of interest. In addition, the use of organic solvents will be assessed as a potential or actual source of emissions to determine if they are adequately characterized, monitored, and controlled. A focus of the organic emissions assessment will be directed at those substances considered to be hazardous or toxic air contaminants. Pantex personnel have provided a Hood Registration & Certification inventory to the Environmental Survey Team. The list will assist in the review of potential sources of air emissions from process areas of the facility.

Fugitive emissions from the resuspension of contaminated soils will be evaluated as a potential means of the alborne release of radionuclides and hazardous materials from the facility. Consideration will be given to historical and current operations to determine the potential for soils contamination and windborne releases.

3.2 Records Required

In addition to those documents reviewed prior to the survey, the following records may be examined at the Pantex Facility.

- o Air permits (Registrations, Installation, and Operation);
- o Source and emissions inventories;
- o Emission test data, emission calculations, etc.;
- o Descriptive documentation on add-on emission controls;
- o Standard operating procedures for process and control equipment;
- o Correspondence between regulatory agencies relative to air issues;
- o Reports on accidental releases of airborne substances;
- o Ambient air monitoring program procedures relative to:
  - calibration procedures and records,
  - laboratory procedures and quality assurance,
- o Other records as determined on site.

4.0 RADIATION

4.1 Issue Identification

The radioactive survey will involve an assessment of the facility-wide radioactive emissions, emissions control and monitoring, and the associated impact on the environment. The assessment will include discharges to the atmosphere, surface water, groundwater, soils and off-site disposal.

The assessment will be based upon observations of programatic processes, operations, effluent control and monitoring equipment, and waste disposal along with discussions with operational and supervisory personnel. Operational reports, incident reports records and other data associated with continuous, intermittent and accidental releases will be reviewed. The radioactive dose assessment methodologies and biological pathway assessments will be examined. The potential for radioactive releases via unmonitored release pathways to the environment will be of particular importance.

The assessment will be conducted on a process by process basis including:

- o Weapons assembly;
- o Weapons retirement;
- o Damaged weapons;
- o Weapons storage;
- o Component test firing;
- o Weapons surveillance.

The environmental monitoring program will be reviewed using both observation of monitoring stations, sample collection and analysis and review of prior annual reports and other DOE reporting requirements.

The radiological survey will be coordinated with the air, water, solid waste, CERCLA and hydrogeology aspects of the survey.

4.2 Records Required

In addition to those documents reviewed prior to the survey, the following records will be examined at the Pantex Facility.

- o Radionuclide environmental monitoring data (atmospheric, ground water, surface water, soil and vegetation);
- o Radionuclide effluent monitoring system design and monitoring data;
- o Radiological accident reports and data;
- o Laboratory procedures and analytical methods;
- o Dose assessment methodologies;
- o Plot plans with monitoring locations;
- o Radiological food pathway assessment strategies;
- o Other records as determined on-site.

5.0 SURFACE WATER/DRINKING WATER

5.1 Issue Identification

Pantex process activities that generate wastewaters will be reviewed through a detailed process evaluation lasting several days. Discrete process liquid discharge points will be identified and evaluated to develop an inventory of wastewater sources. A review of the present condition of the wastewater collection and treatment systems will be made. Liquid waste treatment, process, collection and handling equipment will be examined and records of operations will be reviewed. The objective of the review is to build a survey information base for the identification of physical evidence of existing or potential environmental contamination.

Buildings in Zones 11, 12, and 16 will be examined to view normal activities, including maintenance activities generating process wastewaters and other liquid wastes. Site surface drainage features, including culverts, channels, and playas, will also be observed. Sampling of surface waters and plant wastewaters will also be observed. The first week will end with a record review session to review drawings and materials pertaining to wastewater and stormwater treatment operation and maintenance.

The second week of the survey will review wastewater-related activities in Zone 16 and other zones, and will also observe the disposal of treated effluent on the Texas Tech (T) agricultural research site.

Extensive reviews will also be made of possible undetected sources of contaminants flowing to the storm and sanitary sewage systems. This will require review of most plant production schematic drawings, visits to the respective areas around production facilities and a thorough tour of plant buildings, yard areas, and grounds, particularly areas where the ground surface is or was known to be contaminated.

Other information sources and visitation points that will be examined are:

- o Wastewater streams and treatment plant performance and/or effluent quality information; this will include observation of sample collection and analysis techniques used for the monitoring;
- o Residuals (sludge and sediment) disposal from the wastewater treatment plants and playas (both the technical and the administrative aspects);
- o Spill protection provisions for fuels and hazardous materials storage units, including review of the SPCC Plan and of such physical controls as tank containment dikes and runon/runoff drainage control for potential contaminants;
- o Water quality information concerning raw and treated domestic and process waters, with particular attention to such parameters as trihalomethanes, coliforms, chlorine residuals, and asbestos fibers;
- o Potential or actual flooding problems during or immediately after heavy rainstorms due to capacity limitations of culverts and/or playa basins;
- o Equipment related to drinking water treatment and distribution.

5.2 Records Required

In addition to those documents reviewed prior to the survey, the following records may be examined at the Pantex Facility.

- o Detailed drawings of the process, storm, and sanitary sewer systems and the domestic and process water systems both within buildings and in yard area;
- o Films of the recent TV inspections of the plant sewer systems;
- o Detailed drawings of the high explosive process and sanitary wastewater treatment units;

- Detailed drawings of the domestic and process water supply treatment, storage, and distribution systems;

- Additional schematic diagrams and/or descriptions of all production processes;

- Spill Prevention, Control, and Countermeasure (SPCC) Plan on the site, covering all fuel and hazardous material storage units;

- Analytical data used for preparation of the surface water monitoring or similar reports;

- Discharge monitoring reports and any problem area mitigation studies;

- Records of drinking water quality both on and off-site;

- Operators log books and reports for wastewater treatment plant operations;

- Sampling log books and laboratory tracking reports;

- Treatment plant and monitoring equipment maintenance records and/or logs;

- Progress reports and/or final reports for on-going R&D studies of wastewater control and treatment options;

- Internal memos and correspondence relating to surface water/drinking water problems;

- Other records as determined on site.

6.0 HAZARDOUS/RADIOACTIVE/SOLID WASTES

6.1 Issue Identification

The procedure for hazardous/radioactive/solid waste survey is to review known sources or activities and identify any additional sources or activities which have the potential to result in contamination of environmental media.

The waste portion of the survey will concentrate on those facilities mentioned in Pantex Part A&B RCRA notifications. Specifically, the hazardous waste staging sites, and the explosive waste treatment areas will be examined. In addition, the team will devote a significant portion of the time on-site to a detailed process-by-process investigation of hazardous or mixed waste generation, treatment, storage, and release points.

Hazardous wastes which have been identified in existing documentation (e.g., high explosive wastes, mercury compounds, spent plating solutions) will be tracked through the system and waste-related site activities and records reviewed to develop an inventory of Pantex waste management practices.

The review of radioactive and non-hazardous solid waste will proceed similar to that for hazardous wastes. Known waste streams and activities such as the weapons assembly and retirement area waste treatment and waste certification processes will be a focus of the survey. The detailed process tour described above will gather information on radioactive and non-hazardous solid wastes to delineate any previously unidentified sources of waste that have the potential to result in environmental contamination.

Discussions will be held with individuals knowledgeable of current and past waste management practices. This will be accomplished during the process tour, and in the process of reviewing facility records and documentation. The objective is to develop an understanding of past and existing waste management activities that may serve as the basis for problem identification by the survey team.

Existing documentation indicates the disposal of waste in many inactive waste pits in the western portion of the site. The review of solid/hazardous/radioactive waste will be coordinated with the CERCLA and hydrologic surveys to identify any possible releases that may pose a threat to the environment.

The survey will examine site information pertaining to Pantex underground and above ground storage tanks. The review will focus on tank volume, contents, construction, age, history and leak detection capabilities.

6.2 Records Required

In addition to those documents reviewed prior to the survey, the following records will be reviewed at the Pantex Facility:

- o Waste analysis plans and information regarding the use of the plan by facility generators;
- o Any additional inspection documentation (state and federal);
- o Groundwater monitoring, sampling, and analytical documentation;
- o Any release notification or occurrence documentation;
- o Waste inventory documentation (quantities and sources);
- o Any enforcement action documentation;
- o Groundwater monitoring system construction documentation;
- o Internal facility inspection documentation;
- o RCRA manifests;
- o Correspondence with regulatory agencies on solid waste;

- o Records dealing with the reuse/recycing of wastes;
- o Records of on-site collection, transport and storage systems;
- o Records of waste oil management;
- o Records of tank inspection; and
- o Other records as determined onsite.

7.0 HYDROGEOLOGY

7.1 Issue Identification

The preliminary review of the data available for the Pantex Facility indicates that the site overlies an important regional water source, the Ogallalla Aquifer. The aquifer is insulated from site influence by a thick unsaturated zone. The current water table is approximately 400 feet below the land surface. Although this substantial thickness of unsaturated sediments would be expected to provide substantial protection to the aquifer, some studies in similar settings have found contaminant migration to great depth within the time frame that the Pantex Facility has been operated.

This survey effort will focus on a number of issues including evaluation of previous studies of site hydrogeology, assessment of the adequacy of the environmental monitoring program, and an evaluation of the potential for contamination from the retention playas, the old landfills, and historical spills.

The retention playa (Playa Lake No. 1) receives discharges of treated plant liquid effluents. The effluent includes treated sanitary sewage, laundry effluent, boiler-house waste water, and cooling tower water. As a continuous source of water to the subsurface, this playa represents a potential source of contaminated liquid to the aquifer. Therefore, this portion of the survey will focus on determining whether enough liquid could infiltrate from the playa to be transported substantial distances vertically.

The Pantex Facility includes a number of landfills, the majority of which are closed, that may contain varying amounts of hazardous materials. Although net infiltration at the site is very low, these landfills will be viewed as potential sources of ground-water contamination. In this portion of the survey, which will be coordinated with the CERCLA specialist, the landfills will be located, examined, and reviewed to evaluate the likelihood of contaminant migration.

Operating records of the Pantex Facility indicate that several chemical or petroleum spills have occurred at the site. Once again in coordination with the inactive waste site specialist, the available information on these events will be reviewed and the status of clean-up actions will be assessed.

In terms of site hydrogeology, the survey will focus on an evaluation of the potential of downward migration of contaminants through a thick vadose zone and on the occurrence and potential usage of perched water zones.

7.2 Records Required

In addition to those documents reviewed prior to the survey, the following records will be examined at the Pantex Facility:

- o Historic air photos (2 per year if available);
- o Wells installation reports, boring logs;
- o Well Sampling procedure, schedule;
- o Monitoring parameters, data and results;
- o Ground-water sampling QA/QC and lab procedures; and
- o Other records as determined on site.

8.0 INACTIVE WASTE SITES AND RELEASES

8.1 Issue Identification

The survey will identify environmental problems and potential risks associated with the historical handling, storage and disposal of hazardous substances at the Pantex Facility. The survey will focus on current and future risks related to past land disposal practices and past spills/releases.

The June 1986 draft Phase I Installation Assessment report, prepared under the Comprehensive Environmental Assessment Program for Pantex, identified 46 inactive sites that could potentially result in a risk to public health, or the environment. As part of the Pantex survey, the background information sources used in developing the Phase I report will be reviewed including the material gathered through interviews. Records indicating the types and quantities of materials disposed of in the inactive sites will be evaluated as well as the facility design and methods of waste containment. Information available through historical aerial photography will be assessed to identify disturbed land areas and to further define site locations and associated changes in appearance over time. Visual inspections will be conducted for many of the sites included in the Phase I report, in addition to any newly-identified sites, to note surface features and to locate monitoring points.

Sites that have undergone some type of remediation will be addressed. Records and analytical data in support of the site cleanup will be obtained for review. Also, inactive tanks or containers that may have held hazardous substances will be located and their status assessed. Former storage areas and staging locations will be included in this effort. Each of these facilities will be evaluated in terms of the potential to cause a present or future risk to workers, the neighboring population, or to the environment.

8.2 Records Required

In addition to those documents reviewed prior to the survey the following records will be reviewed at the Pantex Facility:

- o Information sources used to develop the Phase I Report;
- o Historical aerial photographs;
- o Historical files on past operations, substances used, and methods of handling and disposal;
- o Files on past off-site waste handling and disposal;
- o Records of facility expansion and building rubble disposal;
- o Descriptions of corrective actions;
- o Diagrams of inactive waste management facilities, including buried tanks and structures;
- o On-going CERCLA-related studies;
- o Other records as determined on-site.

9.0 TOXIC SUBSTANCES AND QUALITY ASSURANCE

9.1 Issue Identification

The toxic survey will include all raw materials and process-related chemicals used on the Pantex site. Use, handling, and disposal of polychlorinated biphenyls (PCBs), asbestos, pesticides, and hazardous substances will be within the scope of this effort.

All toxic and hazardous substances purchased, used, or manufactured on the site will be evaluated. Tracking, control, and management of these substances will be reviewed. Records of usage will be evaluated to determine the potential for environmental contamination.

The inventory of PCB and PCB contaminated electrical equipment in use at the facility will be reviewed for completeness. The condition of this equipment, its potential for leakage, and the quantity of contaminated fluids will be identified. Current status of the PCB transformer at 11-14 will be determined. Disposal practices will be reviewed for current and past inventories to determine the method of disposal and location of disposal sites. Procedures for PCB analysis, removal, handling, and disposal will be reviewed. Inspection and reporting requirements for PCB transformers will be evaluated in an effort to focus the survey teams attention as potential problem areas.

The use of asbestos at Pantex as insulation or in processes will be reviewed to identify pathways of contamination. Also, asbestos removal and disposal practices will be evaluated, and disposal sites visited, to define potential areas of concern.

Pesticides usage on the site will be reviewed including application records, storage and disposal practices, and environmental monitoring to assess risk for environmental contamination

The quality assurance survey of the environmental program will be primarily an evaluation of the site sampling and analytical capabilities at Pantex. The intent will be to verify and review the quality assurance procedures for obtaining process/effluent and environmental samples, performing the analytical work to identify the concentration of pollutants, and the handling and reporting of data. All aspects of the quality assurance program relating to environmental management of the Pantex site will be reviewed, including operator training, equipment and instrument calibration/maintenance, precision and accuracy studies, blank, split, and spike sample analyses, sample handling and chain-of-custody procedures, data reduction and validation, data reporting and documentation, and calculation and logbook reviews.

The procedures for sampling and analysis will be monitored to ensure proper implementation and conformance to accepted requirements. Quality assurance plans will be reviewed for the sampling and analytical activities, as well as any internal QA audits that have been completed.

The QA programs currently in force at Pantex will be evaluated. QA procedures imposed on any outside sampling or analytical laboratories will also be reviewed in this study effort.

9.2 Records Required

In addition to those documents reviewed prior to the survey, the following records will be examined at the Pantex Facility:

- o Toxic substances labeling and tracking system;
- o Procedures for handling, control, and management of toxic substances;
- o Inventory of toxic chemicals and purchasing records of chemical substances;
- o PCB annual inventory documents (1978 to 1986);

- Inventory of current PCB-contaminated electrical equipment;
- PCB handling, storage, and disposal records and procedures;
- Locations of buildings containing asbestos, including usage;
- Asbestos use, handling and disposal records, including method and location of disposal;
- Pesticide training, handling, storage, disposal redords, and environmental monitoring;
- Analytical laboratory and environmental sampling quality assurance plans and procedures manuals;
- QA audits and reports of laboratory and sampling program;
- QA results for prepared and analytical samples;
- Operator training records (laboratory and sampling);
- Instrument maintenance and calibration records (laboratory and sampling);
- Laboratory and sampling calculations and workbooks;
- Precision and accuracy studies; and
- Other records as determined on site.

Appendix C

Site-Specific Survey Activities

TABLE

Pantex Survey Site Agenda
November 2-14, 1986

	AIR	RAD	WATER	GW	CERCLA	UST/SOLID WASTE	TSCA/QA	RCRA	SAMPLING
Monday 11/3 AM	Introduction Pantex Briefing HE Burn-Pad General Site Tour	Same as Air	Same as Air	Same as Air	Same as Air	Same as Air	Same as Air	Same as Air	
PM	MAA Tour	Same as Air	Same as Air	Air Photos Review	Air Photo Review	MAA Tour	Review Chemical Records/ Purchasing	MAA Tour	
Tuesday 11/4 AM	HE Tour	Same as Air	Same as Air	Well Sampling*	Zone 11 Site Investigations	HE Tour	HE Tour	HE Tour	
PM	Zone 11-OPS Briefing Zone 12-Further Evaluation	Zone 11 OPS Briefings Disc. W/Envir. Personnel-Maps	Same as Air	Landfill Operations	Zone 11 Site Investigations Continued	Zone 11 OPS Briefing, Tank Storage Information	Visit PCB Facilities Zone 11-OPS Briefing	Zone 11 OPS Briefing	
Wednesday 11/5 AM	Onsite Air Monitoring*	Radiation & Effluent Monitoring*	Site Tour (Playas, Culverts)	Site Tour (Playa, Culverts)	Site Tour (Playa, Culverts)	Solid Waste Landfill Operations	Review PCB Records	Haz & Radioactive Waste Records Review	
PM	Offsite Air Monitoring*	Radiation & Effluent Monitoring* Continued	Observe Sampling	CEARP Info. Review	CEARP Interview Information Review	Zone 12 Tanks (Outside MAA)	Observe Sampling*	Equipment Evaluation of Rad & Haz Waste Staging 11-7N,11-14E,4-AB	
Thursday 11/6 AM	Observe HE Test Fire*	Observe HE Test Fire* FS-4,5	Zone 11,36, 15,17,18	Disc. with Environ-inental Personnel	Disc. with CEARP Personnel	Zone 11 Tank Investigations	Pesticide/ Herbicide Records Review	Observe HE Test Fire*	
PM	Burn Area* (Cage Burn)	Burn Area* (Cage Burn)	Zone 11,14, 5,38	Disc. with CEARP Personnel	Disc. with CEARP Personnel	Zone 11 Tank Investigations Continued	Examine Field Use of Pesticides/Herbicides	Burn Area (Cage Burn)	

* Schedule will be coordinated with sites normal sampling/test fire/burn area schedule where possible.

TABLE

Pantex Survey Site Agenda
November 2-14, 1986
Continued

	AIR	RAD	WATER	GW	CERCLA	UST/SOLID WASTE	TSCA/QA	RCRA	SAMPLING
Friday 11/7 AM	Zone 11-17,20, 5,21	Rad Waste Burial Site Nuc. Weapons Residue	Examine SW Records & Observe Procedures for Envir. Lab, WW Trt. Plant	Zone 12 Site Investigations	Zone 12 Site Investigations	Zone 12 Tank Investigations (w/i MAA)	Asbestos Records Review	Process & Equipment Evaluation of Zone 11	
PM	Zone 11-17,20, 5,21 (Cont'd)	Rad Waste Staging Area	Examine SW Records & Observe Procedures for Envir. Lab Continued	Zone 12 Site Investigations Continued	Zone 12 Site Investigations Continued	Zone 12 Tank Investigations (w/i MAA) Continued	Asbestos Disposal Sites	Disc. with Site Waste Management Personnel	
Monday 11/10 AM	Zone 11-36,43, 51,52	Damaged Weapons Facilities	Tour Zone 16,10 Storm Drainage Patterns	Zone 4,5 Site Investigations (Burning Grounds Firing Sites	Zone 4,5 Site Investigations (Burning Grounds Firing Sites	Scrap Storage & Handling Practices	Review QA Procedures of Environmental Lab	Further Process & Equipment Evaluation of Zones 11&12 - Zone 12 Laboratory & Craft Areas	Accompany CERCLA Site Investigation
PM	Zone 11-36,43 51,52 Continued	Landfills 16,17,18	Leased Land Operations	Leased Land Operations	Leased Land Operations	Underground Tanks & Solid Waste Handling on Leased Lands	Evaluation of Environmental Lab QA Practices	Further Process & Equipment Evaluation of Zones 11&12 - Zone 12 Laboratory & Craft Areas Continued	Accompany CERCLA Site Investigation Continued
Tuesday 11/11 AM	Zone 13-Sewage Trt. Zone 16-1, 4,5	Weapons Staging (Zone 4)	Records Review	Zone 7,8,10 Site Investigations	Zone 7,8,10 Site Investigations	Revisit/Record Review	Review Contract Lab Proc. (Organic Lab)	Zone 13-Sewage Trt. Zone 16-1,4,5	Accompany CERCLA Site Investigation
PM	Sample Request Devel.	Sampling Request Devel.	Sampling Request	Sampling Request Devel.	Sampling Request Devel.	Sampling Request Devel.	Sampling Request Devel.	Sampling Request Devel.	Logistics/ Health & Safety

* Schedule will be coordinated with sites normal sampling/test fire/burn area schedule where possible.

TABLE

Pantex Survey Site Agenda
November 2-14, 1986
Continued

	AIR	RAD	WATER	GW	CERCLA	UST/SOLID WASTE	TSCA/QA	RCRA	SAMPLING
Wednesday 11/12 AM	Zone 12-5,9,8, 16,59,68	Zone 12-44E Weapons Ref. (Zones 12,4)	WWTP Records & Collection System (Films) Records Review & Revisits	Records Review & Revisits	Zone 6,15 Site Investigations	Assist in Review of RCRA/CERCLA issues (e.g., spills)	Review Contract Lab Proc. (Rad)	Evaluation of Haz/ Mixed/Rad Waste Packaging Certification & Shipment	Site Tour Including Sampling Locations
PM	Zone 12-5,9,8, 16,59,68 Continued	Sandia Operations	WWTP Records & Collection System (Films) Records Review & Revisits Continued	Records Review & Revisits Continued	Zone 6,15 Site Investigations Continued	Assist in Review of RCRA/CERCLA issues (e.g., spills) Continued	Revisits/ Record Review	Record Review/ Revisits	Site Tour Including Sampling Locations Continued
Thursday 11/13 AM	Records Review	Records Review	Debriefing	Debriefing	Sample Location Visit	Sample Location Visit	Debriefing	Debriefing	Debriefing
PM	Debriefing	Debriefing	Sample Location Visit	Sample Location Visit	Debriefing	Debriefing	Records Review	Debriefing	Debriefing
Friday 11/14 AM	Closeout	Closeout	Closeout	Closeout	Closeout	Closeout	Closeout	Closeout	Closeout

PRELIMINARY

Appendix D

Pantex Water Discharge Notification

on file

RECEIVED
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PERMIT NO. 02296

TEXAS WATER COMMISSION
Stephen F. Austin State Office Building
Austin, Texas

PERMIT TO DISPOSE OF WASTES
under provisions of Chapter 26
of the Texas Water Code

I. Name of Permittee:
   A. Name United States Department of Energy
   Pantex Plant
   B. Address P. O. Box 30030
   Amarillo, Texas 79120

II. Type of Permit: Regular XXX Amended ______

III. Nature of Business Producing Waste:
Pantex Plant is engaged in the fabrication of chemical high explosive components for nuclear weapons, nuclear weapons assembly and disassembly, nuclear weapons modification and repair, and surveillance testing and disposal of chemical high explosives and nonradioactive components.

IV. General Description and Location of Waste Disposal System:

Description: Wastewaters from two operating areas designated Zone 11 and Zone 12 are diverted into two on-site playa lakes (No. 1 and No. and disposed of by evaporation or used by the Texas Tech University Research Farms to irrigate on-site farmland. Three separate wastewater streams are discharged into Playa Lake No. 1 as follows:

1) Domestic sewer discharge includes boiler blowdown, metal plating plant wastewater, laundry waste and

This permit is valid until amended or revoked by the Commission.

APPROVED, ISSUED, AND EFFECTIVE this 19th day of May 1980.

ATTEST: Mary Ann Hefner

[signature]
For the Commission

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Page 1 of 2

IV. Description (Continued):

domestic sewage. This combined wastewater stream is either (a) pumped to a wastewater treatment plant including primary settling, trickling filter and final settling prior to discharge to Playa Lake No. 1 or (b) diverted directly into Playa Lake No. 1.

2) Cooling tower blowdown and filtered cooling water from machining of high explosive components in Zone 12 operating area discharge to an open ditch along the east side of Zone 12 operating area then to the Playa Lake No. 1.

3) Acid wastewaters from high explosive chemical manufacture are neutralized with calcium carbonate in a hypalon lined pond, then discharged to an open ditch along the east side of Zone 11 operating area, then into Playa Lake No. 1. A portion of filtered cooling water from the machining of high explosive components in Zone 11 operating area discharge to the same ditch.

One wastewater stream is discharged into Playa Lake No. 2. Filtered cooling water from machining of high explosive components in Zone 11 operating area discharges to an open ditch on the west side of Zone 11, then to Playa Lake No. 2.

The playa lakes also collect rainfall from portions of the plant site.

Location: Approximately 17 miles northeast of the City of Amarillo and 10 miles west of the City of Panhandle on State Highway 2373, south of State Highway 293 and north of U. S. Highway 60 in Carson County, Texas.

V. Conditions of the Permit:

There shall be no discharge from the Pantex Plant to waters in the State.

Character: Industrial and Domestic Waste

Volume: Not to exceed an average of 600,000 gallons per day to the two playa lakes.

Quality:

1. The domestic sewer discharge shall be sampled at the point of discharge into Playa Lake No. 1, and the following discharge limitations shall apply:

Pollutant	30-day Average mg/l	Never to Exceed Grab Sample mg/l
Biochemical Oxygen Demand (5-day)	50	150

V. Conditions of the Permit (Continued):

2. Industrial wastewater discharged from Zone 11 and Zone 12 operating areas shall not exceed a chemical Oxygen Demand of 300 mg/l at any time based on grab samples. The sampling points shall be at each of the three drainage ditches downstream from Zones 11 and 12.

3. The pH of discharge from the domestic sewer, Zone 11 east ditch and Zone 12 east and west ditches shall not be less than 6.0 nor greater than 9.0 standard units at any time based on a grab sample.

Point of Discharge: No discharge to area streams. All effluent shall be discharged to two playa lakes located on the Pantex Plant site, which is located in the watershed of McClellan Creek which flows into the North Fork Red River, Segment No. 0224 in the Red River Basin.

VI. Special Provisions:

1. The permittee shall take all measures necessary to protect groundwater from contamination by wastewater from this operation. The wastewater in the playa lakes shall be restricted to that portion of the lake basin which has clay of sufficient thickness and density to limit the seepage rate to 0.1 acre-foot per acre of pond per year (1×10^{-7} cm/sec). Soil test results confirming the adequacy of the lake bottom and establishing the usable area of the lakes shall be submitted to the Department for review within 180 days after the date of issuance of this permit.

2. All solid waste materials shall be disposed of so that no contamination of surface or ground waters can occur. Waste materials disposed of off-site shall be at locations approved under the provisions of the State Solid Waste Disposal Act, Article 4477-7.

3. The permittee shall maintain records of all sampling and testing of wastewaters and shall make these records available for inspection upon request of authorized Texas Department of Water Resources representatives.

4. The permittee shall comply with the provisions of Rules 156.19.05.001-.010 of the Department, relative to monitoring and reporting data on effluent described in "Conditions of the Permit".

5. The permittee shall be responsible and accountable for the disposal of wastewater by irrigation, and shall provide facilities and land area needed if those under contract fail to perform.

VI. SPECIAL PROVISIONS (CONTINUED):

6. Application rates for the irrigated land shall not exceed 5.3 acre-feet/acre/year. The permittee is responsible for providing equipment to determine application rates and maintaining records of effluent applied as irrigation water. These records shall be available for review by the Department staff.

7. Irrigation tailwater control facilities shall be provided to prevent discharge to area streams of any wastewater which drains from the irrigated land.

8. In the event the industrial operations at the Pantex Plant are expanded, the permittee shall notify the Department and submit an application for an amended permit if the quantity or quality of the discharge will be changed due to addition of industrial facilities.

9. Flow measuring devices and readily accessible sampling points shall be provided by the permittee for each outfall.

Standard Provisions

(a) This permit is granted in accordance with the Texas Water Code and the rules and other Orders of the Department and the laws of the State of Texas.

(b) In the event the permittee discharges wastes which exceed the quantity or quality authorized by this permit, the permittee shall give immediate notice to the Executive Director.

(c) Acceptance of this permit constitutes an acknowledgement and agreement that the permittee will comply with all the terms, provisions, conditions, limitations and restrictions embodied in this permit and with the rules and other Orders of the Department and the laws of the State of Texas. Agreement is a condition precedent to the granting of this permit.

(d) This permit cannot be transferred without prior notification to the Executive Director.

(e) The application pursuant to which the permit has been issued is incorporated herein; provided, however, that in the event of a conflict between the provisions of this permit and the application, the provisions of the permit shall control.

RECEIVED
DIST 1

APR 25 '77

TEXAS WATER
QUALITY BOARD

APR

TEXAS WATER
QUALITY BOARD

PERMIT NO. 11823-01

TEXAS WATER QUALITY BOARD
P.O. Box 13246, Capitol Station
Austin, Texas 78711

PERMIT to dispose of wastes under provisions of Article 7621d-1, Vernon's Texas Civil Statutes

Name of Permittee

A. Name City of Amarillo - Utilities Division
(Old Air Force Base)

B. Address P. O. Box 1971
Amarillo, Texas 79185

Type of Permit: Regular XXX Amended

Nature of Business Producing Waste

Residential, Light Industrial & School

General Description and Location of Waste Disposal System

Description: The wastewater from the former Amarillo Air Force Base and the Highland Park School are discharged to a 24" sewer line owned by the City of Amarillo, which terminates in a playa lake owned by Texas Tech University. Approximately 3.55 MGD of treated wastes from Iowa Beef Processors are discharged to the same 24" sewer between the former air base and the playa lake discharge. (1) There is a bar screen and a lift station at the terminal of the 24" sewer to lift the sewage to the playa lake. All of the effluent from the playa lake is to be used by the University (Pantex Tech Farms) for irrigation on 1200 acres of prepared land owned by the university. None of the wastewater will be discharged to the waters of the State. (2) The Iowa Beef discharge to the sewer is controlled by a contract between the company and the City of Amarillo. Iowa Beef has Permit No. 0'673 for 3.55 MGD (average flow) discharge via pipelines to a playa lake to be used for irrigation by Texas Tech University.

CONTINUED ON CONTINUATION SHEETS I, II

APPROVED this 7th day of April, 1977.

Dick Whittington — Chief Director, Deputy

J. Douglas Toole — For the Board

ENDORSEMENT TO PERMIT NO. 11823

FOR CITY OF AMARILLO (OLD AIR FORCE BASE)

APPROVED APRIL 7, 1977

In order to better describe the wastewater facilities under the above referenced permit by eliminating reference to Iowa Beef Processors' wastewater, "Description" under Item IV, "General Description and Location of Waste Disposal System" is hereby changed so that the same shall hereinafter be and read as follows:

> "Description: The wastewater from the former Amarillo Air Base area is carried by a 24-inch outfall sewer owned by the City of Amarillo. This line terminates into a bar screen and lift station on Texas Tech University Farm. Wastewater is lifted to a treatment pond where it is retained a minimum of 24 hours before it overflows by gravity to a large playa lake for secondary oxidation and storage. Treated water is pumped from this playa lake to irrigation of some 1200 acres of cropland by Texas Tech University. In the event of operating problems with the treatment pond (playa lake) irrigation system, the entire flow can be diverted to the U.S.E.R.D.A. Pantex complex trickling filter wastewater treatment plant through an existing gravity line."

This endorsement is APPROVED, ISSUED AND EFFECTIVE this 6th day of July, 1978 in accordance with Rule 156.25.15.001 of the Texas Department of Water Resources.

Mary Ann Hefner, Chief Clerk
Texas Water Commission

NAME: City of Amarillo (Old Air Force Base) APPROVED: April 7, 1977

Location: The sources of wastewater all located adjacent to U.S. 60 are in Potter County. The point of discharge to the playa lake is approximately 14,000 feet east of the Potter-Carson county line and 7000 feet north of U.S. 60 in Carson County, Texas.

V. Conditions of the Permit: No discharge of pollutants to the waters of the State of Texas is authorized.

Character: Domestic Sewage Effluent

Volume: 30-day Average 0.38 MGD Daily Maximum 0.5 MGD

Quality: Treatment shall be sufficient to prevent nuisance conditions in the irrigation systems. A greater degree of treatment than specified in the following items A, B, and C is generally not required to prevent nuisance.

		Effluent Concentrations* (Not to Exceed)	
A. Item	Unit of Measure	30-Day Average	7-day Average
BOD_5	mg/l	50	50

B. When three, four, or five consecutive grab samples have been collected at various times on separate days by the same entity, the existence of concentrations of any specific pollutant in more than two samples in excess of the value shown for the specific pollutant in Column 1 of Table 1 is a violation. Each grab sample containing pollutants in excess of the concentrations shown for such pollutant in Column 2 of Table 1, Part III of this permit, is a violation. Each failure to comply with the above requirement for a specific pollutant is a violation except the case where the pollutant parameters involved are expressions of the same characteristic of the effluent.

Table 1

Pollutant	Column 1	Column 2
BOD_5, mg/l*	50	100

The foregoing requirements shall be applied with judgment and in the context of the other information available.

C. 24-Hour Composite Sample.

Table 2

Pollutant	Column 1
BOD_5, mg/l*	70

Drainage Area: The plant site and irrigated land are located in the drainage area of Segment 0224 of the Red River Basin.

*The sampling shall be at the intake pump for irrigation system.

...T NO: [illegible]

...AME: City of Amarillo (Old Air Force Base)

APPROVED: April 7, 19[illegible]

VI. Special Provisions:

1. This permit is granted subject to the policy of the Board to encourage the development of areawide waste collection, treatment and disposal systems. The Board reserves the right to amend this permit in accordance with applicable procedural requirements to require the system covered by this permit to be integrated into an areawide system, should such be developed; to require the delivery of the wastes authorized to be collected in, treated by or discharged in any other particular to effectuate the Board's policy. Such amendments may be made when, in the judgment of the Board, the changes required thereby are advisable for water quality control purposes and are feasible on the basis of waste treatment technology, engineering, financial and related considerations existing at the time the changes are required, exclusive of the loss of investment in or revenues from any then existing or proposed waste collection, treatment or disposal system.

2. The permittee shall comply with the provisions of Board Order No. 69-1219-1 relative to monitoring and reporting data on effluent described in "Conditions of the Permit".

3. The permittee is responsible for the proper disposal of any excess sludge resulting from the operation of these facilities.

4. The permittee is required to operate and maintain these facilities in accordance with accepted practices for this type of waste treatment facility and shall include related maintenance such as painting, proper disposal of solid waste, and weed and grass cutting.

5. Irrigation practices shall be designed and managed so as to prevent contamination of ground and surface waters and to prevent the occurrence of nuisance conditions in the area. Tailwater control facilities shall be provided to prevent the discharge to area streams of any wastewater which drains from the irrigated land.

6. Application rates for the irrigated land shall not exceed 4.2 acre-feet/acre/year. Records regarding this irrigation rate shall be made available for review by the Texas Water Quality Board staff.

7. The permittee shall maintain records of all sampling and testing done and shall make these records available for inspection upon request of authorized Texas Water Quality Board representatives.

8. This permit becomes effective upon date of Board approval and is valid until amended, cancelled or revoked by the Board.

Appendix E

Summary of Pantex Water Usage

SUMMARY OF EXISTING BUILDINGS AND WATER USES

LOADS FOR SEWER PARTEI -- SUMMARY OF BUILDINGS AND WATER USES -- YEAR 1983 DATE:02/27/84 FILE NAME: PTISEWRI

SA	BLDG NO	DESCRIPTION	OCCUPANCY (# PEOPLE)	DOMESTIC (GPM)	USAGE (HOURS)	ELEC (GPM)	USAGE (HOURS)	EL (GPM)	USAGE (HOURS)	INDUSTRIAL (GPM)	TOTAL (GPD)	LOAD @ ... (GPD)	... LOAD (CFS)	TOTAL (GPM)	LOAD @ ... (GPM)	... LOAD (CFS)
ZONE 10																
56A	10-9	WAREHOUSE	3	0.00	8					0	40.3	40.3	0.00006	0.1	0.1	0.00017
ZONE 11																
46	11-30	TECHNICAL SECURITY SUPPORT	17	0.50	8					0	241.9	241.9	0.00037	0.5	0.5	0.00112
47	11-5	PHYSICAL PROPERTIES FACILITY	1	0.13	8	5	24	0.9	24	5.9	8534.5	8534.5	0.01321	6.0	6.0	0.01341
47A	11-2	OFFICE & CHANGEHOUSE	22	0.92	8			23	0.5	23	1133.5			23.9		
47A	11-11	MACHINE OPERATIONS	3	0.21	8	15	8	2	8	17	7300.0			15.2		
47A	11-41	COMPRESSOR BUILDING	0	0.00	8			15	24	15	21600.0			15.0		
47A	11-27	PHOTO OPTICS FACILITY	23	0.27	8					0	461.7			1.0		
47A	11-29	PHOTOGRAPHIC LABORATORY	7	0.20	8			8	8	8	3981.1			8.3		
47A	11-54	CORPS OF ENGINEERS	5	0.21	8					0	100.8	34379.9	0.05350	0.2	63.6	0.14178
51	11-9	PRODUCTION STORAGE	16	0.43	8					0	322.6	322.6	0.00050	0.7	0.7	0.00150
52A	11-36B	STEAM BOILER	0	0.00	8			14	24	14	13587.2			9.4		
52A	11-36	SYNTHESIS FACILITY	5	0.08	8					0	40.3			0.1		
52A	11-36E	EQUIPMENT ROOM	0	0.00	8	5	24	5	24	10	14400.0	27947.5	0.04324	10.0	19.5	0.04336
53B	11-28	ASSEMBLY & INSPECTION	3	0.13	8					0	60.5			0.1		
53B	11-42-1	OFFICES	4	0.17	8					0	80.6			0.2		
53B	11-51	REPLACEMENT HE MACHINING FACILITY	5	6.21	8	12	24	7	24	19	27460.8	27601.9	0.04270	19.2	19.5	0.04345
54	11-50	REPLACEMENT HE MACHINING	5	0.21	8	19	8			19	9729.8			19.2		
54	11-15B	CONTROL ROOM	0	0.00	8	10	24			10	14400.0			10.0		
54	11-15A	PRESSING OPERATION FACILITY	0	6.00	8	5	24			5	7200.0	30829.8	0.04768	5.0	34.2	0.07622
55	11-17	CHEMISTRY LABORATORY	7	0.29	8	0	24			0	141.1			0.3		
55	11-22	CONTROL ROOM	2	0.00	8	0	24			0	40.3			0.1		
55	11-40	SHOP & BATTERY CHARGING FAC.	12	0.50	8					0	241.9	423.4	0.00065	0.5	0.9	0.00196
55A	11-31	WEAPONS MATERIAL ANALYTICAL L.	6	0.00	8	5	24	2	24	7	10080.0	10080.0	0.01560	7.0	7.0	0.01560
55B	11-19	HE SWATCH FRICTION TEST FAC.	0	0.00	8	5	24			5	7206.0			5.0		
55B	11-20	OPERATING BUILDING	12	0.50	8	4	24			4	6001.9			4.5		
55B	11-20E	MECHANICAL ROOM	0	0.00	8			2	24	2	[illegible]			[illegible]		
55B	11-20E2	MECHANICAL ROOM	0	0.00	8			5	24	5	7200.0			5.0		
55B	11-21B	BOILER	0	0.00	8			12	24	12	11577.6			8.0		
55B	11-21E	REST AND EQUIPMENT ROOM	0	0.00	8	5	24			5	7200.0	39179.3	0.06062	5.0	27.5	0.06136
ZONE 12																
10	12-4	BOILER HOUSE	1	0.04	8	44.2	24	56.92	24	101.12	118584.6	118584.6	0.18347	82.4	82.4	0.18353
11	12-1	CLASS ROOMS & CHANGEHOUSE	10	0.42	8			106	0.5	106	3381.6			106.4		
11	12-3	OFFICES	46	1.93	8					0	9.9	3381.6	0.00523	1.9	106.4	0.24137
118	12-76	CAFETERIA	20	0.84	8			21.13	8	21.13	10545.6	10545.6	0.01632	22.0	22.0	0.04897

SUMMARY OF EXISTING BUILDINGS AND WATER USES (Cont'd.)

LOADS FOR SEWER   PANTEX -- SUMMARY OF BUILDINGS AND WATER USES -- YEAR 1983   DATE:02/27/.   FILE NAME: PTXSEW83

MH	BLDG NO	DESCRIPTION	OCCUPANCY (# PEOPLE)	DOMESTIC (GPM)	USAGE (HOURS)	IL(A) (GPM)	USAGE (HOURS)	IL(B) (GPM)	USAGE (HOURS)	INDUSTRIAL (GPM)	TOTAL (GPD)	LOAD @ MH (GPD)	MH LOAD (CFS)	TOTAL (GPM)	LOAD @ MH (GPM)	MH LOAD (CFS)
11B	12-10	LAUNDRY	6	0.75	8			50	0	50	24121.0	24121.0	0.03732	50.3	50.3	0.11195
12A	12-5	GENERAL STORES, SHOPS, & OFFICES (1/3)	60	2.52	8			1.7	24	1.7	3657.6			4.2		
12A	12-6	OFFICES (1/2)	48	2.02	8			0	0	0	4007.7			10.0		
12A	12-6A	OFFICES	49	2.06	8					0	987.8	9153.1	0.01463	2.1	16.3	0.03630
12B	12-11	METROLOGY LAB	15	0.63	8					0	302.4			0.6		
12B	12-11A	OFFICES	13	0.55	8					0	262.1			0.5		
12B	12-15	PRODUCTION SUPPORT FACILITY	30	1.26	8	4.84	24			4.84	7574.4	8138.9	0.01259	6.1	7.3	0.01621
13B	12-5	GENERAL STORES, SHOPS & OFFICES (1/3)	61	2.56	8			1.6	24	1.6	3533.8			4.2		
13B	12-7	OFFICES	28	1.18	8					0	564.5			1.2		
13B	12-6	OFFICES (1/2)	47	1.97	8			7	8	7	4367.5			9.0		
13B	12-37	PRODUCTION CONTROL CENTER	57	2.39	8					0	1149.1			2.4		
13B	12-52	INERT GAGING	34	1.43	8					0	685.4			1.4		
13B	12-101	WORK ANALYSIS	33	1.39	8					0	665.3	10905.6	0.01687	1.4	19.5	0.04349
13B	12-35	MAINTENANCE SHOP	58	2.44	8					0	1169.3	1169.3	0.00181	2.4	2.4	0.00543
13E	12-58	GENERAL STORES AND WAREHOUSE	7	0.29	8					0	141.1	141.1	0.00022	0.3	0.3	0.00065
14A	12-36	ADMINISTRATION	130	5.00	8			10	8	10	7502.1	7502.1	0.01173	15.0	15.0	0.03519
14B	12-39	FIRE STATION	17	0.71	8					0	342.7	342.7	0.00053	0.7	0.7	0.00159
19	12-2	CENTRAL HEALTH ADDITION	38	1.60	8					0	766.1			1.6		
19	12-28	SAFETY LABORATORY	24	1.01	8					0	483.8	1249.9	0.00193	1.0	2.6	0.00580
1A	12-5	GENERAL STORES, SHOPS & OFFICES (1/3)	60	2.52	8			1.7	24	1.7	3657.6			4.2		
1A	12-5C	SHOPS & OFFICES	1	0.04	8					0	20.2	3677.8	0.00569	.0	4.3	0.00930
20	12-23	WEAPONS TOOLING STORAGE	10	0.42	8					0	201.6	201.6	0.00031	0.4	0.4	0.00094
20D1	12-100	PURCHASING (TEMP)	25	1.05	8					0	504.0	504.0	0.00078	1.1	1.1	0.00234
20C	12-75	GUARD HOUSE	15	0.63	8					0	302.4	302.4	0.00047	0.6	0.6	0.00140
22A2	12-84	ASSEMBLY BAYS-PHASE I	30	1.26	8					0	604.8	604.8	0.00094	1.3	1.3	0.00281
22A4	12-85	ASSEMBLY CELL	10	0.42	8					0	201.6			0.4		
22A4	12-94	WEAPONS AGING FACILITY	3	0.13	8					0	60.5	262.1	0.00041	0.1	0.5	0.00122
22A5	12-96	ASSEMBLY CELL	10	0.42	8					0	201.6	201.6	0.00031	0.4	0.4	0.00094
22A6	12-98	ASSEMBLY CELLS	40	1.68	8					0	806.4	806.4	0.00125	1.7	1.7	0.00374
22A7	12-99	ASSEMBLY BAYS	40	1.68	8					0	806.4	806.4	0.00125	1.7	1.7	0.00374
22A8	12-86	INERT ASSY & TEST FACILITY	60	2.52	8					0	1209.6	1209.6	0.00187	2.5	2.5	0.00561

SUMMARY OF EXISTING BUILDINGS AND WATER USES (Cont'd.)

LOADS FOR SEWER PART1 -- SUMMARY OF BUILDINGS AND WATER USES -- YEAR 1983 DATE:02/27/84 FILE NAME: PTISEW03

MH	BLDG NO	DESCRIPTION	OCCUPANCY (# PEOPLE)	DOMESTIC (GPM)	USAGE (HOURS)	I(1R) (GPM)	USAGE (HOURS)	I(1HR) (GPM)	USAGE (HOURS)	INDUSTRIAL (GPM)	TOTAL (GPD)	LOAD @ GH MH LOAD (GPD)	MH LOAD (CFS)	TOTAL (GPM)	LOAD @ MH (GPM)	MH LOAD (CFS)
23	12-53	INSPECTION TESTING	3	0.13	8					0	60.5			0.1		
23	12-64	ASSEMBLY & STAGING	50	2.94	8	5	24			5	8369.3	8429.8	0.01304	7.4	7.6	0.01683
25	12-44	ASSEMBLY CELLS 1-6 & 0-37 (A)	38	1.60	8					0	764.1			1.6		
25	12-44E	EQUIPMENT ROOM & OFFICE	4	0.17	8	20	24			20	20080.6			20.2		
25	12-44EA	EQUIPMENT ROOM	0	0.00	8	6.71	24			6.71	9662.4			6.7		
25	12-81	BATTERY CHARGING FACILITY	0	0.00	8			6.94	24	6.94	9993.6	49382.7	0.07678	6.9	35.4	0.07898
26	12-01	SPRAY PAINTING	4	0.17	8					0	80.6			0.2		
26	12-49	MAINTENANCE FACILITY (AREA C)	23	0.97	8					0	463.7			1.0		
26	12-95	CLASS "C" STAGING	5	0.21	8					0	100.8	645.1	0.00100	0.2	1.3	0.00299
27	12-02	WAREHOUSE	13	0.35	8					0	267.1			0.5		
27	12-61	INERT DEHUMIDIFIED STORAGE	5	0.21	8					0	100.8			0.2		
27	12-82	COMPONENT REACCEPTANCE FAC	23	0.88	8					0	423.4	784.2	0.00122	0.9	1.6	0.00365
29	12-42F	WEST CENTRIFUGE	10	0.42	8					0	201.6			0.4		
29	12-42A	WEST FACILITY	10	0.42	8					0	201.6	403.2	0.00062	0.4	0.8	0.00187
3	12-10	HE PREPARATION	17	0.50	8					0	241.9			0.5		
3	12-68	TOOL & DIE SHOP	41	1.72	8					0	826.6	1068.5	0.00165	1.7	2.2	0.00496
30	12-14	OFFICES	5	0.21	8					0	100.8			0.2		
30	12-98	INERT MACHINING FACILITY	3	0.13	8	6.46	24			6.46	9362.9			6.6		
30	12-16	PROTECTIVE MATERIAL FABRICATION	10	0.42	8					0	201.6	9665.3	0.01495	0.6	7.2	0.01686
40	12-63 2 & 3	PRESS BAYS	0	0.00	8	3.33	24			3.33	4795.2			3.3		
40	12-17F 1-4	FAN BUILDINGS	0	0.00	8	10.34	24	18	24	28.34	0.0			0.0		
40	12-17	HE OPERATIONS	35	1.47	8					0	705.6	3500.8	0.00051	1.5	4.8	0.01069
4C	12-62	ETS FACILITY	0	0.00	8	6.32	24			6.32	9100.8	9100.8	0.01408	6.3	6.3	0.01408
5A	12-72	CREDIT UNION	10	0.42	8					0	201.6	201.6	0.00031	0.4	0.4	0.00094
5B	12-19 E	EQUIPMENT ROOM	0	0.00	8	7.89	24			7.89	11361.6	11361.6	0.01758	7.9	7.9	0.01758
5F	12-19	HE FORMULATION	42	1.76	8					0	846.7			1.8		
5F	12-19F 1-8	FAN BUILDINGS	0	0.00	8			18	24	18	0.0	846.7	0.00131	0.0	1.8	0.00393
6	12-21	SUBASSEMBLY & X-RAY	19	0.00	8					0	383.0			0.8		
6	12-31AE	REFSIE EQUIPMENT FACILITY	0	0.00	8	3.16	24			3.16	4550.4	4933.4	0.00763	3.2	4.0	0.00862
6C	12-24E	EQUIPMENT ROOM	0	0.00	8	14.31	24			14.31	20606.4			14.3		
6C	12-24 S	ASSEMBLY & INSPECTION	11	0.46	8					0	221.8			0.5		
6C	12-24B	MACHINING	13	0.55	8			122.2	8	122.2	262.1	21090.2	0.03263	0.5	15.3	0.03413
8	12-36E	EQUIPMENT ROOM	0	0.00	8	6.29	24	2	24	6.29	9057.6			6.3		
8	12-26	ASSEMBLY & INSPECTION	177	7.43	8					0	3568.3	12625.9	0.01953	7.4	13.7	0.03050

SUMMARY OF EXISTING BUILDINGS AND WATER USES (Cont'd.)

LOADS FOR SEWER   PANTEX -- SUMMARY OF BUILDINGS AND WATER USES -- YEAR 1983   DATE:07/27/84   FILE NAME: PTXSEWB1

RM	BLDG NO	DESCRIPTION	OCCUPANCY (# PEOPLE)	DOMESTIC (GPM)	USAGE (HOURS)	SL(IR) (GPM)	USAGE (HOURS)	IL(IR) (GPM)	USAGE (HOURS)	INDUSTRIAL (GPM)	TOTAL (GPD)	LOAD @ PK (GPD)	PK LOAD (CFS)	TOTAL (GPM)	LOAD @ PK (G.M)	PK LOAD (CFS)
9	12-9	INERT PARTS FAB. & OFFICES	13	0.33	8	12.54	24			12.54	18319.7	18319.7	0.02834	13.1	13.1	0.02918
9A	12-59E	EQUIPMENT ROOM	0	0.00	8	3.75	24			3.75	5400.0			3.8		
9A	12-59	CHEMISTRY LABORATORY	19	0.00	8			5	24	5	7583.0	12983.0	0.02009	3.8	9.5	0.02137
9D	12-33	SUBASSEMBLY	7	0.29	8					0	141.1	141.1	0.00422	0.3	0.3	[illegible]
9E	12-11	SUBASSEMBLY	7	0.29	8					0	141.1			0.3		
9E	12-32	SUBASSEMBLY	7	0.29	8	11.73	24			11.73	17032.3	17173.4	0.02657	12.0	12.3	0.02744
9	12-97	TECHNICAL SUPPORT FACILITY	62	2.60	8					0	1249.9			2.6		
9	12-102	QUALITY ASSURANCE (IEMP)	53	1.47	8					0	705.6	1955.5	0.00303	1.5	4.1	0.00908
2	12-20	ENGINEERING SUPPORT BUILDING	10	0.[illegible]	8					0	207.2			0.6		
2	12-69	ADMINISTRATIVE SPACE	65	2	8					0	1310.4	1392.6	0.00246	2.7	1.3	0.00739
ZONE 16																
2401	16-10	VEHICLE WASH BLDG. (VWF)	0	0.00	8			200	0.33	200	4000.0			200.0		
2401	16-1	VEHICLE MAINTENANCE FACILITY	100	4.20	8						2016.0	6016	0.00931	4.2	204.2	0.05493
245	16-2	TRANSPORTATION SAFEGUARDS	80	3.36	8					0	1612.8	1612.8	0.00250	3.4	3.4	0.00709
		TOTALS	2272	95.42	--------	259.07	--------	223.09	--------	982.96	579742.6	579742.6	0.89694	982.3	982.3	1.96605

Source: Pantex Plant Water System Master Plan, 1985

END

DATE FILMED

11 / 16 / 90