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PREFACE TO THE DEPARTMENT OF ENERGY NATIONAL INSTITUTE FOR PETROLEUM AND ENERGY RESEARCH ENVIRONMENTAL SURVEY PRELIMINARY REPORT

This report contains preliminary findings based on the first phase of an Environmental Survey at the U.S. Department of Energy's (DOE) National Institute for Petroleum and Energy Research (NIPER), located in Bartlesville, Oklahoma. The Survey is being conducted by DOE's Office of Environment, Safety and Health.

The NIPER Survey is a portion of a 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 1989.

The preliminary findings in this report are subject to modification based on comments from the DOE Bartlesville Project Office concerning their technical accuracy. The modified preliminary findings will be incorporated into the Environmental Survey Summary Report.

January 1989
Washington, D.C.

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EXECUTIVE SUMMARY

Introduction

This report presents the preliminary findings of the first phase of the Environmental Survey of the U.S. Department of Energy's (DOE) National Institute for Petroleum and Energy Research (NIPER), conducted February 29 through March 4, 1988.

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. Team members are being provided by private contractors. The objective of the Survey is to identify environmental problems and areas of environmental risk associated with NIPER. 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 NIPER, and interviews with site personnel.

Site Description

NIPER occupies 18 acres in the northwest section of Bartlesville, Oklahoma. It is operated by the Illinois Institute of Technology Research Institute (IITRI) under a cooperative agreement with DOE. NIPER is the primary Federal facility devoted to research in petroleum production and petroleum fuels, and conducts research in enhanced oil recovery, natural gas recovery, fuel chemistry and thermodynamics, and fuel/engine testing.

State and Federal agencies were contacted and expressed no environmental concerns with regard to NIPER operations. The U.S. Environmental Protection Agency, however, did send a letter informing NIPER of the applicable underground storage tank regulations.

Summary of Findings

The major preliminary findings of the NIPER Environmental Survey are summarized as follows:

- Shelf life for several containers containing approximately 40 liters of peroxide-forming chemicals was exceeded, resulting in a potential for explosion and fire. Subsequent to the Survey, the chemicals were properly disposed of.

- Petroleum storage tanks may be constructed within a floodplain in a manner that could result in structural failure and petroleum releases during a major flood.

Overall Conclusions

The Survey found no environmental problems at NIPER that represent an immediate threat to human life. The preliminary findings identified at NIPER indicate that the site is affected by relatively minor environmental problems, most of which are regulatory in nature, and are the result of both current and historical operational practices.

The environmental problems described in this report vary in terms of magnitude and risk. A complete understanding of the significance of some of the problems identified requires a level of study and characterization beyond the scope of the Survey. Actions currently under way or planned at the site will contribute toward meeting this requirement.

Transmittal and Follow-Up of Findings

The preliminary findings of the Environmental Survey for NIPER were shared with the DOE Bartlesville Project Office (BPO) and the site contractor at the Survey closeout briefing held March 4, 1988. The BPO has developed a draft action plan, dated May 20, 1988, to address the Survey preliminary findings. A final action plan addressing all the Survey findings cited herein will be prepared by the BPO within 45 days after receiving this Preliminary Report. Those problems that involve extended studies and multiyear budget commitments will be the subject of the Environmental Survey Summary Report and the DOE-wide prioritization.

Within the Office of the Assistant Secretary for Environment, Safety and Health, the Office of Environmental Guidance and Compliance (OEG) has immediate responsibility for monitoring environmental compliance and the status of NIPER Survey findings. The Office of Environmental Audit will continue to assess the environmental problems through a program of systematic environmental audits that will be initiated toward the conclusion of the DOE Environmental Survey in 1989.

1.0 INTRODUCTION

The purpose of this report is to present the preliminary findings made during the Environmental Survey, February 29 through March 4, 1988, at the U.S. Department of Energy's (DOE) National Institute for Petroleum and Energy Research (NIPER), Bartlesville, Oklahoma. The DOE Bartlesville Project Office (BPO) manages NIPER although the Illinois Institute of Technology Research Institute (IITRI) operates the facility through a cooperative agreement with DOE. As a preliminary report, the contents are subject to revision. Revisions to the preliminary findings, based on BPO technical accuracy review, will be incorporated into the Environmental Survey Summary Report.

The NIPER Survey is part of the larger DOE-wide Environmental Survey 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 them. 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 NIPER 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 NIPER 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 develop the preliminary findings included in this report. The team carried out its activities in accordance with the guidance and protocols of the DOE Environmental Survey Manual. 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, and the overall Survey Plan is presented in Appendix C.

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 findings that pertain to a specific environmental medium (air, soil, surface water, and groundwater), whereas Section 4.0 includes those that are non-media-specific (e.g., waste management, toxic and chemical materials, direct radiation, quality assurance, and inactive waste sites and releases). A list defining the abbreviations used throughout the text is provided in Appendix D. Because the findings are highly varied in 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 findings that, based on information available to the Team Leader, involve immediate threat to human life. Findings of this category shall be conveyed immediately to the Environment, Safety and Health personnel at the scene or in control of the facility or location in question for action. Category I findings are environmental problems with the highest potential risk, the strongest confidence in the finding, based on the information available, and the most restrictive appropriate response 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 exposure, or a one-time exceedance where residual impacts pose an immediate potential for human exposure.

  - Evidence that a health-based environmental standard may be exceeded, as discussed in the preceding situation, within the time 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., substantive technical regulatory procedures designed to directly or indirectly minimize or prevent risks), such as inadequate monitoring or failure to obtain required permits.

Category II findings include 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 Project Offices, Operations Offices, and Program Offices as to appropriate response; however, the need for that response is such that management should not wait for the completion of the DOE-wide Survey to respond. Unlike Category I findings, a sufficient near-term response to Category II findings by the Project and Operations Offices may include further characterization before any action is taken to rectify the situation.

- 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 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 problems. Under this category, the range of alternatives available for response and the corresponding time limits for response are the greatest. Environmental problems included within this category will typically require lengthy investigation and remediation phases, as well as multiyear budget commitments. These problems will be included in the DOE-wide prioritization to ensure that DOE's limited resources are used effectively.

In general, 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 concentration of some nonregulated material is sufficient to be included as an environmental problem. Likewise, concentrations of regulated materials even though below limits 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 that are violations of regulations or requirements (e.g., improper storage of hazardous chemicals in unsafe tanks). Such conditions present a potential hazard 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 of management practices that are indirectly related to environmental risk but are not appropriate for inclusion in Categories I through III. Such findings can be based on 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 action.

Based on the professional judgment of the Team Leader, the findings within 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 multistep, iterative process to prioritize DOE's problems.

Normally, the next phase of the Survey process is the Sampling and Analysis (S&A) effort, the results of which are used to further define environmental problems and risks as identified during the Survey. However, based on the on-site portion of the NIPER Survey, no S&A needs were identified.

It is clear that certain of the findings and observations contained in this report are highly varied in 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 will assist the BPO in planning these near-term responses.

The BPO submitted a draft action plan dated May 20, 1988, in response to the preliminary findings presented at the conclusion of the on-site Survey activities and summarized in the NIPER Survey Status Report dated April 2, 1988. The draft action plan for the NIPER Survey has been reviewed by the Office of Environmental Guidance and Compliance (OEG), which has immediate responsibility for monitoring the status and overseeing the adequacy of corrective actions taken by the Project Office in response to the Survey findings.

As required in the December 2, 1987, memorandum from the Assistant Secretary for Environment, Safety and Health to the Operations Office Managers entitled, Follow-up of Environmental Survey Findings, the BPO will prepare and submit a final action plan to the Deputy Assistant Secretary (DAS) for Environment within 45 days after receiving this Preliminary Report. The final action plan for the NIPER Survey will address all the preliminary findings cited herein and incorporate OEG's comments on the draft action plan.

2.0 GENERAL SITE INFORMATION

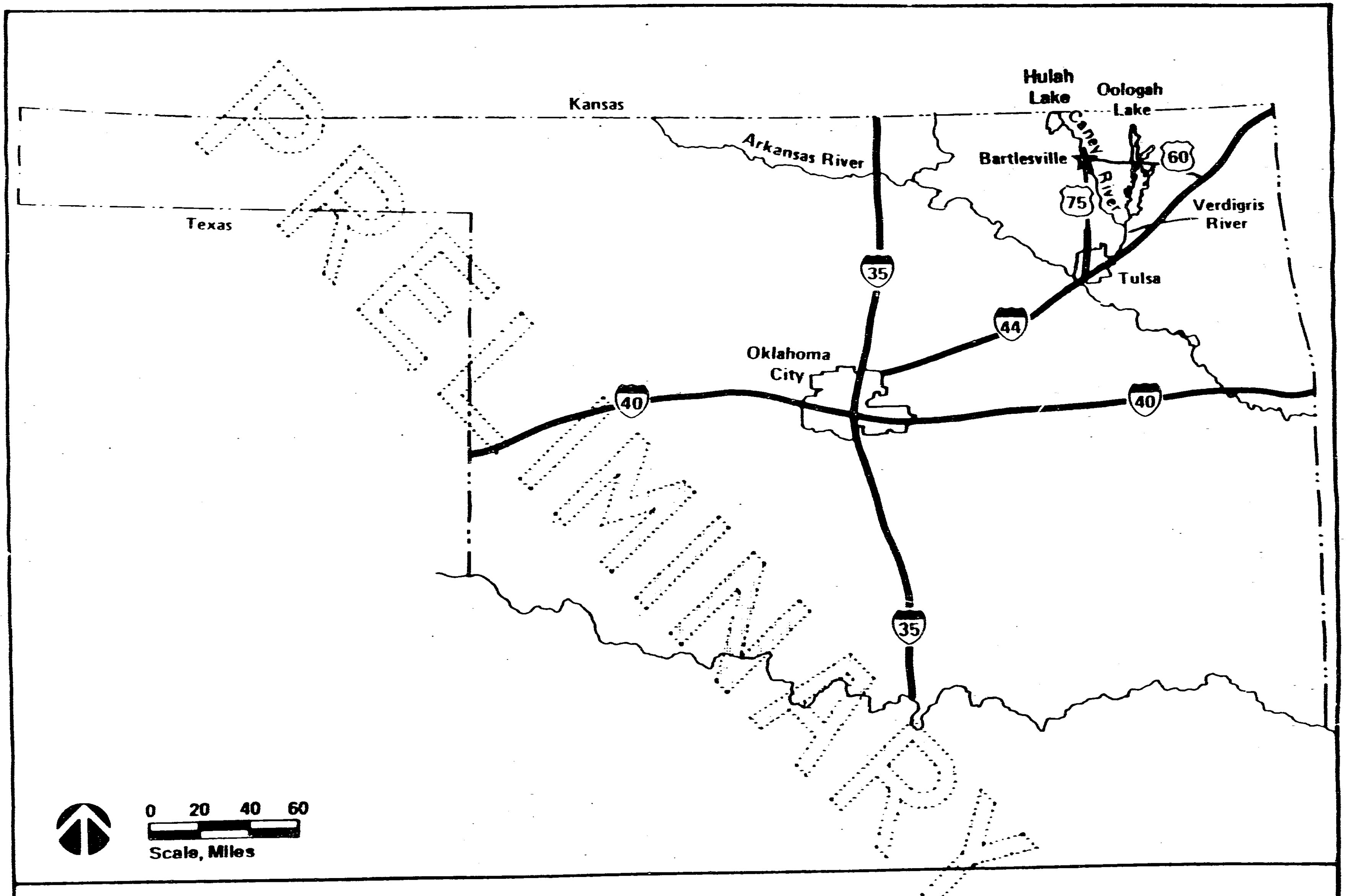
Much of the information contained in this section is summarized from the Site Development Plan (NIPER, 1984a), the National Institute for Petroleum and Energy Research (NIPER) Environmental Assessment (DOE, 1986), and from other literature provided by NIPER.

2.1 Site Setting

NIPER occupies 18 acres in the northwestern section of Bartlesville, Oklahoma, in Washington County, close to the border of Osage County. The general location of the site is shown in Figure 2-1, and the site is illustrated in detail in Figure 2-2. NIPER is bordered on the south by Cudahy Street, on the north by Herrick Street, on the east by Kaw Avenue, and on the west by Rogers Avenue. Virginia Avenue and Penn Avenue, two public roads, transect the site in a north-south direction, and Lupa Street, also a public road, bisects it in an east-west direction. NIPER also leases a small plot of land (less than 1/4-acre) for the storage of petroleum samples. This facility, known as the Caves, is located in Osage County, approximately 3 miles northwest of the main NIPER facility (Figure 2-3).

Washington County had a population of 48,113 according to the 1980 census, and Osage County, directly west of Washington County, had a population of 39,327 in 1980. The population of the Bartlesville area, including parts of Washington and Osage counties, was 37,700 in 1983. The estimated 1983 population of Washington County was 52,500 and that for Osage County 45,400. Approximately 250 people work at NIPER.

NIPER is surrounded by residential areas. Several industrial facilities and commercial developments are located about 1/2 mile west of the site. The Caney River, which flows south through the center of Bartlesville, flows within 1/2 mile of the northern boundary of the site, and is shown in Figure 2-3. The area around the site is flat, and the site elevation ranges from 673 to 689 feet above sea level. The North Acres or northern portion of the site (Blocks C and D) and a small portion of Blocks A and B lie within the 500-year floodplain of the Caney River, and most of Blocks A and B lie within the 100-year floodplain. The Caves facility is located on a hillside surrounded



LOCATION OF BARTLESVILLE IN THE STATE OF OKLAHOMA

FIGURE 2-1

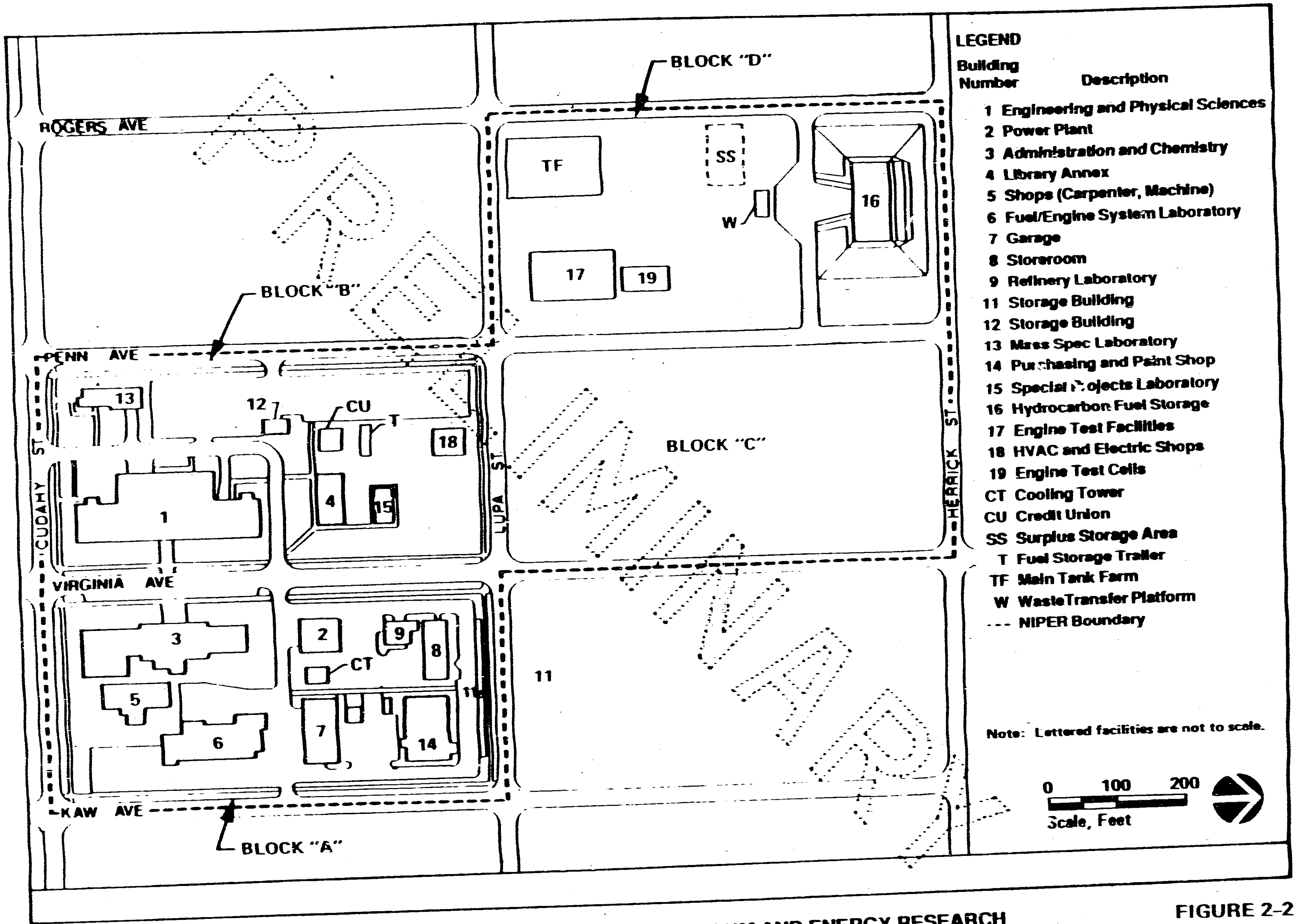
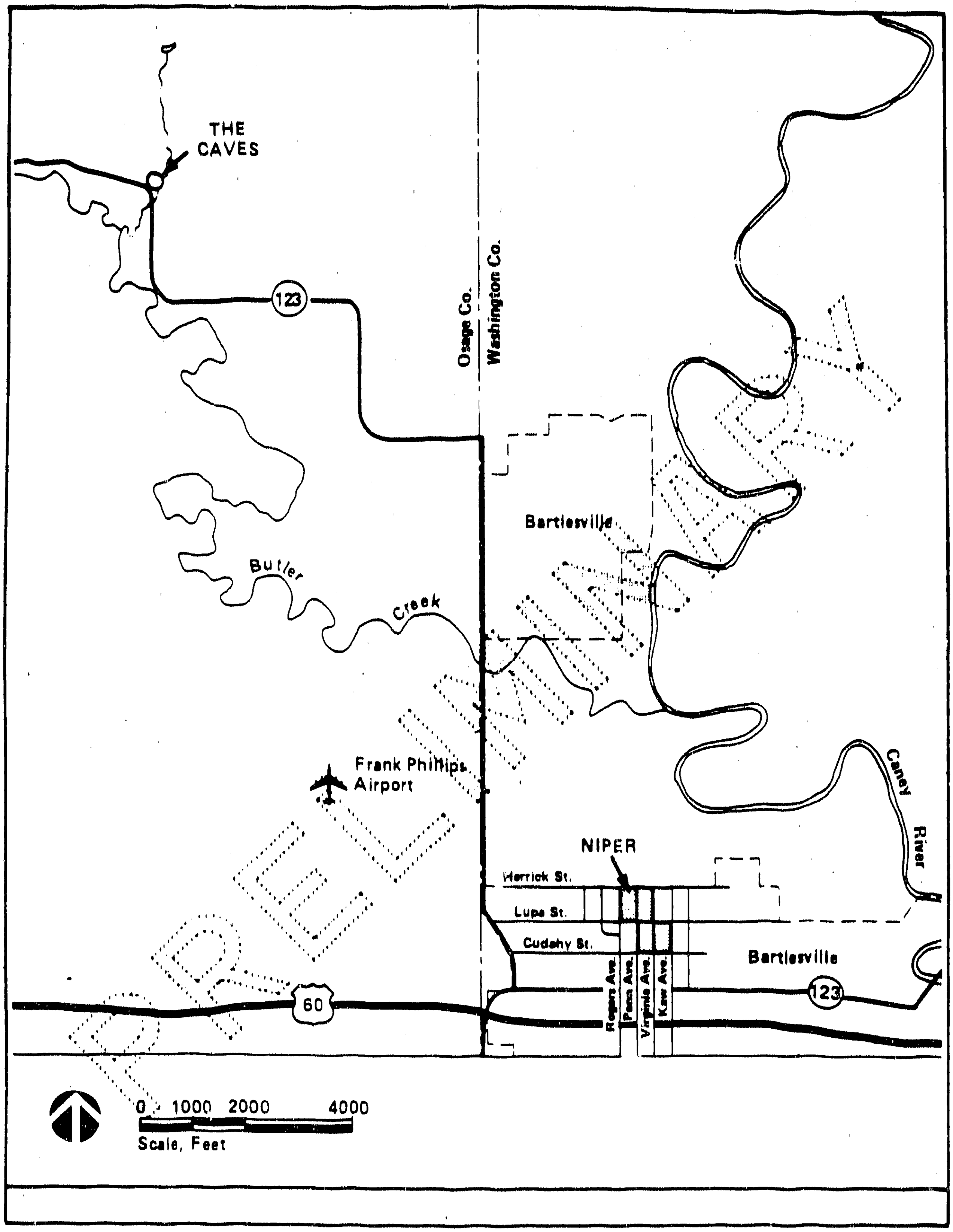


FIGURE 2-2

NATIONAL INSTITUTE FOR PETROLEUM AND ENERGY RESEARCH
SITE PLAN



LOCATION OF NIPER AND THE CAVES FACILITY FIGURE 2-3 by woodlands and is approximately 100 yards from an unnamed, intermittent tributary that eventually flows to the Caney River (Section 3.3.1.1).

Vegetation immediately south and east of the site is typical of that of a landscaped residential area. The area north and west of the site is mixed landscaped area, woodland, and floodplain forest and grassland. The woodlands west of the river and at the Caves facility consist of oak, hickory, redbud, serviceberry, and black haw. The floodplain forest is typically elm, oak, pecan, walnut, soft maple, and cottonwood. Undisturbed grassland in the area contains native prairie grasses. Some of the local grassland is used as grazing land.

The nearest location for which complete meteorological data are available is Tulsa International Airport in Tulsa, Oklahoma, approximately 40 miles south of Bartlesville. Wind roses and other meteorological data are expected to be only qualitatively representative of the Bartlesville area because of the distance between Tulsa and Bartlesville, and are therefore not discussed in this section.

The climate in the Bartlesville area is warm and temperate, typical of the central continental areas of the United States. The area is, however, subject to periodic high winds and sudden changes in temperature. Prevailing winds are from the south except during January and February, when northern winds prevail. Average summer and winter temperatures are 72°F and 47°F, respectively. The average annual rainfall in the Tulsa area is approximately 36 inches, and monthly precipitation ranges from a low of 1.5 inches in December to a high of 5 inches in May.

2.2 Overview of Major Site Operations

NIPER was established in 1918 as the Bartlesville Petroleum Experiment Station, the original name given to the laboratory by the U.S. Department of Interior Bureau of Mines. The laboratory was transferred to the U.S. Energy Research and Development Administration (ERDA) in 1975, and subsequently to the U.S. Department of Energy (DOE) in 1978. The laboratory underwent several name changes between 1918 and 1978, and was renamed the National Institute for Petroleum and Energy Research (NIPER) in 1983, as a unit of the Illinois Institute of

Technology Research Institute (IITRI), which operates NIPER under a cooperative agreement with DOE.

NIPER consists of approximately 20 major buildings and facilities located on three adjacent blocks shown in Figure 2-2. A fourth block controlled by NIPER is presently unoccupied. NIPER also uses the Caves facility, located 3 miles to the northwest, to store petroleum samples (Figure 2-3).

Research is conducted at NIPER for both Federal agencies and private industry. Research activities at NIPER fall into the following two basic categories and six subcategories:

- Energy Production Technology
  - Oil Reservoir Characterization and Evaluation
  - Enhanced Oil Recovery
  - Hydraulic Fracturing Technology
- Fuels Technology
  - Fuel Processing and Thermodynamics
  - Fuel Chemistry
  - Fuels/Engine Research and Testing

These research activities are briefly described below.

2.2.1 Energy Production Technology

Oil Reservoir Characterization and Evaluation - Research is conducted on the geological, geophysical, and chemical characteristics of reservoir cores and fluids, involving the determination of rock properties, rock/fluid interactions, and adsorption and heterogeneity effects by chemical and physical analytical methods. Data are used in geostatistical models to predict oil reservoir characteristics and oil recovery.

Enhanced Oil Recovery - NIPER conducts laboratory development and field studies of enhanced oil recovery (EOR) methods, including chemical flooding, thermal recovery, gas displacement, and microbial recovery. Research laboratory activities include formulation and evaluation of EOR fluids and special core analyses such as wettability, permeability, and capillary pressures. Laboratory and field studies are used to determine the technical, environmental, and economic feasibility of various EOR methods.

Hydraulic Fracturing Technology - NIPER develops technologies for improving natural gas recovery by hydraulic fracturing, involving fracture modeling, characterization of fracture fluids, and fracture conductivity studies.

Chemical and physical studies related to Energy Production Technology are conducted in laboratories within Buildings 1 and 3.

2.2.2 Fuels Technology

Fuel Processing and Thermodynamics - Research activities in this area focus on the processing of raw materials to fuels, including determination of thermodynamic properties of organic compounds and laboratory-scale studies of refinery processes such as distillation and hydrotreating of crude oils. These studies are conducted within Buildings 1, 3, 9, and 15.

Fuel Chemistry - Research related to the composition of hydrocarbon samples is conducted at NIPER in support of fuels processing and other research. Analyses of fuels and feedstocks are performed using chemical separations and various spectrographic methods. Specific investigations include upgrading of heavy oil and laboratory-scale tests of the effects of crude oil composition on processes. Fuel chemistry studies are conducted in Buildings 1, 3, and 13.

Fuels/Engine Research and Testing - Gasoline and diesel-fueled internal combustion engines are tested using alternative fuels and fuels derived from varying oil feedstocks. Specific tests include automobile dynamometer tests to determine performance and emissions from engines with varying fuels and operating conditions, and performance and emissions testing of stationary diesel and gasoline engines. Engine testing is conducted in Buildings 6, 17, and 19. Fuel storage and blending in support of fuel/engines research is conducted in Building 16 and at the Hydrocarbon Fuel Storage Tank Farm (i.e., the Main Tank Farm).

2.3 State and Federal Concerns

State and Federal agencies were contacted and expressed no environmental concerns with regard to NIPER operations. The U.S. Environmental Protection Agency (EPA), however, did send a letter informing NIPER of the applicable regulations concerning underground storage tanks (USTs).

3.0 MEDIA-SPECIFIC FINDINGS AND OBSERVATIONS

Discussions in this section pertain to existing or potential environmental problems in the air (including noise), soil, surface water, and groundwater media. They include a summary of the available background environmental information related to each medium, a description of the sources of pollution and their control techniques, a review of the environmental monitoring program specific to each medium, and a categorization and explanation of the environmental problems found by the Survey team related to each medium.

3.1 Air/Noise

Discussion in the following sections relates to the ambient air quality in the Bartlesville area, air emissions sources and controls, the facility environmental air quality monitoring program, and findings and observations related to air emissions. Area climatology is discussed in Section 2.0. Additional sections are included relating to ambient noise levels in the Bartlesville area, noise emissions and controls, the facility noise monitoring program, and findings and observations related to noise emissions.

3.1.1 Background Environmental Information

3.1.1.1 Ambient Air Quality/Attainment Status

Bartlesville, Oklahoma, is part of Air Quality Control Region 186. The State of Oklahoma does not operate any air quality monitoring stations in the Bartlesville area, and local ambient air quality data are not available. The air quality in the region is better than Federal and state standards for sulfur dioxide, total suspended particulate (TSP), nitrogen oxides, carbon monoxide (CO), and ozone (O_3) (Oklahoma SDH, 1987). The area is also expected to be in compliance with the state ambient air quality standard for hydrogen sulfide (H_2S) as emissions of H_2S in the area are low; however, no monitoring data are available to demonstrate compliance. Table 3-1 summarizes Federal and state ambient air quality standards for criteria pollutants and H_2S.

TABLE 3-1

SUMMARY OF AMBIENT AIR QUALITY STANDARDS (CRITERIA POLLUTANTS - NONRADIOACTIVE)

Parameter	Averaging Time	NAAQS	Oklahoma AAQS
TSP	Annual Geometric Mean Primary[a]		75 µg/m^3
	Annual Arithmetic Mean Primary[a]	50 µg/m^3	--
	Annual Geometric Mean Secondary[a]		60 µg/m^3
	24-Hour Primary[a,c]	150 µg/m^3	260 µg/m^3
	24-Hour Secondary[b,c]	150 µg/m^3	150 µg/m^3
SO_2	Annual Arithmetic Mean Primary[a]	80 µg/m^3	80 µg/m^3
	24-Hour Primary[a,c]	365 µg/m^3	365 µg/m^3
	3-Hour Secondary[a,c]	0.500 ppm	1300 µg/m^3
CO	1-Hour Primary and Secondary[a,c]	35 ppm	35 ppm
	8-Hour Primary and Secondary[a,c]	9 ppm	9 ppm
NO_2	Annual Arithmetic Mean Primary and Secondary[a]	0.05 ppm	0.05 ppm
Ozone	1-Hour Primary and Secondary[a,d]	0.12 ppm	0.12 ppm
Lead	Calendar Quarter Primary and Secondary[a]	1.5 µg/m^3	
H_2S	30-Minute Average	--	0.1 ppm

Sources: NAAQS-40 CFR 50; Oklahoma Air Pollution Regulations, Regulation 1.2, Regulation 3 4

NAAQS National Ambient Air Quality Standards
AAQS Ambient Air Quality Standard
NO_2 nitrogen dioxide
µg/m^3 microgram(s) per cubic meter
ppm part(s) per million

Notes:

a Primary National Ambient Air Quality Standards (NAAQS) are intended to protect public health.
b Secondary NAAQS are intended to protect public welfare.
c Not to be exceeded more than once a year.
d Statistically estimated number of days with concentrations in excess of the standards is not to be more than 1.0 per year.

3.1.1.2 Ambient Noise Levels

There are no regulatory standards for ambient noise applicable to the Bartlesville area, although the EPA and Federal Highway Administration (FHWA) have published noise guidelines (Canter, 1977; ICUA, 1981). Background ambient noise data for the Bartlesville area are not available. Generic data for low-density urban areas indicate that average ambient noise levels in the Bartlesville area are projected to be about 60 decibels (dB) during the day, and about 55 dB at night (ICUA, 1981). The EPA guideline for ambient noise is 55 dB, measured as a 24-hour (day/night) average. However, noise levels in the vicinity of NIPER cannot be easily compared to the EPA 24-hour guideline because operation of noise-generating equipment at the facility is intermittent and generally occurs only during daylight hours.

As no regulatory standards for ambient noise are applicable to NIPER, evaluation of noise levels generated by NIPER is best accomplished by use of short-term guidelines. FHWA ambient noise guidelines are used in Federal facility design and environmental impact assessments to evaluate noise impacts of facility construction and use, in the absence of specific noise standards for a particular area. These guidelines are related to land use in the area. The FHWA guideline that is most relevant to NIPER operations is the 1-hour average. The FHWA 1-hour average guideline for exterior (outside of buildings) noise in residential areas is 70 dB, and the interior (inside of buildings) guideline is 55 dB.

Noise measurements taken by NIPER personnel indicate that short-term exterior noise levels during testing of diesel- and gasoline-fired engines at NIPER have exceeded 70 dB at the site boundary, and have ranged to 75 dB at some test conditions. Interior noise data are not available. Noise monitoring at NIPER is discussed in detail in Section 3.1.3.2.

3.1.2 General Description of Pollution Sources and Controls

3.1.2.1 Air Emission Sources and Controls

NIPER emits small quantities of a large variety of organic solvents, acids, reduced sulfur compounds, and petroleum constituents from laboratory operations, petroleum storage facilities, and other operations, based on chemical inventory records (NIPER, 1984b). Volumes of organic compounds and acids used in the laboratories are generally measured in gallons, and total emissions of these compounds are on the order of pounds per day. For those chemicals used in laboratory hoods, no emission controls are applied, and the hoods exhaust directly to the atmosphere. VOCs are also emitted from hydrocarbon fuel storage areas. Small quantities of hydrogen sulfide are emitted from research activities in Buildings 9 and 15. NIPER also emits combustion products from the site steam plant and from diesel- and gasoline-fired internal combustion engines. Carbon monoxide, oxides of sulfur and nitrogen (NO_x), and hydrocarbons are emitted from gas-fired boilers in Building 2, and diesel and gasoline engines in Buildings 6, 7, 17, and 19. Volatile organic compounds (VOCs), some of which are toxic air contaminants regulated by the state, and acids are emitted from laboratory operations, primarily in Buildings 1 and 3. There are no operations at NIPER, other than the gas-fired boilers, that could be considered continuous emission sources.

In general, the Survey team found that air emission sources for fuel-burning equipment at NIPER are below the minimum source size or otherwise do not fall within Federal regulations. However, the State of Oklahoma may require state permits for fuel-burning equipment and other sources of hydrocarbons for which NIPER has not applied. Additionally, the site has not prepared an air emissions inventory for hazardous and toxic emissions to demonstrate compliance with state standards.

Air emissions from NIPER operations generally can be attributed to the following facilities:

- Laboratory Operations - Buildings 1 and 3
- Power Plant/Utilities - Building 2
- Machine Shop and Carpentry Shop - Building 5
- Garage/Automobile Engine Testing Laboratory - Building 7
- Refinery Laboratory - Building 9
- Mass Spectroscopy Laboratory - Building 13
- Paint Shop - Building 14
- Special Projects Laboratory - Building 15
- Hydrocarbon Fuel Storage - Building 16, Main Tank Farm, Caves facility

- Fuel/Engine Systems Laboratories - Buildings 6, 17, and 19

The relative locations of these facilities are illustrated in Figures 2-2 and 2-3. Air emissions and controls for each facility are discussed in detail below.

Buildings 1 and 3 - Engineering and Physical Sciences and Chemistry Laboratories

Buildings 1 and 3 contain most of the physical and chemical laboratories at NIPER. The major portion of the VOCs and acids used at NIPER are used in these two buildings. Specific activities in Building 1 include chemical characterization and distillation of crude oil, extraction of petroleum fluids from core samples, and core flooding and steam flow studies. Laboratory studies conducted in Building 3 include crude oil distillation, chemical and physical characterization of crude oil and diesel fuel, and acid digestion and ashing of crude oil.

Most common acids and organic solvents are used to some extent in Buildings 1 and 3. Specific organic compounds used routinely throughout the Building 1 and 3 laboratories include toluene, petroleum ether (a hydrocarbon mixture composed primarily of pentane, hexane, and heptane), ethyl ether, acetone, acetonitrile, carbon disulfide, and various aliphatic hydrocarbons, chlorofluorocarbons, and alcohols. Toluene and petroleum ether are used to clean laboratory equipment as well as for laboratory studies. Carbon disulfide is used as a sample diluent in gas chromatographic analyses. Benzene, chloroform (chloromethane), and carbon tetrachloride are used in several laboratories in Building 3, including Rooms 209 and 313. Chlorinated solvents, including methylene chloride (dichloromethane) and 1,1,1-trichloroethane are also used, but not to as large an extent as are the non-chlorinated solvents. Acids used in the laboratories include sulfuric, acetic, hydrochloric, hydrofluoric, and phosphoric acids. Mercury is used in one laboratory for core characterization studies.

Organic compounds and acids used in laboratory hoods in Buildings 1 and 3 evaporate into the hood exhausts to some extent. It is expected that the major portions of the compounds used in most of the Building 1 and 3 laboratories are disposed of as liquid waste and not evaporated, based on the nature of the laboratory operations. Waste management and disposal are discussed in Section 4.1.

Ventilation of the laboratories in Building 1 is accomplished by a system of laboratory hoods that vent to several exhaust blowers on the roof of the building. Makeup air is provided by several makeup air blowers located on the opposite side of the building roof from the exhausts. The configuration of the makeup and exhaust blowers on the roof of Building 1 is horizontal.

Ventilation of the laboratories in Building 3 is accomplished by a system of 22 laboratory hoods that vent to a single exhaust blower in the building attic, and individual emergency exhaust fans that vent through the building windows. Routine ventilation is provided by the exhaust blower; the window fans are used only in emergency situations such as laboratory spills of volatile chemicals. Makeup air is provided to the laboratories by a single makeup air blower also located in the building attic.

The configuration of the makeup and exhaust blowers in Building 3 is horizontal, and the two blowers are separated by a distance of about 10 feet. Building 3 has experienced periodic recirculation of the laboratory exhaust into the building intake air. A ventilation study of Building 3 has been completed, and it indicated that up to 8 percent of the exhaust gas can be recirculated under worst-case conditions. Installation of a 10-foot vertical stack on the laboratory exhaust was proposed as a solution to the problem. Installation of the stack was not completed at the time of the Survey. Addition of this stack is expected to eliminate the recirculation of the exhaust, and will also significantly increase dispersion of the exhaust gas.

Building 1 has also experienced periodic recirculation of laboratory exhaust; the problem is not as pronounced as in Building 3, as a smaller quantity of chemicals is used than in Building 3. A ventilation study was planned for Building 1 in 1988, subsequent to the Survey.

Specific laboratory operations in Buildings 1 and 3 that have air emission implications are discussed individually in the following paragraphs.

<u>Building 1 - Core Characterization Laboratory, Room 130</u> - Toluene is used to extract petroleum field fluids from core samples in a laboratory hood in this laboratory.

Some toluene is evaporated into the hood exhaust during the extraction process. The pore spaces and pore size distribution of core samples are measured in this laboratory by subjecting the cores to mercury under pressure. The cores are weighed before and after the pressure test, and the pore spaces in the core sample can be determined from the weight of mercury absorbed by the core sample. The test is destructive, and the mercury-containing cores are disposed of as hazardous waste as discussed in Section 4.1. Air emissions of mercury from this laboratory are expected to be negligible, as the mercury is used in approximately 1-pound quantities and at room temperature.

<u>Building 3 - Extraction Laboratory, Room 313</u> - Laboratory studies conducted in Room 313 are related to the separation of petroleum constituents by solvent extraction, chemical separation, and liquid chromatography. Separations are conducted in two laboratory hoods and in one large, fully enclosed canopy hood, all of which exhaust to the laboratory ventilation system. Mostly nonchlorinated solvents are used for large-scale extractions of fuels in the canopy hood, the most common being pentane and ether. Some methylene chloride, chloroform, and dichloroethane are also used.

Liter quantities of benzene are used to separate petroleum constituents from solid adsorbents in small-scale extraction apparatus in the laboratory hoods. The benzene, containing petroleum constituents, is evaporated in a vacuum evaporator and then collected in a water-cooled condenser. According to the laboratory operator, about 4 gallons (gal) per month of benzene are used in the laboratory. Most of the benzene used is disposed of as liquid waste as discussed in Section 4.1.

<u>Building 3 - Distillation Laboratory, Room 216</u> - Batch-scale distillations of crude oils are conducted in the distillation laboratory using one 6-liter and one 1-liter laboratory-scale apparatus. Residual still-bottoms and condensed hydrocarbon liquids are collected in bottles for analysis, and noncondensible hydrocarbons such as methane and ethane (light ends) and small amounts of H_2S are vented through a flexible hose to a laboratory hood. According to the operator, approximately 4 to 5 batch distillations per month are conducted in the laboratory. Emissions of hydrogen sulfide will not affect ambient air quality, based on the small amount emitted.

Building 3 - Diesel Fuel Characterization Laboratory, Room 211 - Diesel fuel is digested in liter quantities in a laboratory hood in this laboratory, using hot sulfuric acid. The digested fuel samples are subsequently ashed in an oven and the ash analyzed. Small amounts of oil fumes and acid fumes are emitted during the acid digestion and ashing.

Building 2 - Power Plant/Utilities

Building 2 contains two gas-fired hot water boilers and two lithium bromide absorption water chillers. The boilers provide heat and hot water for NIPER operations, and also operate the chillers. The boilers and chillers were installed in 1961. The capacity of each boiler is 9.0 million British thermal units per hour (MMBtu/hr) heat input (6.25 MMBtu/hr output), and the total annual natural gas consumption of the boilers is on the order of 30 million cubic feet (ft^3). The boilers emit small amounts of sulfur dioxide, carbon monoxide, nitrogen oxides, and hydrocarbons. Emissions of sulfur dioxide are on the order of 20 pounds per year (lb/yr), and non-methane hydrocarbon emissions are on the order of 200 lb/yr, based on EPA emission factors (EPA, 1986).

The boilers and chillers in Building 2 are scheduled to be replaced in 1988 by two smaller gas-fired boilers and two electrically driven water chillers. The capacity of each of the new boilers is expected to be 4 MMBtu/hr heat input. The new boilers are expected to be smaller than the existing boilers, and natural gas consumption and emissions of combustion products will decrease upon installation of the new boilers and chillers. Construction permits for the proposed new boilers had not been applied for at the time of the Survey.

Building 5 - Machine Shop and Carpenter Shop

Building 5 contains a metal machine shop and carpenter shop. The machine shop consists of several tools, such as lathes, drill presses, soldering benches, and welding machines, which are normally used with steel, aluminum, copper and other metals. One pour of lead (800 lb) was done in 1986. Lead has not been used in the machine shop in significant quantities before or since 1986 and significant emissions of lead from the machine shop are not expected. The machines are vented by flexible hoses and wall-mounted vents during use, which exhaust cutting fluid fumes, welding fumes, and particulates from the machine areas. One solvent parts cleaner, which uses approximately 200 gal/year of a proprietary mixture of nonchlorinated solvents, is located in the machine shop and emits small amounts of these solvents.

The carpenter shop consists of several power saws and benches, which are normally used with wood. Materials such as plexiglass, ceramic materials, and non-asbestos ceiling tiles, are also cut in the shop on a nonroutine basis. The machines are exhausted to a bag filter, which collects dust from the cutting operations. The control efficiency of the bag filter has not been measured, although the efficiency of a bag filter is generally above 99 percent. No control parameters (i.e., pressure drop across the filters) are monitored. The bags are manually cleaned about twice a year and the dust disposed of in a municipal landfill. The parts cleaner in the machine shop emits small amounts of solvents to the atmosphere. Other air emissions from the machine shop and the carpenter shop are negligible.

Building 7 - Garage/Automobile Engine Testing Laboratory

Building 7 is used to test automobile engine emissions and to maintain NIPER fleet vehicles. A separate area of the building is used for storage of fuel samples, solvents, and other organic materials. The automobile test area is an open area containing emissions test equipment. Automobile emissions tests are conducted infrequently, and the exhaust from the tests is vented outside the building by a flexible hose at floor level. The exhaust gas composition and total emissions are roughly similar to those of an automobile in normal service, on the order of 400 ppm of NO_x, 40 ppm of hydrocarbons, and 0.3 percent carbon monoxide based on EPA emission factors (EPA, 1986).

The vehicle maintenance area of Building 7 contains two cold solvent cleaners and one cold caustic cleaner, which are used to clean such items as automobile parts and tools. Both solvent cleaners are about 1 foot by 2 feet in area. One of the cleaners is equipped with a slot vent and cover, and is exhausted to a roof vent. The other solvent cleaner is a small portable unit that has a cover but is not ventilated. This unit was not covered during the Survey. Both cleaners use a proprietary mixture of chlorinated solvents, and solvent use is on the order of two or three 55-gallon drums every 6 months. The caustic cleaner uses a mixture of detergent, cresol, and chlorinated solvents, and also was not fully covered during the Survey. The fuel/solvent storage area contains cans and drums of fuel samples, fuel additives, waste gasoline, and solvents. The storage area is exhausted by the general building ventilation system, and solvent odors were noticeable in this area during the Survey.

Fugitive emissions of volatile hydrocarbons result from the solvent and cold caustic cleaners and solvent/fuel storage areas. The emissions are not large, based on the inventory of volatile materials stored and used in the building; however, emissions can be reduced through use of covers on solvent cleaners and storage containers.

Building 13 - Mass Spectroscopy Laboratory

Building 13 contains several mass spectrometers, which are used for analyses of hydrocarbon and other laboratory samples. Organic constituents emitted from mass spectrometer exhaust vents include gram quantities of a wide variety of reagents and samples, and also chlorinated and nonchlorinated solvents (e.g., toluene, methylene chloride, acetone) used in laboratory operations and for cleaning laboratory equipment. Perchloric acid is used sporadically in a laboratory hood in Building 13 to clean ceramics. The hood is equipped with a manual water washdown system, and the hood is washed after each use. Chromic acid is used in pint quantities on an intermittent basis in a hood adjacent to the perchloric acid hood. Emissions of chromic and perchloric acids to the atmosphere are negligible based on the amounts used.

Building 14 - Paint Shop

Building 14 contains a walk-in paint spray booth and an open area for spray/brush painting. The majority of projects involve brush painting. The spray booth is exhausted through a fan to a roof vent, and paint emissions are controlled by a fiberglass filter. The filter controls particulate emissions, but is not designed to be effective in controlling solvent emissions, which pass through the filter. The spray/brush painting area is exhausted by a floor vent that is not equipped with a filter. Expected emissions of solvents from paint shop operations are less than 100 lb/day, based on the amount of paint used. The facility was inactive during the Survey.

Building 9 - Refinery Laboratory

Building 9 contains a laboratory-scale (6 gal/hr feed rate) vacuum distillation unit that is used to separate crude oils. The unit was being operated on a nonroutine basis at the time of the Survey, but may be operated 24 hours per day, depending on the requirements of the particular experimental study. Crude oil feeds are generally heavy oils, and some high-sulfur oils are used in the laboratory. The laboratory also contains a gas chromatograph and a bench-scale (10-cubic-centimeter-capacity) catalytic cracking unit. The laboratory does not have a building-wide ventilation system, and ventilation is provided by several hoods. The distillation unit and chromatograph are exhausted individually, and flexible trunks are used to exhaust odorous fumes from the laboratory.

At the time of the Survey, the distillation unit was scheduled to be used for a series of experiments involving the reaction of H_2S with oil. The nature of the planned experiment is that the H_2S reacts nearly completely with the oil; however, some emissions of H_2S are expected. It is estimated by NIPER personnel that one 20-liter cylinder of pure H_2S will be used in the experiments. It is not expected that emissions of H_2S will result in any violation of the state ambient air quality standard for H_2S, based on the small amount emitted.

The exhaust from the crude oil distillation unit may contain hydrogen, light aliphatic hydrocarbons, and hydrogen sulfide, depending on the composition of the feed oil and the type of experiment. Light hydrocarbons are collected in a liquid nitrogen trap, and may be bottled for analysis or disposed of. Hydrogen sulfide, a condensible gas, is also collected by the nitrogen trap. The nitrogen trap is exhausted through a roof vent to the atmosphere. Oil fumes from the hot distillation products are exhausted by a flexible trunk. Fugitive emissions of toluene and acetone result from cleaning of 5-gallon metal cans used for petroleum samples, and from cleaning other laboratory equipment. The waste liquid toluene is collected and reused to clean laboratory glassware.

Building 15 - Hydrotreatment Laboratory

Building 15 contains a laboratory-scale hydrotreatment unit that treats heavy hydrocarbon fractions with hydrogen gas. The unit uses 870 cubic centimeters per minute (cm^3/min) of hydrogen and can treat 120 cm^3/hr of crude oil. The unit was operating during the Survey, and had been operated 24 hours per day for the 4 months prior to the Survey. No experiments had been conducted for 2 years prior to that time. The hydrotreater may be operated on a continuous or intermittent basis depending on the requirements of the particular experimental study. The laboratory also contains an autoclave used for supercritical extraction studies using toluene, and two hoods used for cleaning equipment and heating oil samples.

The exhaust from the hydrotreater contains hydrogen, light aliphatic hydrocarbons (methane to hexane), ammonia, and approximately 5,000 parts per million (ppm) of H_2S. The exhaust rate during continuous operation is 750 cm^3/min. No emission controls are applied to the hydrotreater exhaust. It is not expected that emissions of H_2S will result in any violation of the state ambient air quality standard for H_2S, based on the small amount of H_2S emitted. Oil fumes result from periodic heating of oil samples, and fugitive emissions of toluene and other organic solvents result from equipment cleaning.

Building 16 - Hydrocarbon Fuel Storage Building

Bulk chemicals and petroleum samples are stored in two rooms in Building 16. Many of the chemicals stored are volatile hydrocarbons, and the petroleum samples stored contain volatile components. Fuels are blended in a separate fuel mixing room in the building. The storage rooms are mantained below ambient temperature to minimize evaporation and degradation of the stored materials. The center room is maintained at 45°F and the outer rooms (including the fuel mixing room) are maintained at 60°F. Materials are stored in closed containers and no open containers were found during the Survey. The building ventilation system exhausts at a rate of approximately 10,000 ft^3/min, and provides 12 complete air changes per hour to prevent the formation of explosive conditions. The fuel mixing system has a dedicated ventilation system used when fuels are being blended. The building is equipped with explosimeters to monitor explosive conditions, and a foam system for fire suppression.

Fugitive emissions of organic chemicals and petroleum constituents result from evaporation of stored bulk chemical and petroleum samples into the Building 16 ventilation system and blending of fuels in the fuel mixing room. Exhaust concentrations are expected to be negligible under normal storage conditions, based on the use of closed containers, controlled temperature conditions, and the high exhaust volume. Emissions of VOCs are estimated to be on the order of 100 lb/year.

Main Tank Farm

The Main Tank Farm contains four 30,000-gallon, two 20,000-gallon, and three 10,000-gallon fuel storage tanks. In addition, two 10,000-gallon tanks are located adjacent to Building 19, and one 1,000-gallon fuel tank is located at the tank farm. The tanks are used to store and mix petroleum fuels in response to changing experimental requirements. The tanks are filled from tank trucks using quick-disconnect-type hose connections, and have permanent submerged fill pipes.

Each tank is equipped with an emergency vent designed to open at 0.5 pounds pressure, and a custom-designed U-tube breathing vent that keeps the stored fuel under nitrogen pressure to prevent air contamination. Nitrogen is bubbled through the U-tubes to maintain nitrogen pressure in each tank, and all tanks are connected to the same nitrogen supply system.

As nitrogen gas is periodically vented from the storage tanks to compensate for changes in tank pressure, the nitrogen system is only partially effective in controlling hydrocarbon emissions from the tanks, which result from changes in temperature and from filling and emptying the tanks. Fugitive emissions of fuel oil constituents result from fuel storage tank working and breathing losses. Fugitive emissions from the tank farm are estimated to be on the order of 100 lb/year based on EPA emission factors (EPA, 1986).

Building 6, Building 17, and Building 19 - Fuel/Engine Systems Laboratories

Building 6 contains two engine test cells and a vehicle test room. One engine test cell contains two 150-horsepower (hp) stationary diesel engines, one of which is partially dismantled, and the second cell contains one 750-hp stationary diesel engine. At the time of the Survey, Building 17 contained two 250-hp gasoline (aircraft) engines, two small dismantled diesel engines, and six small gasoline engines. The six gasoline engines are scheduled to be taken out of service in 1988. The characteristics of each engine are summarized in Table 3-2.

The stationary engines are used with dynamometers to test engine wear and performance and emissions characteristics of various fuels. Exhaust gas volume and composition are among the parameters measured. The vehicle test room is used for automobile dynamometer tests and emission tests.

Building 6 also contains several chemistry laboratories in which analyses of fuels and fuel additives are performed. Analyses are performed in several laboratory hoods. Chemicals used in the laboratories include benzene, carbon tetrachloride, acrylonitrile, methylene chloride, and hydrochloric, nitric, and acetic acids. Air emissions from these laboratories are negligible, based on the quantities of chemicals used.

The diesel engines in Buildings 6 and 17 exhaust through mufflers and smoke chambers to individual roof vents that rise approximately 6 feet above the roofs of the two buildings. The gas engines in Building 17 have a single exhaust. The muffler for the 750-hp engine exhausts vertically, and the mufflers for the two 150-hp engines exhaust horizontally. The engines in Building 17 exhaust through wall vents. There are individual mufflers on each engine in addition to an external muffler for the diesel engines.

Emissions are monitored during tests and vary depending upon the type of fuel and test conditions. Test runs may vary from 1 to 8 hours, depending on the particular test program. During the Survey, both the 750-hp and 150-hp engines in Building 6 were operated for several hours over several days' time. The operation of the large engine was part of a month-long test program. None of the engines in Building 17 were operated during the Survey.

The diesel and gasoline engines in Buildings 6 and 17 emit small amounts of sulfur dioxide, carbon monoxide, nitrogen oxides, hydrocarbons, and particulates. As the emissions vary significantly depending on the test program and fuel type, emission estimates are based on annual operating hours and EPA emission factors (EPA, 1986). Estimated emissions are summarized in Table 3-2. Although it is likely that these engines may occasionally exceed various emission standards, the intrinsic

TABLE 3-2

CHARACTERISTICS OF NIPER TEST ENGINES

Engine Type	Number of Engines	Present Location	Scheduled Relocation	Engine Emissions[a] (1986-1987 lb/yr)				Installation (year)	Engine Size (Horsepower)	Engine Status	1986-1987 Hours of Operation
				CO	HC	NO_x	SO_2				
Diesel	One	Building 6	Building 17	750	280	3,470	230	1986	750	In Use	150
Diesel	One	Building 6	None	20	7.5	93	6.2	1987	150	In Use	20
Diesel	One	Building 6	None	20	7.5	93	6.2	1987	150	Dismantled	20
Gasoline	Two	Building 17	Building 19	22,000[b]	760[b]	570[b]	30[b]	1988	250	In Use	0
Gasoline	Six	Building 17	Storage	NA	NA	NA	NA	1986	Unknown	In Storage	NA
Diesel	Two	Building 17	None	NA	NA	NA	NA	1986	Unknown	Dismantled	NA

Sources: EPA, 1986; information provided to the Survey team during the on-site portion of the Survey.

HC - Hydrocarbons
NA - Not Available. These engines were operated sporadically during 1986 and 1987.

a Based on EPA Emission Factors Published in EPA Document AP-42 (EPA, 1986)
b Projected emissions based on 100 hr/yr operation

nature of the research performed, namely the testing and measurement of engine performance as it relates to emissions levels, necessitates that emissions exceeding accepted standards occasionally occur. After the Survey, the Oklahoma State Administration verbally indicated to NIPER that emissions sources typically are exempt from emission limitations under such circumstances.

Stationary gasoline and diesel engines are considered by the state to be "fuel-burning equipment" and as such, installation of new engines and operation of existing engines require state permits unless specifically exempted by the state. NIPER contacted the State Administrator by telephone after the completion of the Survey, and the Administrator indicated that, based on the small size and low number of operating hours of the existing test engines, they would be exempt from permit requirements. The state requested written notification of the size and hours of operation of each engine, and is expected to provide written exemption of the existing engines to NIPER based on this information. The state may also exempt installation of any new engines from permit requirements.

3.1.2.2 <u>Noise Emission Sources and Controls</u>

Elevated noise levels from NIPER operations are the result of stationary diesel and gasoline engine testing in Buildings 6 and 17, as located on Figures 3-1 and 3-2. Testing occurs periodically during daylight hours and may last from 1 to 8 hours. Noise emissions from the engines are controlled by commercial and custom designed industrial mufflers, and to some extent by the physical enclosure of the test buildings and other surrounding buildings. The muffler for the 750-hp diesel engine in Building 6 and the diesel engines in Building 17 were custom-designed by measuring the frequency distribution of noise emissions from the engine, and designing the mufflers specifically to reduce the highest level frequencies. The mufflers for the two 150-hp diesel engines in Building 6 are commercial industrial mufflers. The mufflers for the Building 6 engines are located outside the building on the roof. Mufflers for the engines in Building 17 are also located outside the building.

Mufflers of proper design and size have proven effective in reducing noise emissions from stationary engines at NIPER. Diesel engine tests were conducted in Building 17

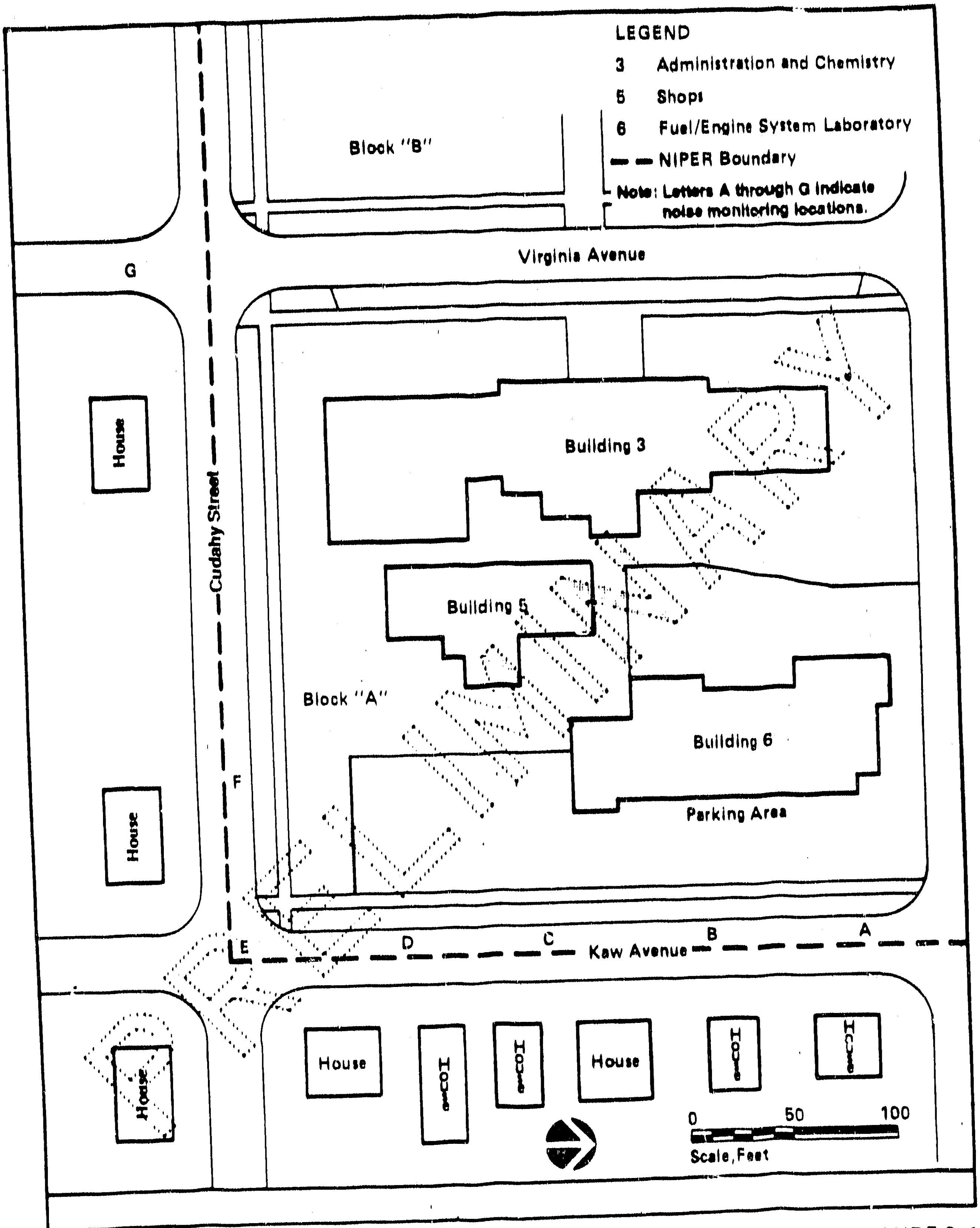
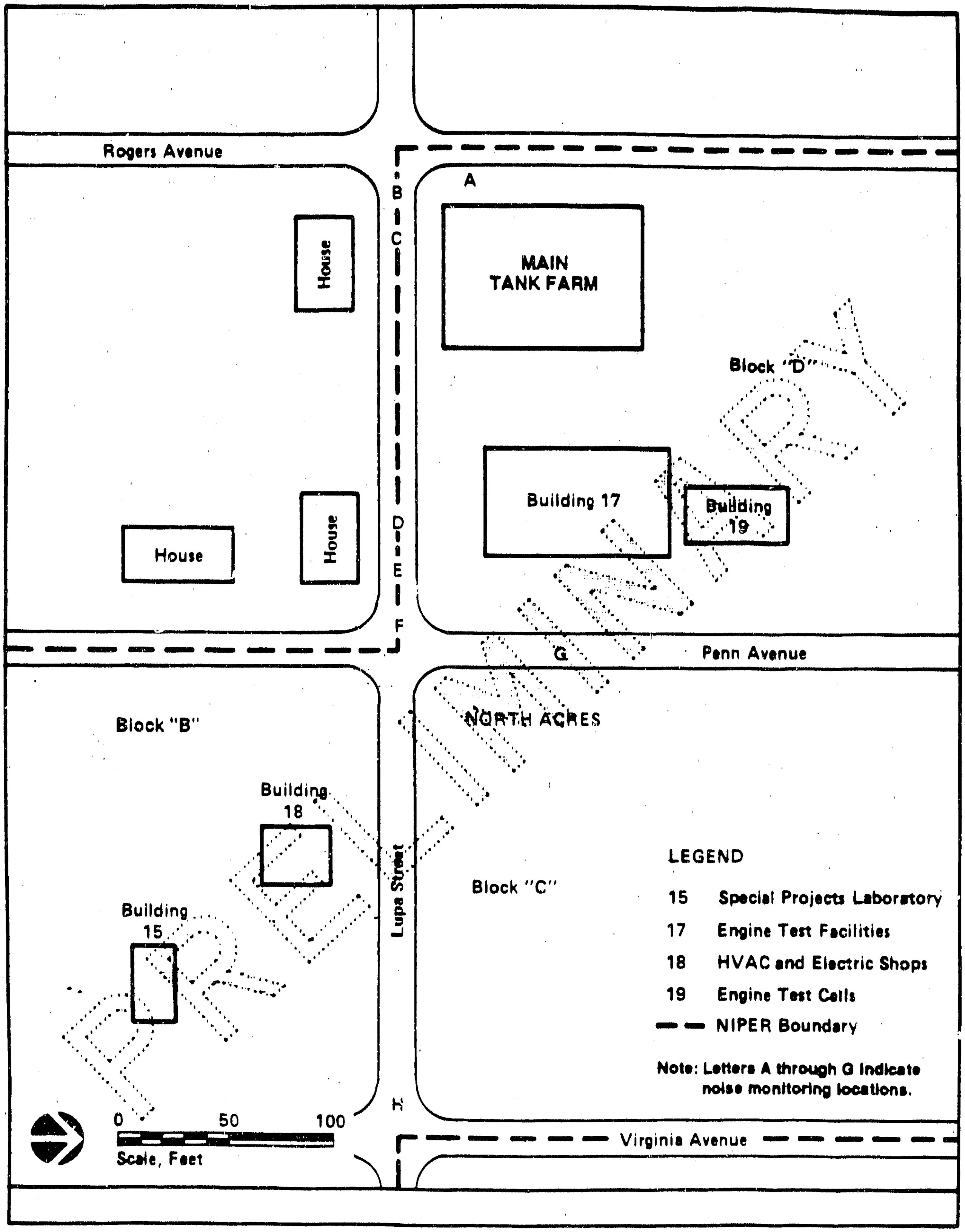


FIGURE 3-1

LOCATION OF BUILDING 6
IN RELATION TO SITE BOUNDARY, NEARBY RESIDENCES,
AND NOISE MONITORING LOCATIONS



LOCATIONS OF BUILDINGS 17 AND 19
IN RELATION TO SITE BOUNDARY, NEARBY RESIDENCES,
AND NOISE MONITORING LOCATIONS

FIGURE 3-2

in July 1986 with and without mufflers. Noise levels measured by NIPER personnel at the site boundary were 72 dB without the muffler and 60 dB with the muffler. Uncontrolled noise levels as high as 90 dB have been measured at the site boundary. Tests of the 750-hp engine in Building 6 conducted during the Survey were inadvertently started using a smaller muffler than that normally used for the engine. A maximum noise level of 86 dB was measured at the property line (Figure 3-1) using the smaller muffler. After installation of the larger muffler, noise levels ranging from 62 to 69 dB were measured at the property line.

Noise levels from the engine tests have historically been a cause of complaints from local residents. NIPER historical records indicate that complaints were received by the facility when daytime noise levels at the site boundary near Buildings 6 or 17 exceeded 70 dB, and when nighttime noise levels, during the period prior to 1987 when night testing was conducted, exceeded 65 dB. Noise measurements by NIPER personnel have shown that noise levels at the site boundary have exceeded 70 dB during tests conducted at both Building 6 and Building 17 under several different test conditions for both the diesel and gasoline engines. The FHWA daytime guideline for exterior (outside of buildings) noise in residential areas is 70 dB. Noise monitoring data are discussed in detail in Section 3.1.3.2.

Movement of some of the test engines from Building 6 to Building 17 and from Building 17 to Building 19 (Figure 3-2) is scheduled for mid-1988, partially in response to noise concerns. The 750-hp diesel engine in Building 6 is scheduled to be moved to Building 17, which has a cooling system and test area specifically designed for the engine. The two 150-hp engines are to remain in Building 6. The two 250-hp aircraft gasoline engines in Building 17 are scheduled to be moved to Building 19 when the building is completed. Each engine will be equipped with a separate exhaust when installed in Building 19. New engines may be installed in Buildings 6, 17, and/or 19, depending on the requirements of future projects.

Movement of the 750-hp diesel to Building 17 is expected to reduce site-boundary noise levels from tests of this engine, since the engine test area in Building 17 is specifically designed for the engine. Movement of the two 250-hp gasoline engines to Building 19 is also expected to reduce noise levels at the site boundary relative to previous tests conducted in Building 17, since Building 19 is further from the site boundary (Figure 3-2). Additionally, the engine manifolds are expected to be redesigned when the two 250-hp gasoline engines are moved to Building 19. The level of noise reduction resulting from the movement of the engines cannot be predicted.

The 150-hp diesel engines will continue to be tested in Building 6, and tests of the two small dismantled diesel engines in Building 17 may also be conducted in the future. Such tests may result in noise emissions above FHWA-recommended exterior noise levels for residential areas.

3.1.3 Environmental Monitoring Program

3.1.3.1 Air Emission Monitoring

NIPER does not conduct any monitoring of exhaust gas emissions or ambient air concentrations as part of a routine environmental monitoring program. Emissions of criteria pollutants from engine tests are measured as part of the experimental test program; however, these measurements are not intended for and are not used for characterizing environmental impacts of the tests. Emissions of pollutants from engine testing and laboratory operations are small, as discussed in Section 3.1.2, and are not expected to significantly impact local ambient air quality.

NIPER is not required under state regulations to maintain either an emission sampling or air monitoring program. However, the facility may need to demonstrate compliance with State of Oklahoma Toxic Air Contaminant Regulation 3.8, relating to ambient air concentrations of toxic and hazardous air pollutants, if emissions are above de minimis limitations, by using chemical inventory data, dispersion modeling, source characterization, and/or ambient air quality monitoring.

3.1.3.2 Noise Emission Monitoring

Noise measurements are periodically taken by the facility environmental engineer during engine testing using a commercially-procured noise meter. The NIPER engine test group generally provides notification to the engineer before engine tests are performed so that noise monitoring may be conducted. Noise measurements are taken at a series of standard locations around the perimeter of the facility. Figures 3-1 and 3-2 show the locations of Building 6 and Buildings 17 and 19, respectively, and include the locations of off-site residences and points where noise measurements are routinely obtained. Measurements may also be taken at other locations in response to specific complaints from local residents. The results of the noise monitoring are used internally by NIPER personnel.

Noise measurements were taken on two occasions during the Survey. Tests of the 750-hp engine in Building 6 were run for 2 hours on February 29, 1988, and for 1 hour on March 1, 1988. The tests were inadvertently started using a smaller muffler than that normally used for the 750-hp engine, and a maximum noise level of 86 dB was measured at the property line. The facility environmental engineer ordered the test discontinued and a larger muffler installed. After installation of the larger muffler, the test was resumed, and noise levels ranging from 62 to 69 dB were measured at the property line. A test of one of the 150-hp diesel engines in Building 6 was run on March 3, 1988, for about 2 hours. Noise levels ranging from 64 to 74 dB were measured during this test.

The most recent noise measurements at NIPER, other than those taken during the Survey, were taken in 1986. Table 3-3 summarizes historical noise data obtained by NIPER for Buildings 6 and 17 (Building 19 is a new facility, and no engines were installed there at the time of the Survey). Noise levels exceeding the FHWA daytime guideline of 70 dB were measured at several locations near Building 6 in 1988, including monitoring location D (Figure 3-1) and an unspecified location. Noise levels also in excess of 70 dB were measured at several locations near Building 17 in 1986, including monitoring locations D and F (Figure 3-2).

The noise meter used is calibrated every 3 to 4 months by the facility environmental engineer using a commercially-procured tone generator. Nonroutine calibrations may be done before taking measurements that are particularly sensitive, principally for measurements taken in response to community complaints. The tone generator is inserted into the noise meter and provides a series of sounds at specific frequencies and decibel levels to which the noise meter responds. The tone generator itself requires calibration, and is calibrated annually by the NIPER Electronics Department.

TABLE 3-3

SUMMARY OF MAXIMUM SITE-BOUNDARY NOISE LEVELS RESULTING FROM ENGINE TESTS

Test Date	Building	Maximum Noise Level (dB)	Location[a]	Engine(s) Tested[b]
6/12/86	Building 6	63.5	B	750-hp diesel
6/17/86	Building 6	69.5	B/C	750-hp diesel
6/18/86	Building 6	67.5	B/C	750-hp diesel
7/2/86	Building 17	72	D	Multi-Engine (not specified)
8/13/86	Building 17	65.5	E	Multi-Engine (gasoline/diesel)
8/14/86	Building 17	68	E	Multi-Engine (4 gasoline)
9/19/86	Building 17	71	F	Multi-Engine (2 gasoline)
10/30/86	Building 17	61.5[c]	F	Multi-Engine (4 gasoline)
12/11/86	Building 17	58	D	Multi-Engine (2 diesels)
2/29/88	Building 6	86[d]	NS	750-hp diesel
3/1/88	Building 6	69	NS	750-hp diesel
3/2/88	Building 6	69	F	150-hp diesel
3/3/88	Building 6	74	D	150-hp diesel

[a] Refer to Figures 3-1 and 3-2.

[b] Some engine tests conducted prior to 1987 required engines to be operated 24 hr/day; no nighttime engine tests have been performed since that time. Some tests conducted in Building 17 in 1986 and 1987 required six gasoline engines to be operated at the same time, and other tests involving operation of more than one engine were performed during this period. The six gasoline engines formerly located in Building 17 have been taken out of service, and no further multi-engine tests or nighttime tests are planned.

[c] Specially designed muffler in use.

[d] Incorrect muffler in use.

NS Not specified

3.1.4 Findings and Observations

3.1.4.1 Category I

None

3.1.4.2 Category II

None

3.1.4.3 Category III

None

3.1.4.4 Category IV

1. Exceedances of noise guidelines. Ambient noise levels at the NIPER site boundary resulting from tests of stationary diesel and gasoline engines in Buildings 6 and 17 periodically exceed the FHWA guideline for new Federal facilities affecting residential areas, and are a cause of complaints by local residents.

   Ambient noise levels resulting from engine tests vary with engine load and measurement location. Noise measurements taken at NIPER during engine tests have exceeded the FHWA guideline of 70 dB under several engine test conditions at off-site locations in proximity to Building 6 (location D in Figure 3-1) and Building 17 (locations D and F in Figure 3-2). Although mufflers are used to control engine noise, they are not adequate to reduce off-site noise levels to below 70 dB at all measurement locations and engine loads. Local residents have historically lodged complaints at noise levels above 70 dB. Movement of some engines to Buildings 17 and 19 is expected to mitigate noise levels to some extent. However, movement of the engines, planned for mid-1988, is not expected to reduce noise levels below 70 dB at all off-site locations and all test conditions.

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2. Lack of air permits. NIPER has not applied for state air permits for stationary diesel and gasoline engines, and recently installed hydrocarbon emission sources.

New and existing stationary engines, classified by the state as fuel-burning equipment, and hydrocarbon emission sources at NIPER are subject to permitting under State of Oklahoma Air Pollution Control Regulations 3.7 (Control of Emissions of Organic Materials), 3.4 (Control of Emissions of Sulfur Compounds) and 1.4 (Air Resources Management - Permits Required). According to the regulations, there is presently no threshold source size or emission rate below which fuel-burning equipment and hydrocarbon emission sources do not require permits. NIPER has not applied for air emissions permits for stationary engines or other air emission sources.

3. Lack of hazardous and toxic air pollutant emission inventory. NIPER has not prepared an air emission inventory for hazardous and toxic air pollutant emissions to demonstrate compliance with applicable standards as required by state regulations.

State of Oklahoma Toxic Air Contaminant Regulation 3.8 requires facilities that emit more than 1,200 lb/year of any known or suspected human carcinogen or high-toxicity substance (Category A) to the air to prepare an air emission inventory and demonstrate that ambient concentrations of toxic substances are within standards. Similar limitations apply to moderate-toxicity (Category B) and low-toxicity (Category C) substances. The de minimis (exemption) emission rate for each moderate-toxicity substance is 1.2 tons/year or 1.1 lb/hour, and that for each low-toxicity substance is 6 tons/year or 5.6 lb/hour.

NIPER uses a number of known and suspected carcinogens and highly toxic substances, including benzene, carbon tetrachloride, and chloroform, as well as a wide variety of moderate- and low-toxicity substances, primarily in Buildings 1 and 3. Smaller quantities of these substances are used in Buildings 5, 6, 7, 9, 13, and 15. Fugitive emissions of VOCs containing Category A, B, and C substances result from paint spraying operations in Building 14, chemical storage in Building 16, and petroleum fuel storage at the Main Tank Farm.

NIPER does not have a comprehensive toxic pollutant inventory that would demonstrate that emission levels are below the regulatory exemption.

3.2 Soil

This section describes the soils at the main NIPER facility and the Caves, and pollution sources and controls. Findings and observations related to soils are discussed in Sections 3.3.4 (Surface Water), 4.2.2 (Toxic and Chemical Materials), and 4.5.2 (Inactive Waste Sites and Releases).

3.2.1 Background Environmental Information

Soils at NIPER are residual sands, silts, and clays derived from the weathering of bedrock, fluvial deposition, and fill placed during construction of the facility. A portion of the NIPER site is located within the Caney River floodplain and soils there are typically poorly drained and have a higher organic content than the residual soils.

There are two principal soil associations at NIPER, the Dennis-Okemah-Parsons Association and the Osage-Verdigris Association (Polone, 1968). The Dennis-Okemah-Parsons Association is found on the southern portions of the NIPER site and covers about 60 percent of the site. The association consists of shallow to deep, fine- to medium-grained soils on nearly level to gently sloping lowlands, with low to moderately low permeabilities (Table 3-4). Within this association the Dennis soils make up 45 percent, the Okemah soils 20 percent, the Parsons soils 20 percent, and a combination of Bates, Eram, Dwight, Collinsville, and Talihina soils make up the remainder.

The Osage-Verdigris Association is found on the Caney River bottomlands located in the more northerly section of the NIPER facility and occupies about 40 percent of the site. This association consists of deep, fine-grained soils on nearly level floodplains, with very low permeabilities (Table 3-4). Within this association, the Osage soils make up about 50 percent and the Verdigris soils the remaining 50 percent (Polone, 1968).

The Caves area, located in Osage County approximately 3 miles northwest of NIPER, is situated within the Niotaze and Darnell soil complex. This uplands complex consists of moderately deep Niotaze soils that are generally poorly drained (Table 3-4). The surface is a stony loam, the subsoil a yellowish-brown silty clay, and the

TABLE 3-4

ENGINEERING PROPERTIES OF THE PRINCIPAL SOIL SERIES AT NIPER

Series	Depth to bedrock (feet)	Depth from Surface (inches)	Classification	Percentage passing sieve		Permeability of least permeable layer (inches per hour)	Available water capacity (inches per inch of soil)	Reaction (pH units)	Shrink-swell potential
			USDA Texture	No. 10 (2.0 mm)	No. 200 (0.074 mm)				
Darnell[a]	1-2	0-12	Fine stony loam Sandy loam	85-100	36-60	2.0	.12 .16	5.1-7.3	Low
Dennis[b]	3-6	0-10 10-15 15-52	Silt loam Clay loam Clay loam	100 100 100	75-90 75-95 75-95	— — 0.05-0.2	.14 .17 .17	5.6-7.8 4.5-6.0 5.6-6.5	Low Moderate Moderate
Niotaze[a]	2-3	0-32	Stony loam Silty clay	50-100 15-90	30-90 90-100	0.06-0.2	.10 .18	4.5-7.3	Low High
Okemah[b]	3-7	0-16 16-20 20-60	Silt loam Silty clay loam Silty clay	100 100 100	80-95 80-95 80-95	— — 0.05-0.2	.14 .14 .17	6.1-7.3 7.4-8.4 7.4-8.4	Low Moderate Moderate to high
Osage[b]	10 +	0-50	Clay	100	75-90	<0.05	.17	6.1-7.3	High
Parsons[b]	3-7	0-11 11-50	Silt loam Clay	100 100	70-90 85-95	— <0.05	.14 .17	5.1-6.0 6.1-8.4	Low High
Verdigris[b]	10 +	0-60	Clay loam or silt loam	100	75-95	0.2-0.8	.17	5.6-6.5	Low to moderate

Sources: Polone, 1968 and U.S. Department of Agriculture, 1975

[a]Soils at the Caves
[b]Soils at NIPER

underlying material a grayish shale. The Darnell soils are shallow, well-drained, and have a high permeability (Table 3-4). The surface is a brownish, stony, fine sandy loam and the underlying material is a sandstone (U.S. Department of Agriculture, 1975).

Although there are no specific data on the corrosivity of the soils at NIPER, corrosion is generally promoted by acidic soils, clayey texture, and fluctuating water table. These conditions are present at NIPER, particularly in the Verdigris and deeper Dennis soil types.

3.2.2 General Description of Pollution Sources and Controls

The main source for soil contamination at NIPER is an accidental surface spill during delivery, transfer, storage, or disposal of hydrocarbon fuels, oil, and solvents, as discussed in sections concerning surface water (Section 3.3.2), aboveground and underground storage tanks (Section 4.2.1.5), and inactive waste sites and releases (Section 4.5.1).

There are, however, some controls in place that help reduce the possibility of a release or reduce the extent of potential contamination. These include earthen berms and a clay liner at the Main Tank Farm (described in Section 4.2.1.5), earthen berms on all other surface storage tanks used for hydrocarbon fuel products (also described in Section 4.2.1.5), and concrete-lined and curbed containment for waste management areas (described in Section 4.1.1.4). A spill prevention, control, and countermeasure (SPCC) plan is in place that delineates specific spill control measures and remedial procedures to be used in the event of a release of a hazardous substance to the environment. NIPER also has several procedures for the handling of hazardous waste, as discussed in Section 4.1.

3.2.3 Environmental Monitoring Program

Soil samples have not been analyzed for hazardous constituents. There is no ongoing environmental monitoring program that includes soil as a study medium, nor is a future program planned.

3.2.4 Findings and Observations

The findings that involve soil contamination are the result of current and past releases, spills, or disposal practices and are therefore discussed within the context of other findings in Sections 3.3.4 (Surface Water), 4.2.2 (Toxic and Chemical Materials), and 4.5.2 (Inactive Waste Sites and Releases).

3.2.4.1 Category I

None

3.2.4.2 Category II

None

3.2.4.3 Category III

None

3.2.4.4 Category IV

None

3.3 Surface Water

This section deals with surface-water features in the Bartlesville area; surface-water pollution sources and controls at NIPER; historical liquid waste monitoring programs at NIPER; and findings and observations related to surface water. Drinking water sources and uses are also discussed.

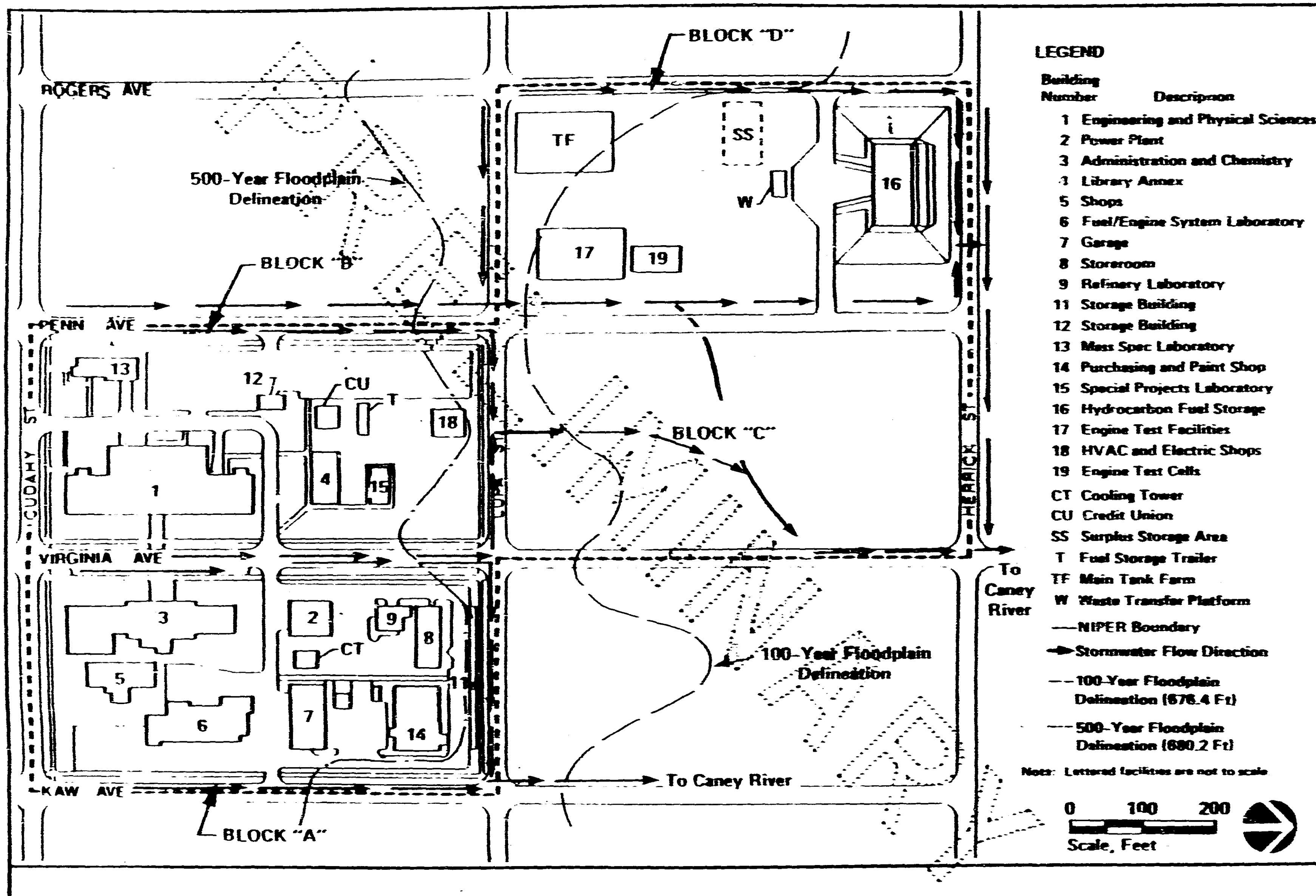
3.3.1 Background Environmental Information

3.3.1.1 Surface-Water Drainage

NIPER facilities are centered in a four-block complex in Bartlesville (Figure 2-2). A petroleum storage area known as the Caves and also part of NIPER is located 3 miles northwest of the main area (Figure 2-3). Both areas are located within the Caney River basin. The main facility is 1/2-mile southwest of the Caney River. The Caves are approximately 100 yards from an unnamed, intermittent tributary that flows into Butler Creek 1/4-mile downstream and subsequently into the Caney River 5 miles downstream (Figure 2-3). Butler Creek is dammed to form Lake Hudson 2 miles upstream of the intermittent tributary confluence.

Gaging stations on the Caney River nearest the main site are 23 miles upstream and 40 miles downstream. Flows at the upstream station averaged 347 cubic feet per second (ft^3/s) for a 35-year period of record preceding October 1985, the month for which the most recent data are available; extremes have been measured at no flow to 51,000 ft^3/s. Flows at the downstream station averaged 925 ft^3/s for a 32-year period of record preceding October 1982; extremes have been measured at no flow to 38,500 ft^3/s (Hauth et al., 1987). The flows of the Caney River are regulated by Hulah Dam, 23 miles upstream of NIPER, and Copan Dam, on the Little Caney River, 17 miles upstream of NIPER. The Caney River flows into the Verdigris River, 72 miles downstream of Bartlesville; the Verdigris River then flows into the Arkansas River 60 miles downstream (Figure 2-1).

The NIPER site has no permanent surface-water features. During rainfall events and snowmelt, drainage occurs by overland runoff from permeable and impervious surfaces across the site. Overland flow is then collected in gutters and unlined drainage ditches, as illustrated in Figure 3-3, which eventually discharge to the



STORMWATER FLOW PATTERNS IN GUTTERS AND DRAINAGE DITCHES AND FLOODPLAIN DELINEATIONS AT NIPER

FIGURE 3-3

Caney River (Figure 2-3). Stormwater also infiltrates into permeable surfaces and most likely is transported in the shallow groundwater to the Caney River, as discussed in Section 3.4.

At the Caves, there are also no permanent surface-water features. Drainage occurs by overland flow to the off-site intermittent tributary described previously.

3.3.1.2 Flood-Prone Areas

Based on the National Flood Insurance Program Flood Insurance Rate Map (HUD, 1980), the 100-year and 500-year floodplains of the Caney River with elevations of 676.4 feet and 680.2 feet, respectively, include portions of the NIPER site (Figure 3-3) (Ebert & Phinney Architects, Inc., 1986). Most of Blocks A and B are outside both floodplains while most of Blocks C and D are within both floodplains. A review of site documents and plans and interviews with site personnel indicate that there is some uncertainty regarding the elevations of some NIPER structures. As a result, it is not clear which facilities at NIPER may be prone to flooding. Table 3-5 presents reported elevations of some structures, as well as elevations measured during the Survey with the assistance of NIPER personnel, using a surveyor's transit. Of the structures listed, all are outside the 100-year floodplain but within the 500-year floodplain.

During a 500-year flood event in October 1986, floodwaters were measured at 22 inches above the floor in Buildings 16 and 17. Some of the tanks at the Main Tank Farm, which had been newly installed and were only partially filled with fuel, floated. They were filled with water to anchor them and, after the floodwaters receded, the ballast water and an unreported, although probably small, amount of fuel were pumped out onto the surrounding ground.

3.3.1.3 Water Supply, Uses, and Treatment

Water supply to NIPER is provided by the Bartlesville municipal system. Water is piped from Lake Hudson and Hulah Lake, described in Section 3.3.1.1, to a water treatment plant in Bartlesville. As a secondary source, water may also be taken from the Caney River downstream of NIPER in Bartlesville. After treatment by sedimentation and chlorination, the water is distributed to users through ductile or

TABLE 3-5

ELEVATIONS OF STRUCTURES AT NIPER (IN FEET ABOVE MEAN SEA LEVEL)

Location	Engineering Plans	Measured During Environmental Survey
Building 16 First Floor	680.0[a]	679.4
Building 17 First Floor	679.0[b]	-[c]
Building 19 First Floor	-	679.2
Waste Transfer Platform Floor	-	678.0
Main Tank Farm Top of Berm Bottom of Tank 9	678.0[b] -	676.6 677.5
Tank Area Adjacent to Building 19 Top of Berm	-	678.0

[a]Benham, Holloway, & Spragens, 1979
[b]Ebert & Phinney Architects, Inc., 1986
[c]No measurement available

cast-iron pipe. The current water treatment plant was constructed in about 1930; before that time, the city was served by another treatment facility. NIPER has reportedly been on the municipal system since the Institute's inception in 1918. Municipal water is used at NIPER at drinking fountains, at lavatory sinks and toilets, at laboratory sinks, and for the cooling tower and boiler systems and lawn irrigation. There are no other sources of water with the exception of bottled, deionized water that is used in laboratories.

3.3.2 General Description of Pollution Sources and Controls

Three types of wastewater are generated as a result of NIPER operations -- sanitary wastewater, industrial wastewater, and stormwater. The sources of these wastewaters and the treatment and disposal methods used are discussed in the following subsections.

3.3.2.1 Sources of Wastewater

Sanitary Wastewater

Sanitary wastewater is generated from 17 buildings at NIPER -- Buildings 1, 2, 3, 4, 5, 6, 7, 8, 9, 13, 14, 15, 16, 17, 18, 19, and the Credit Union (Figure 3-3). The major sources at all of these buildings are lavatory sinks and toilets and drinking water fountains. The building sanitary lines flow into one of three 8-inch municipal lines that run under Blocks A, B, and D, respectively (Figure 3-3). The 8-inch lines from Blocks A and B connect to a 15-inch municipal line that runs east under Lupa Street, while the 8-inch line under Block D connects to a 15-inch municipal line that runs under Herrick Street. The 15-inch lines eventually connect to the City of Bartlesville publicly-owned treatment works (POTW), as described in Section 3.3.2.2.

This same system also carries industrial wastewater from NIPER as described below.

Industrial Wastewater

The major sources of industrial wastewater at NIPER are laboratory drains in Buildings 1, 3, 6, 9, 13, and 15; shop drains in Building 5, 7, and 14; and cooling tower blowdown and once-per-year complete draining of the main cooling tower and the cooling tower associated with Building 17. A minor source is the small photographic laboratory in Building 3.

Most liquid hazardous wastes, which are generated in relatively small quantities in laboratory and research areas at NIPER, are generally managed pursuant to the Resource Conservation and Recovery Act (RCRA), as described in Section 4.1. They are segregated in separate containers and hauled off-site for disposal. However, small quantities of some chemicals, including acids and bases, may be discharged into laboratory and shop drains.

The main cooling tower and the cooling tower associated with Building 17 use potable water treated with algicides and non-chromate-containing corrosion inhibitors. Approximately 2,300 gallons of cooling water, as blowdown, are discharged from NIPER per day to the sanitary sewer system. Also once per year the cooling towers are emptied of their contents for maintenance. As a result, an additional unknown volume of cooling water is discharged to the sanitary sewer system. The concentrations of algicides and corrosion inhibitors contained within the blowdown and the yearly maintenance discharge are unknown.

The photographic laboratory annually discharges approximately 18 gallons of process solutions, containing 252 grams of silver, to the sanitary sewer. The effluent concentration of silver when released to the city sewer system has been estimated to be 0.011 milligram per liter (mg/L) (modified from Steele, 1988a).

Because the industrial and sanitary systems are combined in NIPER buildings, both types of wastewaters flow into the same municipal sewer collector lines, described previously. There are no separate records for the volumes of sanitary and industrial wastes discharged. However, it is estimated that a combined 16,800 gallons per day are discharged to the municipal system, including 2,300 gallons of cooling water (Steele, 1988a).

Stormwater

Stormwater is generated by rainfall and snowmelt runoff from paved areas (parking lots, roads), rooftops, and permeable areas such as lawns. Stormwater most likely incorporates oils, grease, and lead and other metals from parking lots, driveways, and roads as it flows across the site. In addition, it may incorporate petroleum from leaks and spills at such NIPER facilities as the Main Tank Farm, as described in Section 4.5.1, and from such potential sources as other aboveground tanks (Section 4.2.1.5), the Hydrocarbon Fuel Storage Building, and the Waste Transfer Platform. As an example, an oily sheen was observed on surface water in a drainage ditch that receives runoff from the Main Tank Farm area. Precipitation that falls within the berm surrounding the Main Tank Farm collects in a sump within the berm. Periodically, the sump is visually inspected for evidence of spills. If no fuel is observed, the sump contents are pumped outside of the berm and are allowed to percolate into the soils or to flow along the drainage ditches leading to the Caney River. However, nonvisible contaminants or contaminants adsorbed onto sediment and debris on the bottom of the sump may be discharged.

The routing of stormwater flows was discussed in Section 3.3.1.1. In addition, stormwater percolates through permeable surfaces into the shallow groundwater, which flows to the Caney River. Thus, any significant leaks and releases on the surface or from underground tanks may result in surface-water contamination as a result of groundwater transport.

3.3.2.2 Wastewater Treatment and Disposal

Sanitary and Industrial Wastewater

There is no pretreatment of the combined industrial and sanitary wastewater at NIPER before it is routed to the City of Bartlesville POTW. However, there is an oil-water separator at the Hydrocarbon Fuel Storage Building (Building 16), which is used in the event of a spill within this facility. All floor drains within Building 16 are connected to this separator. If an oil spill occurs, oil is routed through the separator to a 500-gallon sump (Section 4.2.1.5), while any separated water is discharged to the sanitary sewer system. With the exception of the October 1986 flood, in which the water level in Building 16 was 22 inches above the floor, the oil-water separator has never been used.

The POTW, located in Bartlesville, has a 7-million-gallon-per-day capacity. It uses a secondary activated sludge system, and the sludge is land-applied. The liquid effluent from the plant is discharged to the Caney River and is NPDES-permitted.

Before the POTW was constructed in the late 1930s, most wastewater throughout Bartlesville was discharged directly to the Caney River.

The City of Bartlesville is in the process of instituting its industrial pretreatment program. NIPER is presently classified as a significant user since, based on a qualitative analysis, it could potentially have a significant impact on the operation of the POTW. However, once the City's pretreatment program is fully developed and a more detailed analysis is made of the volume and quality of NIPER's effluent, NIPER may be removed from that category. During the Survey, NIPER had an industrial wastewater permit, effective for a term of 5 months from January 31, 1988, to June 30, 1988.

The City of Bartlesville has sampled the sanitary sewers downstream of NIPER at least twice; in April 1983, a grab sample was taken, while in January 1987, a 24-hour composite sample was taken. In both cases, the samples were analyzed for six metals for which discharge limits are provided in the Bartlesville Code (Section 20-204); none of the resulting values exceeded these limits. Cyanide was also analyzed in the 1983 sample and did not exceed the discharge limit provided in the Code. Samples of sanitary sewage discharging from NIPER have also been taken by NIPER personnel, as described in Section 3.3.3.

Stormwater

Stormwater flowing off the NIPER sites is not treated. The stormwater collection and disposal system is described in Section 3.3.1.1.

3.3.3 Environmental Monitoring Program

No environmental samples of surface-water runoff at NIPER are collected. However, sanitary sewage discharging from the facility has been sampled by NIPER personnel, in addition to those samples collected by the City as described in the previous section. The NIPER samples were taken as grab samples from the sewer manholes downstream of Blocks A and B in October 1978, February 1981, and July 1982. The sample from downstream of Block A also included some upstream, non-NIPER contributions. There were no written sampling protocols developed for these sampling efforts.

Samples were analyzed by an outside laboratory contractor for a variety of components including pH, solids, nutrients, chromium, and mercury (Williams Brothers Laboratories, 1978, 1981, 1982). Levels were generally within the range expected for municipal wastewater (Benefield and Randall, 1980). These results may not be indicative of present concentrations since research programs, facilities, and therefore discharge constituents have changed over the past 6 to 10 years.

3.3.4 Findings and Observations

3.3.4.1 Category I

None

3.3.4.2 Category II

None

3.3.4.3 Category III

1. Structures and facilities may be improperly constructed within the floodplain. Facilities and structures that store or are associated with the storage of hazardous materials at Block D at NIPER may be improperly constructed within the 500-year floodplain and, in the event of a low-probability flood, may result in contamination of the Caney River and its floodplain.

   In 10 Code of Federal Regulations (CFR) Part 1022, DOE requires that construction of DOE structures and facilities be, at a minimum, in accordance with the standards and criteria set by the National Flood Insurance Act (furthered by Executive Order 11988, Floodplain Management). The Federal Emergency Management Agency regulations in 44 CFR Part 9 (Floodplain Management and Protection of Wetlands), in turn, set forth the policies, procedures, and responsibilities for floodplain management. In these regulations, critical actions, defined as those actions that create or extend the useful life of structures and facilities which produce, use, or store highly volatile, flammable, explosive, toxic, or water-reactive materials, shall not be located in the 500-year floodplain if a practicable alternative exists outside the 500-year floodplain. However, mitigation measures may be undertaken including elevation of the lowest floor at or above the 500-year floodplain elevation or, in the case of nonresidential structures, floodproofing the structure below the 500-year floodplain elevation.

Building 16 (described in Section 4.2.1.4), the Waste Transfer Platform (described in Section 4.1.1.4), and the aboveground tanks at the Main Tank Farm and adjacent to Buildings 17 and 19 (described in Section 4.2.1.5) store flammable, toxic, and water-reactive materials. As a result, their construction would be considered a critical action as defined in 44 CFR Part 9. They are therefore to be located outside the Caney River 500-year floodplain or elevated above or floodproofed below the 500-year floodplain elevation of 680.2 feet, as delineated on the U.S. Department of Housing and Urban Development Flood Insurance Rate Map.

Based on review of building plans and elevation measurements made during the Survey, it appears that the lowest floor elevations of Building 16 and the Waste Transfer Platform and the bottom of some of the tanks in the Main Tank Farm and the tanks adjacent to Buildings 17 and 19 are below the 500-year floodplain elevation. In addition, the berm that surrounds the Main Tank Farm and the berms containing the tanks adjacent to Buildings 17 and 19 also appear to be below the 500-year floodplain elevation.

As a result, in the event of a low-probability flood such as a 500-year flood, the hazardous materials in Building 16, the Waste Transfer Platform, and the aboveground fuel tanks could be released into the surface waters of the Caney River. When floodwaters recede, there could also be the potential for residual hazardous materials to contaminate the soils of the floodplain and the groundwater underneath.

In October 1986, the Bartlesville area experienced a 500-year flood. Building 16 had 22 inches of water above the floor, and aboveground fuel storage tanks at the Main Tank Farm were floating. There were releases of unspecified but most likely small quantities of fuel when the ballast water, used to anchor the tanks, was released. However, no releases due directly to the flooding were reported.

3.3.4.4 Category IV

1. Lack of stormwater runoff quality characterization. The lack of characterization of stormwater runoff quality at NIPER precludes an assessment of the impacts of NIPER operations on surface water.

   Several areas at NIPER have the potential to affect surface-water quality, including the active petroleum product drips and weeps at the Main Tank Farm, identified in detail in Section 4.2.2.2, Finding 2, and some of the inactive waste sites identified in Section 4.5.2.3, Finding 1, such as the fuel-stained soil areas at the Main Tank Farm and the Surplus Storage Area. Although no permanent surface-water features exist at NIPER, stormwater runoff from these areas could incorporate contaminants and discharge them to the Caney River, 1/2-mile northeast of the site, via surface drainage ditches and shallow groundwater discharge. Although the Survey expects little surface-water contamination to result from normal NIPER operations, the degree to which contaminants may be entering the surface water has not been determined.

2. Lack of compliance with DOE floodplain environmental review procedures. NIPER structures and facilities constructed within the floodplain have not undergone DOE floodplain environmental review as delineated in 10 CFR Part 1022.

   In 10 CFR Part 1022, DOE has set forth policies and procedures for compliance with floodplain environmental review requirements. These include evaluation of potential effects of any DOE action taken in a floodplain, and identification, evaluation, and, if appropriate, implementation of alternative actions that may mitigate or avoid adverse floodplain impacts. Specific procedures set forth in this regulation consist of preparation of a floodplain assessment that contains a project description, an impacts assessment, and an alternatives evaluation, as well as early public review. The regulation became effective on March 7, 1979, and all structures at NIPER that are the subject of this finding were constructed after that date.

The environmental documentation addressing construction of the Main Tank Farm, Buildings 17 and 19, and the tanks adjacent to those buildings (DOE, 1986) does not comply with 10 CFR Part 1022 since the project description is incomplete, there are no floodplain impacts or alternatives assessments, and there was no early public review. Additionally, there was no environmental documentation performed for the Waste Transfer Platform.

3.4 Hydrogeology

This section discusses regional geologic conditions, aquifer characteristics, pollution sources and controls, environmental monitoring programs, and the effect that NIPER operations have on the groundwater.

3.4.1 Background Environmental Information

Most of the background environmental information in this section has been summarized from a publication of the Oklahoma Water Resources Board entitled Appraisal of the Water and Related Land Resources of Oklahoma (Oklahoma Water Resources Board, 1971).

3.4.1.1 Geology

NIPER is underlain by several stratigraphic units as depicted in Table 3-6. These units are part of the Prairie Plains Homocline, a gently eastward-sloping alluvial plain underlain by gently westward-dipping sedimentary Pennsylvanian rocks. The region is mainly rolling hills, with east-facing escarpments capped by resistant limestones and sandstones, and with interlaced valleys incising shales as a result of erosion from the Caney River and its tributaries. The rock formations in the Bartlesville area are of Middle Pennsylvanian age and belong to the Missouri subseries. West of the river are primarily sandstone and shale; east of the river the limestone predominates. Varied depositional environments near the NIPER site over the last 320 million years have produced a stratigraphic section with localized discontinuities such as formations that dramatically vary in thickness over short lateral distances.

The edge of the Osage hills is located approximately 1 mile west of the Caney River; the elevation varies from 640 to over 1,000 feet. Local relief in this area may be as much as 300 feet with a mature topography.

The regional drainage is dendritic, with a lattice-work pattern developed as a result of streams following local fractures and structurally controlled escarpments. Streams flow to the south-southeast.

TABLE 3-6

GENERALIZED STRATIGRAPHIC SECTION FOR THE PRAIRIE PLAINS HOMOCLINE OF WASHINGTON COUNTY

Age	Stratigraphic Unit	Lithologic Description	Thickness (feet)
Holocene	Alluvium	Lenses and cross-bedded gravel, sand, silt, and clay	0 - 30
Pleistocene	Terrace Deposits	Siliceous gravel, sand, and silt. Coarse to fine grained, some clay	0 - 100
Pennsylvanian	Chanute Formation	Creamy to red-brown, fine-grained sandstone; Thayer coal (1.5'); coarse-grained sandstone (0-60'); conglomerate (0-20')	13 - 150
	Dewey Formation	Blue-gray limestone, medium crystalline grading southward into sandy limestone and shale	0 - 60
	Nelly Bly Formation	Dark gray shale with four red-brown fine to medium-grained sandstone beds	80 - 550
	Stark Shale	Black fissile shale	3 - 10
	Canville Limestone	Dense siliceous limestone	.5 - 1.1
	Hogshooter Limestone	Light gray to dark gray and brown massive limestone	1 - 50
	Coffeyville Formation	Coal seams and black fissile shales, with red-brown, fine to medium-grained sandstone	175 - 475

Source: Oklahoma Water Resources Board, 1971

There are no major active faults in the Bartlesville area and seismic activity in the region is low. Although there are subsurface coal seams, they are very thin and of minor economic significance (Oklahoma Water Resources Board, 1971). Oil is the principal mineral commodity mined in the vicinity of NIPER; it has played an important role in the development of the region and still represents an important viable resource.

3.4.1.2 Groundwater Regime

Local groundwater occurs in the unconsolidated alluvium and in the sedimentary bedrock pores and fractures. Details are not known concerning site-specific quality, flow, rate of movement, gradient, lithology, and variation in levels other than what can be inferred from regional studies, since NIPER has not characterized the local groundwater regime. From local excavations it is known that shallow groundwater levels are seasonally variable since NIPER lies partially within the low-lying Caney River floodplain. The water table in the vicinity of NIPER varies from 8 to 10 feet below the surface in the spring to 15 to 17 feet in the fall. Recharge of the groundwater is from precipitation infiltration and, seasonally, from Caney River flow; regional discharge is to the Caney River. Additionally, the topography is the main controlling factor determining local groundwater flow characteristics. Therefore, in general, groundwater flow is expected to be toward the Caney River. However, during flood events, groundwater flow direction can reverse due to bank storage.

The shallow groundwater in the unconsolidated alluvium reportedly is used through residential wells in the rural area surrounding Bartlesville, for both potable and irrigation purposes (Steele, 1988b). The City of Bartlesville currently obtains all its water from surface-water sources, as described in Section 3.3.1.3. The fine-grained sandstone, limestone, and shale underlying the alluvium beneath NIPER contain no known aquifers, and wells placed in this material may be expected to have a low yield.

The regional groundwater quality in the alluvium is typically "hard" with median hardness values of 185 milligrams per liter (mg/L) and some values up to 540 mg/L. The median values of sulfate (26 mg/L), chloride (22 mg/L), nitrate (0.8 mg/L), and total dissolved solids (335 mg/L) indicate moderate quality and water of sodium or calcium bicarbonate type (Oklahoma Water Resources Board, 1971). Local wells would be expected to reflect these values.

3.4.2 General Description of Pollution Sources and Controls

Shallow groundwater is subject to potential contamination by present and past activities at NIPER.

Potential sources of shallow groundwater contamination associated with current activities at NIPER include leaks and spills from aboveground storage tanks, such as those at the Main Tank Farm (Section 4.2.1.5), and leaks from underground fuel tanks, including those west of Building 7 and in the courtyard east of Building 9 (Section 4.2.1.5). Several presently active and past leaks and spills were observed at the Main Tank Farm (Section 4.2) and the Surplus Storage Area (Section 4.5.1). In addition, an off-site potential source of contamination is the Caves, approximately 3 miles northwest of NIPER (Section 4.2).

Potential sources of groundwater contamination associated with past activities at NIPER include various small hydrocarbon spills, and the use of chromium as a corrosion inhibitor in the NIPER cooling tower (Section 4.5.1).

NIPER has an SPCC plan, which identifies earthen berms and compacted clay for spill containment of hydrocarbon fuels at the Main Tank Farm. However, the plan does not include leak testing or monitoring of underground tanks.

To reduce the possibility of groundwater contamination, NIPER has implemented a waste management program to remove hazardous wastes from the site (Section 4.1). The site also has numerous administrative controls on all chemicals that could present a hazard to the environment. If a release were to occur, the NIPER SPCC plan should help reduce the environmental impacts associated with a chemical release.

3.4.3 Environmental Monitoring Program

There is no groundwater monitoring program at NIPER, and no future monitoring is proposed. Currently there are no physicochemical or structural baseline data available on the NIPER site.

3.4.4 Findings and Observations

3.4.4.1 Category I

None

3.4.4.2 Category II

None

3.4.4.3 Category III

None

3.4.4.4 Category IV

1. Lack of groundwater characterization. The lack of characterization of the groundwater regime at NIPER precludes an assessment of NIPER's operational impact on groundwater resources.

   To date, no groundwater environmental monitoring program has been initiated at NIPER to assess groundwater quality and flow characteristics of the shallow saturated zone underlying the site. As a result, no baseline data are available, and therefore no reliable assessment of impacts to groundwater could be made in the event of release of hazardous material to the groundwater. Also, small continuous leaks from tanks and pipelines may go undetected. Lack of groundwater data could also hamper remedial action and possibly complicate recovery procedures.

There are several areas that could be contributing contaminants to the groundwater underlying the NIPER facility. Examples of these potential sources, which were identified by the Survey, are as follows:

- Nine underground storage tanks (USTs) containing various fuels and oils are positioned across the site. Currently no leak-testing is performed on these tanks. A leak in a tank may be undetected and cause degradation of the groundwater. This is discussed in more detail in Finding 2 of Section 4.2.2.3.

- Surface tanks at the Main Tank Farm do not have adequate spill and leak containment. These tanks are currently leaking and weeping fuel, which may impact the groundwater by infiltration (Section 4.2.1.5). This is discussed further in Finding 1 in Section 4.2.2.3.

- There are several potential inactive waste sites and releases thay may have resulted in groundwater contamination, as discussed in Finding 1 of Section 4.5.2.3.

4.0 NON-MEDIA-SPECIFIC FINDINGS AND OBSERVATIONS

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 section where appropriate and where information was available.

4.1 Waste Management

NIPER, in performing its research activities, uses and ultimately disposes of a wide range of substances, consisting of hazardous and nonhazardous materials. However, because of the inherent nature of the laboratory research activities performed, wastes are generated in small quantities relative to those generated at a typical non-research production facility. The proper handling and disposal of laboratory waste involve special procedures not typically utilized at some of the larger DOE production facilities. Laboratory activities vary from year to year as projects are discontinued, finished, or changed, or as new projects are undertaken, and consequently the wastes and the handling and disposal procedures associated with these changes also vary.

This section identifies and characterizes four major classifications of waste -- hazardous waste, mixed waste, radioactive waste, and nonhazardous waste. This section also discusses the handling and disposal of these wastes at NIPER.

4.1.1 General Description of Pollution Sources and Controls - Hazardous Waste

Hazardous waste management activities at NIPER include the generation, on-site handling, and off-site removal of hazardous waste. The handling of these wastes is currently regulated under Subtitle C of the Resource Conservation and Recovery Act (RCRA). Under RCRA, NIPER has properly identified itself as a small-quantity generator (SQG) of hazardous waste, since it generates between 100 and 1,000 kilograms of hazardous waste each month.

Hazardous waste is generated only at the main NIPER site; no hazardous waste is generated at the remote Caves facility.

The following subsections describe the types of hazardous waste generated at NIPER, the handling of the waste at its point of generation, its handling elsewhere on the site, and its off-site disposal.

4.1.1.1 Description of Wastes

NIPER generates and manages the following five categories of hazardous waste:

- Nonchlorinated solvent waste
- Chlorinated solvent waste
- Labpack chemicals
- Safety Kleen solvents
- Miscellaneous waste discharged to drains.

Each of these waste types is generated under different conditions and is handled differently after it is generated. The wastes are generated from the use of various hazardous chemicals in a variety of research applications. Several hundred types of solvents and other chemicals are used at NIPER, and the qualitative inventory of chemicals varies as new research projects are undertaken and old ones are discontinued. Therefore, the makeup of the hazardous waste generated is constantly changing both qualitatively and quantitatively. Each of the five hazardous waste categories is discussed below.

Nonchlorinated Solvent Waste

Nonchlorinated solvent waste is the primary hazardous waste stream at NIPER. Virtually all laboratories handling chemicals generate some of this waste. The generation rate at any given generation point varies substantially, however, depending on the research being performed. The rates may vary from zero to several gallons of waste solvent per month. Laboratories generating these wastes include those in Buildings 1, 3, 6, 9, 13, and 15 (Figure 2-2).

The solvents most prevalent in nonchlorinated solvent waste are propyl alcohol, toluene, pentane, and diesel fuel. Lesser amounts of other nonchlorinated solvents, fuels, crude oil, and some chlorinated solvents also are present in this waste stream (NIPER, NDa). Up until a few months before the Survey, the chlorinated solvent stream was not routinely segregated from the nonchlorinated solvent stream. In addition, potentially hundreds of other chemicals and reagents could be present in this waste stream in trace quantities, including many that are RCRA-listed (i.e., listed in 40 CFR Part 261, Appendix VIII) or that are extraction procedure (EP) toxic substances. The degree to which unidentified chlorinated solvents and trace amounts of other hazardous substances contribute to this waste stream has not been determined at NIPER. However, their contribution is important, as evidenced by the return to NIPER in February 1988 of eight drums of solvent waste identified by NIPER as nonchlorinated but subsequently identified by the disposer as containing between 5 and 13 percent organic chloride (weight percent).

Based on solvent distribution to all laboratories, information which is generated from a computerized inventory of supplies in Building 16, NIPER has determined the composition of its solvent waste (Table 4-1). Although this composition includes both nonchlorinated and chlorinated solvent waste, it does not include any of the specialty chemicals or reagents originating from the storeroom in Building 8, and does not account for the portion of chemicals which may be expended during use and not disposed of. Based on the high chloride content of the eight returned drums discussed above, the actual composition of the designated nonchlorinated solvent waste stream may deviate substantially from that reported in the NIPER determination. Since the return of the eight drums, NIPER is attempting to correct the problem of misidentifying wastes through improved segregation of the chlorinated solvent waste stream, but no on-site analysis or other measures have been performed to determine the effectiveness of the segregation.

Some of the research activities associated with the generation of nonchlorinated solvent waste include cleaning laboratory equipment, cleaning rock core samples, and performing solvent extractions.

According to disposal records of hazardous waste maintained by the site, summarized in Table 4-2, the average combined monthly generation rate of nonchlorinated and chlorinated solvent waste at NIPER was approximately 196

TABLE 4-1

REPORTED CHEMICAL COMPOSITION OF MIXED CHLORINATED AND NONCHLORINATED SOLVENT WASTE AT NIPER

Chemical	Average Percent Concentration[a]	Percent Range[a]
Propyl Alcohol[b]	15	0-50
Toluene[b]	15	0-30
Pentane[b]	14	0-28
Acetone[b]	14	0-28
Diesel Fuel[b]	14	0-28
Benzene[b]	4	0-8
Petroleum Ether[b]	4	0-8
Hexane[b]	4	0-8
Methyl Alcohol[b]	3	0-6
Methylene Chloride[c]	3	0-6
Chloroform[c]	1	0-2
Acetonitrile[b]	1	0-2
Ether[b]	1	0-2
Tetrahydrofuran[b]	1	0-2
Heptane[b]	1	0-2
Crude Oil[b]	1	0-2
Cyclohexane[b]	0.5	0-1
Cyclopentane[b]	0.5	0-1
Stoddard Solvent[b]	0.5	0-1
Xylene[b]	0.5	0-1
Butyl Alcohol[b]	0.5	0-1
Isoamyl Alcohol[b]	0.5	0-1
Hexadecane[b]	0.5	0-1
Isooctane[b]	0.5	0-1
Acetic Anhydride[b]	Trace	
Aniline[b]	Trace	
Carbon Disulfide[b]	Trace	
Dioxane[b]	Trace	
Dimethyl Sulfoxide[b]	Trace	
Dimethylformamide[b]	Trace	
Decane[b]	Trace	
Ethylene Glycol[b]	Trace	
Ethyl Acetate[b]	Trace	
Glycerine[b]	Trace	
Methyl Ethyl Ketone[b]	Trace	
Nonane[b]	Trace	
Pyridine[b]	Trace	
Used Lube Oil[b]	Trace	

Source: NIPER, NDa

[a] Percent of constituent in combined chlorinated and nonchlorinated solvent waste at NIPER.
[b] Nonchlorinated solvent
[c] Chlorinated solvent

TABLE 4-2

HAZARDOUS WASTE DISPOSED OF OFF-SITE BY NIPER, NOVEMBER 1986 THROUGH FEBRUARY 1988

Date	Quantity (gallons)	Type (EPA Waste I.D. Number)[a,b]	Disposer
Feb. 17, 1988	10	F002	Safety Kleen
Jan. 19, 1988	20	D001	Safety Kleen
Jan. 18, 1988	1000	D001, F002	HRI[c]
Jan. 5, 1988	18	D001	Safety Kleen
Nov. 24, 1987	20	D001	Safety Kleen
	10	F002	Safety Kleen
Oct. 29, 1987	18	D001	Safety Kleen
Sept. 30, 1987	20	D001	Safety Kleen
Sept. 1, 1987	18	D001	Safety Kleen
Aug. 4, 1987	48	D001	Safety Kleen
July 27, 1987	1,250	D001, F002	HRI[c]
July 7, 1987	18	D001	Safety Kleen
June 11, 1987	58	D001	Safety Kleen
	20	F002	Safety Kleen
May 12, 1987	18	D001	Safety Kleen
April 23, 1987	18	D001	Safety Kleen
April 16, 1987	24	D001	Safety Kleen
March 19, 1987	15	D001	Safety Kleen
March 9, 1987	1,100	D001, F002	HRI[c]
Feb. 25, 1987	15	D001	Safety Kleen
Feb. 17, 1987	22	D001	Safety Kleen
Jan. 21, 1987	18	D001	Safety Kleen
Dec. 30, 1986	18	D001	Safety Kleen
Dec. 23, 1986	34	D001	Safety Kleen
Nov. 26, 1986	30	D001	Safety Kleen

Source: NIPER, NDb

[a] F002 - chlorinated organic solvent waste
[b] D001 - ignitable waste
[c] HRI - Hydrocarbon Recyclers, Incorporated

gallons between November 1986 and February 1988 (NIPER, NDb). Solvent waste managed on-site as nonchlorinated is disposed of as chlorinated solvent waste since a small concentration of organic chloride is present in the waste. However, the actual month-by-month generation rate is not measured by NIPER.

Chlorinated Solvent Waste

Chlorinated solvent waste is generated in many of the research laboratories at NIPER. The laboratories and research activities that result in the generation of these wastes are the same as those generating the nonchlorinated solvent waste. However, the laboratories typically have on hand relatively smaller quantities of chlorinated solvents than nonchlorinated solvents, usually in bottles from 500 milliliters to 4 liters in size, from which chlorinated solvent waste may eventually be generated. Because the cost of disposing of this waste is higher than that of nonchlorinated solvents, the use of chlorinated solvents is discouraged.

According to the NIPER waste composition determination presented in Table 4-1, which is based on solvent distribution to all laboratories as described above, the two primary chlorinated solvents in this waste are chloroform and methylene chloride (also called dichloromethane). A substantial but unmeasured fraction of nonchlorinated solvents, crude oil, and fuels is also mixed in this waste stream. As stated in the previous subsection, the NIPER waste composition determination is believed to provide only a gross approximation of the composition of NIPER solvent waste, and is likely to be qualitatively inaccurate. As a result, the Survey team also observed other chlorinated solvents stored in the laboratories that were not on the waste inventory. These substances included 1,2-dichloroethane, 1,1,1-trichloroethane, trichloroethylene, carbon tetrachloride, tetrachloroethylene, and 1,4-dichlorobenzene, and they are likely to be present in the waste stream. No accounting has been made of any RCRA-listed or EP-toxic substances that may be present in the laboratories and also may be present in the waste stream.

Up until a few months before the Survey, the chlorinated solvent waste was not routinely segregated from the nonchlorinated solvent waste. No records are available for this waste stream since historically it has not been segregated from the nonchlorinated solvent waste stream. Therefore, its average and actual generation rates are not known. However, its generation rate is known to be substantially less than that of the nonchlorinated solvent waste stream based on the solvent usage inventory summarized in Table 4-1.

Labpack Waste

Labpack waste includes contaminated or out-of-date chemicals or other chemicals that for some reason are not suitable for research and have been identified for disposal. These chemicals wastes include reactive waste, corrosive waste, and RCRA-listed wastes. Spilled mercury is included in this category of waste. The generation rate, while unknown, is small relative to the other waste streams on-site based on the current inventory of such wastes. This labpack waste inventory, presented in Table 4-3, is stored in Building 11 and is maintained by NIPER.

Safety Kleen Solvents

NIPER also has several parts washers located in various shops and laboratories. The parts washers each contain approximately 5 gallons of a special blend of nonchlorinated solvents. The units are self-contained, with the solvent recirculating until it is unusable. The maintenance of these units is performed entirely by the off-site vendor who owns them, Safety Kleen, Incorporated.

Miscellaneous Waste Discharged to Drains

Most research at NIPER is performed in solvent media, and the resulting waste solvents are saved and disposed of off-site. However, a few activities use acids and bases in aqueous media, and these waste solutions are disposed of down the laboratory drains. The NIPER Guide to Laboratory Safety requires that aqueous solutions be diluted before being disposed of down the drain (NIPER, NDd). Any heavy metal salts which may have been added to these solutions are also disposed of down drains. The use of heavy metal reagents is not controlled at NIPER so as to track their eventual disposal, so no information is available as to types or quantities of such substances disposed of.

TABLE 4-3

REPORTED CURRENT INVENTORY OF CHEMICAL WASTE STORED IN BUILDING 11

Quantity	Chemical	Quantity	Chemical
1 gallon	DDT	1 gallon	2,4-Dichlorophenoxyacetic Acid
2 pounds	Potassium Bromide	1 gallon	Ethylenediamine
3 pounds	Potassium Bromate	1 gallon	3,3-Iminodipropionitrile
0.25 pound	Sodium Dichromate	0.5 gallon	2,4-Lutidine
0.25 pound	Potassium Nitrite	0.25 gallon	Thiodipropionitrile
1 pound	Potassium Chromate	120 grams	Paraformaldehyde
1 pound	Sodium Sulfide	10 grams	Silver Nitrate
3 pounds	Potassium Dichromate	400 grams	Naphthalene
0.25 pound	Phenyl-a-Naphthylamine	1 pound	Potassium Permanganate
0.25 pound	Benzidine Dihydrochloride	50 grams	Dibenzyl Paraminophenol
0.5 gallon	Dimethyl Sulfate	25 grams	2-Methyl 1,4-Naphthoquinone
0.125 pound	Rubidium Chloride	25 grams	Diamylhydroquinone
2 pounds	Cuprous Cyanide	25 grams	3,5-Dinitrobenzoyl Chloride
0.5 pound	Naphthylamine	25 grams	Phenyl 2-Thienyl Ketone
50 grams	Benzidine	25 grams	Dithioxamide
40 grams	p-Nitrophenol	5 grams	Diphenyl Benzidine
0.0625 pound	Nitrosobetanaphthol	10 grams	Furil Dioxime
25 grams	1-Nitroso-2-Naphthol	1 pound	Trioxymethylene
1 gram	p-methoxy Azobenzene	2 pounds	Sulfamic Acid
100 grams	Silver Cyanide	1 pound	Pyridine Hydrochloride
2 pounds	Potassium Iodide	350 pounds	Isocyanate Solution
1 pound	Sodium Iodide	500 grams	Benzenesulfonic Acid
1 gallon	1-Dodecanethiol		

Source: NIPER, NDc

Unbroken chemical bottles and jars are supposed to be empty and rinsed when disposed of, but no specific guidance has been given to researchers regarding rinsing of chemical bottles and other glassware prior to disposal. Disposal of the rinsate down the drain may therefore be occurring.

A small photographic laboratory operates in the basement of Building 3. The laboratory uses chemicals containing silver that are disposed of down the drain. A calculation performed by NIPER shows the average contribution of silver to the total wastewater discharge at NIPER to be 10.5 grams/day (g/day) of silver with an average concentration of 0.011 mg/L in the total NIPER wastewater discharge (modified from Steele, 1988a). This issue is further discussed in Section 3.3.2.1.

The disposal of laboratory-generated hazardous wastes down sewer drains is permitted under RCRA in certain circumstances as stated in 40 CFR 261.3(a)(iv)(E).

4.1.1.2 Waste Management at Waste Generation Points

Nearly all hazardous wastes at NIPER are generated in laboratories by individual researchers. The researchers are responsible for their waste until it is removed from the laboratory.

The solvent waste generated in laboratory operations is handled by placing it in various containers at satellite accumulation areas in or near the laboratory where it is generated. Red metal safety cans between 1 and 5 gallons in capacity are provided to the laboratories by the Safety staff for waste accumulation. However, some laboratories use the 4-liter glass chemical product jugs in which solvents are supplied to accumulate waste.

Most laboratories that generate essentially no chlorinated solvent waste either have a single safety can of their own or share one with other laboratories. These containers receive the generated solvent waste. Each of the laboratories believed to generate a relatively large quantity of chlorinated solvent waste is provided with a second red safety can, usually of 1-gallon size, designated specifically for chlorinated solvents.

The red safety cans are not marked as waste except when designated for the accumulation of chlorinated solvent waste. They are also used for the storage of product solvents in some laboratories and shops. The glass product jugs may or may not be marked as hazardous waste containers. When marked, they usually have "Waste" handwritten across the product label.

The containers typically are stored on the floor or in a hood. In some laboratories the containers are left open, allowing the solvent waste to evaporate. Secondary containment devices such as drip pans typically are not used.

When the waste container is full, the laboratory calls the Safety staff to pick it up and empty it. Containers at various laboratories are picked up by the Safety staff at varying intervals of 4 days to 18 months, depending on the individual laboratory's waste generation rate. The laboratories typically receive their emptied waste containers the same day the waste is picked up. Procedures for pickup are detailed in Section 4.1.1.3.

Laboratory personnel also identify various chemicals that are no longer wanted and may be disposed of. Once such a chemical has been identified, the Safety staff is contacted to remove it from the laboratory. In practice, however, some laboratories store a stock of contaminated, out-of-date, or unneeded chemicals. In actuality, these chemicals are likely to be hazardous wastes; however, from a regulatory standpoint they may not necessarily be classified as hazardous waste until they have actually been identified as such. The Survey team was not able to discern the quantity of such chemicals in the laboratories. According to a NIPER inventory, in the last 4 years, since the last off-site shipment of these wastes, approximately 6 gallons and 373 pounds of this waste have been removed from the laboratories and stored on-site in an accumulation area in Building 11 (Table 4-3) (NIPER, NDc). Of the above-mentioned waste, 350 pounds is waste isocyanate solution. This subject is further discussed in Section 4.2.

The laboratories also generate hazardous wastes that may be poured down laboratory sink drains as discussed in Section 4.1.1.1. These wastes include those materials that are readily biodegradable or that can be chemically neutralized. In the case of chemically neutralizable wastes (i.e., acidic and basic solutions), the neutralization must be performed before the waste is disposed of. The NIPER policy concerning wastes disposed of down drains states that prior approval from the Safety staff be obtained before any waste is poured down the drain (Steele, 1987a). The Survey team did not actually observe the handling of such wastes; however, all laboratory personnel interviewed appeared to be cognizant of the policy.

NIPER has developed several brief documents describing the proper handling of hazardous wastes. Four documents were made available to the Survey team and are listed in Table 4-4. The table also identifies the responsibilities of both the generators of hazardous waste in the laboratories and those of the Safety staff. The Safety staff handles the waste once it has been removed from the laboratories.

4.1.1.3 Waste Management by the Safety Staff

NIPER has a two-person Safety staff which is responsible for management of hazardous waste once it is removed from the laboratories. To fulfill this responsibility, staff members perform several activities to control the disposition of all hazardous waste at NIPER.

Except for hazardous waste that is disposed of down drains and waste that is stored in the laboratories indefinitely, all hazardous waste eventually is removed from its generation point by the Safety staff. The Safety staff is contacted by various laboratories needing waste to be removed and, twice each week, Safety personnel collect the waste containers from these laboratories.

Waste solvent containers are either hand-carried or placed on a cart and then taken to a pickup truck used to transport the waste to the Waste Transfer Platform immediately south of Building 16. The Waste Transfer Platform is being used as a 180-day hazardous waste accumulation area. The pickup truck is equipped with a special rack used to immobilize the containers while they are transported. During transport, both nonchlorinated and chlorinated solvents are kept in the red metal safety cans or glass product jugs in which they were accumulated.

Once the safety cans are received at the Waste Transfer Platform, the contents are immediately pumped into 55-gallon drums, which are stored at the facility. Once emptied, the safety cans are immediately returned to their respective laboratories. Other containers not needed for waste accumulation in the laboratories, such as

TABLE 4-4

DOCUMENTED GUIDANCE FOR HAZARDOUS WASTE HANDLING AT NIPER

Document Description	Relevant Issues Addressed
Memorandum from Safety staff to all employees; one page; dated December 8, 1987	• Chemicals are not to be poured down drains.
Memorandum from Safety staff to all employees; one page dated January 22, 1988	• Chlorinated solvent waste is to be segregated. • Hazardous waste is not to be put in general trash.
A Guide to Laboratory Safety; 12 pages; undated	• Chlorinated solvent waste is to be segregated and properly contained. • Nonchlorinated solvent waste is to be segregated and properly contained. • Mercury is to be segregated, and properly contained. • Other organic waste is to be segregated and properly contained. • Certain chemicals may be diluted or neutralized and poured down drains. • Unknown chemicals are to be considered hazardous. • Hazardous waste containers are to be properly marked.
NIPER Waste Management and Disposal; policy statement; one page; undated	• Solvent waste is to be segregated as chlorinated and nonchlorinated waste. • Solvent waste is to be collected in safety cans. • Laboratories are to notify the Safety staff to remove and empty the waste cans. • The Safety staff is to recontainerize solvent waste into 55-gallon drums at the Waste Transfer Platform. • Drums of solvent waste are to be accumulated only at the Waste Transfer Platform and for no longer than 90 days. • Solvent waste is to be transported and disposed of only by a contractor designated on the Oklahoma Disposal Plan. • Laboratory chemical waste is to be disposed of in accordance with the regulations of the state where it is disposed of. • Disposal is to be performed in accordance with the Disposal Plan on file with the Safety staff.

Source: NIPER, NDd; NIPER, NDe; Steele, 1987a; Steele, 1987b; Steele, 1988c product jugs or sample bottles, may be emptied immediately or may remain at the platform and may be emptied when it is more convenient. Containers are segregated into three categories -- chlorinated solvent waste, nonchlorinated solvent waste, and nonhazardous organic waste (nonhazardous waste is further discussed in Section 4.1.4) and their contents are pumped into a corresponding drum. At the platform, the waste is accumulated in drums until it is shipped off-site. Hazardous waste solvent shipments occur at a frequency of two to four each year (not including Safety Kleen solvent shipments).

The pickup truck transporting solvent waste to the platform travels less than one-half block on Penn Avenue. DOE owns the property on the east side of the road along the entire route the truck travels to get to the Waste Transfer Platform, but the road it travels on is an unrestricted public road. NIPER does not possess a hazardous waste transporter permit from the EPA. NIPER has informally approached the Waste Management Service of the Oklahoma Department of Health, which manages the RCRA program in Oklahoma, on this issue and was advised that the issue was not one of concern.

For hazardous wastes that are to be labpacked, the Safety staff either hand-carries them or transports them on the cart to a room in Building 11, which also is being used as a 180-day hazardous waste accumulation area. At Building 11, labpacked wastes are stored in their original containers for eventual off-site disposal. The Safety staff maintains a current inventory of the wastes being stored in Building 11. The inventory record at the time of the Survey is presented in Table 4-2.

The Safety staff at NIPER also assumes the responsibility of spill control for mercury. The laboratories at NIPER are equipped with mercury cleanup kits for small spills; however, large spills are cleaned up with a mercury vacuum unit, which is stored in the basement of Building 3. The unit has a waste receptacle approximately 1 liter in size. At the time of the Survey, the receptacle was approximately half-filled with mercury and mercury-contaminated debris. The receptacle normally is emptied into a plastic bottle after every use, and the bottle is transported to and stored at the waste accumulation area at Building 11.

The Safety staff is also responsible for all recordkeeping associated with the management and disposal of hazardous wastes. In connection with this responsibility, the Safety staff maintains several files, including the following :

- records on solvent usage of each laboratory, based on monthly solvent requisition reports
- records of correspondence with regulators
- records of off-site disposal and destruction
- records of correspondence with disposal contractors
- on-site waste inventories
- records of NIPER policy decisions
- records of guidance issued to the staff.

Another responsibility of the Safety staff is to provide guidance and training to researchers and other personnel in several safety and environmental areas, including the handling of hazardous waste. In this area, the Safety staff periodically issues memorandums and is constantly on call to meet with other staff to provide information on proper procedures for waste identification, segregation, and handling and to resolve special issues on a case-by-case basis.

4.1.1.4 Waste Management Facilities

Hazardous waste at NIPER is managed in two on-site facilities -- the Waste Transfer Platform and Building 11. The Waste Transfer Platform is an open-air facility. It is approximately 12 feet by 18 feet and is elevated on steel approximately 5 feet above ground level. The platform is constructed of a steel grate and stairway and a metal roof. Underneath the facility is a concrete pad with an uninterrupted concrete curb. The platform has two small lockers containing respirators and protective clothing. Spill control and pumping equipment is located adjacent to the lockers. The Survey observed that the facility was not equipped with firefighting equipment, an emergency communications device, or emergency action information.

The 180-day accumulation area in Building 11 is heated, air conditioned, and lighted, and has a concrete floor. Building 11 is a long wooden shed covered with metal siding set atop a concrete pad. The building is divided into several rooms in a single row, each separated by interior wooden partitions. Each of the rooms has an external door. The room being used as an accumulation area is normally kept locked and is approximately 8 feet by 15 feet.

At the time of the Survey, seven large cardboard boxes in the room were being used to store numerous glass and plastic containers of various hazardous waste chemicals. In addition, several metal cans containing 350 pounds of waste isocyanate solution had been labpacked into drums in the room. These wastes had been accumulating in Building 11 since the last shipment of labpacked hazardous waste from NIPER, sometime before 1986. The room also contained vermiculite (for labpacking and spill control) and empty drums. The room is also used to store a steel shelving unit, a supply of paper, copper piping, and three metal boxes containing nonwaste reactive chemicals.

4.1.1.5 Off-Site Disposal

NIPER is currently disposing of its nonchlorinated solvent waste stream with Hydrocarbon Recyclers, Incorporated (HRI), which operates a RCRA-permitted storage and treatment facility in Tulsa, Oklahoma, approximately 40 miles south of NIPER. The solvent waste from NIPER is analyzed by HRI for chloride content and is diluted with fuels and other organic wastes so as to have a chloride content low enough to allow its incineration as cement kiln fuel. After adequate blending, the waste is shipped to a RCRA-approved cement kiln approximately 80 miles north of NIPER in Fredonia, Kansas, where it is burned. The transporter removing the waste from NIPER is U.S. Pollution Control, Incorporated, a RCRA-permitted hazardous waste transporter and a subsidiary of HRI.

In the past, NIPER has also used Ashland Oil Company as a transporter and disposer for this waste stream. Ashland also operates a RCRA-permitted storage and treatment facility in Tulsa and eventually burns the waste as fuel.

To reduce potential liability from the improper disposal of its solvent waste, the NIPER Safety staff has visited the Ashland facility, the HRI facility, and the Fredonia, Kansas, facility to observe their handling of hazardous waste.

Specifications associated with the last several shipments of the NIPER solvent waste stream are presented in Table 4-2. The NIPER Safety staff reportedly prepares each of these shipments for removal from the site by labeling and containerizing the waste and filling out the associated hazardous waste manifests.

The last shipment of nonchlorinated solvent hazardous waste from NIPER included 8 drums determined by HRI to contain between 5 and 13 percent (by weight) of organic chloride. These drums were subsequently returned to NIPER only a few days before the Survey, not because of regulatory concerns but because of the increased disposal cost associated with the excessive chloride content. Because of the chloride component typically present in the nonchlorinated solvent waste stream, NIPER manifests all such waste as nonspecific-source spent halogenated solvent (EPA waste code F002) as well as characteristic ignitable waste (EPA waste code D001). At the time of the Survey, the eight returned drums were being stored on the Waste Transfer Platform.

At the time of the Survey, NIPER had not yet shipped any of its segregated chlorinated solvent waste. The segregation program was gradually initiated only in the last few months before the Survey, and NIPER had not yet accumulated enough chlorinated solvent waste for its first shipment. NIPER anticipated that HRI would be used for disposal of this waste, and that on-site procedures similar to those used for nonchlorinated solvent waste would be used for labeling, containerizing, and manifesting.

Most of the hazardous waste shipments from NIPER consist of Safety Kleen degreasing solvents. However, each of these shipments is relatively small, usually in the range of 5 to 20 gallons. In connection with these shipments, Safety Kleen performs the labeling, containerizing, and manifesting usually performed by the Safety staff. Specifications associated with the shipments of Safety Kleen waste are presented in Table 4-2. The waste is transported to a RCRA-permitted Safety Kleen treatment facility in Tulsa where the waste is reclaimed.

Other wastes are currently being stored on-site at NIPER and have been stored for several months or years. These wastes include a variety of chemicals including mercury. The last shipment of waste that was labpacked and disposed of off-site occurred in 1982. This shipment was transported and disposed of in a secured landfill by Resource Triangle Industries of Greenbrier, Tennessee. The waste chemicals for labpacks currently stored at NIPER have been accumulating for an unspecified period between 1984 and 1988 and were expected to be disposed of in the spring of 1988. The NIPER Safety staff has not yet specified a transporter and disposer for this shipment.

The waste mercury and mercury-contaminated debris being accumulated on-site in the vacuum and in other small containers is expected to be included in the upcoming labpacked shipment. The last time waste mercury was removed from the site was in 1984, when 180 pounds of waste mercury was sold for recycling to the U.S. General Services Administration at Tinker Air Force Base near Oklahoma City.

Waste asbestos also has been generated at NIPER. This waste is generated in various laboratories at infrequent intervals and includes asbestos-containing tapes, gloves, bottles, and other laboratory containers. The generation, handling, and disposal of asbestos at NIPER are further discussed in Section 4.2.1.2.

4.1.2 General Description of Pollution Sources and Controls - Mixed Waste

Mixed radioactive and hazardous waste is not currently generated, stored, treated, or disposed of at NIPER.

4.1.3 General Description of Pollution Sources and Controls - Radioactive Waste

Radioactive waste is not currently generated, stored, treated, or disposed of at NIPER. Radioactive waste generated at NIPER prior to 1981 as a result of research in Building 13 is discussed in Section 4.3.

Microcurie quantities of product tritium are currently being stored in a vault in Room 211 of Building 1 for use in a scheduled future research effort. However, the tritium was not in use before or at the time of the Survey, and no radioactive waste had been generated in association with it.

Procedures for the handling of radioactive wastes have been established and documented in the NIPER Radiation Safety Manual (Steele, ND).

4.1.4 General Description of Pollution Sources and Controls - Nonhazardous Waste

Nonhazardous waste is generated only at the main NIPER site; none is generated at the remote Caves facility.

The nonhazardous waste generated at NIPER can be classified into the following two major categories: miscellaneous nonhazardous waste and waste petroleum products (oil and fuel). Each of these waste streams is generated and handled independently at NIPER and is discussed below.

NIPER also generates sanitary and industrial wastewaters. These waste streams are discussed in Section 3.3.2.

4.1.4.1 <u>Miscellaneous Nonhazardous Waste</u>

Miscellaneous nonhazardous waste is generated from a variety of different activities in nearly every building at NIPER. The types and quantities of this waste are not typically identified or measured at NIPER, and few records are maintained of past generation, handling, or disposal practices. The waste generation and disposal information is based for the most part on observations of NIPER activities during the Survey. Nonhazardous waste generated by the NIPER administrative offices, laboratories, and shops, along with the nonhazardous trash handling and disposal practices is discussed below.

Administrative Offices

Administrative offices at NIPER generate paper and cardboard waste. In 1984, NIPER estimated that it generated 200 to 300 pounds of waste paper and cardboard from all sources in a typical business day (Snow, 1984). This waste is generated primarily in Buildings 1 and 3. A small snack bar in Building 3 also generates a small quantity of food wastes.

Laboratories

The laboratories generate several types of trash, including paper, packing materials, empty chemical bottles and jars, broken glass, rock samples, and residues from an autoclave. These laboratories are located in Buildings 1, 3, 6, 9, 13, and 15.

Broken glass is accumulated in special cardboard receptacles, segregated from the rest of the waste stream. Unbroken chemical bottles and jars are supposed to be empty and rinsed when disposed of, but no specific guidance has been given to researchers regarding rinsing of chemical bottles and other glassware prior to disposal. All rock samples are generally saved, but occasionally a core sample may break or be otherwise defective and will be disposed of. The bottles, rock samples, paper, and packing materials are accumulated together in each laboratory's trash receptacles.

A breadbox-sized autoclave located in Room 209 of Building 1 is used to destroy nonhazardous biological waste associated with a research effort using nonpathogenic microbes that are injected down oil wells to increase oil recovery.

Shops

The various shops at NIPER also produce a wide variety of different nonhazardous wastes. Building 7 is used for automobile and engine maintenance. Wastes including used automotive parts and oily rags are generated at this location. The Yard Maintenance Shed adjacent to Building 7 and the heating, ventilation, and air conditioning (HVAC) shop in Building 18 generate small mechanical parts as waste. The electrical, metal, and carpentry shops located in Building 5 generate used electrical parts, scrap wood and metal, sawdust, and metal turnings.

The Paint Shop in Building 14 generates dried paint sludges, paint cans, pails, brushes, rollers, and used paint filters. Nearly all paint used contains a titanium-based pigment. However, small amounts (i.e., approximately 2 gallons or less) of other paints, which may contain other potentially hazardous pigments (such as lead and chromates), also are used several times each year. Also in the Paint Shop, a small metal brush cleaner box containing approximately 2 gallons of diesel fuel generates an unknown quantity of paint sludge, estimated at 1 or 2 lb/year.

During the Survey, the power plant in Building 2 was generating a one-time batch of 210 gallons of lithium bromide in 85 gallons of water from changing out the power plant chillers.

Trash Handling and Disposal

All trash is picked up either nightly or at other intervals by the NIPER janitorial staff. The trash is bagged and transported to the central collection facility adjacent to the eastern end of Building 11. The facility is an outdoor chain-link fence cage with a gravel floor and approximate dimensions of 8 feet by 18 feet. There the bags are stored until removed by an outside contractor, usually twice each week, and disposed of in the Bartlesville City Landfill.

The Survey identified three miscellaneous nonhazardous wastes that are handled separately from the rest of the trash. NIPER plans to dispose of the lithium bromide solution from the power plant down the drain, in accordance with the manufacturer's recommendations. NIPER has disposed of the sludge from the paint shop brush cleaner by burying it outside at the northeastern corner of NIPER adjacent to the central trash collection facility. NIPER disposes of nonhazardous autoclave residues by pouring them down the drain and following them with bleach.

4.1.4.2 Waste Petroleum Products

Waste Oil and Fuel Generation

Waste fuel and oil are generated at NIPER primarily as a result of ongoing research programs; however, a small quantity also is generated from maintenance of facilities. The generation rates of this waste at each individual generation point are not measured.

The laboratories produce waste fuel primarily from the engine testing programs, which are currently housed in Building 6 and are soon to be started in Buildings 17 and 19. Waste fuels are generated when engine fuel systems have to be flushed with fresh fuel at the start of a test run and when a specially blended fuel is no longer needed at the end of a test run.

These laboratories as well as laboratories involved in oil recovery and oil refining research programs produce waste oil. The engine testing laboratories produce waste oil from oil changes performed on the test engines. The oil changes are performed in the garage in Building 7. The waste oil produced from other laboratories in Buildings 1, 9, and 15 is generated primarily from experiments using crude oil.

The only shop generating waste oil is the garage in Building 7 which, in addition to servicing the engines used directly for research, also services the cars and trucks used in the operation and maintenance of NIPER facilities.

The Paint Shop in Building 14 generates small quantities of waste diesel fuel from the cleaning of brushes and other painting equipment.

Building 16, the Hydrocarbon Fuel Storage Building, also generates small quantities of waste oil and fuel. The building serves as an archive for virtually thousands of samples of special fuels and crude oils. Occasionally samples are identified that no longer need to be stored, and these samples are subsequently considered waste.

Building 16 has floor drains that lead to an oil-water separator, described in Section 3.3.2.2, before leading to the sanitary sewer. NIPER reported that no spills have ever reached the drains, so the separator has never actually been used. The only exception to this was during a major flood in the fall of 1986, when the separator flooded. During the Survey, traces of oil were observed in the separator.

Waste Oil and Fuel Handling and Disposal

At NIPER, all types of waste oil and fuel are handled using the same group of procedures. The waste oil and fuel are kept segregated from both hazardous waste and nonhazardous solid waste. In cases where waste oil or fuel has been mixed with hazardous solvents, the resulting mixture is handled as a hazardous waste. Otherwise, the waste oil and fuel are accumulated either in 55-gallon drums or in 5-gallon metal containers. When filled containers need to be removed from the laboratories or shops, the supervisor at the generation point calls the Safety staff.

The Safety staff is responsible for picking up the waste from the generation point and transporting it to the Waste Transfer Platform near Building 16. When transported, the waste is essentially handled with the same NIPER equipment (i.e., the cart and pickup truck) and procedures as the hazardous waste, described in Section 4.1.1.3. At the Waste Transfer Platform, the waste oil and fuel drums are kept segregated from the hazardous waste containers. The waste oil and fuel in containers smaller than 55 gallons are recontainerized in 55-gallon drums using the pump kept on the platform. Until they are picked up by the disposal contractor, the drums remain at the platform.

The disposal contractor used by NIPER for the disposal of waste oil and fuel is Waste Oil Service Company (WOSC) of Oklahoma City. WOSC transports and sells the waste to the Double Eagle Refining Company, also located in Oklahoma City, which reclaims the oil and fuel. In the past, NIPER has also used HRI, its current hazardous waste disposal contractor, to dispose of its waste oil and fuel.

NIPER records for the generation and disposal of waste oil and fuel for 1987 and the last half of 1986 are summarized in Table 4-5.

4.1.5 Findings and Observations

4.1.5.1 Category I

None

4.1.5.2 Category II

None

TABLE 4-5

NONHAZARDOUS WASTE OIL AND FUEL DISPOSED OF OFF-SITE BY NIPER, OCTOBER 1986 THROUGH FEBRUARY 1988

Date	Quantity (gallons)	Disposer
undated (4th quarter 1987)	787	WOSC
undated (3rd quarter 1987)	250	WOSC
undated (3rd quarter 1987)	3,400	WOSC
undated (3rd quarter 1987)	400	WOSC
undated (3rd quarter 1987)	150	WOSC
Oct. 30, 1986	5,000	HRI
Oct. 29, 1986	6,500	HRI
Oct. 28, 1986	8,050	HRI

Source: NIPER, NDb

WOSC = Waste Oil Service Company
HRI = Hydrocarbon Recyclers, Incorporated

4.1.5.3 Category III

None

4.1.5.4 Category IV

1. Insufficient management of hazardous waste at satellite accumulation areas. Hazardous wastes at NIPER satellite accumulation areas are not properly stored or adequately labeled to be in full compliance with RCRA regulations.

Examples of improper storage and inadequate labeling practices that may result in the mismanagement of hazardous wastes are provided in the following paragraphs.

Improper Storage

Many laboratories at NIPER are using 4-liter glass chemical bottles to accumulate solvent waste instead of the metal or plastic cans provided by the Safety staff and specified in the NIPER policy. In some laboratories, waste containers holding volatile solvents are stored with the lids open in violation of 40 CFR Part 265.173(a), allowing fumes to vent to the atmosphere. For example, Laboratories 201, 209, 219, and 311 in Building 3 and Laboratory 028 in Building 1 were using glass chemical bottles for accumulating solvent waste. Laboratory 313 in Building 3 was accumulating waste in an open 4-liter beaker in a laboratory sink. Open hazardous waste containers were found in Buildings 13 and 15.

Inadequate Labeling

Many of the metal waste containers provided to the satellite accumulation areas are not labeled as hazardous waste accumulation containers in accordance with 40 CFR Part 262.34. In addition, the glass chemical bottles referred to above usually have "WASTE" handwritten on the product label, but no indication is given as to whether the waste is hazardous and, if it is hazardous, whether its identity is in any way related to the chemical name originally printed on the product label. In some cases, the writing has been scratched out, written over, or has faded, contributing to possible confusion over the intended or actual use of the container.

2. Inadequately managed 180-day hazardous waste accumulation areas. The waste storage room in Building 11 and the Waste Transfer Platform in front of Building 16 are being used as 180-day hazardous waste accumulation areas and, as such, do not conform to RCRA regulations.

RCRA requirements pertaining to storage times, emergency communications, firefighting equipment, and emergency action information are not met at Building 11 and at the Waste Transfer Platform as follows:

40 CFR Part 262.34(d) limits the maximum hazardous waste storage period to 180 days. Hazardous wastes stored in Building 11 have been stored for an unspecified period in excess of 180 days.

40 CFR Parts 265.32(a) and (b) require that waste accumulation areas have an emergency alarm and/or telephone. The Waste Transfer Platform is not so equipped, and the hazards at this facility may not clearly warrant an exemption from this requirement.

40 CFR Parts 265.32(c) and (d) require firefighting equipment and/or sprinkler systems in waste accumulation areas. The Waste Transfer Platform is not so equipped, and the hazards at this facility may not clearly warrant an exemption from this requirement.

40 CFR Part 262.34(d)(5)(ii) requires posting of specific emergency action information next to the telephone at waste accumulation areas. The information is not posted at the Waste Transfer Platform, and the hazards at this facility may not clearly warrant an exemption from this requirement.

4.2 Toxic and Chemical Materials

This section discusses the usage, storage, management, and disposal of polychlorinated biphenyls (PCBs); asbestos; pesticides, herbicides and similar compounds; and toxic and process chemicals, as well as findings and observations related to these substances.

4.2.1 General Description of Pollution Sources and Controls

4.2.1.1 Polychlorinated Biphenyls

PCB-containing equipment at NIPER has been used to a very limited extent historically, and at present, none exists. In 1981, as a result of analysis of transformers and various machinery containing hydraulic oil and pump oil, 10 items were found to contain PCBs (Table 4-6). Since the highest concentration of these items was 42 parts per million (ppm), which is below the 50-ppm regulatory criterion, the PCB-containing equipment is considered non-PCB for the purposes of regulatory compliance. Consequently NIPER does not need a formal protocol that provides for the storage, handling, or disposal of PCBs or PCB-containing equipment.

4.2.1.2 Asbestos

No friable asbestos is used, handled, or stored at NIPER. However, some large pipes in the Power Plant (Building 2) are covered with asbestos insulation, which is in turn, wrapped and covered with epoxy paint. The asbestos-wrapped pipes are labeled as containing asbestos, and were observed by the Survey team to be in good condition.

Historically, small amounts of asbestos were removed from laboratories by the Safety staff of NIPER. The material was bagged, labeled, and disposed of in the Bartlesville Public Landfill, which is a state-certified asbestos disposal site. Larger asbestos removal projects are handled exclusively by off-site licensed asbestos removal contractors. There are no formal protocols for asbestos removal at NIPER.

TABLE 4-6

PCB ANALYSIS AT NIPER

Sample No.	PCB-Containing Equipment Identification	PCB Content (ppm)
801845	Hydraulic Oil 709	<0.4
801846	Hydraulic Oil Car Lift	<0.4
801847	500 kVA Transformer (Bldg. 3)	42.0
801848	500 kVA Transformer (Bldg. 2)	41.0
801849	750 kVA Transformer (Bldg. 1)	0.65
801850	Bobcat Hydraulic Oil	<0.4
801851	Fork Lift Hydraulic Oil	4.0
801852	Tractor (17.2-hp) Hydraulic Oil	<0.4
801853	Tractor (24.4-hp) Hydraulic Oil	<0.4
801854	Vacuum Pump Oil (Rm. 309, Bldg. 3)	<0.4

Source: Techrad, 1981

4.2.1.3 Pesticides, Herbicides, Insecticides, Rodenticides, Algicides

No herbicides, insecticides, or rodenticides are currently being stored, mixed, or applied at NIPER. These products are handled and applied as needed by off-site contractors and monitored by Maintenance and Safety staff personnel. Historical use of herbicides and insecticides was handled by the Maintenance staff and no formal protocols were in place regarding the storage, mixing, use, or disposal of various chemicals such as Roundup and orthophosphate-based bagworm spray concentrates. Two small unused bottles of Roundup and orthophosphate are presently stored in a cabinet in the yard shack north of Building 9. However, the spraying for insects and weeds at NIPER is currently contracted to an outside vendor.

Various cooling tower treatment chemicals are used in two 300-ton absorption water chilling towers at Building 2. Approximately 1 gallon of concentrated NALCO 2810 Microbiocide, which contains 5-chloro-2-methyl-4-isothiazolin-3-one and 2-methyl-4-isothiazolin-3-one, is added every 6 weeks to the cooling water, plus a small amount of NALCO 2807 inhibitor cooling treatment. Another microbiocide, NALCO 2593, is sporadically used. The chemicals are stored in a cabinet near the towers north of Building 2. The cooling water blowdown containing diluted treatment chemicals is discharged to the municipal sewer system, as described in Section 3.3.2.1. Empty containers are triple-rinsed and discarded in solid waste trash bins.

4.2.1.4 Toxic and Process Chemicals

Small quantities of many types of hazardous and nonhazardous organic and inorganic chemicals are used in NIPER laboratories. Additionally, because of the NIPER emphasis on fuels research, crude oils, refined hydrocarbons, fuels, light oils, and solvents used in cleaning operations are utilized in relatively large quantities.

Procurement and Inventory Control

Chemical and fuel purchases are made by laboratory managers. For most chemical and fuel purchases, requisitions are submitted to the Purchasing and Supply Department, which maintains bulk storage and distribution areas in Buildings 16 and 8 and in aboveground and underground tanks (Section 4.2.1.5). The requisitions specify the material needed, quantity, order number, date, laboratory room number, building number, and the signature of the requisitioner. An individual may order a small quantity of a specialty chemical and make a direct purchase but the purchaser is required to submit the product information to Purchasing so the item can be logged in the computer inventory, which contains the chemical name, account number, specific laboratory, and the name of the requisitioner. Material Safety Data Sheets (MSDSs) are maintained in files at each laboratory where the chemicals are used.

Receiving, Distribution, and Storage

The principal bulk chemical storage area is Building 16, a flammable-liquid-dedicated, reinforced-concrete storage bunker used to store approximately 23,000 gallons of various solvents, fuels, and oils. The building has an elaborate Halon fire suppressant system and a carefully controlled climate. Floor drains lead to an underground oil-water separator, which discharges water to the sanitary sewer and oil to the 500-gallon concrete oil capture tank (Section 3.3.2.2).

Bulk petroleum products for use in research and to power NIPER vehicles are stored at the Main Tank Farm and in other tanks at NIPER (Section 4.2.1.5). Petroleum is delivered by tanker truck and transferred directly into the tanks. Researchers pump fuel directly from the Main Tank Farm tanks into carboys and drums, and transport the vessels back to the laboratories. The two tanks west of Building 19 feed directly into Building 19 via underground tanks. Product in the tanks at Block A is pumped directly into vehicles or transportable carboys and drums.

The remote Caves facility, which is also used as a petroleum storage area, is a soil-covered bunker built into the side of a hill approximately 3 miles northwest of NIPER. The concrete structure is used as an archival repository for approximately 33,000 gallons of various oils, fuels, and alcohols, which are retained in 55-gallon metal drums and carboys. The structure is locked and surrounded by a chain-link fence with a locked gate. The structure is purposely unmarked on the exterior to discourage vandalism. Spill control consists of a concrete floor sloping to the back of the bunker.

Two other buildings are used to store bulk chemicals, including toxic reagents, solvents, and reactive materials. Building 8 houses miscellaneous flammable solvents such as toluene, acetone, and alcohol, and toxic chemicals such as mercury and arsenic. The flammable chemicals are stored in metal cabinets and the toxic reagents are stored on open shelves. The building also houses a multipurpose storeroom where miscellaneous nonchemical supplies such as office supplies, electrical fixtures, and hardware are stored. Building 11 is used to store various water-reactive and pyrophoric chemicals such as sodium hydride, calcium hydride, sodium metal, oxalyl chloride and super hydride (aluminum vitride). These chemicals are individually double-packaged and stored on the floor in a metal box, which is examined by a safety officer on a monthly basis.

Each laboratory also maintains small-quantity stocks of chemicals, reagents, and gas cylinders at each point of use. Storage is provided in cabinets, lockers, and shelves, or under hoods in the work area. Numerous toxic and hazardous chemicals that are no longer used were observed in laboratories by the Survey team. Additionally, in Buildings 1, 3, and 16, product containers of peroxide-forming chemicals, such as anhydrous diethyl ether, diethylene glycol monomethyl ether, and 1,4-dioxane, were found to have exceeded their safe shelf lives.

4.2.1.5 Petroleum Product and Hazardous Substance Storage Tanks

There are currently 25 active storage tanks at NIPER. Nine of the active tanks are underground, as identified on Table 4-7, and the remainder are aboveground, as identified on Table 4-8. In addition, there are two inactive underground tanks, as identified on Table 4-7. The locations of the tanks are shown on Figure 4-1 and are discussed below.

Underground Storage Tanks

There are nine active and two inactive underground storage tanks (USTs) at NIPER (Table 4-7). Eight of the active tanks are used for diesel and gasoline storage, and the ninth is a sump for the oil-water separator outside Building 16, which is used in the event of a spill within this facility. The separator is described in more detail in Section 3.3.2.2. The two inactive tanks were used for the storage of waste oils, and are discussed in Section 4.5.1.

TABLE 4-7

DESCRIPTION OF UNDERGROUND PETROLEUM AND CHEMICAL STORAGE TANKS AT NIPER

Tank No.[a]	Location	Capacity (gal)	Age (yrs)[b]	Construction Material	Internal Protection[c]	External Protection[d]	Contents	Comments
1	NE of Bldg. 2	2,000	26	Steel	None	None	Diesel	Active
2	W. of Bldg. 7	4,000	8	Fiberglass	None	None	Diesel	Active
3	W. of Bldg. 7	4,000	8	Fiberglass	None	None	Diesel	Active
4	W. of Bldg. 7	4,000	8	Fiberglass	None	None	Diesel	Active
5	W. of Bldg. 7	4,000	8	Fiberglass	None	None	Diesel	Active
6	E. of Bldg. 9	2,000	8	Fiberglass	None	None	Gasoline	Active
7	N. of Bldg. 6	1,000	20	Steel	None	None	Gasoline	Active
8	NE of Bldg. 7	4,000	20	Steel	None	None	Gasoline	Active
9	W. of Bldg. 7	550	9	Fiberglass	None	None	Waste oil and solvents	Inactive; emptied and abandoned in 1984
10	SW of Bldg. 14	10,000	Unknown	Steel	None	None	Waste oil and solvents	Inactive; emptied, abandoned, and filled with concrete in 1980
11	S. of Bldg. 16	500	8	Concrete	None	None	Spilled fuels and solvents	Sump for an oil-water separator

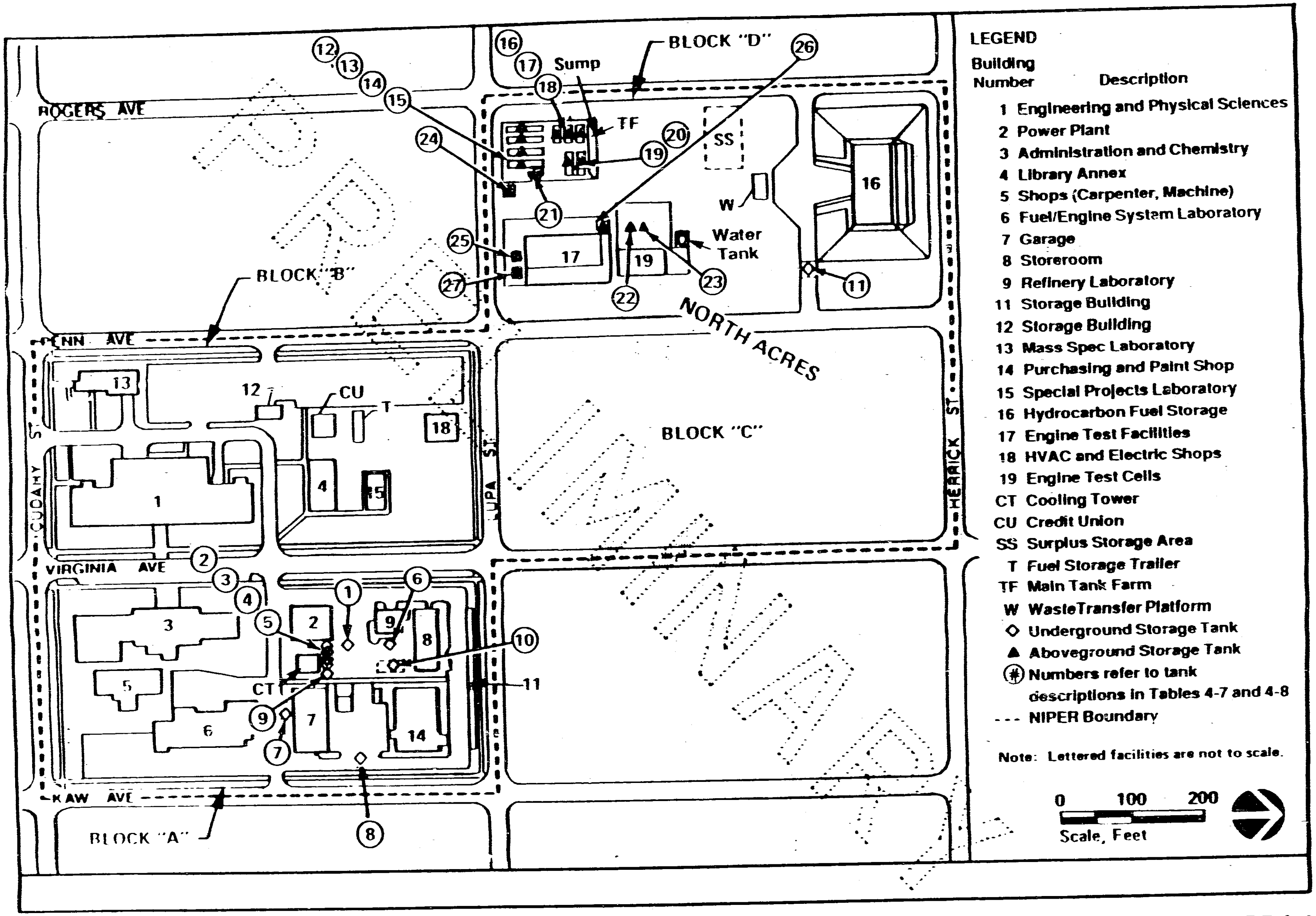
Sources: Boyd, 1987; Tipton, 1986
[a] Keyed to Figure 4-1
[b] As of 1988
[c] Cathodic protection, lining, epoxy resins
[d] Cathodic protection, painted, asphalt fiberglass coated, plastic coated

TABLE 4-8

DESCRIPTION OF ABOVEGROUND PETROLEUM AND CHEMICAL STORAGE TANKS AT NIPER

Tank No.[a]	Location	Capacity (gal)	Age (yrs)	Construction Material	Contents	Containment	Comments
12	Main Tank Farm	30,000	4	Steel	Diesel	Earthen Berm	Active
13	Main Tank Farm	30,000	4	Steel	Diesel	Earthen Berm	Active
14	Main Tank Farm	30,000	4	Steel	Diesel	Earthen Berm	Active
15	Main Tank Farm	30,000	4	Steel	Diesel	Earthen Berm	Active
16	Main Tank Farm	10,000	4	Steel	Diesel	Earthen Berm	Active
17	Main Tank Farm	10,000	4	Steel	Diesel	Earthen Berm	Active
18	Main Tank Farm	10,000	4	Steel	Diesel	Earthen Berm	Active
19	Main Tank Farm	20,000	4	Steel	Diesel	Earthen Berm	Active
20	Main Tank Farm	20,000	4	Steel	Diesel	Earthen Berm	Active
21	Main Tank Farm	1,000	4	Steel	Diesel	Earthen Berm	Active
22	W. of Bldg. 19	10,000	4	Steel	Gasoline	Earthen Berm	Active
23	W. of Bldg. 19	10,000	4	Steel	Gasoline	Earthen Berm	Active
24	Main Tank Farm	600	4	Steel	Liquid Nitrogen	None	Active; on concrete pad
25	S. of Bldg. 17	~1,000	Unknown	Steel	Gasoline	Earthen Berm	Active; leased
26	W. of Bldg. 17	300	New	Steel	Diesel	Earthen Berm	Active; on concrete pad
27	S. of Bldg. 17	~300	Unknown	Steel	Gasoline	Earthen Berm	Active

Source: Boyd, 1987
[a] Keyed to Figure 4-1



ABOVEGROUND/UNDERGROUND STORAGE TANKS AT NIPER

FIGURE 4-1

No leaks or large spills have been reported to be associated with the tanks; however, testing or monitoring is not performed on the tanks. Steel tanks are subject to deterioration from aging and corrosion, and fiberglass tanks are subject to cracking. Although there are no specific data on soil corrosivity at NIPER, conditions that promote corrosion are present (Section 3.2.1).

Aboveground Storage Tanks

The Main Tank Farm, as shown on Figure 4-1, contains 11 of the 16 aboveground storage tanks (ASTs) at NIPER. As indicated in Table 4-8, 10 of the tanks at the Main Tank Farm contain various fuels and 1 contains liquid nitrogen; this latter tank is located immediately outside the tank farm berm. All Main Tank Farm tanks are of steel construction and are horizontally mounted on concrete pylons. The entire tank farm is surrounded by an earthen berm. Its subbase is compacted clay overlain by plastic sheets to minimize weed growth and 2-inch nominal screened limestone gravel. Water from precipitation within the berm accumulates in a sump on the north side of the tank farm, and is periodically pumped out of the bermed area onto the adjacent grassy area as discussed in Section 3.3.2.1. During the Survey, active drips from some of the tanks were identified and oil stains in other areas of the tank farm were observed.

The other five ASTs also contain various fuels. They are constructed of steel, are located within earthen berms, and are underlain by natural soil or in one case, a concrete pad.

4.2.2 Findings and Observations

4.2.2.1 Category I

None.

4.2.2.2 Category II

1. Potential release of toxic chemicals. Ethers, dioxane, and other organic solvents are being stored at NIPER for periods that exceed safe storage practices.

   Dioxane and various ethers may degrade over time in the presence of oxygen and form peroxides. The peroxides, if present, could explode during normal handling operations, resulting in severe or fatal human injury. At NIPER, peroxidizable compounds that had exceeded their shelf lives were observed by the Survey team. Additionally, these compounds were stored next to other reactive, toxic, and flammable chemicals. Such storage, in the event of an explosion, could result in fire and a release of toxic chemicals to the air, soil, surface water, or groundwater. Areas where this problem was identified are specified below.

   In Building 16, the Hydrocarbon Fuels Storage Building, where large volumes of flammable compounds are stored, four 4-liter bottles of 1,4-dioxane were found that were manufactured in 1982. This chemical has a recommended 2.5-year shelf life after the manufacture date although, according to the manufacturer, it should be discarded 12 months after opening to preclude formation of explosive peroxides. The bottles were stored on an open metal shelf and were full of liquid. Three of the bottle caps were not sealed; therefore, the integrity of the product may have been compromised.

   The Survey team noticed that one of the unsealed bottles was approximately half full of feathery crystals. Initially the crystals were thought to be explosive peroxide crystals. However, subsequent investigation revealed that they were non-explosive frozen dioxane crystals. Since the outdated material could still contain explosive peroxides, the site management concluded that the questionable solvents could be dangerous and should be disposed of in a safe expedient manner. After the Survey, the solvents were opened under water by NIPER personnel and poured into 55-gallon drums containing other waste solvent at the site's Hazardous Waste Transfer Platform.

Stored on the same shelf in proximity to the dioxane were nineteen 4-liter metal cans containing anhydrous ether. Six of the cans had an expiration date of 12/1/86, and contained no peroxide inhibitor. The manufacturer indicated the shelf life of the anhydrous ether may be extended 1 year since the metal cans have a liner that suppresses the formation of peroxide providing the container seal is not broken. Thirteen cans did contain an inhibitor, but had no expiration dates on the labels.

Two bottles of tetrahydrofuran, which can also form peroxide, were found in the same area as the ether and were not dated.

In Laboratory 309 in Building 3, a bottle of Dowanol DM-diethylene glycol methyl ether was found in a flammables storage cabinet. The bottle contained approximately 8 ounces of slightly cloudy liquid. The bottle had a 10/1/85 expiration date, and the label specified "Use within one year." This substance may also form explosive peroxides over an extended storage period.

In Building 1, Room 15, a 4-liter bottle of ethyl ether was in a hood work area. The bottle was partially full but had no expiration date or "date opened" on the label.

Each of these potentially unstable solvents was disposed of in the manner described for the 1,4-dioxane after the on-site portion of the Survey was completed.

2. <u>Active drips and weeps at the Main Tank Farm</u>. Petroleum products are actively dripping from drain pipes and weeping from fixtures on Tanks 2, 3, 6, 7, 9, and 10 at the Main Tank Farm, resulting in localized surficial gravel and underlying soil contamination and possibly groundwater and surface-water contamination.

Petroleum products were observed to be dripping from drain pipes at Tanks 3 and 10, and weeping from valves and joints on Tanks 2, 6, 7, 9, and 10 at the Main Tank Farm. As a result, gravel overlying a discontinuous plastic liner of suspect integrity, used to control weeds, is contaminated. Because of inadequate spill containment (Section 4.2.2.3, Finding 1), the soils and shallow groundwater underlying the tank farm may also be contaminated. However, there has been no subsurface sampling to confirm this (Section 3.4.4.4, Finding 1).

As discussed in Section 3.3.2.1, water within the Main Tank Farm sump is periodically pumped outside the bermed tank farm area and allowed to percolate into the soils, or to flow along drainage ditches leading to the Caney River. If fuel is present in the sump, it may be discharged along with the water and may result in surface-water contamination.

4.2.2.3 Category III

1. Ineffective AST spill containment. Aboveground storage tanks lack effective spill containment, which is resulting in surface soil contamination and may result in groundwater and surface-water contamination.

   During the Survey, NIPER personnel indicated that a clay liner had been placed beneath the Main Tank Farm, which has 10 aboveground fuel storage tanks. However, they did not know its design thickness or permeability. Additionally, a plastic liner on top of the clay, used for weed control, was discontinuous. As a result, any leaks or spills from the tanks that have contaminated the surficial material within the tank farm may be moving through the plastic liner and clay layer, and contaminating the underlying soil and groundwater and potentially nearby surface water. At the Main Tank Farm, fuel stains on the soil beneath valve ports on some of the ASTs as well as active dripping of fuel from several of the ASTs, as described in Finding 2 of Section 4.2.2.2 above, were observed by the Survey team.

2. Potential undetected releases from USTs. The integrity of underground storage tanks at NIPER is in question and undetected releases may be contaminating the soil, groundwater, and potentially surface water.

   Eight USTs are currently used at NIPER to store diesel fuel and gasoline, and one UST is a sump used to contain petroleum products at Building 16. Three are constructed of steel and are 20 or more years old, five are constructed of fiberglass-reinforced plastic and are approximately 8 years old, and the sump is constructed of concrete and is 8 years old. None of the USTs have internal or external protection, nor have they undergone integrity testing. Since steel tanks are subject to deterioration from aging and corrosion, fiberglass tanks are subject to cracking, particularly during installation, and concrete tanks are also subject to cracking, leaks may have developed or may develop in the future. If leaks are occurring, they would be undetected and could result in soil, groundwater, and potentially surface-water contamination.

4.2.2.4 Category IV

1. Potential safety hazard from lack of administrative controls on management of reactive, toxic, and hazardous chemicals. NIPER lacks formal administrative controls on management of reactive, toxic, and hazardous chemicals, which could result in improper waste disposal or handling and create a potential safety hazard.

   The purchase of bulk and reagent-grade chemicals is not centralized, and procedures to track shelf lives of reactive, toxic, and hazardous chemicals are not in place, thereby allowing potentially unsafe accumulations of these substances in the laboratories and storage areas. During the Survey, the Survey team noted two areas where peroxide-forming chemicals, such as dioxane and various ethers, were being stored beyond their recommended shelf lives (Section 4.2.2.2, Finding 1). Excessively long storage of these chemicals can result in their decomposition into unstable, potentially explosive peroxides.

   Some laboratories were storing hazardous solvents and chemical reagents which were left over from discontinued programs and were of unknown age. These substances included compounds which, if declared wastes, would be EP toxic or RCRA-listed hazardous wastes. In some cases, these compounds had been contaminated or had decomposed over time and subsequently were not useful for research purposes. For example, Laboratory 120 in Building 1 contained a jug of chromic acid at least 4 years old, which was left over from an experiment that was no longer being performed. The jug was visibly contaminated with an unidentified substance and had never been used by the current group of researchers in the laboratory.

In addition, NIPER has no formal standard operating procedure identifying chemical storage requirements, including proper labeling and segregation of incompatible chemicals. The Survey noted acids and solvents being stored in unlabeled undersink cabinets in various laboratories in Buildings 1, 3, 6, 8, 13, and 16, and incompatible chemicals being stored together in several laboratories, including Laboratory 19 in Building 1, where potassium metal, phenyl lithium, and phosphorus pentoxide (all pyrophoric) were being stored in a flammables cabinet with a number of 4-liter bottles of acetone and other solvents. In Laboratory 309 in Building 3, numerous pyrophoric and water-reactive chemicals were being stored in flammables cabinets with petroleum ethers and other solvents. Improperly labeled or segregated chemicals could result in an improper emergency response in the event of a fire or other uncontrolled chemical release.

4.3 Radiation

This section discusses the actual or potential radiological impacts to the environment from past and present operations at NIPER.

4.3.1 General Description of Pollution Sources and Controls

No experiments involving radionuclides were being conducted at NIPER at the time of the Survey. NIPER formerly conducted petroleum research studies using a variety of radioactively traced compounds and radioactive sources in Building 13, which is now the Mass Spectroscopy Laboratory. Radionuclide experiments were discontinued in 1980, and Building 13 was decontaminated and decommissioned prior to conversion to its present use. The conversion of the building to nonradioactive use required the removal of approximately 50 curies of radioactive source materials, including organic liquids; the dismantling and removal of laboratory equipment and building materials contaminated with tritium; and disposal of the radioactive waste sources and materials at the low-level waste disposal facility in Hanford, Washington. Two plutonium-beryllium sources were removed from the building and sent to the DOE Los Alamos National Laboratory for reprocessing (DOE, 1981).

Experiments involving tritiated water were scheduled to be conducted in Room 211 of Building 1 in 1988, after the Survey. They include a series of diffusion studies of packed sand cores to test surfactants. Ten milliliters of tritiated water with a total activity of 5 microcuries were being stored in a safe in the laboratory at the time of the Survey. The laboratory was not outfitted for radioactive tracer experiments at the time of the Survey, and the proposed test program had not yet been approved by DOE. Releases of radionuclides from tracer experiments are expected to be negligible, based on the amount of tritium to be used.

4.3.2 Environmental Monitoring

NIPER conducts no monitoring of emissions or environmental concentrations of radionuclides. Other than the monitoring activities associated with the decommissioning of Building 13, described above, NIPER has never conducted any radiological monitoring. Data from monitoring associated with decommissioning activities are summarized in the draft Environmental Assessment (DOE, 1981). The proposed use of small amounts of tritium in Room 211 of Building 1, expected to begin in 1988, after the Survey, would not require monitoring of tritium emissions or ambient tritium concentrations, as the emissions are expected to be non-detectable.

4.3.3 Findings and Observations

4.3.3.1 Category I

None

4.3.3.2 Category II

None

4.3.3.3 Category III

None

4.3.3.4 Category IV

None

4.4 Quality Assurance

4.4.1 General Description of Environmental Monitoring

There is no environmental monitoring program at NIPER other than informal, periodic noise measurements (Section 3.1.3.2). Also, sanitary sewage samples have been taken periodically by various groups, and analyzed by various outside laboratories (Sections 3.3.2.2 and 3.3.3). NIPER does not perform any laboratory analyses of environmental or wastewater samples. Therefore, there was no environmental sampling and analysis quality assurance program for the Survey to review.

4.4.2 Findings and Observations

4.4.2.1 Category I

None

4.4.2.2 Category II

None

4.4.2.3 Category III

None

4.4.2.4 Category IV

None

4.5 Inactive Waste Sites and Releases

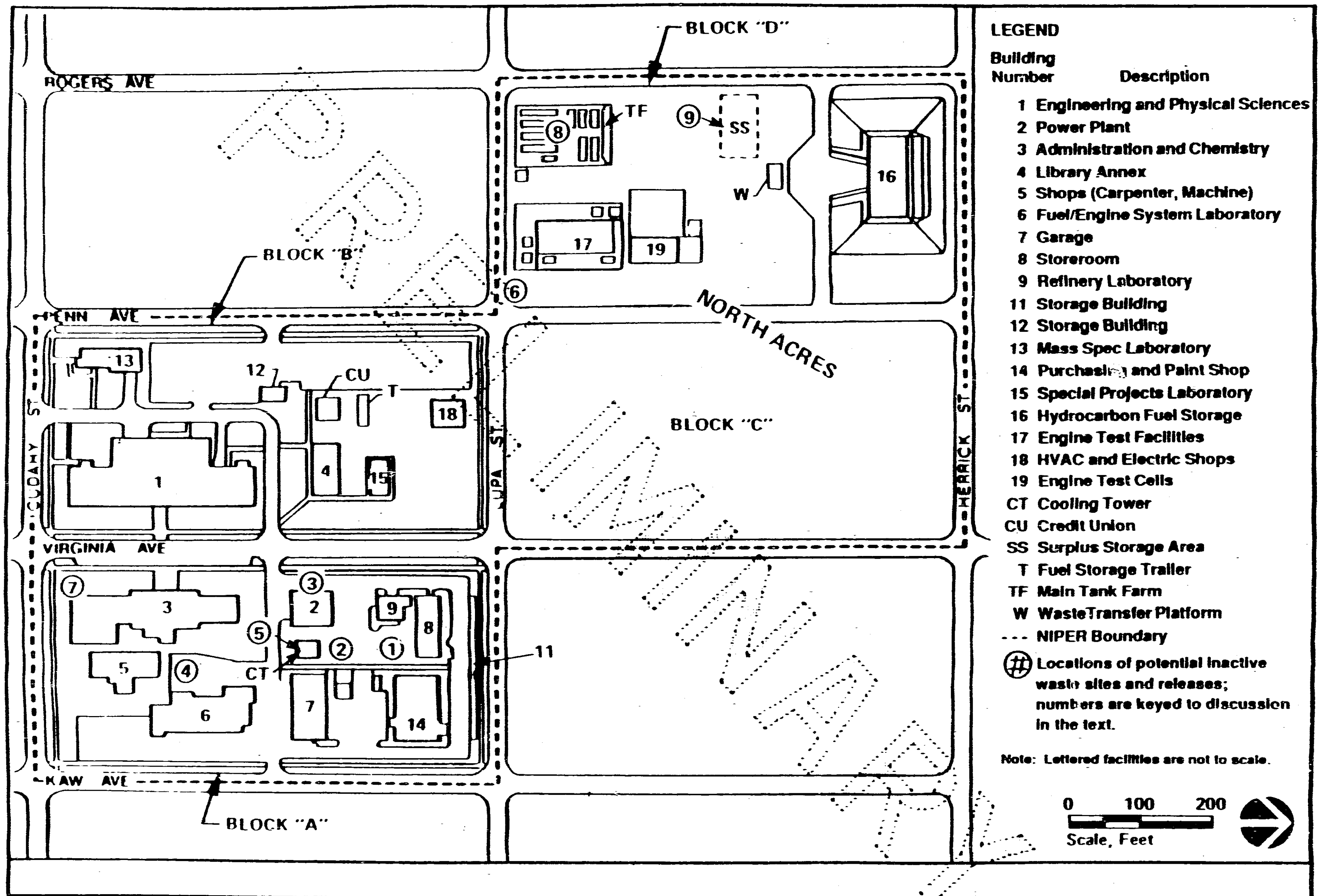
This section of the report deals with inactive waste sites that may be present, and with spills and other types of releases that may have occurred at NIPER. The pollution sources described below are based on on-site observations made during the Environmental Survey; a review of historical photographs, maps, and incident, site planning, and site characteristics reports; and interviews with active and retired NIPER employees (Hughes, 1988; Sanders, 1988).

4.5.1 General Description of Pollution Sources and Controls

NIPER was started in 1918 when Block A (Figure 4-2) was donated by the Bartlesville Chamber of Commerce for the formation of a petroleum research center. Block B was purchased in 1943 and Blocks C and D were acquired in 1978 (NIPER, 1984a). All blocks had been farm and pastureland before being acquired, although Blocks C and D had been developed to include 16 homes before becoming U.S. Government property.

Because of the previous agricultural and domestic land uses, it is likely that any inactive waste sites and releases on NIPER property are the result of NIPER operations. Although there are no documents, such as an Installation Assessment, detailing inactive waste sites and releases at NIPER, several potential sites were noted during the Survey. They are discussed below, summarized in Table 4-9, and located on Figure 4-2; the site numbers used below and on Table 4-9 refer to the locations on Figure 4-2. Environmental features that would be affected by inactive waste sites and releases include the Caney River system, described in Section 3.3.1, and shallow groundwater, described in Section 3.4.1.

<u>Site 1 - 10,000-Gallon Waste Oil Tank</u>. In the early 1920s, a 10,000-gallon railroad tanker car was buried southeast of Building 8. Until 1980, it was used for the temporary storage of waste oils and other organics such as alcohols and ketones. On a regular basis, the contents were pumped out and hauled off-site for recycling. In 1980, the tank was emptied, abandoned in place, and filled with concrete. There is no record that the tank was tested for leaks before closure or that the soil adjacent to the tank was sampled for evidence of leaks.



LOCATIONS OF POTENTIAL INACTIVE WASTE SITES AND RELEASES AT NIPER

FIGURE 4-2

TABLE 4-9

POTENTIAL INACTIVE WASTE SITES AND RELEASES AT NIPER

Name	Figure Reference Number[a]	Dates of Use/Occurrence	Size/Depth	Volume Received/Spilled	Constituents Received/Spilled	Additional Information
10,000-Gallon Waste Oil Tank	1	1920s-1980	Unknown-buried 10,000-gallon railroad car	Unknown	Waste oil, other organics	Emptied of contents and filled with concrete; no leak testing or soil sampling upon closure.
550-Gallon Waste Oil Tank	2	1980-1984	Unknown-buried 550-gallon fiberglass tank	Unknown	Waste oil, other organics	Emptied and abandoned; no leak-testing or soil sampling upon closure.
Oil Storage Vaults and Racks	3	?-early 1980s	Unknown	Unknown	Drummed petroleum products	In-ground vaults filled with gravel, covered with soil, and grassed over; aboveground racks removed.
Former Cooling Tower	4	?-early 1960s	Unknown	Unknown	Chromates	Removed in early 1960s.
Present Cooling Tower	5	Early 1960s-1979	Unknown	Unknown	Chromates	Chromate use discontinued in 1979; tower still active.
Day Tank Transfer Spill	6	1986	Unknown	50 gallons	Gasoline	Hosed down and all spilled material reportedly absorbed.
Well Capping Spill	7	1978(?)	Unknown	50-200 gallons	Crude oil	Cleaned up.
Main Tank Farm Leaks	8	1986-present	420 square feet	Unknown	Petroleum products	Stains and active leaks present.
Surplus Storage Area Leak	9	Unknown	100 square feet	Unknown	Petroleum product (?)	Stain evident; may be the result of residual petroleum product spilled from nearly empty stored drums.

[a]Located on Figure 4-2

Site 2 - 550-Gallon Waste Oil Tank. A 550-gallon fiberglass tank was placed underground northeast of the cooling tower in 1980 to succeed the 10,000-gallon tank described above. This tank was pumped out periodically and the contents, including waste oils and other organics, taken off-site for recycling. In 1984, the tank was emptied and abandoned although no further closure action has taken place.

Site 3 - Oil Storage Vaults and Racks. Until the early 1980s, three or four in-ground concrete vaults, located along Virginia Avenue west of Buildings 2 and 9, were used for the storage of mainly 55-gallon drums containing petroleum products. In addition, immediately north of these vaults, drums were stored aboveground on racks. The contents of the drums were used for ongoing refinery experiments. Once Building 16, the Hydrocarbon Fuel Storage Building, was constructed in the early 1980s, the vaults were abandoned, filled with gravel, and grassed over, and the racks were removed. The construction date and the dimensions of the vaults and racks were not reported during the Survey. There is no record of petroleum product releases from drums stored on the racks and in the vaults.

Site 4 - Former Cooling Tower. A cooling tower, located north of Building 5, was installed in 1938 and removed in 1961. Chromates were used as corrosion inhibitors in this tower and may have contaminated the ground or subsurface soil as a result of drift and leakage from the tower or through any seams or cracks in the tower basin. It appears from photographs that the cooling tower was located in a paved area. Therefore, the surface area of exposed soil to receive drift fallout was probably small, although the potential for downgradient transport in surface-water runoff was present due to the impervious nature of the pavement.

Site 5 - Present Cooling Tower. The cooling tower presently used at NIPER was constructed in the early 1960s east of the power plant to replace the former tower, described above. Chromates were used in this cooling tower until late 1979 and may have contaminated the ground as a result of drift and leakage from the tower or through any seams or cracks in the tower basin. Concentrations of total chromium and hexavalent chromium from cooling tower water sampled in April 1979, while chromates were still being used, were reported at 4.0 mg/L and 3.5 mg/L, respectively (Williams Brothers Laboratories, 1979). However, the existing tower, like the former cooling tower, is surrounded by pavement. Therefore, the surface area of exposed soil to receive drift fallout was small, although the potential for downgradient transport in surface-water runoff was increased due to the impervious nature of the pavement.

Site 6 - Day Tank Transfer Spill. In July 1986, 50 gallons of an unspecified type of gasoline spilled into a ditch along Lupa Street, southeast of Building 17. The surface area that was affected was not reported at the time of the release. The spill occurred as a result of overflow during the transfer of gasoline from a permanent tank to a day tank. The Bartlesville Fire Department responded and hosed the spill. All spilled gasoline was reportedly then recovered with an absorbent (NIPER, 1986).

Site 7 - Well Capping Spill. In approximately 1978, an abandoned oil and gas well was discovered at the northeast corner of Virginia Avenue and Cudahy Street. Because the well was found to be inadequately capped, it was redeveloped so it could be fully grouted. During drilling, a pocket of gas was encountered, and approximately 50 to 200 gallons of crude oil blew out of the hole and onto the surrounding grass and pavement. The spill was cleaned up although the method used was not reported.

Site 8 - Main Tank Farm Leaks. The Main Tank Farm was installed in mid-1986. It is designed with an earthen berm on the perimeter and a gravel base underlain by a discontinuous plastic liner, used to control weeds, and clay of unknown thickness and permeability. Control of runoff from within the tank farm is described in Section 3.3.2.1. Several leaks have occurred within the Main Tank Farm, as evidenced by stained soil. Examples include a 30-foot by 8-foot area between Tanks 4 and 6, a 12-foot by 12-foot area next to Tank 4, and a 6-foot by 6-foot area next to Tank 10. In addition, petroleum products were dripping from drain pipes at Tanks 3 and 10 and were weeping from valves and pipe joints on Tanks 2, 6, 7, 9, and 10. These leaks are discussed further in Section 4.2.1.5 and Finding 2 of Section 4.2.2.2.

Site 9 - Surplus Storage Area Leak. During the Survey, a 100-square-foot area of stained soil was noted at the Surplus Storage Area. The date of occurrence, volume, and specific material spilled are unknown, although the soil had a petroleum product odor. Petroleum products are not used in this area although several empty drums and other vessels that may have contained residual liquids are stored in the Surplus Storage Area.

4.5.2 Findings and Observations

4.5.2.1 Category I

None

4.5.2.2 Category II

None

4.5.2.3 Category III

1. Potential contamination from confirmed and unconfirmed inactive waste sites and releases. Confirmed and unconfirmed inactive waste sites and releases at NIPER may be contaminating the soil, groundwater, and surface water.

   During the Survey, information obtained through review of historical photographs and site records, visual inspection, and personnel interviews indicates the presence of nine confirmed and unconfirmed inactive waste sites and releases. These are listed below and described in Section 4.5.1:

   - 10,000-Gallon Waste Oil Tank
   - 550-Gallon Waste Oil Tank
   - Oil Storage Vaults
   - Former Cooling Tower
   - Present Cooling Tower
   - Day Tank Transfer Spill
   - Well Capping Spill
   - Main Tank Farm Leaks
   - Surplus Storage Area Leak

   There is presently no evidence that hazardous materials have been released from the 10,000- and 550-gallon waste oil tanks and the concrete oil storage vaults and racks. However, the integrity of underground storage tanks at NIPER is in question (Finding 2, Section 4.2.2.3), as is the integrity of the concrete vaults. If cracks or holes had developed during the active lifetime of the tanks and vaults, free liquids containing hazardous substances could have been released to the underlying soil and to groundwater.

There is similarly no evidence of leakage of the chromate-containing water from the cooling towers, although releases through wind drift and possibly through cracks in the concrete holding basin beneath the cooling tower occurred. The resulting releases could have resulted in chromate contamination of the underlying soil and groundwater. Additionally, stormwater runoff may transport surface contamination to the drainage ditches and eventually to the Caney River.

The remaining sites including the day tank transfer spill, well capping spill, Main Tank Farm leaks, and Surplus Storage Area leak are all confirmed releases, although the former two were reportedly cleaned up. Each of these releases has resulted in surface soil contamination, and any residual contamination may result in groundwater and surface-water contamination.

NIPER has no soil, surface-water, and groundwater monitoring program, as discussed in Sections 3.2.3, 3.3.4.4 (Finding 1), and 3.4.4.4 (Finding 1), to identify the concentration and extent of actual and suspected contamination from inactive waste sites and releases.

4.5.2.4 Category IV

1. Lack of inactive waste sites and releases investigations. Inactive waste sites and releases have not been investigated at NIPER in accordance with DOE CERCLA Order 5480.14.

   Spills, unplanned releases, and inactive waste sites at NIPER have not been identified and investigated. DOE Order 5480.14, dated April 26, 1985, requires that each DOE site submit to DOE Headquarters a Phase I Installation Assessment (IA). The purpose of an IA is to evaluate site history and records in order to identify inactive hazardous waste sites and releases that may pose environmental or public health risks and may require further characterization and remediation.

An IA has not been developed for NIPER. During the Survey, information obtained through review of historical photographs and site records, visual inspection, and personnel interviews indicates the presence of nine potential inactive waste sites and releases that could be addressed in an IA. These are listed above in Finding 1 of Section 4.5.2.3 and described in Section 4.5.1.

REFERENCES

Benefield, L. D., and C. W. Randall, 1980. Biological Process Design for Wastewater Treatment, Prentice-Hall, Inc., Englewood, New Jersey.

Benham, Holloway & Spragens, 1979. Hydrocarbon Fuel Storage Building, Drawing #A-3, Tulsa, Oklahoma.

Boyd, M. W., 1987. Storage Tanks Above/Belowground, National Institute for Petroleum and Energy Research, Bartlesville, Oklahoma.

Canter, L.W., 1977. Environmental Impact Assessment, University of Oklahoma.

DOE (U.S. Department of Energy), 1981. Environmental Assessment - Conversion of Idle Bartlesville Energy Technology Center (BETC) Radiological Facility by Decontamination of the Present Radiological Facility, Draft, U.S. Department of Energy, February.

DOE (U.S. Department of Energy), 1986. Addendum, Environmental Assessment, Land Acquisition and Facility Construction, Bartlesville Energy Research Center (now National Institute for Petroleum and Energy Research).

Ebert & Phinney Architects, Inc., 1986. Site Grading Plan, A Diesel Fuel Storage Facility & Diesel Engine Testing Laboratory Foundation, Bartlesville, Oklahoma.

EPA (U.S. Environmental Protection Agency), 1986. Compilation of Air Emission Factors, EPA Publication AP-42, U.S. Environmental Protection Agency, Washington, D.C.

Hauth, L.D., J.K. Kurklin, D.M. Walters, and T.E. Coffey, 1987. Water Resources Data, Oklahoma, Water Year 1985, U.S. Geological Survey Water-Data Report OK-85-1, Oklahoma City, Oklahoma.

HUD (U.S. Department of Housing and Urban Development), 1980. Flood Insurance Rate Map, City of Bartlesville, Oklahoma, Washington County, Panel II of 28, Community-Panel Number 400220 0011 B.

Hughes, K., 1988. Former NIPER Employee, Personal Communication with W.M. Levitan, NUS Corporation, March 2.

ICUA (Interagency Committee on Urban Noise), 1981. Guidelines for Considering Noise in Land Use Planning and Control, Federal Interagency Committee on Urban Noise, NTIS PB81-214124, June.

NIPER (National Institute for Petroleum and Energy Research), 1984a. Site Development and Utilization Plan, NIPER Engineering, Bartlesville, Oklahoma.

NIPER (National Institute for Petroleum and Energy Research), 1984b. Chemical Inventory, NIPER Engineering, Bartlesville, Oklahoma.

NIPER (National Institute for Petroleum and Energy Research), 1986. Supervisor's Investigation Report on Day Tank Overflow, NIPER Engineering, Bartlesville, Oklahoma.

NIPER (National Institute for Petroleum and Energy Research), NDa. Chemical Composition of Mixed Solvent Waste, NIPER Safety Department, Bartlesville, Oklahoma.

NIPER (National Institute for Petroleum and Energy Research), NDb. Hazardous Waste Disposal Records File, 1982-1988, NIPER Safety Department, Bartlesville, Oklahoma.

NIPER (National Institute for Petroleum and Energy Research), NDc. Waste Chemicals for Disposal, NIPER Safety Department, Bartlesville, Oklahoma.

NIPER (National Institute for Petroleum and Energy Research), NDd. A Guide to Laboratory Safety, NIPER Safety Department, Bartlesville, Oklahoma.

NIPER (National Institute for Petroleum and Energy Research), NDe. Correspondence file, current 1988, NIPER Safety Department, Bartlesville, Oklahoma.

Oklahoma SDH (State Department of Health), 1987. Oklahoma Air Quality Annual Report-1986, Oklahoma State Department of Health, Oklahoma City, Oklahoma.

Oklahoma Water Resources Board, 1971. Appraisal of the Water and Related Land Resources of Oklahoma, Publication 36, Oklahoma Water Resources Board, Region 9.

Polone, D. J., 1968. Soil Survey Washington County, Oklahoma, U.S. Dept. of Agriculture, Washington County, Oklahoma.

Sanders, R., 1988. NIPER Employee, Personal Communication with W.M. Levitan, NUS Corporation, March 1.

Snow, R. H., 1984. Letter to S. Sanders, U.S. EPA. NIPER (National Institute of Petroleum and Energy Research), Bartlesville, Oklahoma, May 21.

Steele, G., 1987a. Memorandum to all employees, National Institute for Petroleum and Energy Research, Bartlesville, Oklahoma, December 8.

Steele, G., 1987b. NIPER Waste Management and Disposal, National Institute for Petroleum and Energy Research, Bartlesville, Oklahoma.

Steele, G., 1988a. Correspondence to A. Chavez, E.O.S., Bartlesville, Oklahoma, February 1.

Steele, G., 1988b. NIPER Employee, Telephone Communication with D.C. Habib, NUS Corporation, November 29.

Steele, G., 1988c. Memorandum to all employees, National Institute for Petroleum and Energy Research, Bartlesville, Oklahoma, January 22.

Steele, G., ND. Radiation Safety Manual, National Institute for Petroleum and Energy Research, Bartlesville, Oklahoma.

Techrad (Technology Research & Development, Inc.), 1981. Report of Analysis, letter to G. Steele, February 10.

Tipton, J., 1986. Form "Notification for Underground Storage Tanks," National Institute for Petroleum and Energy Research, Bartlesville, Oklahoma.

U.S. Department of Agriculture, Soil Conservation Service, 1975. Soil Survey of Osage County, U. S. Department of Agriculture, Soil Conservation Service.

Williams Brothers Laboratories, 1978. Water Quality Data for Sewage Effluent, Tulsa, Oklahoma.

Williams Brothers Laboratories, 1979. Water Quality Data for Chromium in the Cooling Tower and Sanitary Sewer, Tulsa, Oklahoma.

Williams Brothers Laboratories, 1981. Water Quality Data for Sewage Effluent, Tulsa, Oklahoma.

Williams Brothers Laboratories, 1982. Water Quality Data for Sewage Effluent, Tulsa, Oklahoma.

BIBLIOGRAPHY

Benefield, L. D., and C. W. Randall, 1980. Biological Process Design for Wastewater Treatment, Prentice-Hall, Inc., Englewood, New Jersey.

Benham, Holloway & Spragens, 1979. Hydrocarbon Fuel Storage Building, Drawing #A-3, Tulsa, Oklahoma.

Boyd, M. W., 1987. Storage Tanks Above/Belowground, National Institute for Petroleum and Energy Research, Bartlesville, Oklahoma.

Canter, L.W., 1977. Environmental Impact Assessment, University of Oklahoma.

DOE (U.S. Department of Energy), 1978. Environmental Assessment, Land Acquisition and Facility Construction, Bartlesville, Washington and Osage Counties, Oklahoma, DOE/EPA-0025.

DOE (U.S. Department of Energy), 1981. Environmental Assessment– Conversion of Idle Bartlesville Technology Center (BETC) Radiological Facility by Decontamination of the Present Radiological Facility, Draft, U.S. Department of Energy, February.

DOE (U.S. Department of Energy), 1986. Addendum, Environmental Assessment, Land Acquisition and Facility Construction, Bartlesville Energy Research Center (now National Institute for Petroleum and Energy Research).

DOE (U.S. Department of Energy), 1987. Real Property Maintenance Management Plan, FY 1988, U.S. Department of Energy, Bartlesville, Oklahoma.

Ebert & Phinney Architects, Inc., 1986. Site Grading Plan, A Diesel Fuel Storage Facility & Diesel Engine Testing Laboratory Foundation, Bartlesville, Oklahoma.

EPA (U.S. Environmental Protection Agency), 1986. Compilation of Air Emission Factors, EPA Publication AP-42, U.S. Environmental Protection Agency, Washington, D.C.

ERDA (U.S. Energy Research and Development Administration), ND. Environmental Statement, Proposed Land Acquisition, Bartlesville, Oklahoma, Bartlesville Energy Research Center, Bartlesville, Oklahoma.

Hauth, L.D., J.K. Kurklin, D.M. Walters, and T.E. Coffey, 1987. Water Resources Data, Oklahoma, Water Year 1985, U.S. Geological Survey Water-Data Report OK-85-1, Oklahoma City, Oklahoma.

HUD (U.S. Department of Housing and Urban Development), 1980. Flood Insurance Rate Map, City of Bartlesville, Oklahoma, Washington County, Panel II of 28, Community-Panel Number 400220 0011 B.

Hughes, K., 1988. Former NIPER Employee, Personal Communication with W.M. Levitan, NUS Corporation, March 2.

ICUA (Interagency Committee on Urban Noise), 1981. Guidelines for Considering Noise in Land Use Planning and Control, Federal Interagency Committee on Urban Noise, NTIS PB81-214124, June.

IIT Research Institute, 1986. Annual Site Environmental Monitoring Report for Calendar Year 1986, Bartlesville, Oklahoma.

McClelland Consulting Engineers Incorporated, 1983. Industrial Pretreatment Program, City of Bartlesville, Little Rock, Arkansas.

NIPER (National Institute for Petroleum and Energy Research), 1984. Chemical Inventory, NIPER Engineering, Bartlesville, Oklahoma.

NIPER (National Institute for Petroleum and Energy Research), 1984. Site Development and Utilization Plan, NIPER Engineering, Bartlesville, Oklahoma.

NIPER (National Institute for Petroleum and Energy Research), 1986. Quality Assurance Plan, NIPER Engineering, Bartlesville, Oklahoma.

NIPER (National Institute for Petroleum and Energy Research), 1986. Supervisor's Investigation Report on Day Tank Overflow, NIPER Engineering, Bartlesville, Oklahoma.

NIPER (National Institute for Petroleum and Energy Research), 1987. Chemical Composition of Mixed Solid Waste, NIPER Engineering, Bartlesville, Oklahoma.

NIPER (National Institute for Petroleum and Energy Research), 1987. Toxic Substances Inventory, NIPER Engineering, Bartlesville, Oklahoma.

NIPER (National Institute for Petroleum and Energy Research), ND. A Guide to Laboratory Safety, NIPER Safety Department, Bartlesville, Oklahoma.

NIPER (National Institute for Petroleum and Energy Research), ND. Chemical Composition of Mixed Solvent Waste, NIPER Safety Department, Bartlesville, Oklahoma.

NIPER (National Institute for Petroleum and Energy Research), ND. Correspondence file, current 1988, NIPER Safety Department, Bartlesville, Oklahoma.

NIPER (National Institute for Petroleum and Energy Research), ND. Hazardous Waste Disposal Records File, 1982-1988, NIPER Safety Department, Bartlesville, Oklahoma.

NIPER (National Institute for Petroleum and Energy Research), ND. Location of Buildings Containing Asbestos, NIPER Engineering, Bartlesville, Oklahoma.

NIPER (National Institute for Petroleum and Energy Research), ND. Waste Chemicals for Disposal, NIPER Safety Department, Bartlesville, Oklahoma.

Noltensmeyer, S., 1988. Industrial Wastewater Pretreatment Program, Discharge Permit, City of Bartlesville, Bartlesville, Oklahoma.

Oklahoma Office of Community Affairs and Planning, 1971. Aerial Topographic Survey of City of Bartlesville, Oklahoma, Washington County, M-71-11, S.H. 23, State Planning Agency, Oklahoma City, Oklahoma.

Oklahoma SDH (State Department of Health), 1987. Oklahoma Air Quality Annual Report - 1986, Oklahoma State Department of Health, Oklahoma City, Oklahoma.

Oklahoma Water Resources Board, 1971. Appraisal of the Water and Related Land Resources of Oklahoma, Publication 36, Oklahoma Water Resources Board, Region 9.

Polone, D. J., 1968. Soil Survey Washington County, Oklahoma, U.S. Dept. of Agriculture, Washington County, Oklahoma.

Sanders, R., 1988. NIPER Employee, Personal Communication with W.M. Levitan, NUS Corporation, March 1.

Science Applications, Inc., 1987. Environmental Assessments and Impact Statements, National Institute for Petroleum and Energy Research, Bartlesville, Oklahoma.

Snow, R.H., 1984. Letter to S. Sanders, U.S. EPA; National Institute of Petroleum and Energy Research, Bartlesville, Oklahoma, May 21.

Steele, G., 1978 to 1987. Uniform Hazardous Waste Manifests, National Institute for Petroleum and Energy Research, Bartlesville, Oklahoma.

Steele, G., 1984-1986. Incident and Accident Reports, National Institute for Petroleum and Energy Research, Bartlesville, Oklahoma.

Steele, G., 1985. TSCA Procedures, National Institute for Petroleum and Energy Research, Bartlesville, Oklahoma.

Steele, G., 1987. Memorandum to all employees, National Institute for Petroleum and Energy Research, Bartlesville, Oklahoma, December 8.

Steele, G., 1987. NIPER Waste Management and Disposal, National Institute for Petroleum and Energy Research, Bartlesville, Oklahoma.

Steele, G., 1987. Spill Prevention and Emergency Response, National Institute for Petroleum and Energy Research, Bartlesville, Oklahoma.

Steele, G., 1988. Correspondence to A. Chavez, E.O.S., Bartlesville, Oklahoma, National Institute for Petroleum and Energy Research, Bartlesville, Oklahoma, February 1.

Steele, G., 1988. Memorandum to all Employees, National Institute for Petroleum and Energy Research, Bartlesville, Oklahoma, January 22.

Steele, G., 1988. NIPER Employee, Telephone Communication with D.C. Habib, NUS Corporation, November 29.

Steele, G., ND. Radiation Safety Manual, National Institute for Petroleum and Energy Research, Bartlesville, Oklahoma.

Techrad (Technology Research & Development, Inc.), 1981. Report of Analysis, letter to G. Steele, February 10.

Tipton, S., 1986. Form, "Notification for Underground Storage Tanks," NIPER, Bartlesville, Oklahoma.

U.S. Department of Agriculture, Soil Conservation Service, 1975. Soil Survey of Osage County, Oklahoma.

Webster, R. B., 1987. Environmental Evaluation, Bartlesville Project Office, U.S. Department of Energy, Pittsburgh Energy Technology Center.

Williams Brothers Laboratories, 1978. Water Quality Data for Sewage Effluent, Tulsa, Oklahoma.

Williams Brothers Laboratories, 1979. Water Quality Data for Chromium in the Cooling Tower and Sanitary Sewer, Tulsa, Oklahoma.

Williams Brothers Laboratories, 1981. Water Quality Data for Sewage Effluent, Tulsa, Oklahoma.

Williams Brothers Laboratories, 1982. Water Quality Data for Sewage Effluent, Tulsa, Oklahoma.

APPENDIX A
SURVEY PARTICIPANTS

NATIONAL INSTITUTE FOR PETROLEUM AND ENERGY RESEARCH
SURVEY PARTICIPANTS
FEBRUARY 29 - MARCH 4, 1988

DOE

Team Leader	Joseph Boda
Assistant Team Leader	Lee Stevens
Bartlesville Project Office Representative	Alex Crawley

Technical Specialists

Air	Robert Lanza (ICF)
Surface Water	William Levitan* (NUS)
Groundwater/Soils	Wayne Downey (NUS)
Waste Management	Donald Habib (NUS)
Toxic and Chemical Materials/Tanks	Wayne Downey (NUS)
Direct Radiation	Robert Lanza (ICF)
Quality Assurance	Wayne Downey (NUS)
Inactive Waste Sites and Releases	William Levitan (NUS)

* Contractor Coordinator

APPENDIX B

SITE-SPECIFIC SURVEY ACTIVITIES

B.1 Pre-Survey Preparation

The DOE Office of Environmental Audit, Assistant Secretary for Environment, Safety and Health, selected a Survey team for the National Institute for Petroleum and Energy Research (NIPER) in late 1987. The site is managed by the DOE Bartlesville Project Office (BPO) and is operated for DOE under a cooperative agreement by the Illinois Institute of Technology Research Institute (IITRI). Mr. Joseph Boda was designated the DOE Team Leader, Mr. Lee Stevens the Assistant Team Leader, and Mr. Alex Crawley the BPO representative. The remainder of the team was composed of contractor specialists from NUS Corporation and ICF, Inc. (Appendix A).

Survey team members began reviewing NIPER general environmental documents and reports in October 1987. Messrs. Boda and Stevens, along with two members of NUS Corporation, conducted a pre-Survey site visit on January 18 to 20, 1988, to become familiar with key DOE and NIPER personnel. They toured the facility and completed a cursory review of the documents assembled in response to an information request submitted to NIPER on December 23, 1987. The request listed environmental documents and reports required by the Survey team for Survey planning purposes.

The Survey team reviewed the information received during the pre-Survey visit and prepared a Survey Plan (Appendix C) for the NIPER facility. This plan described the specific approach to the Survey for each of the technical disciplines and included a proposed schedule for the on-site activities. A Health and Safety Plan was also prepared for use by the Survey team.

B.2 On-Site Activities

The on-site phase of the Survey was conducted during the period of February 29 through March 4, 1988. The opening meeting was held on February 29, 1988, at NIPER and was attended by representatives from NIPER and BPO, and the Survey team members.

Discussions during this meeting primarily concerned the purpose of the Survey, logistics at NIPER, and an introduction of the key personnel involved in the Survey.

During the Survey, team members reviewed pertinent file documents including permits and applications, background studies, engineering drawings, accident reports, chemical releases, and spills, as well as various operating logbooks. The research activities and associated processes were carefully analyzed to identify existing and potential pollutants. Site operations and monitoring procedures were observed, where possible. Extensive interviews were held with NIPER personnel concerning environmental controls, operations, monitoring and analysis, regulatory permits, and waste management.

The Survey team members met daily to report observations, discuss findings, and evaluate progress. These meetings were also useful for planning schedule changes, if required, to meet the overall objectives of the Survey.

A site closeout briefing was held on March 4, 1988, at which the DOE Team Leader and Assistant Team Leader presented the Survey team's preliminary findings and observations. The findings were considered preliminary pending additional research and review.

B.3 Sampling and Analysis

Based on the on-site NIPER Survey, no Survey-related sampling needs were identified.

B.4 Report Preparation

The Environmental Survey Preliminary Report for the NIPER site will be prepared for DOE review. The preliminary findings are subject to modification based on comments from BPO, NIPER, and the DOE Office of Fossil Energy. The modified findings will be incorporated into the Environmental Survey Summary Report.

APPENDIX C

NIPER SURVEY PLAN

DOE ENVIRONMENTAL SURVEY
NATIONAL INSTITUTE FOR PETROLEUM AND ENERGY
RESEARCH (NIPER)
Bartlesville, OK
February 29 - March 4, 1988

1.0 INTRODUCTION

The Environmental Survey is a one-time baseline inventory of existing environmental information and environmental problems and risks at DOE operating facilities. The Survey will be conducted in accordance with the principles and procedures contained in the DOE Environmental Survey Manual.

The Survey is an internal management tool to aid the Secretary and Under Secretary in allocating resources for maintaining aggressive environmental programs and for mitigating environmental problems at DOE facilities.

2.0 SURVEY IMPLEMENTATION

The Environmental Survey at NIPER will be managed by the DOE Team Leader, Joseph Boda, and the Assistant Team Leader, Lee Stevens. Alex Crawley will serve as the Bartlesville Project Office (BPO) representative on the Survey team. Technical support will be provided by contractor personnel as follows:

Radiation:	Robert Lanza, ICF Technology Inc.
Surface/Drinking Water:	William Levitan, NUS Corporation*
Waste Management:	Donald Habib, NUS Corporation
Inactive Waste Sites/Releases:	William Levitan, NUS Corporation
Hydrogeology/Storage Tanks:	Wayne Downey, NUS Corporation
Toxic and Chemical Materials:	Wayne Downey, NUS Corporation
Air:	Robert Lanza, ICF Technology Inc.

* Team Coordinator

2.1 Pre-Survey Activities

Members of the Survey team began reviewing NIPER environmental documentation available at the DOE Office of Environmental Audit in October 1987. From that review, a memorandum dated November 25, 1987, was sent to the BPO requesting additional information. Messrs Boda, Stevens, Habib, and Levitan conducted a pre-Survey site visit on January 18-20, 1988, to become familiar with the site, to identify any potential environmental problems, and to coordinate plans for the upcoming Survey with BPO and NIPER contractor personnel. During the pre-Survey visit, the team met with representatives of BPO and NIPER contractor personnel. In addition, the team toured the facilities and gathered documents assembled by site personnel in response to the information request memorandum. Additional information was requested and received from BPO and NIPER personnel during the pre-Survey visit, based upon the review of available data on-site.

2.2 On-Site Activities and Reports

The Environmental Survey of the NIPER site will be conducted from February 29 to March 4, 1988. The Survey will include the facilities operated by the Illinois Institute of Technology Research Institute (IITRI) located at NIPER. The agenda for this Survey can be found in the attached Table 1. Modifications to this plan may be made during the course 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 project-specific and area-specific tours of the facility. Table 2 indicates specific areas of interest for each of the technical specialists.

A closeout meeting will be conducted on Friday, March 4, to describe observations and initial findings of the on-site activities. A status report stating the findings identified at the closeout meeting will be sent to BPO within 4 weeks of the conclusion of the Survey. A Survey Preliminary Report will be prepared within approximately 4 months of the conclusion of the on-site effort. Subsequently, sampling and analysis (S&A) may be conducted at the site to strengthen the Survey findings and fill important data gaps. The results of the S&A effort, if implemented, will then be used along with BPO and NIPER comments on the Survey Preliminary Report in the preparation of a Survey Interim Report. The findings of each of the Interim Reports from all scheduled Surveys will be updated as appropriate and included in the Survey Summary Report to the Secretary, which is scheduled for completion in 1989.

2.3 Sampling and Analysis

Based upon the results of the on-site portion of the Survey, the Survey team will identify S&A needs, if required. A sampling team will draft an S&A Plan based upon these needs. The Assistant Team Leader, Lee Stevens, will coordinate the review of this S&A Plan with BPO, the NIPER contractor, and EPA's Environmental Monitoring Systems Laboratory at Las Vegas, which has quality assurance responsibility for the Survey's S&A efforts. Results of the S&A effort, if conducted, will be transmitted to the Survey Team Leader for incorporation into the Interim Report. The Interim Report should be available in late 1988.

3.0 AIR EMISSIONS AND RADIOACTIVE MATERIALS

3.1 Issue Identification

The radioactive and regulated/hazardous air-related Survey activities will involve an assessment of the laboratory-wide air emission sources, emissions controls and sampling/monitoring data. Areas of investigation will include laboratory emissions of acid fumes, toxic metals, organics, and volatile hydrocarbons (VOCs), and the emissions of carbon monoxide, nitrogen and sulfur oxides, and VOCs from fuel burning equipment. Operational and procedural practices associated with emission controls will also be evaluated.

The general approach to the Survey will involve a review of existing environmental reports, chemical inventories, operating procedures, ventilation diagrams, stack monitoring reports, and other relevant documents to identify significant sources of air emissions. Following the document review will be the physical inspection of significant processes and control and monitoring equipment. The Survey will identify air contaminants from significant emissions sources, identify and evaluate existing control and monitoring equipment for the air contaminants, and assess the potential for environmental problems from the emissions.

The radiological materials assessment will involve inspection of former radioactive materials storage and handling areas. Radioactive materials are not presently used at NIPER.

Several areas for specific investigation have been identified during a review of available documentation:

- Emissions of criteria pollutants from Buildings 6 and 17, and other combustion sources;
- VOC emissions from petroleum/fuel laboratories and other laboratories, storage areas, and the paint shop;
- Ambient air concentrations of particulates, carbon monoxide, nitrogen and sulfur oxides, and volatile organic compounds, on and off-site;
- Evaluation of the effect of laboratory emissions on air quality;
- Former radioactive materials storage and handling; and
- Potential/actual emissions of regulated/hazardous pollutants, carcinogens, and toxic substances from unpermitted and/or uncharacterized sources.

3.2 Records Required

- Emissions data for research and development engines (test reports);
- Local ambient air quality data for criteria pollutants;
- Descriptive documentation on existing and proposed add-on air emission control equipment;
- Ventilation system drawings;
- Operating, testing and maintenance procedures for air emission control and monitoring equipment; and
- Correspondence between NIPER and regulatory agencies related to criteria and/or toxic airborne contaminant releases, including permits, former radioactive material storage and handling area decontamination and decommissioning report, and associated documentation.

4.0 SURFACE/DRINKING WATER (SW)

4.1 Issue Identification

A number of documents provided in response to the information request have been reviewed with regard to the surface water technical specialty area. NIPER activities that generate wastewaters will be reviewed through a detailed field evaluation. Discrete 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, processing, 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 data base for the identification of physical evidence of existing or potential environmental contamination. Additionally, drinking water sources, treatment and distribution systems, and drinking water quality data will be reviewed.

The Survey will concentrate on areas of potential concern, including the discharge of contaminants into surface waters. The Survey will also include an identification of potential cross-contamination between chemical/radiological, potable, sanitary, and stormwater sewer systems. Specific attention will be paid to unknown or potential discharges into an inappropriate sewer system, which might cause a particular contaminant to be undetected or untreated. This will be accomplished by a thorough review of site facilities in conjunction with a review of standard operating procedures (SOPs) for the operation and maintenance of wastewater discharge equipment, followed by record review, interviews with site personnel, and observation of procedures.

A review of past water and wastewater conveyance, treatment, and disposal systems will also be accomplished during the Survey to evaluate what environmental problems, if any, may exist as a result of past practices. Site surface drainage features, including channels, swales, culverts and catch basins, will also be reviewed.

4.2 Records Required

- Wastewater Discharge Compliance Certification;
- Wastewater piping diagrams;
- Building 16, 17, and 19 and tank farm as-built drawings; and
- Correspondences with regulatory authorities relating to wastewater discharges and floodplain construction.

5.0 WASTE MANAGEMENT

5.1 Issue Identification

The Survey procedure for activities related to waste management is to review known sources or activities and identify any additional sources or activities that have the potential to result in contamination of environmental media.

Hazardous/radioactive/solid wastes will be tracked through the system and waste-related site activities and records will be reviewed to develop an inventory and assess NIPER's waste management practices.

During the hazardous waste portion of the Survey, the team will devote a significant portion of the time on-site to a detailed facility investigation of hazardous waste generation, storage, and disposal practices. In addition, hazardous waste transfer and storage areas will be examined.

The review of radioactive and nonhazardous solid waste will be similar to that for hazardous wastes. Procedures will be evaluated to determine the NIPER waste classification practices. The detailed investigation described above will produce information on radioactive and nonhazardous solid wastes so as to delineate any previously unidentified sources of waste that have the potential to result in environmental contamination.

Discussions will be held with individuals knowledgeable on current and past waste management practices. This will be accomplished during the investigation 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.

The review of activities related to waste management will be coordinated closely with the inactive waste site, hydrogeologic, toxic and chemical materials, and, surface/drinking water discipline activities to identify any possible releases that may pose a threat to the environment.

Several areas for specific investigation have been identified during a review of available documentation:

- Waste oil management practices;
- Hazardous waste identification and documentation;
- Solid waste management procedures and waste segregation practices; and
- Storage and disposition of scrap/salvage materials.

5.2 Records Required

Documentation, procedures, and internal and external correspondences, not already submitted, associated with the following topics:

- The responsibilities and activities of lab personnel in identifying, segregating, storing, and handling (1) nonhazardous solid waste; (2) hazardous waste; (3) radioactive waste, if any; (4) hazardous and nonhazardous biological waste, if any; and (5) waste oil;
- Quantitative and qualitative characterizations of each of the five waste types listed above;
- The responsibilities and activities of other NIPER personnel, including the site safety officers; and
- The equipment used in picking up and transferring from the points of generation, transporting between on-site facilities, recontainerizing, analyzing, preparing for shipment, and shipping any of the above-mentioned five waste types.

6.0 INACTIVE WASTE SITES/RELEASES

6.1 Issue Identification

The inactive waste sites/releases specialty area review will identify environmental problems associated with the historical handling, storage, and disposal of hazardous substances at the site. The review will involve the evaluation of information developed in response to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) regulations. The Survey will focus on current and future environmental problems related to past land disposal practice and past spills/releases.

As part of the Survey, records indicating the types and quantities of materials disposed of in inactive waste sites will be evaluated, as will the facility design and methods of waste containment. Information available through historical aerial photography, interviews, and site documents, such as Incident Reports, will be assessed to identify inactive waste sites and releases and disturbed land areas, and to further define site locations and associated changes in appearance over time. Visual inspections will be conducted for inactive sites and releases to note surface features and to locate potential monitoring points.

Any inactive waste sites that have undergone remediation will also be addressed. Records and analytical data in support of the site cleanup will be obtained for review. 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 the environment.

6.2 Records Required

- Incident Reports and
- Aerial/historical photographs.

7.0 HYDROGEOLOGY

7.1 Issue Identification

A major concern for the Survey is the potential sources of groundwater contamination. In addition, the potential impacts of any existing contamination on aquifers and the impacts of off-site movement of contaminated groundwater will be assessed by the Survey team.

A general review of existing data will be required to determine the usefulness of this information for the purposes of the Survey. Interviews with site personnel will be conducted to define local groundwater conditions. In addition, information on regional geological and groundwater characteristics will be collected.

Several areas for specific investigation were identified during a review of available documentation:

- Underground storage tank leak testing, age, construction material, content, and location;
- Aboveground storage tank spill containment;
- Solid and liquid waste management operations; and
- Regional and local groundwater flows and quality.

7.2 Records Required

- Reports or data describing regional and local groundwater conditions.

8.0 TOXIC AND CHEMICAL MATERIALS--TSCA

8.1 Issue Identification

The toxic and chemical materials review will address the raw materials and handling of chemical and petroleum products used at NIPER. The use, handling, and disposal of PCBs, asbestos, pesticides, and herbicides will also be within the scope of this effort.

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

The use of asbestos at NIPER will be reviewed to identify pathways of environmental contamination. Also, asbestos removal and disposal practices will be evaluated to define potential areas of concern.

Pesticide/herbicide usage on the site will be reviewed to determine the risks of environmental contamination. The review will focus on application records, storage and disposal practices, and environmental monitoring procedures.

Several areas for specific investigation were identified during a review of available documentation:

- Chemical procurement procedures;
- Material QA procedures;
- Toxic and hazardous materials inventory;
- Operator and technician training;
- Decontamination/disposal manifests and records;
- Maintenance/inspection logbooks; and
- Chemical and petroleum storage.

8.2 Records Required

- No additional toxic and chemical materials information is required at this time.

TABLE 1
NIPER ENVIRONMENTAL SURVEY AGENDA

	Air/Radiation (R. Lanza)	Surface Water/Inactive Waste Sites (W. Levitan)	Toxic and Chemical Materials/Hydrogeology (W. Downey)	Waste Management (D. Habib)
Monday, February 29				
AM	Orientation Document review - vent diagrams, Bldg 13 D&D report (w/SW/Inactive Waste Sites)	Orientation Document review - piping diagrams, building as-builts, incident reports (w/Air/Radiation)	Orientation Bldg 1	Orientation Interview with Site Safety Officer
PM	Bldgs 1 and 13	Bartlesville City Office - interviews regarding wastewater discharge permit, POTW, floodplain construction; historical records	Bldg 1 continued; Interview with site hydrogeologist	Bldgs 3, 5, and 6
Tuesday, March 1				
AM	Bldgs 2 and 3	Interviews with long-term employees	Bldgs 2, 5, 6, 7, 8, 9 including storage tanks	Bldgs 2, 7, 8, 9, 11, and 14
PM	Bldgs 5, 9, and 14; Document review-engine test emissions data	Tank farm, boneyard, waste transfer area, Bldg 16 oil separator system	Bldgs 3, 13, and 14	Bldgs 16, 17, 19, waste transfer area, and boneyard
Wednesday, March 2				
AM	Bldgs 6 and 15	City block containing Bldg 3 - outside areas, bldg piping systems	Bldgs 11, 15, 16, and 17	Bldgs 1, 12, 13, and 18
PM	Bldgs 16, 17, and 19	City block containing Bldg 1 - outside areas, bldg piping systems	Tank farm; Caves	Bldg 15
Thursday, March 3				
AM	Revisits	Revisits	Revisits	Revisits
PM	Findings development	Findings development	Findings development	Findings development
Friday, March 4				
AM	Close-out	Close-out	Close-out	Close-out

TABLE 2

NIPER ENVIRONMENTAL SURVEY

AREAS OF INTEREST FOR TECHNICAL SPECIALISTS

WASTE MANAGEMENT D. Habib	-	Hazardous Waste Non-Hazardous Waste RCRA/Solid Waste Permits Mixed Waste Radioactive Waste
RADIATION R. Lanza	-	Radioactive Emissions and Effluents Source Controls and Monitoring Radioactive Waste
AIR R. Lanza	-	Meteorology Local Air Quality Data Emission Sources, Control and Monitoring Environmental Monitoring - Air Air Permits and Air Emissions Inventory
SURFACE/DRINKING WATER W. Levitan	-	Effluent Sources Wastewater (Process and Sanitary Treatment) Facilities Cooling Water System Drinking Water Distribution Stormwater Management Spill Prevention, Control and Countermeasure Plan Aboveground Storage Tanks
HYDROGEOLOGY/STORAGE TANKS W. Downey	-	Waste Storage and Disposal Sites (Past and Active) Spill/Accident Locations Regional Geology and Groundwater Well Inventory and Construction Groundwater Monitoring Program and Studies Underground and Aboveground Storage Tanks

TABLE 2

NIPER ENVIRONMENTAL SURVEY

AREAS OF INTEREST FOR TECHNICAL SPECIALISTS (Continued)

INACTIVE WASTE SITES/ RELEASES W. Levitan	-	Past Waste Site Locations Characterization Studies Spill/Accident Locations Remediation Work Former Production Locations
QUALITY ASSURANCE W. Downey	-	Environmental Sampling Program Environmental Analytical Program Data Management and Handling QA Program Overview
TOXIC AND CHEMICAL MATERIALS-TSCA W. Downey	-	Process Chemicals and Substances Inventory Asbestos Use Evaluation Asbestos Removal and Disposal PCBs In-Service, Storage, and Disposal Pesticide Use, Storage, and Disposal Warehousing and Storage Tanks for Process Chemicals

LIST OF ABBREVIATIONS, ACRONYMS, CHEMICAL SYMBOLS, AND INITIALISMS

AAQS	Ambient Air Quality Standards
AST	aboveground storage tank
BPO	DOE Bartlesville Project Office
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
cm^3	cubic centimeter(s)
CO	carbon monoxide
DAS	Deputy Assistant Secretary
dB	decibel(s)
DOE	U.S. Department of Energy
EOR	enhanced oil recovery
EP	extraction procedure
EPA	U.S. Environmental Protection Agency
ERDA	U.S. Energy Research and Development Administration
°F	degree(s) Fahrenheit
FHWA	U.S. Federal Highway Administration
ft^3	cubic feet
ft^3/s	cubic feet per second
gal	gallon
HC	hydrocarbons
hp	horsepower
hr	hour
HRI	Hydrocarbon Recyclers, Incorporated
H_2S	hydrogen sulfide
HUD	U.S. Department of Housing and Urban Development
HVAC	heating, ventilation, and air conditioning
IA	Installation Assessment
IIT	Illinois Institute of Technology
IITRI	Illinois Institute of Technology Research Institute
kg	kilogram
lb	pound
MAAC	Maximum Allowable Air Concentration
mg/L	milligram(s) per liter
min	minute
MMBtu	million British thermal units
MSDS	material safety data sheet
NAAQS	National Ambient Air Quality Standards
NIPER	National Institute for Petroleum and Energy Research

LIST OF ABBREVIATIONS, ACRONYMS, CHEMICAL SYMBOLS, AND INITIALISMS

NO_2	nitrogen dioxide
NO_x	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
O_3	ozone
OEG	Office of Environmental Guidance and Compliance (DOE)
PCB	polychlorinated biphenyl
POTW	publicly-owned treatment works
ppm	part(s) per million
RCRA	Resource Conservation and Recovery Act
S&A	sampling and analysis
SO_2	sulfur dioxide
SPCC	spill prevention, control, and countermeasures
SQG	small quantity generator
TSP	total suspended particulate
$\mu g/m^3$	microgram(s) per cubic meter
UST	underground storage tank
VOCs	volatile organic compounds
WOSC	Waste Oil Service Company
yr	year

APPENDIX D

LIST OF ABBREVIATIONS, ACRONYMS, CHEMICAL SYMBOLS, AND INITIALISMS

END

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