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SITE INVESTIGATION (SI) REPORT

FOR

LEE ACRES SITE
FARMINGTON, SAN JUAN COUNTY, NEW MEXICO

BLM Site Code: NM 0000000000
AEPCO Site No. 1 Group A

(FINAL REPORT)

Under BLM Contract No. AA852-CT5-26
AEPCO Project No. 1200.1721

Submitted to:
Department of the Interior
Bureau of Land Management (BLM)
18th and C Streets, N.W.
Washington, D.C. 20240

Submitted by:

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30 May 1986

#17311124 ID88068653 TD 811.5 .S573 1986

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30 May 1986

U.S. Department of the Interior
Bureau of Land Management
18th and C Streets, N.W.
Washington, D.C. 20240

Attn.: Mr. Robert Sulenski
Contracting Officer's Representative

Subj.: Final SI Report for the Lee Acres Site, Farmington, New Mexico

Ref.: BLM Contract No. AA852-CT5-26
AEPCO Project No. 1200.1700; Task 1721

Dear Mr. Sulenski:

In accordance with the requirements of the subject contract and BLM comments dated 14 May 1986, AEPCO is pleased to submit the enclosed copies of the final report for the Lee Acres Site, Farmington, New Mexico. This final report was prepared to reflect our understanding and repsonse to BLM comments. One remaining issue not addressed in this final report concerns the unresolved status of the Markle's "well" water sample which our field team collected during the field reconnaissance of the site. To ensure the final report submitted herein would serve as a stand-alone document, all information and discussion related to the Markle's water supply issue were deleted.

In our May 27 response to this specific comment, we have requested that BLM grant AEPCO the authority to contact the Markle family and/or appropriate State of New Mexico personnel to find out the exact status of Markle's water supply. I would like to assure you that we are still committed to do so should such authority be granted. We are also open to any suggestions that you may have on alternative courses of action to resolve this issue.

Should you have any questions regarding the enclosed contract deliverable, please feel free to contact me.

Sincerely yours,

James S. Whang, Ph.D., P.E.

JSW:ktd

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EXECUTIVE SUMMARY

A site investigation (SI) was performed at the Lee Acres Landfill site with the objectives of using available information as supplemented by sampling and analysis to:

- o Define the type and estimate the quantities of hazardous material/wastes on site;
- o Estimate the status of contamination migration; and
- o Classify the site for possible future site actions.

A. Site Location and Layout

The currently active Lee Acres Site, covering an area of approximately 960 acres, is located 2 miles east-southeast of Farmington (a town of approximately 25,000 residents), San Juan County, New Mexico. The site contains the Lee Acres Modified Sanitary Landfill, the Giant Refining Co. facility, the Lee Acres Subdivision (approximately 166 dwelling units and 631 residents), and the El Paso Natural Gas Co. facility. Bloomfield Highway immediately south of the Giant Refining Co. dissects the site.

Covering approximately 20 acres, the landfill has been partially modified by landfill operations and liquid waste storage activities. Until recently, the entire landfill was fenced, but without a gate. A fence also separated the waste storage pits from the rest of the landfill. Other than natural terrain barriers, no other access control mechanisms are presently in place.

B. Landfill History

The landfill has been used as a sanitary landfill by San Juan County and is administered by the County Department of Public Works under a lease with the BLM Farmington Resource Area (FRA). The lease was issued on 16 April 1981.

Besides normal sanitary wastes, other industrial liquid wastes were dumped in the liquid waste pits in the landfill. Several notices of lease violations were sent by the BLM FRA manager to San Juan County concerning exposed trash, reseeding, installation of cattleguard, placement and repair of fences, and placement of warning signs. Most of these deficiencies or non-compliances were corrected after receipt of the BLM's notices, although much of the fencing has since been removed or damaged.

In April, 1985, one dike of the landfill liquid waste pits was breached during a severe rain storm. Landfill wastes entered the arroyo, posing a possible threat to the San Juan River. During the same period, several releases of toxic vapors from the liquid waste pits caused 15 people, including onsite remedial workers, to experience difficulty in breathing, severe headaches, skin rashes, or other symptoms. Also during that time, the Governor called in the National Guard to secure the perimeter of the landfill. The New Mexico Environmental Improvement Division (N.M. EID) ordered that the landfill be closed for liquid wastes, and a private contractor was hired by N.M. EID to treat the pit contents with ferric chloride to control the pH and prevent further releases of fumes.

C. Contamination Concerns

The site and its vicinity consist of an outwash of gravel and sands. The uppermost aquifer occurs at a 30 to 40 foot depth with no apparent impervious layer for protection. This aquifer consists of an alluvium (40-80 feet thick) with unconsolidated sands, gravels, silts, and clays. It is highly vulnerable to contamination from surface discharges and leachates from surface contamination. In the project area, the shallow groundwater flows from north to south and discharges into the San Juan River. Bedrock in the region may be fractured, and intercommunication between the shallow unconsolidated and the bedrock aquifers may exist.

Surface runoff in the area is normally scarce, because the annual precipitation only averages approximately 7 inches. The runoff basically follows the terrain, flowing from east to west, joining the arroyo, and eventually discharging into the San Juan River.

A preliminary geophysical study conducted on the area surrounding the Lee Acres Site by the State of New Mexico revealed two major anomalies in high conductivity values (potentially "contaminated" plumes) downgradient from the landfill. The first conductive plume seemed to originate from the onsite waste storage pits and to follow a north-south pathway. The second plume seemed to originate from an area within or near the Giant Refining Co.'s property and also to run along a north-south path. This finding suggests that there may be at least one other source of contamination. The exact characteristics and quantities of the wastes at these other source(s) are unknown. Nevertheless, multiple sources of contamination exist at the site.

During the field inspection one landfill trench, one dead animal pit, and four liquid waste pits were identified in the landfill. To the best of the field team's knowledge, these facilities are not lined. Field evidence, such as the presence of grease-like materials and high volatile organic vapor concentrations in the headspace at the liquid waste pits, suggests that area petroleum refineries and gas production facilities might have disposed petroleum production water into these pits. An estimated 8,800 cubic yards of liquid, semi-solid, and solid wastes are present in these pits as a result of unrestricted dumping of wastes. The contaminants cover a surface area of between 2 and 5 acres occupied by the four liquid waste pits.

Analytical findings for waste samples collected previously by N.M. EID personnel and those collected during this investigation indicate that the wastes contain elevated concentrations of highly volatile and mobile organic compounds. Some of these are toxic and/or carcinogenic, including toluene, benzene, trichloromethane, 1,1,1-trichloroethane, trichloroethylene (a positive human carcinogen), dichloromethane, ethylbenzene, and all three isomers of xylene. High concentrations of sulfide and strontium and trace amounts of naphthalene, phenanthrene, and 2-methyl naphthalene were also detected in the solid medium of the wastes. Compounds detected in the aqueous phase of the wastes are quite similar to those in the solid phase. The aqueous phase also contained 2,4-dimethylphenol, phenol, and 2- and 4-methylphenol. These findings indicate that the wastes in the liquid waste pits are slightly corrosive, highly volatile, slightly flammable, and potentially toxic.

Drinking water related odor and taste complaints have been registered by local residents. Residential well water samples collected downgradient from the landfill contained low but detectable concentrations of benzene, tetrachloroethene, trichloroethylene, 1,1-

dichloroethene, 1,1-dichloroethane, 1,2-dichloroethene, 1,1,1-trichloroethylene, and dichlorobromomethane. This finding is indicative of the existence of source(s) of contamination at the landfill. SI findings from the well water monitoring program reveal that at least two downgradient wells contain detectable levels of hazardous substances. Contamination of the downgradient wells in the Lee Acres Subdivision may be partially due to the Lee Acres Landfill contamination and other, yet to be firmly identified, potenial source(s) of contamination.

Approximately 136 houses (516 residents) in the Lee Acres Subdivision are connected to a public water system extended from the City of Bloomfield and managed by the Lee Acres Water Users Association. The remaining population of approximately 115 people (30 houses) is assumed to continue to rely on shallow groundwater for water supply. Some of the houses that are on the public water system still use well water for lawn watering, car washing, gardening, filling of swimming pool(s), and/or possibly other non-sanitary, non-food preparation purposes. Cross-contamination of the public water by the contaminated groundwater is possible, if the existing residential plumbing systems are not completed segregated from the public water system.

The extent of groundwater contamination cannot be effectively quantified, due to the lack of a comprehensive area groundwater monitoring program. However, the groundwater flow direction and the findings from a limited geophysical study conducted by the State indicate that all wells downgradient from the landfill are threatened by the general contamination in the area.

Nevertheless, the geophysical survey results preliminarily confirm the hypothesis that these plumes have not migrated far enough to reach the residential wells nearest to and downgradient from the above mentioned sources. The northern part of the Lee Acres Subdivision is probably within the leading edge of these plumes.

D. Site Ranking and Classification

Using available information, field data, and laboratory analysis of representative samples, the site was ranked based on EPA's Uncontrolled Hazardous Waste Site Ranking System. The ranking is influenced by a large number of variables with scores ranging from 0 to 100. A composite score of greater than 28.5 for a private site (i.e., non-Federally owned) is sufficient for inclusion on the National Priority List (NPL). The Lee Acres Landfill site scores for routes of exposure are:

Groundwater route:	39.72
Surface water route:	9.65
Air route:	47.18
Composite score:	36.04

The environmental health risks of fire/explosion and direct contact are:

Fire and explosion:	11.67
Direct contact:	16.67

It is important to note that the composite score of 36.04 and the potential involvement of other source(s) of contamination in the privately owned land may make this site eligible for inclusion on the NPL and potential Superfund funding for portions of remediation activities in areas not located on the public lands.

In accordance with BLM's criteria, the Lee Acres Landfill is classified as a Class IV site. A Class IV site is defined as one containing hazardous wastes or other hazardous substances in such form and quantity and under such conditions so as to constitute an imminent and substantial endangerment to human health and the environment.

E. Conclusions and Recommendations

To minimize the health risks of the existing contamination, it is recommended either that the landfill operations be temporarily suspended pending findings of a follow-up remedial investigation or that the landfill be permanently closed to the public. The landfill fencing should be repaired; and a routine surveillance and maintenance program should be introduced.

Since the area contamination is evidently not solely caused by the Lee Acres Landfill conditions, it is also suggested that a systematic investigation of the entire site including the Giant Refining Co. area be conducted. This investigation should consist, at a minimum, of area groundwater monitoring and geophysical surveys.

Because of the potential involvement of multiple onsite and offsite sources of contamination, EPA, BLM, the State, San Juan County, and other affected parties should be called upon to participate during the followup investigations and/or remedial actions. The goals of this remediation effort will be to:

- develop a systematic technical and institutional approach;
- formulate and implement required initial remedial measures (IRMs);
- designate responsibilities for the conduct of a preliminary assessment (PA) or site investigation (SI) of sources of contamination other than the Lee Acres Landfill site;
- design followup remedial investigations (RIs) and/or feasibility studies (FSs);
- identify and implement an acceptable and cost-effective solution to the multi-source problems encountered in the study area; and
- arrange for equitable financial resources for the remediation program.

1.0 INTRODUCTION

1.1 Background

This Site Investigation (SI) report has been prepared in accordance with:

- the requirements in the Project Guidance Documents prepared by AEPCO, Inc. for the Bureau of Land Management (BLM);
- Section 105 of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980;
- the National Contingency Plan (NCP) (Federal Register Vol. 47, No. 137, July 16, 1982); and
- the Federal Facilities Program Manual for Implementing CERCLA Responsibilities for Federal Agencies prepared by the U.S. Environmental Protection Agency.

1.2 Scope of Services

An SI was performed at the Lee Acres Site by AEPCO, Inc. under a contract agreement with the BLM. The objectives of this SI are to:

- Define the type and estimate the quantities of hazardous materials or wastes on site;
- Estimate the status of contamination migration,
- Determine the extent to which the site is in compliance with Federal and State regulations or permits; and
- Facilitate site classification for subsequent actions including no-action.

This SI report will be the basis for a scoping decision to be made by BLM for requesting funding for follow-up remedial investigation, feasibility studies, and whatever onsite or offsite remedial actions are required. This SI report and subsequent revisions may also serve as the primary planning document for all remedial actions at the site and related enforcement activities.

This report has been prepared primarily from existing information supplemented by a site reconnaissance and limited environmental sampling and laboratory analyses. It contains three major parts:

(1) Compilation of existing data -- (Sections 2 to 4);
(2) Evaluation of data -- (Sections 5 to 7);
(3) Study findings, and site ranking and classification (Section 8); and
(3) Remedial actions -- (Section 9).

2.0 THE SITE

2.1 Site Location

The Lee Acres Site, covering an area of approximately 960 acres is situated at latitude 36°42'45"N and longitude 108°05'40"W in San Juan County, New Mexico. This active site is located approximately 2 miles east-southeast of Farmington, New Mexico. It contains the Lee Acres Modified Sanitary Landfill, the Giant Refining Co. facility, the Lee Acres Subdivision, and the El Paso Natural Gas Co. facility (**Figure 2-1**). Bloomfield Highway (Route 64) immediately south of the Giant Refining Co. facility dissects the site. The site is bordered to the west by an unnamed arroyo and to the south by the San Juan River (**Figures 2-1 and 2-2**).

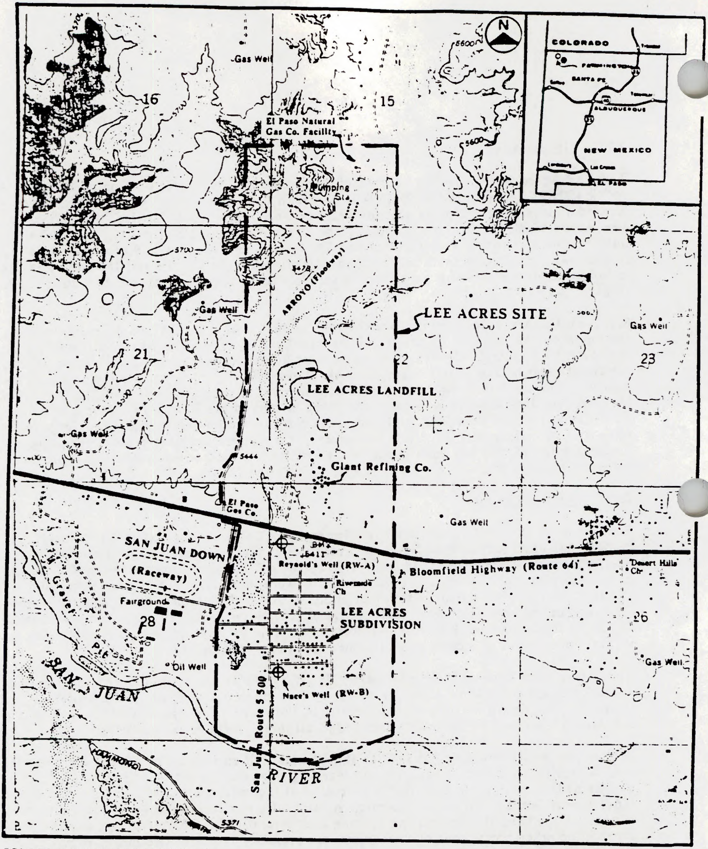
San Juan County is in the northwestern part of New Mexico. The County is bordered on the north by the State of Colorado, on the east by Rio Arriba and Sandoval Counties, on the south by McKinley County, and on the west by the Navajo Indian Reservation. Aztec, the county seat of San Juan County, is on the Animas River, in the northeastern part of the county. The area is home to the Jicarilla, Apache, Laguna, Navajo, and Ute mountain Indians. San Juan County is also the site of major oil and gas fields. The Navajo Mine and Four Corners power plant west of Farmington constitute the world's largest contiguous coal mine and electric power generating complex. The Grants uranium region, spanning the southern edge of the San Juan basin, has generally led the nation in uranium production since the early 1950's.

2.2 Landfill Layout

The layout of the landfill is shown in **Figure 2-3**. Covering approximately 20 acres, the landfill has been partially modified as a result of landfill operations and liquid waste disposal activities. During the field inspection by the AEPCO study team, one landfill trench, one dead animal pit, and four liquid waste pits were identified. The liquid waste pits are aligned in a roughly north to south orientation along the eastern bank of an unnamed arroyo. For the convenience of this study, the four liquid waste pits have been designated as Pits 01 through 04 (or P-01 to P-04) proceeding from north to south. Each successive pit is larger and serves as a cascading catchment for the preceding one.

The active landfill trench (approximately 75 ft. by 300 ft. by 3-10 ft. deep) and the dead animal pit (approximately 25 ft. by 50 ft. by 8 ft. deep) are located in the center of the landfill. The liquid waste pits are located in the western and southwestern ends of the landfill. To the best of the team's knowledge, all three facilities are not lined.

During the landfill visit, it was noticed that the landfill entrance was marked by a culvert with a grating serving as a cattleguard. Warning signs stating that the "dumping of liquid and hazardous wastes is prohibited" were posted at the entrance to the landfill. The entire landfill was fenced, but without a gate. A fence also separates the liquid waste pits from the rest of the landfill. Besides the fencing and natural terrain barriers (e.g., the unnamed arroyo), no other access control mechanisms are presently in place. [Recent information obtained by BLM personnel (14 April 1986) indicates that much of the landfill fencing has since been removed or damaged.]



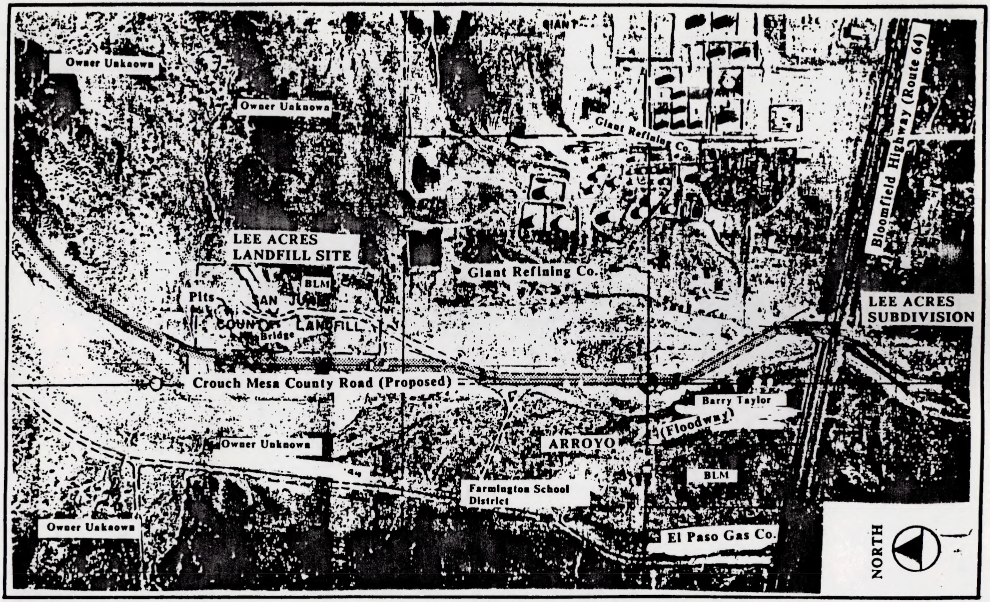
SOURCE: USGS QUADRANGLE MAP

0 2000 4000 FEET

Horn Canyon, N.M. (7.5-Minute Series Quadrangle Map)

⊕ Residential Wells Sampled

FIGURE 2-1. SITE LOCATION MAP



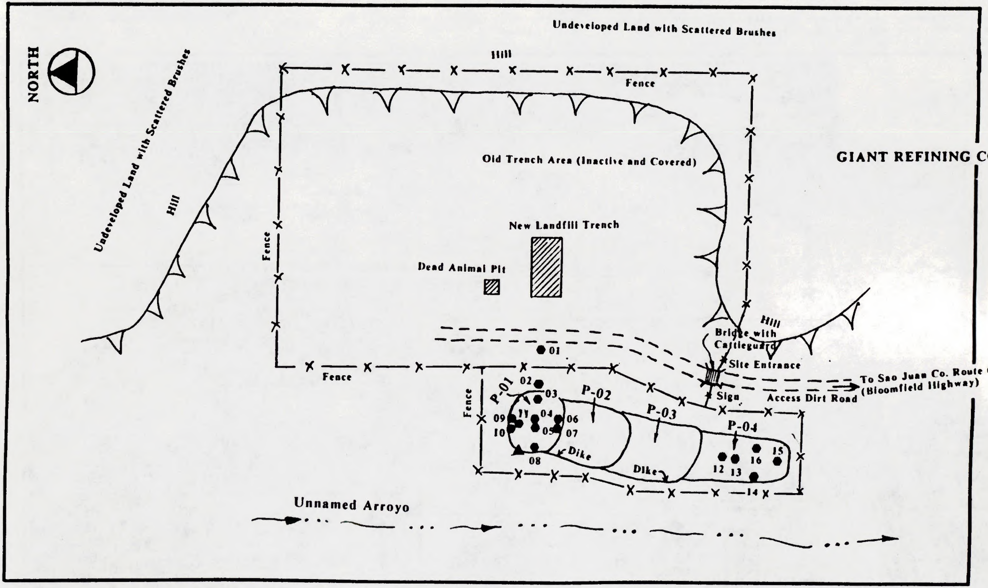
0 600 1,200 feet

(Approximate)

Source: Aerial Photo for the Proposed Crouch Mesa County Road, San Juan County, New Mexico, Prepared by Lawrence A. Brewer & Associates, Inc., Farmington, New Mexico (March 31, 1981)

—•— Property Line (Approximate)

FIGURE 2-2. AERIAL PHOTO OF LEE ACRES SITE
FARMINGTON, NEW MEXICO



0 100 200 300 400 Feet

SCALE (Approximate)

LEGEND:

P-00: Pit No. 00

● 01 Sampling/Monitoring Station

▲ This portion of the dike was damanged during the Storm in April, 1985 (now repaired).

FIGURE 2-3. LEE ACRES LANDFILL LAYOUT

2.3 Landfill Use History

The landfill site has been used as a sanitary landfill since 1981 by San Juan County and is administered by the County Department of Public Works under a lease with the BLM Farmington Resource Area (FRA) manager. The lease was issued on 16 April 1981 (Stella V. Gonzales, Chief, Lands Section, BLM N.M. State Office, Santa Fe, N.M., 16 April 1981).

Besides normal sanitary wastes, liquid wastes were dumped in the liquid waste pits. Several notices of lease violations were sent by the BLM FRA manager to San Juan County concerning exposed trash, reseeding, installation of cattleguard, hydrogen sulfide odors, placement and repair of fences, and placement of warning signs. Most of these deficiencies or non-compliances were corrected after receipt of the BLM's notices (Mat Millenbach, BLM Manager, 6/14/83; Mary Jo Albin, Surface Protection Specialist, FRAH, 5/11/84; J.H. Schultz, N.M. EID, 7/30/84; etc.).

2.4 Landfill Incident and Regulatory Action History

At approximately 2:00 P.M. on 18 April, 1985, the New Mexico Environmental Improvement Division (N.M. EID) was informed that the surface impoundment dike(s) in the Lee Acres Landfill had been breached. Wastes were entering the arroyo, posing a possible threat to the San Juan River. It was also reported that the county would dike the arroyo to prevent further migration of wastes. At approximately 2:30 P.M. on the same day, vapor emissions from the liquid waste pits (primarily Pit P-01) caused several people to feel sick, as reported to the N.M. EID. At 11:40 P.M., the Lee Acres area was experiencing a severe rain storm (Jack Ellvinger, Environmental Supervisor, Hazardous Waste Section, N.M. EID, 14 May 1985).

On Friday, 19 April, the N.M. EID reported the incident to the U.S. Environmental Protection Agency (EPA). On the same day, the woman holding scavenger rights to the landfill and her two children experienced difficulty in breathing and were treated as outpatients at the local hospital emergency room. The air was sampled, using Drager tubes downwind of the pit for benzene, trichloroethylene, ammonia, chlorine, and hydrogen sulfide. The results were negative (op. cit.).

On 20 April, initial samples of the liquid in the pits were collected and sent to a laboratory for analysis for cyanide (CN), hydrogen sulfide (H_2S), chlorinated organics, and metals (op. cit.).

On 21 April, EPA conducted tests using an hNu organic vapor analyzer, but failed to detect any toxic gases. The dikes were inspected and found to be saturated and leaking at approximately 2 gallons per minute (gpm). This was evidenced by the amounts of erosion and the quantity of material in the arroyo. The hydrocarbon-like materials were carried in the water, which was gradually being absorbed into the arroyo bottom leaving some of the hydrocarbon materials on the surface (op. cit.).

On 22 April, two county employees attempting to repair the leaking dike in Pit P-01, experienced severe headaches, and were also treated as outpatients. Local fire department personnel were called in to complete the repairs. Although respiratory difficulties were not reported since they wore proper masks, six of the personnel did develop severe rashes and were treated and released at the local hospital emergency room. At that time, the State

Police asked the Governor to call in the National Guard to secure the perimeter of the landfill (op. cit.).

Also on 22 April New Mexico EID officials met in Santa Fe to discuss alternative emergency remedial actions (op. cit.).

BLM personnel on 23 April, notified San Juan County of a complaint that waste petroleum products were dumped by gas company field personnel in a shallow unfenced pit within the landfill where BLM allottee's cattle would have access to this waste material (op. cit.).

A third release occurred on 23 April after which two National Guardsmen who were providing landfill security were found semiconscious and were taken to the hospital where they were diagnosed as suffering from acute hydrogen sulfide and tetrachloroethylene intoxication. One guardsman was treated and released; the other kept overnight and then released. Also, on 23 April, two women were overcome, one of whom lost consciousness. Both were taken to the hospital, where one was treated and released; and the other was kept overnight and released the following day. The National Guard and the State EID secured the landfill; and they and EPA reported that the landfill was under control (op. cit.) On the same day, New Mexico EID brought in a private contractor, IT Corporation, to take additional samples and make recommendations on the cleanup of the landfill problem. IT Corporation then collected and analyzed some waste samples from the pits; and conducted bench tests to determine the effect of using sodium hydroxide, agricultural lime, or ferric chloride to control pH to prevent further releases of hydrogen sulfide. Through 1985, 15 persons have been treated for possible H_2S poisoning (four have actually been diagnosed.) (B. Hyde, Chief, Hazardous Materials and Program Management Staff, BLM Headquarters, Washington, D.C., 26 April 1985). All those affected were at or located within one half mile of the landfill and were tested to determine if a public health emergency existed. Although the symptoms were consistent with hydrogen sulfide poisoning, the subsequent laboratory results were inconclusive (Raymond R. Sisneros, Environmental Services Section Manager, 16 May 1985).

On 24 April, N.M. EID obtained laboratory results for the samples collected previously. It was found that the wastes contain hydrocarbons and H_2S (approximately 360 ppm). (Raymond R. Sisneros, 14 May 1985).

On 26 April, a hazardous substance release incident and an early alert report for the landfill were filed by Bernie Hyde (B. Hyde, 26 April 1985).

Also on 26 April, after reviewing partial analytical results for samples collected on 24 April, IT Corporation recommended to New Mexico EID that ferric chloride be added to Pit P-01 to precipitate dissolved sulfide as iron sulfide (Joseph K. Register and Kenneth R. Porter, IT Corporation, 22 May 1985).

On 27 April, IT Corp. personnel periodically performed hydrogen sulfide measurements at Pit P-01. At the time the measurements were performed, hydrogen sulfide was below the lower limit of detection of 1 part per million (ppm) in the air. In the afternoon, N.M. EID directed IT Corp. to perform the ferric chloride treatment as soon as possible. Periodic monitoring of hydrogen sulfide was performed between 27 and 29 April (op. cit.).

After an extensive search for suppliers of large quantities of ferric chloride, it was obtained and arrived with pumps on 30 April (op. cit.). On the same day, N.M. EID concluded that the landfill is poorly sited for liquids disposal, because of the shallow groundwater and the presence of the arroyo. It was decided that the landfill would remain open for solid waste deposition; however, disposal of liquids would be prohibited (R.J. Perkins, Acting Bureau Chief, Ground Water/Hazardous Waste Bureau, N.M. EID, Meeting Minutes dated 2 May 1985).

In-situ ferric chloride treatment of pit contents was initiated on 1 May and continued through the following day. During the treatment, vigorous agitation of pit contents caused significant emissions of hydrogen sulfide (concentrations near the pit were measured to be as high as 20 ppm). Fourteen 55-gallon drums of 39-43% ferric chloride solution were mixed with the pit contents (Register and Porter, 22 May 1985).

Follow-up groundwater monitoring was conducted by N.M. EID.

The Occupational Health and Safety Bureau (OHSB) of the N.M. EID prepared an audit of Lee Acres situation. A question of concern addressed in the audit is why the pit suddenly over a two week period began producing and emitting hydrogen sulfide and possible other chemicals when similar pits or lagoons in the Farmington area and statewide have not been a problem. Among the possible explanations discussed are:

(1) acid waste or rinsings which were disposed in the pit, reacted with the sulfides normally contained in oil and gas production water causing hydrogen sulfide to be released, or
(2) the breach and continuous leaking of the pit beginning on 18 April disturbed the contents of the pit sufficiently to cause hydrogen sulfide release. The generation of hydrogen sulfide gas might be resulted from the anaerobic degradation of the sewage and dead animals in the pits.

In any case, hydrogen sulfide was sporadically released from the Lee Acres liquid waste pit(s) beginning on April 18, 1985, and possibly before that time. This assumption is based on hydrogen sulfide readings on Draeger tubes, direct reading instruments data, and strip chart data, albeit in low concentrations. Additionally, the laboratory analysis of the pit sample taken on 20 April confirms the presence of dissolved sulfides ranging from 40 to 336 ppm. National Guardsmen, EID personnel, firemen, and others in the area reported the odor of rotton eggs which is characteristic of hydrogen sulfide (C. Oppenheimer, Bureau Chief, OHSB, 13 May 1985).

Most of these people checked at the hospital emergency room had symptoms consistent with exposure to hydrogen sulfide. According to the National Institute for Occupational Safety and Health Criteria Document for Hydrogen Sulfide "Cough, disturbed sleep, nausea, vomiting, and diarrhea have been reported after exposures to H_2S at a wide range (0.022-2,000 ppm) of concentrations" (op. cit.).

A landfill chronology is presented in **Table 2-1**.

TABLE 2-1. LEE ACRES LANDFILL CHRONOLOGY

SITE: Lee Acres Landfill, Farmington, San Juan County, New Mexico

BLM Site Code: NM 0000000000

AEPCO Site No. 1, Group A

Date	Event
11/14/79, 05/22/80, 05/23/80	A Land Report was prepared by Douglas J. Burger of BLM to determine the the feasibility of using the subject land for a sanitary landfill. The landfill would require the allocation of 40 acres of public land for 15 years.
06/30/80	A letter concerning landfill mineral resources was prepared by Elmer D. Patterson, Acting Area Geologist, U.S.G.S for the proposed landfill.
10/28/80	An environmental assessment report was prepared by the Farmington Resource Area (FRA) for the proposed San Juan County Lee Acres Sanitary Landfill.
12/08/80	Correspondence from David A. Tomko of the State of New Mexico, Environmental Improvement Division to L. Paul Applegate of BLM in support of the proposed landfill.
01/16/81	Initial Classification Decision by Matthew N. Millenbach for the State Director approving the petition for lease of the property by San Juan County, New Mexico for use as a sanitary landfill.
02/12/81	Correspondence from Anita Hisenger, State of New Mexico, Department of Finance and Administration Planning Division, stating no opposition or other comments on the proposed use of the property as a sanitary landfill.
04/16/81	Official lease of the property to San Juan County to operate as a sanitary landfill signed by all parties, along with other legal documents, including stipulations, development and management plan, and assurance of compliance.
06/14/83	Notice of stipulation violations and a solid waste evaluation report were prepared and delivered by the BLM FRA Manager to San Juan County concerning exposed trash, reseeding, installation of cattleguard, and placement of warning signs.
10/04/83	Melvin Hall, Road Superintendent of San Juan County, replied to BLM to the effect that all stipulation violations were corrected.
03/15/84	A memo regarding noncompliance with sanitary landfill operation practices was prepared by BLM.

TABLE 2-1. LEE ACRES LANDFILL CHRONOLOGY
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Date	Event
05/15/84	A second compliance letter was delivered by Mat Millenbach of BLM to the San Juan County Department of Public Works.
04/18/85	The problem at the landfill was first reported to N.M. EID. Vapors emitted from the landfill caused several people to feel sick and a small amount of liquid leaked from the waste storage pit.
04/19/85	The landfill was closed by N.M. EID and the assistance of EPA was requested. Additional dikes were constructed to contain the liquid.
04/20/85	Initial samples of the pit liquid were taken and sent to a laboratory for analysis.
04/22/85	N.M. EID officials met in Santa Fe to discuss remedial action alternatives.
04/23/85 04/24/85	An extract from a telephone conversation between San Juan County and BLM personnel concerning a Lee Acres Hazardous Waste Accident contains the statement: "There were still toxic fumes in the area making people sick and that OSHA was really onto them (i.e., San Juan County) about this situation." BLM personnel reiterated that the lease stipulates that "Hazardous waste items will not be accepted at the site (landfill)."
04/23/85	Mat Millenbach, a BLM Area Manager, notified San Juan County of a complaint that waste petroleum products were dumped by gas company field personnel in a shallow unfenced pit within the landfill, where allotee's cattle would have access to this waste material.
04/23/85	N.M. EID brought in a private contractor to take additional samples and make recommendations on the cleanup of the landfill.
04/25/85	Status report from N.M. EID- Some of the test results have been returned. There is some H_2S gas present in the water, but no evidence of pollutants that would require use of Superfund money at this time. The private contractor has taken some additional samples (results should be available by 04/27/85). The contractor will then come up with alternatives for cleanup and N.M. EID will decide how to proceed. The State Police still have the National Guard keeping the area closed. N.M. EID is continuing to take air samples.

TABLE 2-1. LEE ACRES LANDFILL CHRONOLOGY
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Date	Event
	To date, 15 persons have been treated for possible H_2S poisoning (four have actually been diagnosed).
04/26/85	A hazardous substance release incident and early alert report for Lee Acres Landfill was filed by Bernie Hyde, Chief of Hazardous Materials and Program Management Staff, BLM Headquarters, Washington, D. C.
04/30/85 05/01/85, 05/02/85	News reports on the Lee Acres incidences appeared in the Farmington Daily Times.
10/03/85	Letter from David A. Tomko, Health Program Manager, N.M. EID to Ms. Linda Reynolds (resident near the landfill) informing her that (1) an electromagnetic induction survey will be conducted for the site to locate the contaminated plume; (2) N.M. EID will work with BLM and San Juan County to come up with remedial action(s); and (3) the contamination in her well has been confirmed.
09/14/85	BLM signed a service contract with AEPCO, Inc. to conduct a site investigation for the Lee Acres Landfill site.
11/19/85- 11/22/85	AEPCO visited the landfill and performed a site reconnaissance and a field sampling-plan for the Lee Acres Landfill site.

3.0 ENVIRONMENTAL SETTING AND POTENTIAL RECEPTORS

3.1 Landforms

The eastern part of San Juan County is on a high plateau that is dissected in the north by the San Juan River Valley. Farmington and vicinity consist of plateau and deep valleys formed as a result of distant hills and mountains. Local relief is low.

The site and vicinity feature nearly level to gently sloping terrain consisting of shallow soils, well drained, formed in alluvial and eolian materials on uplands. The site is located approximately 5,350 ft to 5,600 ft above mean sea level. The landfill portion of the project site is rather flat; bordered by hills to the northeast and east. An unnamed arroyo (floodway) runs from north to south along the western edge of the site. The slope within the landfill is approximately 5-8%. The slope between the liquid waste pits (in the west and southwest portions of the landfill) and the unnamed arroyo is quite steep (approximately 15-20%). Signs of erosion of the edge of the western dikes of the pits are evident. In fact, the northwestern portion of the dike for Pit #1 (P0-1) was once damaged, but is now repaired. Liquid wastes in Pit P0-1 leaked to the arroyo during a storm in April, 1985 (Section 2.5). Because of the lack of an inventory of the liquid wastes present in the pit before the dike was breached, the amounts of liquid and semi-solid wastes that escaped from the pit to the arroyo cannot be accurately estimated.

3.2 Surface Waters

San Juan County depends on perennial surface water and groundwater for its water supply. The Animas and San Juan Rivers in the county are the largest streams flowing perennially. Most of the other stream channels in the county, however, are ephemeral or intermittent. Groundwater flowing from bedrock sources also persumably contribute to stream flows in small quantities (Stone, 1983).

The San Juan and Animas Rivers originate in Colorado and flow through the State of New Mexico. The San Juan River, joined by the Animas River at Farmington, flows westward along an arcuate course and leaves the state near Four Corners. Since 1963, flow in the San Juan River has been controlled by the Navajo Dam, which forms a reservoir with a capacity of approximately 1.7 million acre-feet. Data on the discharge and water quality at selected surface water stations along the Animas and San Juan Rivers (both upgradient and downgradient from the site) are summarized in **Table 3-1** (Stone, et al., 1983). The two rivers cover drainage areas of approximately 7,240 and 1,360 square miles, respectively. A 65-year record (1912 to 1977) maintained by the Bureau of Mines reveals that the discharge rate for the San Juan River at Farmington averages approximately 2,370 cubic feet per second (cfs), with a record maximum of 68,000 cfs and a record minimum of 14 cfs. The flow of the Animas River at Farmington averages 909 cfs with a maximum and minimum of 25,000 cfs and 1 cfs, respectively (op. cit.).

Northeastern San Juan County, where the Lee Acres site is located, is drained by the San Juan River. Besides the Animas River, the other tributaries are intermittent streams that are subject to flash flooding during intense rainstorms. Flooding has been controlled on the San Juan River by the construction of the Navajo Dam. However, local flash flooding is still a threat to irrigation systems, farmland, and urban areas along the small tributaries of the San Juan and Animas Rivers.

TABLE 3-1. SUMMARY OF SURFACE HYDROLOGIC DATA

STATION NAME	DRAINAGE AREA (Square Miles)	WATER DISCHARGE (cfs*) MAXIMUM	MINIMUM	MEAN
Animas River at Farmington	1,360	25,000	1	909
San Juan River at Farmington	7,240	68,000	14	2,370
San Juan River at Shiprock	12,900	80,000	8	2,175

* cfs = cubic feet per second

Source: Stone, W.J., F.P. Lyford, P.F. Frenzel, et al, 1983. Hydrogeology and Water Resources of San Juan Basin, New Mexico., Hydrogeologic Report No. 6, New Mexico Bureau of Mines, Santa Fe, New Mexico.

Surface runoff from the site is normally scarce, because the annual precipitation only averages approximately 7 inches. However, during storms with rain intensity averaging approximately 2.5 inches for a typical 10-year 24-hour rain storm and 1.2 inches for a typical 1-year 24-hour rain storm, surface runoff from the site can be excessive. The site is located in a basin of the arroyo, which assumes a north-to-south direction. Surface runoff from the site, basically follows the terrain, flowing from east to west, joining the arroyo, and eventually discharging into the San Juan River on the southern border of the site.

A topographic map for the study area indicates that the arroyo has an estimated drainage area of approximately 730 acres (assuming a 6 mile length and an average width of 1,000 feet). Thus, the estimated flow of the arroyo at its confluence with San Juan River during a 10-year 24-hour rain storm of 2.5 inches, would be approximately:

- o 80 cfs, assuming zero percent soil absorption of rain water;
- o 60 cfs, assuming 25% rain water retention and absorption by soils; or
- o 40 cfs, assuming 50% rain water retention and absorption by soils.

Considering the sandiness and high porosity of the site soils, the lowest flow in the above estimate would most likely represent the actual conditions. Nevertheless, the above range of estimated flow rates represents approximately 1.5% to 2.9% of normal dry weather flow of San Juan River, or less than 0.06% to 0.12% during record high wet-weather flow periods. In other words, San Juan River provides a minimum dilution capacity ranging from approximately 30 to 1,700.

Failure of portions of the dikes for the liquid waste pits has already caused uncontrolled releases of wastes from the landfill to the arroyo and possibly the San Juan River. Therefore, surface waters near the site, including the arroyo and the San Juan River, are potential receptors of wastes deposited in the landfill. It is unknown whether contaminants in the other potential source(s) of contamination in the site have migrated offsite via the surface water route.

3.3 Geology and Soils

3.3.1 Regional Geology

Stone, et al. (1983) report that San Juan County occupies the Navajo Section of the Colorado Plateau physiographic province. The region is a structural depression containing deep Tertiary fill resting on rocks of Late Cretaceous age. Quaternary deposits are restricted mainly to major valleys.

The study area has three distinct geomorphic units. The first unit is in the northern and eastern parts of the County and is characterized by high relief, stepped topography, upland summits, narrow valleys, and steep canyon walls. Surface deposits on uplands consist of thin veneers of eolian sediment in some areas and of gravelly alluvium in others. In many areas, bedrock crops out at the surface. Resistant sandstone beds of the early Tertiary San Jose Formation form prominent structural benches, buttes, and mesas bounded by cliffs. Elevation ranges from 6,400 to 7,200 feet (op. cit.).

The second unit consists of the alluvial fans and flood plains in the entrenched, narrow valleys of the San Juan, Animas, and La Plata Rivers. There are several smaller ephemeral stream systems and high, level terraces and terrace gravels that form a stepped sequence of river cut benches at elevations of as much as 600 feet above the present floodplain. Elevation ranges from 4,800 to 6,000 feet. The unit crosses parts of the other two units (op. cit.).

The third unit is the largest of the three. It is bounded on the north and east by the first geomorphic unit and is dissected by the second one. This unit is characterized by moderate canyon dissection; relatively broad valleys; broad, gently sloping plateaus and mesas; locally thick deposits of alluvium; and sandy eolian sediment. Except for local areas underlain by cliff-forming Ojo Alamo and Pictured Cliff Sandstone of late Cretaceous age, the relatively smooth and gently sloping topography of the plateaus reflects the erodibility of generally shaly bedrock such as that of the Kirtland and Nacimiento Formations of Cretaceous to early Tertiary age. Elevation ranges from 5,600 to 6,400 feet (op. cit.).

3.3.2 Geology of the Site and Vicinity

The Farmington area of San Juan County, consists of plateaus and deep valleys of Cretaceous/Tertiary formations, i.e., belonging to or relating to the last period of the Mesazoic era or corresponding system of rocks. The bedrock geology comprises low dipping (relief) sandstones and shales. The site and its immediate vicinity consist of an outwash of gravel and sands. Rock outcrops are not evidential at the site, but are prevalent in some locations in the geologic region (Wells, 1985; and Garharm, et al., 1977). The bedrock may be fractured (Wells, 1985). The rocks exposed in the field area in the region are upper Cretaceous formations, which consist of the Cliff House Sandstone (uppermost unit of the Mesa Verde Group) and a normal sequence of younger Cretaceous beds culminating with the Fruitland Formation (Gorham, et al., 1977).

3.3.3 Soils

A general soil map prepared by the U.S. Soil Conservation Service for the eastern part of San Juan County, New Mexico (USDA/SCS, 1980) shows a spatial distribution of various soil associations -- a landscape having a proportional pattern of one or more major soils and at least one minor soil. The soils in one association may occur in another but in a different pattern. Several of the soil associations identified in the eastern part of the San Juan County general soil map are present at the site and its vicinity. However, the descriptions, names, and delineations of soils in the soil survey of the County, do not fully agree with those on soil maps for adjacent counties. Differences are the result of better knowledge of soils, modifications in series concepts, intensity of mapping, or the extent of soils within the survey area (op. cit.).

Engineering indices and physical and chemical properties of these soils are presented in **Tables 3-2** and **3-3**, respectively. The soils at the site vary from very shallow to deep, nearly level, well drained, formed in alluvial, residual, and eolian material on uplands.

Most of the surface soils are shallow, varying in depth from 12" to 81", and coarse in texture with small amounts of silts and clay (0-35%) and low shrink-swell potential. The surface soils are low in organic matter (0-4.5%), alkaline in reaction (pH range of 7.9-9.0), and highly permeable (0.2-20 inches/hour).

Because of prior soil excavations for landfill purposes, the soils within portions of the

TABLE 3-2. ENGINEERING PROPERTIES OF SOILS AT AND NEAR THE SITE

SITE NAME: LEE ACRES SITE CODE: 1
CITY: FARMINGTON GROUP NO.: A
COUNTY: SAN JUAN COUNTY BLM CODE: NM 0000000000
STATE: NEW MEXICO
BLM HAZARDOUS MATERIALS MANAGEMENT PROJECT

SOIL NAME	DEPTH (Inch)	CLAY <2mm (%)	PERMEABILITY (Inch/Hr)	SOIL REACTION (pH)	SALINITY (Mmhos/cm)	SHRINK-SWELL POTENTIAL	ORGANIC MATTER (%)
Avalon (Av)	0-14	12-17	2.0-6.0	7.9-8.4	2-8	Low	.5-.5
	14-53	20-30	0.6-2.0	7.9-8.4	2-8	Low	
	53-72	15-25	2.0-6.0	7.9-8.4	2-8	Low	
Avalon (Ay)	0-18	15-25	0.6-2.0	7.9-8.4	2-8	Low	
	18-60	20-30	0.6-2.0	7.9-8.4	2-8	Low	.5-.3
Beebe Variant	0-8	5-15	6.0-20	7.4-8.4	2-4	Low	.5-1
	8-67	5-10	6.0-20	7.4-8.4	2-4	Low	
	67-81	5-10	6.0-20	7.4-8.4	2-4	Low	
Blackston (Bk)	0-11	15-25	0.6-2.0	7.9-8.4	>2	Low	.5-1
	11-27	15-30	0.6-2.0	7.9-9.0	4-8	Low	
	27-80	0-5	6.0-20	7.9-8.4	4-8	Low	
Blackston (Bm)	0-9	15-25	0.6-2.0	7.9-8.4	<2		
	9-25	15-30	0.6-2.0	7.9-9.0	4-8	Low	
	25-60	0-10	6.0-20	7.9-8.4	4-8	Low	
Blancot	0-6	15-26	0.2-2.0	7.9-8.4	<2	Low	
	6-60	20-35	0.6-2.0	7.9-9.0	<4	Moderate	
Fruitland (BR)	0-8	5-10	2.0-6.0	7.4-8.4	<4	Low	.6-.8
	8-60	5-18	2.0-6.0	7.4-8.4	<4	Low	
Doak	0-3	15-27	[illegible]	7.4-8,4	<2	Low	.5-.6
	3-60	25-35	[illegible]	7.4-9.0	2-4	Moderate	
Fruitland (Fr)	0-7	5-10	2.0-6.0	7.4-8.4	<4	Low	.6-.8
	7-60	5-18	2.0-6.0	7.4-8.4	<4	Low	
Fruitland (Fs)	0-6	5-10	2.0-6.0	7.4-8.4	<4	Low	.6-.8
	6-60	5-18	[illegible]	7.4-8.4	<4	Low	
Fruitland (Ft)	0-6	10-18	2.0-6.0	7.4-8.4	2-4	Low	.5-.8
	6-60	10-20	2.0-6.0	7.4-8.4	2.4	Low	
Fruitland (Fy)	0-9	5-10	2.0-6.0	7.4-8.4	<4	Low	.6-.8
	9-60	5-18	2.0-6.0	7.4-8.4	<4	Low	
Blackston	0-11	18-27	2.0-6.0	7.9-8.4	2-4	Low	
	11-28	15-30	0.2-0.6	8.5-9.0	<2	Low	
	28-60	5-15	6.0-20	7.9-8.4	<2	Low	
Stumble (St)	0-5	0-10	6.0-20	7.9-8.4	<2	Low	4.5
	5-29	0-10	6.0-20	7.9-9.0	<4	Low	
	29-49	0-5	6.0-20	7.9-9.0	<4	Low	
	49-81	0-10	6.0-20	7.9-9.0	<4	Low	
Stumble (Sw)	0-6	0-10	6.0-20	7.9-8.4	<2	Low	
	6-29	0-10	6.0-20	7.9-9.0	<4	Low	
	29-60	0-5	6.0-20	7.9-9.0	<4	Low	
Fruitland (Sw)	0-7	5-10	2.0-6.0	7.4-8.4	<4	Low	.6-.8
	7-60	5-18	2.0-6.0	7.4-8.4	<4	Low	
Turley (Tr)	0-9	28-35	0.2-0.6	7.4-9.0	2-4	Moderate	.5-.8
	9-60	25-35	0.2-0.6	7.4-9.0	2-4	Moderate	
Turley (Tv)	0-8	28-35	0.2-0.6	7.4-9.0	2-4	Moderate	.5-.8
	8-60	25-35	0.2-0.6	7.4-9.0	2-4	Moderate	
Walrees	0-6	18-27	0.6-2.0	7.9-9.0	2-8	Low	1-2
	6-30	15-35	0.2-0.6	7.9-9.0	2-8	Low	
	30-81	0-10	<20	7.9-9.0	<2	Low	
Werlog	0-5	10-20	0.6-2.0	7.9-9.0	4-8	Low	.7-.9
	5-60	25-35	0.2-0.6	7.9-9.0	4-8	Low	

Source: Department of Agriculture/Soil Conservation Service, 1980.
Soil Survey of San Juan County, New Mexico. Eastern Part.

TABLE 3-3. PHYSICAL AND CHEMICAL PROPERTIES OF SOILS AT AND NEAR THE SITE

PROPERTIES OF SOILS AT AND IN THE VICINITY OF THE SUBJECT SITE
SITE NAME: 100 Acres
CITY: Farmington
COUNTY: San Juan
STATE: New Mexico
SITE CODE: 1
GROUP NO.: 8
BLM CODE: NM 000000000
BLM HAZARDOUS MATERIALS MANAGEMENT PROJECT
REV. DATE: 16 NOVEMBER 1985

SOIL NAME	DEPTH (INCH)	USDA TEXTURE	UNIFIED CLASSIFICATION	PERCENT OF FRAGMENTS >3 INCHES	PERCENTAGE PASSING SIEVE #4	#10	#40	#200	LIQUID LIMIT (L.L.) (%)	PLASTICITY INDEX (P.I.)*
Avalon (Av)	0-14	Sandy loam	SM	0	100	80-100	60-80	35-50	15-25	NP-5
	14-55	Loam, sandy clay loam, clay loam	CL-ML, CL	0	85-95	80-80	65-85	50-70	20-35	5-15
	55-72	Gravelly sandy loam, gravelly loam, gravelly sandy clay loam	GM, SM-SC, GM, GM-GC	0	55-75	50-70	25-60	25-40	15-25	NP-10
Avalon (Ay)	0-10	Loam	CL-ML	0	100	80-100	70-80	50-70	20-50	5-10
	10-60	Loam, clay loam	CL-ML, CL	0	85-95	80-90	65-85	50-70	20-35	5-15
[illegible] Variant	0-8	Loamy sand	SM, SM-SC	0	100	100	50-75	15-35	15-25	NP-5
	8-67	Sand, coarse sand, loamy sand	SM, SW-SM	0	100	100	50-70	5-25	...	NP
	67-81	Very gravelly sand	GM, SP-SM, GM, GM-GP	0	60-70	40-50	30-45	0-15	...	NP
Blackston (Bh)	0-11	Loam	ML, CL-ML	0	75-100	75-100	85-85	50-70	20-30	NP-10
	11-27	Very gravelly loam, very gravelly clay loam.	GM, GM-GC	25-35	50-50	20-45	20-40	15-50	20-30	NP-10
	27-80	Very gravelly sand.	GP-GP, GP-GP	25-35	30-60	15-30	10-35	5-10	...	NP
Blackston (Bm)	0-9	Gravelly loam	ML, CL-ML	0	80-100	70-100	65-85	50-70	20-30	NP-10
	9-25	Very gravelly loam, very gravelly clay loam	GM, GM-GC	25-35	30-50	20-45	20-40	15-50	20-30	NP-10
	25-60	Very gravelly sand, very gravelly clay loam.	GP-GM, GM, SP-SM, SM	25-35	30-60	15-30	10-55	5-20	...	NP
Blancot	0-6	Loam	CL-ML	0	100	100	75-95	50-80	25-35	5-10
	6-60	Clay loam, sandy clay loam	CL-ML, CL	0	100	100	80-100	50-80	25-40	5-20
Fruitland (Br)	0-8	Sandy loam	SM	0	100	100	60-75	30-45	15-25	NP-5
	8-60	Fine sandy loam, sandy loam.	SM	0	100	100	60-75	50-45	15-25	NP-5
			SM	0	100	100	60-75	50-45	15-25	NP-5
Doak	0-5	Loam	ML	0	100	100	80-95	60-75	20-30	NP-5
	5-60	Clay loam, silty clay loam, loam.	CL, CL-ML	0	100	100	80-100	60-80	25-40	5-20
Fruitland (Fr)	0-7	Sandy loam	SM	0	100	100	80-75	30-45	15-25	NP-5
	7-60	Fine sandy loam, sandy loam	SM	0	100	100	60-75	30-45	15-25	NP-5
Fruitland (Fs)	0-6	Sandy loam	SM	0	100	100	60-75	30-50	15-25	NP-5
	6-60	Fine sandy loam, sandy loam.	SM	0	100	100	60-75	30-50	15-25	NP-5
Fruitland (Ft)	0-6	Sandy loam	SM	0	100	100	60-75	30-45	15-25	NP-5
	6-60	Fine sandy loam, sandy loam.	SM	0	100	100	60-75	30-50	15-25	NP-5
Fruitland (Fy)	0-9	Sandy loam	SM	0	100	100	60-75	50-45	15-25	NP-5
	9-60	Fine sandy loam, sandy loam.	SM	0	100	100	6-75	50-45	15-25	NP-5
Blackston (BA)	0-11	Gravelly loam	GM, GM-SC	0-5	70-90	60-80	65-70	25-50	20-30	NP-10
	11-28	Very gravelly sandy loam, very gravelly loam, very gravelly clay loam.	GM, GM-GC	35-55	20-50	15-40	10-30	5-25	20-30	NP
	28-60	Very gravelly sand, very gravelly sandy loam.	GM	35-55	15-45	10-40	5-20	0-5	...	NP
Stumble (St)	0-5	Loamy sand	SM	0	100	100	50-75	15-15	15-20	NP-5
	5-20	Loamy coarse sand, loamy sand, sand.	SM, SP-SM	0	100	100	60-75	5-25	15-20	NP-5
	20-40	Gravelly sand, gravelly loamy sand.	GP, GM-GM	0	65-85	50-65	20-50	0-10	...	NP
	40-81	Loamy coarse sand, loamy sand, sand.	SM, SM-SP	0	100	100	40-75	5-25	15-20	NP-5
Stumble (Su)	0-6	Loamy sand	SM	0	100	100	50-75	15-25	15-20	NP-5
	6-20	Loamy coarse sand, loamy sand, sand.	SM, SM-SP	0	100	100	40-75	5-25	15-20	NP-5
	20-60	Gravelly sand, gravelly loamy sand.	GM, GM-GP	0	65-85	50-65	20-50	0-10	...	NP
Fruitland (Su)	0-7	Sandy loam	SM	0	100	100	60-75	30-45	15-25	NP-5
	7-60	Fine sandy loam, sandy loam.	SM	0	100	100	60-75	50-45	15-25	NP-5
Turley (Tr)	0-8	Clay loam	CL	0	100	100	85-100	65-80	30-40	10-20
	8-60	Clay loam, silty clay loam, loam	CL	0	100	100	85-100	65-80	30-40	10-20
Turley (Tv)	0-8	Clay loam	CL	0	100	100	85-100	65-80	30-40	10-20
	8-60	Clay loam, silty clay loam, loam.	CL	0	100	100	85-100	65-80	30-40	10-20
Sulct	0-6	Cobbly silty clay loam	CL, ML	15-50	95-100	80-100	80-100	70-80	25-40	10-20
	6-17	Clay loam, silty clay loam, clay	MH, CL	0	100	100	95-100	70-95	40-65	20-50
	17	Weathered bedrock								
Walrees	0-6	Loam	CL-ML	0	100	100	85-95	60-75	20-30	5-10
	6-50	Very fine sandy loam, loam, clay loam	CL-ML, CL	0	100	100	85-100	50-60	25-40	5-15
	50-81	Stratified sand to cobble.	GP-GM, GW	20-45	50-60	25-60	20-50	5-15	...	NP
Werlog	0-5	Loam	CL-ML, ML	0	100	100	85-95	50-75	20-25	NP-10
	5-60	Loam, clay loam, silty clay loam	CL, CL-ML	0	100	100	80-100	60-80	20-40	5-15

* NP = Nonplastic.
Source: Department of Agriculture/Soil Conservation Service, 1980. Soil Survey of San Juan County, New Mexico. Eastern Part.

landfill have been disturbed down to 5-7 feet. No definite clay layer was noticed at these depths. The exact extent of the clay layer, if any, and its depth are unknown.

Field observations from the existing landfill trench (approximately 7 feet deep) reveal the following soil profile:

- o Surface to 2.5 feet: Yellowish brown, medium-to-coarse, well graded, dry, and well drained sand with trace silt;
- o From 2.5- to 3-feet: Dry, well drained, and poorly graded and rounded gravels with rounded uniform medium-to-coarse sand; and
- o From 3- to 7-feet: Light gray, dry, and well drained medium-to-coarse sand.

Because of their high permeability, the soils are highly susceptible to contamination by hazardous liquid and solid wastes dumped in the liquid waste pits within the landfill and in other potential source(s) of contamination on the site. Soils within and near the two on-site underground "conductive" plumes, which were identified by a terrain conductivity study performed by the N.M. EID (Longmire, 1985), may also have been contaminated through groundwater transport of wastes. One of these conductivity anomalies is located south of the liquid waste pits within the landfill, and the second one near the Giant Refining Co. Some of the soils or bottom materials in the arroyo near the site may have been contaminated by the uncontrolled release of wastes from the liquid waste pits.

3.4 Groundwater

The site and its vicinity consist of an outwash of gravel and sands. The uppermost aquifer, the "alluvial gravel valley aquifer", occurs at an approximately 30 to 40 foot depth in this region (Wells, 1985). This finding is confirmed by the range of screen depths of residential wells (e.g., Reynold's residential well is approximately 50 feet below grade). At these depths, there appears to be fill material and unconsolidated outwash of gravel and sand.

Because of the arid setting and limited availability of surface water, the source of most of the water supply in San Juan County, including the site area, is groundwater obtained from wells in surficial valley-fill deposits of Quaternary age and sandstones of Tertiary age (Stone, et al., 1983).

New Mexico contains dozens of geologic formations which are potential fresh-water aquifers (Wilson, 1981). One of the basic fresh-water aquifers that may be associated with the site area appears to belong to the Quaternary age. This aquifer consists of an alluvium (40-80 feet thick) with unconsolidated sands, gravels, silts, and clays (Wilson, 1981; and Stone, et al., 1983), i.e., an alluvial valley aquifer (Wells, 1985).

Typical hydrogeologic properties of alluvial valley aquifers as compiled by Wilson (1981) are shown in **Table 3-4**. Although they are only applicable on a regional basis but not to a specific locale, the values do provide a general guide as to the potential for aquifer contamination and contaminant migration.

Based on the distribution of aquifers in the State of New Mexico and vadoze-zone characteristics, Wilson (1981) constructed a map of aquifers vulnerable to pollution. In accordance with the map, the Lee Acres Site and its vicinity appear to be within a shallow aquifer zone that is highly vulnerable to contamination from surface discharges and

TABLE 3-4. HYDROGEOLOGIC PROPERTIES OF ALLUVIAL VALLEY AQUIFERS IN THE STUDY REGION

PROPERTY	UNIT	RANGE OF VALUES	TYPICAL VALUE
Hydraulic Conductivity	ft/day	1-1,500	100
Saturated Thickness	feet	0-350	50
Transmissivity	sq. feet/day	0-30,000	5,000
Porosity	percent (%)	10-40	30
Specific Yield	percent (%)	1-25	15
Specific Capacity	gal/min.-ft of drawdown	1-200	20
Water Table Gradient	feet/mile	5-100	10
Flow Velocity	feet/day	1.3	....

Source: Wilson, L., 1981. Potential for Groundwater Pollution in New Mexico. New Mexico Geological Society, Special Report No. 10, pp. 47-54.

leachates from surface contamination.

The alluvial valley-fill aquifer water table is shallow (30 to 40 feet) with no apparent impervious layer for protection. The regional groundwater movement throughout the State follows river valleys. In all cases, the regional groundwater flows from upland recharge areas (e.g., San Juan Mountain areas) towards natural discharge zones (e.g., the San Juan River). Local flow conditions are dictated by the size of associated recharge zones and the hydraulic gradient between the recharge zones and the discharge areas. For the site, the discharge area coincides with San Juan River.

Based on a terrain electromagnetic (EM) conductivity survey conducted by the N.M. EID (Longmire, 1985), two conductive shallow underground plumes were preliminarily identified within the site. The first conductive shallow underground plume seems to originate from the liquid waste pits within the landfill and flow southerly towards San Juan River. The second conductive underground plume apparently originates from an area within or near the Giant Refining Co.'s property, and flows southerly toward the San Juan River. From the above observations, it is apparent that the shallow alluvial groundwater aquifer at the site originates north of and upgradient from the site and flows along the unnamed arroyo in a generally southerly direction to San Juan River.

Bedrock in the region may be fractured (Gorham, et al., 1977); and intercommunication between the shallow unconsolidated and the bedrock aquifers may exist (Wells, 1985).

3.5 Climate and Meteorology

San Juan County, is located in a high plateau that is dissected in the north by the San Juan River Valley. Distant high mountains shield the plateau and valley from precipitation and from shallow, extremely cold air masses in winter. The area is arid to semi-arid. Water, therefore, plays a key role in land development. Precipitation varies considerably. Summer shower activity in this area is less frequent and intense than in most of the northwestern half of New Mexico.

Approximately 60% of the total precipitation occurs during summer months as local, often intense thunderstorms (Stone, et al., 1983). An average of 40 thunderstorms a year occur, occasionally accompanied by hail. Precipitation totals are slightly greater in winter than in spring and fall (op. cit.).

Annual precipitation ranges from an average of 7 inches in the valley at Fruitland to 12 inches along the Colorado border. Average annual precipitation generally increases as elevation increases. Wide variations in the amount of precipitation may occur from year to year. Record lows and highs of annual precipitation of 2 and 24 inches, respectively, have been measured. Annual precipitation is 2 to 3 inches less in the valley near Farmington (op. cit.). The recorded 10-year and 1-year 24-hour rainfalls in the region are 2.5 and 1.2 inches, respectively.

Snowfall occurs from November through April. Total snowfall ranges from about 9 inches in the valley to more than 20 inches along the Colorado border. The higher mountains in Colorado receive more snow and are the main source of irrigation water for the eastern part of San Juan County (op. cit.).

Temperatures rarely reach 100°F or higher, and only a few days each year have temperatures of zero or lower. Continental-like average daily temperature fluctuations of 33 degrees are common. Mean temperaturs of 67°F (maximum) and 37°F (minimum) were reported for Farmington (op. cit.).

Evaporation from May through October averages 49 inches at Farmington, but may be as much as 25 percent higher on the plateau, where there is much more wind. Sunshine may be expected about 70 percent of the possible hours (op. cit.).

Average relative humidity is about 50 percent, and ranges from about 70 percent early in the morning to about 30 percent in the afternoon. Late in spring and early in summer the humidity averages 15 to 20 percent in the afternoon. In winter and early in spring, fog occassionally occurs in the valley for brief periods (op. cit.).

Winds blow predominantly from the east and west as a result of the channeling effect of the San Juan Valley. Spring is the windiest season, with an average windspeed of 10 miles per hour. Winds of 25 miles per hour or greater occur only 1 percent of the time, but they occasionally entrain dusts when the soil is dry (op. cit.).

3.6 Land Use

About 8 percent of the land in northeastern San Juan County is used for irrigated agriculture. The remaining 92 percent is used for urban development, range, wildlife habitat, woodland, water areas, recreation, coal mining, and gas and oil exploration (USDA/SCS, 1980).

The land north and northeast of the site is barren and shielded by distant high hills. Within the boundaries of the site, the Giant Refining Company, an inactive petroleum refinery, is located south and southeast of the landfill; and an El Paso Natural Gas facility is located approximately 3,500 feet north of the landfill and on the opposite side of the arroyo.

A subdivision (Lee Acres Subdivision) containing approximately 166 houses is to the south of the site and immediately south of Bloomfield Highway.

San Juan Downs, a racetrack, is about 1,000 feet west of the Lee Acres Subdivision.

Should emissions of toxic chemicals reoccur similar to the incidents in April, 1985, the adjacent land users may be adversely impacted, depending on the emission strength and prevailing wind conditions.

3.7 Population and Geographical Distribution

Early settlers came from Colorado to the Farmington area in 1876. Major enterprises of these settlers were farming and cattle raising. Alfalfa and such fruit as apples, pears, and peaches were the major crops. Abundant rangeland lent itself to the cattle business.

In 1900, the first gas and oil wells were drilled near Farmington, marking the start of industry that plays a major role in the employment and economy of the area.

A town of approximately 25,000 residents, Farmington is located approximately 2 miles west-northwest of the site. The population of northeastern San Juan County is about 50,000 (USDA/SCS, 1980).

Within a 1-mile radius of the center of the site, there are approximately 166 dwelling units housing about 631 residents. It is estimated that approximately 30-50 people visit the landfill daily either to dump wastes or as scavengers. An indetermined number of workers are employed at the Giant Refining Co. and the El Paso Gas Co. facilities. For the purpose of site ranking, it is assumed that approximately 50 people (permanent or transient) make use of these facilities during business hours. During the horse racing season, large crowds of people may visit San Juan Down.

3.8 Water Supply

The status of the water supply in the Lee Acres Subdivision within the site is summarized below based on the information supplied by the Lee Acres Water Users Association (R. Richardson, 18 April 1986):

- o The Lee Acres Water Users Association system is a part of the City of Bloomfield public water system, extending from the City of Bloomfield to the east to the City of Farmington to the west. As a part of the system, 8" and 6" water main lines are laid to the north and south sides of Highway #64, respectively.
- o A total of 136 houses are connected to the public water system via a 4" water main managed by the Lee Acres Water Users Association. The 4" main is not capable of providing fire flow.
- o Some of the houses that are on the public water system still use well water for lawn watering, car washing, gardening, filling of swimming pool(s), and/or possibly other non-sanitary, non-food preparation purposes.

Based on a population density of 3.8 persons per dwelling unit as suggested by the EPA's Uncontrolled Hazardous Waste Site Ranking System (HRS), the total population served by the public water system is estimated to be approximately 516. A row-by-row house survey by the BLM Farmington Resource Area indicated that there are approximately 166 dwelling units in the Lee Acres Subdivision area downgradient from the landfill, which equate to a population of approximately 631. The balance of approximately 30 houses (115 people) not connected to the Lee Acres Water Users Association main is assumed to continue to depend on the shallow groundwater aquifer for water supply.

The sources of water supply to the Giant Refining Co., the El Paso Natural Gas Co., and the San Juan Down facilities are unknown.

3.9 Natural Resources

Natural resources in the region include soil, water, coal, natural gas, and oil. Cattle that graze the rangeland and crops produced on farms are marketable products from the soil. Water for irrigation, industry, municipalities, and recreation is supplied by the San Juan, Animas, and La Plata Rivers. It is stored in the Navajo Dam in Farmington, Morgan and Jackson Lakes. The City of Farmington diverts water from the Animas River to a town-owned power generating plant. Shallow wells supply water to some rural families. Wells, windmills, and livestock watering ponds supply water for grazing animals (USDA, 1980).

The area contains part of a field of strippable coal containing an estimated 6 billion tons. An abundance of additional coal lies beyond the strippable depths at 150 feet. Coal is mined for use by two power generating plants. Part of this coal is under consideration for use in the coal gasification industry (op. cit.).

Since 1951, the gas and oil industry has contributed greatly to the economy of the area. Ninety-eight percent of the gas produced in the area comes from Upper Cretaceous rock at a depth of 1,000 to 8,500 feet. Farmington Sandstone, the Fruitland Formation, and Pictured Cliff Sandstone are the most important geologic formations (Stone, et al., 1983).

3.10 Potential Receptors

The foregoing information indicates that land users who may be affected by the release of hazardous substances from the site are:

- o Neighboring residents and workers;
- o Users of groundwater;
- o Landfill workers and scavengers;
- o Permanent workers at and transient visitors of the Gaint Refining Co. and the El Paso Natural Gas Co.'s facilities;
- o Transient population at the nearby San Juan Down racetrack; and
- o Site trespassers.

A potential health risk exists via consumption of groundwater. However, an alternative public water supply to this area via the Lee Acres Water Users Association is currently available.

The likelihood of the contamination of trespassers via direct contact or air pollution has been partially reduced, since the reactivity of wastes in Pit P-01 within the landfill has been reduced or stabilized by in-situ treatment with ferric chloride. In summary, the three major concerns are:

(1) The wastes in the liquid waste pits (P-01, P-02, P-03, and P-04) and their associated contaminated soils;

(2) The potential contamination of groundwater aquifers by the onsite source(s) of contaminants [e.g., the landfill and source(s) within or near the Giant Refining Co.'s property]; and

(3) The health hazards to the nearby residents who still rely on groundwater for drinking and other domestic uses.

4.0 CHARACTERISTICS AND ENVIRONMENTAL CONCENTRATIONS OF HAZARDOUS SUBSTANCES

The AEPCO field team conducted a reconnaissance of the Lee Acres Landfill during the SI to:

- o Identify any unique features at the landfill including waste disposal areas, ponds, depression areas, utilities, drainage patterns, seeps, drums, odors, vegetation under stress, discoloration, and landfill boundaries.
- o Identify potential sampling locations and collect sample(s) of surface water, groundwater, soils, waste, biota, and/or sediments.
- o Take representative photographs of the landfill.
- o Conduct air quality monitoring using an hNu meter, an explosimeter/oxygen meter, methane detector, a radiometer, and hydrogen sulfide sensitive badges.
- o Observe surface soil and geological characteristics.
- o Identify access routes and potential access problems, if any, for future investigations.
- o Assess potential health and safety hazards.
- o Inspect downgradient surface water discharge areas visually for signs of contamination (e.g., water pollution, vegetation under stress, and effects on wildlife).
- o Identify other potential waste sources, such as spills and/or migration paths.
- o Observe regional geologic patterns (e.g., bedrock outcrops).
- o Estimate surface water flow rates, if any.

The material in this section on the characteristics and environmental concentrations of hazardous substances on and off site was compiled from past studies, the above recent landfill reconnaissance, and the SI waste and environmental sampling and laboratory analyses.

4.1 Environmental Sampling and Analyses Program

4.1.1 Environmental Sampling and Analyses by N.M. EID

In 1985 before, during, and after the April landfill-related incidents, the N.M. Environmental Improvement Division (EID) (Longmire, 1985) and/or its contractor (IT Corporation, 1985) collected and analyzed the following respresentative waste and environmental samples:

- o 5 liquid or semi-solid waste samples collected on 24 April by IT Corporation under a contract with the N.M. EID. (For this report, these samples have been arbitrarily designated as samples WS-A through WS-E).
- o 6 liquid or semi-solid waste samples collected during the period 11 January through 2 May by N.M. EID personnel. (Here designated as samples WS-F through WS-K).
- o 2 surface water samples collected on 18 September by N.M. EID personnel. (Designated as samples SW-A and SW-B).
- o 4 well water samples collected from 2 residential wells during the period 22 April through 6 May by N.M. EID personnel. (Designated as RW-A-01, RW-A-02, RW-B-01, and RW-B-02).

The two residential wells are designated as:

- o Reynold's well (RW-A) approximately 2,500 feet downgradient from or south of the landfill; and
- o Nace's well (RW-B) approximately 4,500 feet downgradient from or south of the landfill.

N.M. EID also conducted a terrain electromagnetic (EM) conductivity survey of an area south of and immediately downgradient from the landfill in an attempt to delineate any conductive underground groundwater plume(s) (Longmire, 1985).

4.1.2 SI Environmental Monitoring and Sampling Program

As part of the SI, the AEPCO field investigation team established an environmental monitoring and sampling network between 20 and 21 November 1985 to monitor the air quality, assess health and safety conditions, and collect representative waste (liquid and semi-solid), surface water, and residential well samples. This environmental monitoring and sampling network consists of:

- o 16 air monitoring stations, including background stations (Stations 01 through 16).
- o 13 waste/sediment/soil sampling stations within the landfill. A waste, sediment, and soil sample was composited from Stations 3-5 and 7-11 in liquid waste pit P-01 and Stations 12-16 in liquid waste pit P-04. This sample is designated as WS-L.
- o 2 liquid waste/surface water sampling stations within the landfill. A liquid sample was composited from one station in Pit P-01 and one station in Pit P-04. This sample is designated as SW-C; and
- o 2 residential wells. These two wells are the same as those sampled by the N.M. EID for well water. The AEPCO samples are designated as RW-A-03 and RW-B-03, respectively.

Figure 2-3 and Table 4-1 provide a quick reference to the locations of these sampling or monitoring stations; and information on field activities, visual observations, and instrument measurements at each station.

4.2 <u>Air Quality and Health and Safety</u>

Organic vapor analyzer (hNu meter), methane detector, radiometer, explosimeter, and oxygen meter readings were taken at each station. Hydrogen sulfide-sensitive badges were also worn during the field investigation. All of the instrument and badge readings were used to assist the team in evaluating health and safety requirements. The readings also provided clues to areas that might contain volatile organic substances.

After background levels were established, it was determined that modified Level C health and safety protection would be adequate for the field work. Thus, full-face self-purifying respirators were carried by the team members at all times during the field investigation for use during unanticipated adverse site conditions. However, no conditions were subsequently met that required the use of the respirators.

The monitoring results are summarized in **Table 4-1**. The results revealed that the background levels in ambient air were:

TABLE 4-1

SUMMARY OF SI ENVIRONMENTAL MONITORING PROGRAM AND RESULTS
LEE ACRES SITE, FARMINGTON, SAN JUAN COUNTY, N.M.

LEE ACRES SITE, FARMINGTON, SAN JUAN COUNTY, N.M.
AEPCO SITE NO. 01, GROUP A
BLM SITE CODE: NM 000000000

MONITORING STATION	DATE	MILITARY TIME	LOCATION	HNU PHOTO-IONIZER (ppm Benzene)	METHANE DETECTOR (ppm)	RADIOMETER (mR/hr)	EXPLOSIMETER/OXYGEN METER: OXYGEN* (%)	EXPLOSIMETER/OXYGEN METER: EXPLOSION LEVEL (%)	WIND DIRECTION	WIND SPEED (mph)	OTHER FIELD OBSERVATI
01	20-Nov-85	09:23	200 feet east of the eastern fence of Pit P-01	0.3	0	0.01	17.8	0.001	From North	Approx. 5	Brown oily scum on top with organic smell
02	20-Nov-85	09:26	Eastern Edge of Pit PO-1 in the dry area	0.3	0	0.01	17.8	0.001	From North	Approx. 5	Brown oily material on t with organic smell
03	20-Nov-85	09:30	50 feet from the eastern edge of Pit P-01 (dry area)	0.3	0	0.01	17.8	0.001	From North	Approx. 5	Black Sediment with organic smell
04	20-Nov-85	09:31	Mid-point of Pit P-01 (wetted area)	0.3	0	0.01	17.8	0.001	From North	Approx. 5	Black Sediment; and oil- and grease-like material with organic smell
05	20-Nov-85	09:34	A depression area about 20 feet from the center of Pit P-01 (wetted area)	0.3	0	8.02	17.8	0.001	From North	Approx. 5	Black Sediment; and oil- and grease-like material with organic smel.
06	20-Nov-85	09:38	50 feet inside the southern edge of Pit P-01 (wetted area)	0.3	0	0.02	17.8	0.001	From North	Approx. 5	Black Sediment; and two empty drums
07	20-Nov-85	09:39	Southern edge of Pit P-01	0.3	0	0.02	17.8	0.001	From North	Approx. 5	Black Sediment with organic smell
08	20-Nov-85	09:40	Western edge of Pit P-01	0.3	0	0.02	17.8	0.001	From East	Approx. 5	Black Sediment with organic smell
09	20-Nov-85	09:42	Northern edge of Pit P-01	0.3	0	0.02	17.8	0.001	From East	Approx. 5	Black Sediment with organic smell
10	20-Nov-85	09:46	Northern edge of Pit P-01 in dry area (3-4 inches below surface)	1.2-1.4	0	0.02	17.8	0.001	From East	Approx. 5	Brown oily scum on top; Black Sediment; and oil- and grease-like material with organic smell
11	20-Nov-85	09:50	Northern edge of Pit P-01 in the wetted area (5 inches below surface)	5-25 with instantaneous peak in the 100 ppm range	0	0.01	17.8	0.001	From East	Approx. 5	Brown oily scum on top; Black Sediment; and oil- and grease-like material with organic smell
12	20-Nov-85	10:01	Northern edge of Pit P-04 in the wetted area (at surface)	0.3	0	0.01	17.8	0.001	From East	Approx. 5	Brown oily scum on top; and Black Sediment with organic smell
13	20-Nov-85	10:03	Northern edge of Pit P-04 in the wetted area and below grade	2.0	0	0.01	17.8	0.001	From East	Approx. 5	Brown oily scum on top; Black Sediment; and oil- and grease-like material with organic smell
14	20-Nov-85	10:05	Western edge of Pit P-04 in the wetted area (3 inches below surface)	1.0	0	0.01	17.8	0.001	From East	Approx. 5	Brown oily scum on top; Black Sediment; and oil- and grease-like material with organic smell
15	20-Nov-85	10:08	Southern edge of Pit P-04 in the wetted area (4 inches below surface)	10.0	0	0.01	17.8	0.001	From East	Approx. 5	Brown oily scum on top; Black Sediment; and oil- and grease-like material with organic smell
16	20-Nov-85	10:15	Eastern edge of Pit P-04 in the wetted area (at surface)	0.3	0	0.01	17.8	0.001	From East	Approx. 5	Brown oily scum on top; and Black Sediment with organic smell
Surface Water	20-Nov-85	11:26	Surface water in Pit P-01	1.0	0	0.01	17.9	0.001	...	...	Clear water underneath a 4-8" oil/grease layer with organic smell
Surface Water	20-Nov-85	11:48	Surface water in Pit P-04	0.3	0	0.01	17.8	0.001	...	...	Clear water with some solids underneath an 1" oil/grease layer with oranic smell
RW-A	20-Nov-85	13:26	Reynold's Well (RW-A) in Lee Acres Subdivision	...	...	...	...	...	...	...	A shallow well with no treatment
RW-B	20-Nov-85	13:43	Mace's Well (RW-B) in Lee Acres Subdivision	...	...	...	...	...	...	...	A shallow well treated with sedimentation and filtration

* Low oxygen concentration may be due to high altitude.

- 0.3 ppm benzene equivalent for volatile organic vapor concentration as measured by an hNu photoionizer;
- Methane concentration below detection limit;
- 0.01 to 0.02 mRem/hour gross radioactivity;
- 17.8% oxygen concentration due to the high altitude at the project site; and
- 0.001% explosimeter reading.

Instrument readings throughout the landfill were consistent with background levels with the exception of hNu readings at Stations 10, 11, 13, 14, and 15 below the surface. These stations are within Pits P-01 and P-04, into which hazardous wastes may have been dumped. The hNu readings generally ranged from 1.2 to 25 ppm benzene equivalent. One instantaneous reading in the 100 ppm range was detected in the headspace (the air space within 1-3 inches of a potential source) of the wastes.

Because these high readings are indicative of the presence of highly volatile substances, representative samples were subsequently collected in these areas for laboratory analyses. Hydrogen sulfide-sensitive badge data suggested that ambient H_2S concentrations were low or negligible.

In summary, Level C protection without full-face self-purifying respirator was adequate for the landfill investigation. However, if excavation work in the liquid waste pit areas is planned, health and safety protection in strict compliance with Level C specifications, at a minimum, is strongly recommended.

4.3 Location of Hazardous Substances

Figure 2-3 shows a general layout of the landfill. The dimensions of the liquid waste pits within the landfill and water marks are signs that the landfill has possibly been contaminated by approximately 8,800 cubic yards of liquid, semi-solid, and solid wastes resulting from unrestricted dumping of a variety of wastes including septic sludges and petroleum production water. The contaminants are estimated to cover a surface area of 2-5 acres occupied by the four liquid waste pits, with the majority of the wastes concentrated in Pits P-01 (the northernmost pit) and P-04 (the southernmost pit).

Particular concerns are (1) the uncontrolled release of wastes to the arroyo and subsequently San Juan River via erosion of containment dikes; (2) leaching of hazardous substances into the shallow unconsolidated aquifer and possibly the bedrock aquifer beneath the pits; and (3) migration of contaminated groundwater off the source(s), the landfill, and the site.

4.4 Form and Physical State of Hazardous Wastes

No records were kept of the volume of wastes dumped nor the exact dates on which they were dumped in the liquid waste pits. The grease-like materials and occasional high hNu readings below the pit surface suggest that area petroleum refineries and gas production facilities might have disposed petroleum production water in these pits. As mentioned, the amount dumped into these pits is roughly estimated to be equivalent to 8,800 cubic yards of various wastes.

Most of the liquid and/or semi-solid wastes disposed at the landfill had presumably been in bulk pumpable form and were contained in the liquid waste pits. No records are available as to whether these pits are lined. If the pits are unlined, the potential exists for leaching of hazardous substances into soils and groundwater aquifer systems. Further, the wastes are considered to have been incompatible to a certain extent when they were dumped. The noncompatibility may be one of the causes of emissions of hydrogen sulfide and possibly other toxic gases in April 1985. Since the occurrence of those emissions, the wastes in Pit P-01 have been stabilized by in-situ treatment using ferric chloride (IT Corporation, 1985). Nevertheless, the noncompatibility of wastes in the liquid waste pits within the landfill remains a matter of concern.

In brief, the waste can be classified as slightly corrosive, volatile, slightly flammable, and potentially toxic. Incidences of acute toxicity from short-term exposure to the air emissions from the liquid waste pits in the landfill occurred in April, 1985 (see Section 2.0). The wastes have been stabilized by in-situ treatment with ferric chloride. This interim remedial measure may minimize acute toxicity from short-term exposure via the air route. Potential chronic health effects via the air route from long-term exposure to the wastes in the liquid waste pits should be further investigated.

4.5 Sampling and Analysis of Hazardous Wastes in the Landfill

4.5.1 Information Collected Prior to the SI

Composition data from representative samples of the wastes in the landfill (Longmire, 1985 and IT Corporation, 1985) are summarized in **Table 4-2**. The pH of the sampled wastes ranged from 6.0 to 8.5. The samples contained elevated concentrations of:

- Volatile organic compounds [benzene, toluene, trichloromethane (or methylene chloride), 1,1,1-trichloroethane, trichloroethene (or trichloroethylene), dichloromethane, ethylbenzene, and all three isomers of xylenes]; and
- Un-identified aliphatic semi-volatile organic compounds containing 12 to 30 carbon atom chains.

The wastes also contained trace amounts of tetrachloroethane (7-16 ug/L) and elevated concentrations of:

- Strontium (4.4-7.3 mg/L);
- Sulfide (7-300 mg/L);
- Sulfate (<100 to 1,881 mg/L); and
- Total dissolved solids (TDS) (6,308-9,018 mg/L).

The high conductivity of the wastes was apparent, based on a measurement of 13,500 umho/cm. This high conductivity is also reflected in the shallow groundwater plume presumably originating from the pits, as evidenced by the high conductivity anomalies registered during the EM terrain conductivity survey performed by the N.M. EID.

4.5.2 Information Collected During the SI

Tables 4-3A through **4-3E** summarize the results of the laboratory analysis of the SI samples. Two composite samples were collected in Pits P-01 and P-04: one (Sample WS-L)

TABLE 4-2

SUMMARY OF WASTE CHARACTERISTICS
REPORTED BY N.M. ENVIRONMENTAL IMPROVEMENT DIVISION
LEE ACRES SITE, FARMINGTON, SAN JUAN COUNTY, N.M.

SITE: LEE ACRES SITE, FARMINGTON, SAN JUAN CO., N.M.
AEPCO SITE NO. 01, GROUP A
BLM SITE CODE: NM0000000000

SUBSTANCE ANALYZED	UNIT	SAMPLES COLLECTED BY IT CORPORATION					SAMPLES COLLECTED BY N.M. EID					
		WS-A 24-Apr-85	WS-B 24-Apr-85	WS-C 24-Apr-85	WS-D 24-Apr-85	WS-E 24-Apr-85	WS-F 11-Jan-85	WS-G 27-Feb-85	WS-H 27-Feb-85	WS-I 25-Apr-85	WS-J 27-Apr-85	WS-K 02-May-8
1. METALS AND OTHER ELEMENTS:												
Silver	mg/L	....	....	....	....	....	<0.10	<0.10	<0.10	....	....	<0.1
Aluminium	mg/L	....	....	....	....	....	2.3	1.8	1.5	....	....	0
Arsenic	mg/L	....	....	....	<0.005	....	0.022	....	....	....	....	....
Boron	mg/L	....	....	....	....	....	0.61	0.58	0.48	....	....	1.
Barium	mg/L	....	....	....	....	....	0.74	0.60	....	....	....	0.
Beryllium	mg/L	....	....	....	....	....	<0.10	<0.10	<0.10	....	....	<0.1
Calcium	mg/L	....	....	....	....	....	204	267	234	....	....	24
Cadmium	mg/L	....	....	....	....	....	<0.10	<0.10	<0.10	....	....	<0.1
Cobalt	mg/L	....	....	....	....	....	<0.10	<0.10	<0.10	....	....	<0.1
Chromium	mg/L	....	....	....	....	....	0.28	0.23	0.15	....	....	<0.1
Copper	mg/L	....	....	....	....	....	<0.10	<0.10	<0.10	....	....	<0.1
Iron	mg/L	....	....	....	....	....	6.9	7.5	6.8	....	....	75
Mercury	ug/L	....	....	....	....	....	....	....	....	....	....	....
Potassium	mg/L	....	....	....	....	....	885	848	548	....	....	39
Magnesium	mg/L	....	....	....	....	....	26.8	15.7	0.80	....	....	25
Manganese	mg/L	....	....	....	....	....	1.5	0.83	....	....	....	2.1
Molybdenum	mg/L	....	....	....	....	....	<0.10	<0.10	<0.10	....	....	<0.10
Sodium	mg/L	....	....	....	....	....	1,507	1,833	1,263	....	....	1,790
Nickel	mg/L	....	....	....	....	....	<0.10	<0.10	<0.10	....	....	<0.10
Lead	mg/L	....	....	....	....	....	<0.10	0.21	0.10	....	....	<0.10
Selenium	mg/L	....	....	....	<0.005	....	0.026	....	....	....	....	....
Silicon	mg/L	....	....	....	....	....	1.2	2.0	2.0	....	....	14
Tin	mg/L	....	....	....	....	....	<0.10	<0.10	<0.10	....	....	<0.10
Stronium	mg/L	....	....	....	....	....	4.4	6.0	4.5	....	....	7.3
Vanadium	mg/L	....	....	....	....	....	<0.10	<0.10	<0.10	....	....	<0.10
Yttrium	mg/L	....	....	....	....	....	<0.10	<0.10	<0.10	....	....	<0.10
Zinc	mg/L	....	....	....	....	....	0.29	0.24	0.54	....	....	<0.10
2. ORGANIC COMPOUNDS:												
Aromatic Purg. Screen	ug/L	....	....	....	....	....	....	....	....	....	....	....
Halogenated Purg. Screen	ug/L	....	....	....	....	....	....	....	....	....	....	....
Benzene	ug/L	260	60	....	....	....	440	1,030	890	360	....	....
Toluene	ug/L	....	80	....	....	....	950	1,980	1,940	1,380	....	....
CHCl3	ug/L	670	....	....	....	....	....	....	....	....	....	....
CHCl2	ug/L	....	....	....	....	....	....	....	....	....	....	....
CHCl2Br	ug/L	....	....	....	....	....	....	....	....	....	....	....
CHClBr2	ug/L	....	....	....	....	....	....	....	....	....	....	....
Tetrachloroethene	ug/L	....	....	....	....	....	....	....	....	....	....	....
Trichloroethene	ug/L	....	....	....	....	....	4	....	....	....	....	....
1,1-Dichloroethene	ug/L	....	....	....	....	....	....	....	....	....	....	....
1,1-Dichloroethene	ug/L	....	....	....	....	....	....	....	....	....	....	....
1,2-Dichloroethene	ug/L	....	....	....	....	....	....	....	....	....	....	....
1,1,1-Trichloroethane	ug/L	....	....	....	....	....	400	0.19	0.23	0.038	....	10
Dichloromethane	ug/L						2,000	0.18	0.21	....	....	....
Ethylbenzene	ug/L	51	....	....	....	....	100	0.16	0.17	0.2	....	25
Methylene Chloride	ug/L	19	33	....	....	....	....	....	....		....	....
Acetone	ug/L	5,400	3,400	....	....	....	....	....	....	0.1	....	....
Isopropyl Alcohol	ug/L	....	60	....	....	....	....	....	....	0.01	....	....
Para-Xylene	ug/L	....	....	....	....	....	130	200	210	....	....	....
Meta-Xylene	ug/L	....	....	....	....	....	380	690	770	....	....	....
Ortho-Xylene	ug/L	....	....	....	....	....	200	320	360	....	....	....
Total Xylenes	ug/L	610	59	....	....	....	710	1,210	1,340	500	....	205
SEMI-VOLATILE COMPOUNDS: (base/neutral/acid)												
C12-C30 aliphatic hydrocarbons	ug/L	10,000	140,000	....	....	....	....	....	....	....	....	....
3. PCBs:												
PCBs	ug/L	<0.1 ND	<0.1 ND	<0.1 ND	<0.1 ND	<0.1 ND	....	....	....	....	ND	....
4. PESTICIDES:												
Aldrin	ug/L	....	....	....	....	....	....	....	....	....	Present	....
DDT	ug/L	....	....	....	....	....	....	....	....	....	Present	....
Siloxanes	ug/L	....	....	....	....	....	....	....	....	>>2	....	....
5. CONVENTIONAL POLLUTANTS:												
Bicarbonate	mg/L	....	....	....	....	....	....	416.6	626.8	....	....	476.1
Chloride	mg/L	2,800	680	440	84	280	2,758.9	3,574.8	2,251.4	....	3,460	4,474.5
Fluoride	mg/L	....	....	....	....	....	....	....	....	....	....	0.94
Ammonia-N	mg/L	....	....	....	....	....	....	....	....	....	....	6.5
Nitrate-N	mg/L	<100 ND	<100 ND	<100 ND	<100 ND	<100 ND	....	....	....	....	....	<0.10
Total Kjeldhal-N	mg/L	....	....	....	....	....	....	....	....	....	....	11.1
Phosphate (PO4-P)	mg/L	....	....	....	....	....	....	....	....	....	....	0.92
Sulfate	mg/L	<100 ND	<100 ND	<100 ND	<100 ND	<100 ND	430	1,881	1,086	....	100	40.2
Sulfide	mg/L	40	42	80	7	7	....	....	....	....	300	....
Cyanide	mg/L	<10 ND	<10 ND	<10 ND	<10 ND	<10 ND	....	....	....	....	....	....
6. OTHER PARAMETERS:												
pH	Std. Unit	8.5	8.5	7.5	7.0	6.0	7.14	8.08	7.64	....	7.0-8.0	6.14
Conductance	umho/cm	....	....	....	....	....	....	....	....	....	....	13,500
Foaming Agents as LAS	mg/L	....	....	....	....	....	....	....	....	....	....	....
Hardness as CaCO3	mg/L	....	....	....	....	....	....	....	....	....	....	....
Redox Potential (Eh)	mv	....	....	....	....	....	....	....	....	....	....	....
Total Solids	mg/L	....	....	....	....	....	6,308	7,695	5,268	....	....	9,018
Alkalinity as CaCO3	mg/L	....	....	....	....	....	....	....	....	....	....	....

NOTES:
- WS-E: Waste Sampling Station E
- ND: Not Detected or Below Detection Limit.
- ....: Analysis Not Requested.
- <: Less than Stated Value.
- >>: Much Greater than Stated Value.
- N.M. EID = New Mexico Environmental Improvement Division

TABLE 4-3A

SI WASTE CHARACTERISTICS AND ENVIRONMENTAL CONCENTRATIONS
EP TOXICITY AND RCRA TEST RESULTS AND OTHER PARAMETERS
LEE ACRES SITE, FARMINGTON, SAN JUAN COUNTY, N.M.

SITE: LEE ACRES SITE, FARMINGTON, SAN JUAN COUNTY, N.M.
AEPCO SITE 1, GROUP A
BLM SITE CODE: NM 0000000000

	WASTE					SURFACE WATER			RESIDENTIAL WELL			NATIONAL ORINKING WATER STANDARO#
PARAMETER	UNIT	STATION WS-L*	OETECTION LIMIT**	RCRA STANDARO***	UNIT	STATION SW-C	OETECTION LIMIT**	UNIT	STATION RW-A-03	STATION RW-B-03	OETECTION LIMIT**	
Silver (Ag)	ug/L	<10 U	10	5,000	ug/L	<10 U	10	ug/L	<10 U	<10 U	10	50
Arsenic (As)	ug/L	<6 U	10	5,000	ug/L	<6 U	10.0	ug/L	<6 U	<6 U	10	50
Boron (B)	ug/L	---	---	---	ug/L	124	---	ug/L	208	37	---	---
Barium (Ba)	ug/L	(77)	200	100,000	ug/L	---	---	ug/L	---	---	---	---
Beryllium (Be)	ug/L	---	---	---	ug/L	<3 U	5	ug/L	<3 U	<3 U	5	---
Cadmium (Cd)	ug/L	5	5	1,000	ug/L	<4 U	5	ug/L	<4 U	<4 U	5	10
Cobalt (Co)	ug/L	---	---	---	ug/L	<20 U	50	ug/L	<20 U	<20 U	50	---
Chromium (Cr)	ug/L	<6 U	10	5,000	ug/L	73	10	ug/L	<6 U	(8)	10	50
Copper (Cu)	ug/L	---	---	---	ug/L	97	25	ug/L	<15 U	<15 U	25	1,000
Mercury (Hg)	ug/L	<0.2 U	0.2	200	ug/L	<0.2 U	0.2	ug/L	<0.2 U	<0.2 U	0.2	---
Manganese (Mn)	ug/L	---	---	---	ug/L	595	15.0	ug/L	<12 U	4,350	15.0	50
Nickel (Ni)	ug/L	---	---	---	ug/L	(37)	40	ug/L	98	<22 U	40	---
Lead (Pb)	ug/L	<40 U	40	5,000	ug/L	168	5	ug/L	<5 U	<5 U	5	50
Selenium (Se)	ug/L	<4 U	5	1,000	ug/L	<4 U	5	ug/L	<4 U	<4 U	5	10
Thallium (Te)	ug/L	---	---	---	ug/L	<3 U	10	ug/L	<3 U	<3 U	10	---
Vanadium (V)	ug/L	---	---	---	ug/L	<20 U	50	ug/L	<20 U	<20 U	50	---
Total Organic Halogen (TOH)	mg/Kg	<100	---	---	ug/L	438	---	ug/L	---	22	---	---
Ignitability: Flash Point	deg. C	131	---	---	---	---	---	---	---	---	---	---
Corrosivity: pH	Std. Unit	8##	---	<2 or >12	---	---	---	---	---	---	---	---
Reactivity:												
Total Sulfide	mg/Kg	95	---	---	---	---	---	---	---	---	---	---
Total Cyanide	mg/Kg	<5	---	---	---	---	---	---	---	---	---	---

WS-L = Waste Sampling Station L
SW-C = Surface Water Sampling Station C
RW-B-03 = Residential Well B, Sample No. 03
U = Not detected or below detection limit
* Extraction Procedure (EP) toxicity test results
** EPA detection limits based on zero dilution
*** Resource Conservation and Recovery Act
# Lower Values of National Interim Primary and Secondary Orinking Water Standards
pH greater than 2 and less than 12 indicates noncorrosive characteristics.
( ): indicates the parameter is found to be above the laboratory's detection limit, but below EPA contract required detection limit.
NONE: Indicates non-reactivity ovserved.
--- Analysis not requested or not applicable.

TABLE 4-3B

SI WASTE CHARACTERISTICS AND ENVIRONMENTAL CONCENTRATIONS
VOLATILE ORGANIC COMPOUNDS (VOCs)
LEE ACRES SITE, FARMINGTON, SAN JUAN COUNTY, N.M.

LEE ACRES SITE, FARMINGTON, SAN JUAN COUNTY, N.M.
AEPCO SITE 1; GROUP A
BLM SITE CODE: NM 0000000000

PARAMETER	WASTE UNIT	WASTE STATION WS-L	WASTE DETECTION LIMIT	SURFACE WATER UNIT	SURFACE WATER STATION SW-C	SURFACE WATER DETECTION LIMIT	RESIDENTIAL WELL UNIT	RESIDENTIAL WELL STATION RW-A-03	RESIDENTIAL WELL STATION RW-B-03	RESIDENTIAL WELL DETECTION LIMIT
Acrolein	ug/Kg	ND	100	ug/L	ND	10	ug/L	ND	ND	10
Acrylonitrile	ug/Kg	ND	100	ug/L	ND	10	ug/L	ND	ND	10
Benzene	ug/Kg	553	100	ug/L	8 U	10	ug/L	ND	ND	10
Carbon Tetrachloride	ug/Kg	ND	100	ug/L	ND	10	ug/L	ND	ND	10
Chlorobenzene	ug/Kg	ND	100	ug/L	ND	10	ug/L	ND	ND	10
1,2-Dichloroethane	ug/Kg	ND	100	ug/L	ND	10	ug/L	ND	ND	10
1,1,1-Trichloroethane	ug/Kg	ND	100	ug/L	3 U	10	ug/L	19	12	10
1,1-Dichloroethane	ug/Kg	ND	100	ug/L	ND	10	ug/L	5 U	ND	10
1,1,2-Trichloroethane	ug/Kg	ND	100	ug/L	ND	10	ug/L	ND	ND	10
1,1,2,2-Tetrachloroethane	ug/Kg	ND	100	ug/L	ND	10	ug/L	ND	ND	10
Chloroethane	ug/Kg	ND	100	ug/L	ND	10	ug/L	ND	ND	10
2-Chloroethylvinylether	ug/Kg	ND	100	ug/L	ND	10	ug/L	ND	ND	10
Chloroform	ug/Kg	ND	100	ug/L	ND	10	ug/L	ND	ND	10
1,1-Dichloroethylene	ug/Kg	ND	100	ug/L	ND	10	ug/L	ND	ND	10
1,2-trans-Dichloroethylene	ug/Kg	79 U	100	ug/L	ND	10	ug/L	2 U	ND	10
1,2-Dichloropropane	ug/Kg	ND	100	ug/L	ND	10	ug/L	2 U	ND	10
1,3-Dichloropropylene	ug/Kg	ND	100	ug/L	ND	10	ug/L	ND	ND	10
Ethylbenzene	ug/Kg	1,060	100	ug/L	3 U	10	ug/L	ND	ND	10
Methylene Chloride	ug/Kg	160	100	ug/L	ND	10	ug/L	ND	ND	10
Methyl chloride	ug/Kg	ND	100	ug/L	ND	10	ug/L	ND	ND	10
Methyl bromide	ug/Kg	ND	100	ug/L	ND	10	ug/L	ND	ND	10
Bromoform	ug/Kg	ND	100	ug/L	ND	10	ug/L	ND	ND	10
Dichlorobromomethane	ug/Kg	ND	100	ug/L	ND	10	ug/L	ND	ND	10
Trichlorofluoromethane	ug/Kg	48 U	100	ug/L	ND	10	ug/L	ND	ND	10
Dichlorodifluoromethane	ug/Kg	ND	100	ug/L	ND	10	ug/L	ND	ND	10
Chlorodibromomethane	ug/Kg	ND	100	ug/L	ND	10	ug/L	ND	ND	10
Tetrachloroethylene	ug/Kg	272	100	ug/L	ND	10	ug/L	2 U	ND	10
Toluene	ug/Kg	5,280	100	ug/L	22	10	ug/L	ND	ND	10
Trichloroethylene	ug/Kg	176	100	ug/L	ND	10	ug/L	3 U	ND	10
Vinyl Chloride	ug/Kg	88	100	ug/L	ND	10	ug/L	ND	ND	10
Total Xylenes	ug/Kg	825	100	ug/L	22	10	ug/L	ND	ND	10
DILUTION RATIO	---	10X	10X	---	1X	1X	---	1X	1X	1X

WS-L = Waste Sampling Station L
SW-C = Surface Water Sampling Station C
RW-B-03 = Residential Well B, Sample No. 03
U = Not detected or below detection limit

TABLE 4-3C

SI WASTE CHARACTERISTICS AND ENVIRONMENTAL CONCENTRATIONS
ACID EXTRACTABLE ORGANIC COMPOUNDS
LEE ACRES SITE, FARMINGTON, SAN JUAN COUNTY, N.M.

LEE ACRES SITE, FARMINGTON, SAN JUAN COUNTY, N.M.
AEPCO SITE 1; GROUP A
BLM SITE CODE: NM 0000000000

ACID EXTRACTABLE ORGANIC COMPOUNDS

	WASTE			SURFACE WATER			RESIDENTIAL WELL			
PARAMETER	UNIT	STATION WS-L	DETECTION LIMIT	UNIT	STATION SW-C	DETECTION LIMIT	UNIT	STATION RW-A-03	STATION RW-B-03	DETECTION LIMIT
Benzoic Acid	mg/Kg	ND	5,000	ug/L	ND	500	ug/L	ND	ND	10
2,4,5-Trichlorophenol	mg/Kg	ND	5,000	ug/L	ND	500	ug/L	ND	ND	10
2,4,6-Trichlorophenol	mg/Kg	ND	1,000	ug/L	ND	100	ug/L	ND	ND	10
p-Chloro-m-cresol	mg/Kg	ND	1,000	ug/L	ND	100	ug/L	ND	ND	10
2-Chlorophenol	mg/Kg	ND	1,000	ug/L	ND	100	ug/L	ND	ND	10
2-Methylphenol	mg/Kg	ND	1,000	ug/L	106	100	ug/L	ND	ND	10
4-Methylphenol	mg/Kg	ND	1,000	ug/L	2,200	100	ug/L	ND	ND	10
2,4-Dichlorophenol	mg/Kg	ND	1,000	ug/L	ND	100	ug/L	ND	ND	10
2,4-Dimethylphenol	mg/Kg	ND	1,000	ug/L	95 U	100	ug/L	ND	ND	10
2-Nitrophenol	mg/Kg	ND	1,000	ug/L	ND	100	ug/L	ND	ND	10
4-Nitrophenol	mg/Kg	ND	5,000	ug/L	ND	500	ug/L	ND	ND	10
2,4-Dinitrophenol	mg/Kg	ND	5,000	ug/L	ND	500	ug/L	ND	ND	10
4,6-Dinitro-o-cresol	mg/Kg	ND	5,000	ug/L	ND	500	ug/L	ND	ND	10
Pentachlorophenol	mg/Kg	ND	5,000	ug/L	ND	500	ug/L	ND	ND	10
Phenol	mg/Kg	ND	1,000	ug/L	220	100	ug/L	ND	ND	10
DILUTION RATIO	---	100X	100X	---	10X	10X	---	1X	1X	1X

WS-L = Waste Sampling Station L
SW-C = Surface Water Sampling Station C
RW-B-03 = Residential Well B, Sample No. 03
U = Not detected of below detection limit
--- Not applicable

TABLE 4-3D

SI WASTE CHARACTERISTICS AND ENVIRONMENTAL CONCENTRATIONS
BASE/NEUTRAL EXTRACTABLE ORGANIC COMPOUNDS
LEE ACRES SITE, FARMINGTON, SAN JUAN COUNTY, N.M.

LEE ACRES SITE, FARMINGTON, SAN JUAN COUNTY, N.M.
AEPCO SITE 1; GROUP A
BLM SITE CODE: NM 0000000000

BASE AND NEUTRAL EXTRACTABLE ORGANIC COMPOUNDS:

PARAMETER	WASTE			SURFACE WATER			RESIDENTIAL WELL			
	UNIT	STATION WS-L	DETECTION LIMIT	UNIT	STATION SW-C	DETECTION LIMIT	UNIT	STATION RW-A-03	STATION RW-B-03	DETECTION LIMIT
Acenaphthene	mg/Kg	ND	1,000	ug/L	ND	10	ug/L	ND	ND	10
Benzidine	mg/Kg	ND	1,000	ug/L	ND	10	ug/L	ND	ND	10
1,2,4-Trichlorobenzene	mg/Kg	ND	1,000	ug/L	ND	10	ug/L	ND	ND	10
Hexachlorobenzene	mg/Kg	ND	1,000	ug/L	ND	10	ug/L	ND	ND	10
Hexachloroethane	mg/Kg	ND	1,000	ug/L	ND	10	ug/L	ND	ND	10
bis (2-chloroethyl) ether	mg/Kg	ND	1,000	ug/L	ND	10	ug/L	ND	ND	10
2-Chloronaphthalene	mg/Kg	ND	1,000	ug/L	ND	10	ug/L	ND	ND	10
1,2-Dichlorobenzene	mg/Kg	ND	1,000	ug/L	ND	10	ug/L	ND	ND	10
1,3-Dichlorobenzene	mg/Kg	ND	1,000	ug/L	ND	10	ug/L	ND	ND	10
1,4-Dichlorobenzene	mg/Kg	ND	1,000	ug/L	ND	10	ug/L	ND	ND	10
3,3-Dichlorobenzidine	mg/Kg	ND	1,000	ug/L	ND	10	ug/L	ND	ND	10
2,4-Dinitrotoluene	mg/Kg	ND	1,000	ug/L	ND	10	ug/L	ND	ND	10
2,6-Dinitrotoluene	mg/Kg	ND	1,000	ug/L	ND	10	ug/L	ND	ND	10
1,2-Diphenylhydrazine (as azobenzene)	mg/Kg	ND	1,000	ug/L	ND	10	ug/L	ND	ND	10
Butl benzyl phthalate	mg/Kg	ND	1,000	ug/L	ND	10	ug/L	ND	ND	10
Di-n-butyl phthalate	mg/Kg	ND	1,000	ug/L	ND	10	ug/L	ND	ND	10
Di-n-octyl phthalate	mg/Kg	ND	1,000	ug/L	ND	10	ug/L	ND	ND	10
Diethyl phthalate	mg/Kg	ND	1,000	ug/L	ND	10	ug/L	ND	ND	10
Dimethyl phthalate	mg/Kg	ND	1,000	ug/L	ND	10	ug/L	ND	ND	10
Benzo (a) anthracene	mg/Kg	ND	1,000	ug/L	ND	10	ug/L	ND	ND	10
Benzo (a) pyrene	mg/Kg	ND	1,000	ug/L	ND	10	ug/L	ND	ND	10
3,4-Benzofluoranthene	mg/Kg	ND	1,000	ug/L	ND	10	ug/L	ND	ND	10
Benzo (k) fluoranthene	mg/Kg	ND	1,000	ug/L	ND	10	ug/L	ND	ND	10
Fluoranthene	mg/Kg	ND	1,000	ug/L	ND	10	ug/L	ND	ND	10
4-Chlorophenyl phenyl ether	mg/Kg	ND	1,000	ug/L	ND	10	ug/L	ND	ND	10
4-Bromophenyl phenyl ether	mg/Kg	ND	1,000	ug/L	ND	10	ug/L	ND	ND	10
bis (2-chloroisopropyl) ether	mg/Kg	ND	1,000	ug/L	ND	10	ug/L	ND	ND	10
bis (2-chloroethoxy) methane	mg/Kg	ND	1,000	ug/L	ND	10	ug/L	ND	ND	10
Hexachlorobutadiene	mg/Kg	ND	1,000	ug/L	ND	10	ug/L	ND	ND	10
Hexachlorocyclopentadiene	mg/Kg	ND	1,000	ug/L	ND	10	ug/L	ND	ND	10
Isophorone	mg/Kg	ND	1,000	ug/L	ND	10	ug/L	ND	ND	10
Naphthalene	mg/Kg	16 U	1,000	ug/L	24	10	ug/L	ND	ND	10
Nitrobenzene	mg/Kg	ND	1,000	ug/L	ND	10	ug/L	ND	ND	10
N-Nitrosodimethylamine	mg/Kg	ND	1,000	ug/L	ND	10	ug/L	ND	ND	10
N-Nitrosodiphenylamine	mg/Kg	ND	1,000	ug/L	ND	10	ug/L	ND	ND	10
bis (2-ethylhexyl) phthalate	mg/Kg	ND	1,000	ug/L	ND	10	ug/L	ND	ND	10
Chrysene	mg/Kg	ND	1,000	ug/L	ND	10	ug/L	ND	ND	10
Acenaphthylene	mg/Kg	ND	1,000	ug/L	ND	10	ug/L	ND	ND	10
Acenaphthylene	mg/Kg	ND	1,000	ug/L	ND	10	ug/L	ND	ND	10
Anthracene	mg/Kg	ND	1,000	ug/L	ND	10	ug/L	ND	ND	10
Benzo (ghi) perylene	mg/Kg	ND	1,000	ug/L	ND	10	ug/L	ND	ND	10
Fluorene	mg/Kg	ND	1,000	ug/L	ND	10	ug/L	ND	ND	10
Phenanthrene	mg/Kg	63 U	1,000	ug/L	11	10	ug/L	ND	ND	10
Dibenzo (a,h) anthracene	mg/Kg	ND	1,000	ug/L	ND	10	ug/L	ND	ND	10
Indeno (1,2,3-cd) pyrene	mg/Kg	ND	1,000	ug/L	ND	10	ug/L	ND	ND	10
Pyrene	mg/Kg	ND	1,000	ug/L	ND	10	ug/L	ND	ND	10
2-Methyl naphthalene	mg/Kg	35 U	1,000	ug/L	25	10	ug/L	ND	ND	10
DILUTION RATIO	---	100X	100X	---	1X	1X	---	1X	1X	1X

WS-L = Waste Sampling Station L
SW-C = Surface Water Sampling Station C
RW-B-03 = Residential Well B, Sample No. 03
U = Not detected of below detection limit
--- Not applicable

TABLE 4-3E

SI WASTE CHARACTERISTICS AND ENVIRONMENTAL CONCENTRATIONS
PESTICIDES AND PCBs
LEE ACRES SITE, FARMINGTON, SAN JUAN COUNTY, N.M.

LEE ACRES SITE, FARMINGTON, SAN JUAN COUNTY, N.M.
AEPCO SITE 1; GROUP A
BLM SITE CODE: NM 0000000000

PESTICIDES AND PCB IN RESIOENTIAL WELL WATER SAMPLES

PARAMETER	WASTE UNIT	WASTE STATION WS-L	WASTE DETECTION LIMIT	SURFACE WATER UNIT	SURFACE WATER STATION SW-C	SURFACE WATER DETECTION LIMIT	RESIDENTIAL WELL UNIT	RESIDENTIAL WELL STATION RW-A-03	RESIDENTIAL WELL STATION RW-B-03	RESIDENTIAL WELL DETECTION LIMIT
Aldrin	ug/Kg	ND	1,000	ug/L	ND	10	ug/L	NO	ND	10
Dieldrin	ug/Kg	ND	1,000	ug/L	ND	10	ug/L	ND	ND	10
Chlorodane	ug/Kg	ND	1,000	ug/L	ND	10	ug/L	ND	ND	10
4,4-DDT	ug/Kg	ND	1,000	ug/L	ND	10	ug/L	ND	ND	10
4,4-DDE	ug/Kg	ND	1,000	ug/L	ND	10	ug/L	ND	ND	10
4,4-DDD	ug/Kg	ND	1,000	ug/L	ND	10	ug/L	ND	ND	10
alpha-Endosulfan	ug/Kg	ND	1,000	ug/L	ND	10	ug/L	ND	ND	10
beta-Endosulfan	ug/Kg	ND	1,000	ug/L	ND	10	ug/L	ND	ND	10
Endosulfan sulfate	ug/Kg	ND	1,000	ug/L	ND	10	ug/L	ND	ND	10
Endrin	ug/Kg	ND	1,000	ug/L	ND	10	ug/L	ND	ND	10
Endrin aldehyde	ug/Kg	ND	1,000	ug/L	ND	10	ug/L	ND	ND	10
Neptachlor	ug/Kg	ND	1,000	ug/L	ND	10	ug/L	ND	ND	10
Neptachlor epoxide	ug/Kg	ND	1,000	ug/L	ND	10	ug/L	ND	ND	10
alpha-BHC	ug/Kg	ND	1,000	ug/L	ND	10	ug/L	ND	ND	10
beta-BHC	ug/Kg	ND	1,000	ug/L	ND	10	ug/L	ND	ND	10
gamma-BHC	ug/Kg	ND	1,000	ug/L	ND	10	ug/L	ND	ND	10
delta-BHC	ug/Kg	ND	1,000	ug/L	ND	10	ug/L	ND	ND	10
PCB-1016 (Aroclor 1016)	ug/Kg	ND	1,000	ug/L	ND	10	ug/L	ND	NO	10
PCB-1221 (Aroclor 1221)	ug/Kg	ND	1,000	ug/L	NO	10	ug/L	ND	ND	10
PCB-1232 (Aroclor 1232)	ug/Kg	ND	1,000	ug/L	ND	10	ug/L	ND	ND	10
PCB-1242 (Aroclor 1242)	ug/Kg	ND	1,000	ug/L	ND	10	ug/L	ND	ND	10
PCB-1248 (Aroclor 1248)	ug/Kg	ND	1,000	ug/L	ND	10	ug/L	ND	ND	10
PCB-1254 (Aroclor 1254)	ug/Kg	ND	1,000	ug/L	ND	10	ug/L	ND	ND	10
PCB-1260 (Aroclor 1260)	ug/Kg	ND	1,000	ug/L	ND	10	ug/L	ND	ND	10
DILUTION RATIO	---	100X	100X	---	1X	1X	---	1X	1X	1X

WS-L = Waste Sampling Station L
SW-C = Surface Water Sampling Station C
RW-B-03 = Residential Well B, Sample No. 03
U = Not detected or below detection limit
--- Not applicable

for the solid medium, representing the waste, sediment, and soil matrix; and the second one (Sample SW-C) representing primarily the surface water and, in lesser degree, the liquid waste accumulated in both pits. The results of the laboratory analyses are discussed below.

Ignitability (Table 4-3A)

The composite waste sample generally showed a less than ignitable flash point of 131°C. Owing to the compositing technique used, the waste sample may contain certain soil materials and/or other non-hazardous wastes, which tend to increase the flash point to a level higher than that which would be exhibited by actual original hazardous wastes dumped into the pits. Therefore, the results most likely under-estimate the ignitability potential of the original wastes dumped into the pits.

Corrosivity (Table 4-3A)

In accordance with the RCRA corrosivity testing procedures, the waste pH was determined to be 8. Treatment of the wastes in Pit P-01 with ferric chloride during April, 1985 probably altered the pH value of the wastes. Based on the existing pH value, the waste is not considered to be corrosive.

Reactivity (Table 4-3A)

The waste sample was subjected to the reactivity test specified in the Resource Conservation and Recovery Act (RCRA). Potential reaction products such as hydrogen sulfide (95 ug/Kg present in the waste sample) and possibly hydrogen cyanide (<5 mg/Kg) were detected. Therefore, the wastes are considered to be potentially reactive; and noncompatibility of the wastes with other materials, documented in the incidents occurred in April, 1985, cannot be ruled out.

Extraction Procedure (EP) Toxicity Test Results and Total Organic Halogens (TOH) (Table 4-3A)

The extractants from the waste sample subjected to the RCRA EP Toxicity test contain heavy metals, however, at concentrations below EPA contract detection limits, with the exception of barium at 77 ug/L. These low concentrations of heavy metals are well below the RCRA standards; therefore, they are not considered hazardous.

Owing to the compositing technique used, the waste sample may contain certain soil materials and/or other non-hazardous wastes, which tend to reduce the concentrations of hazardous substances dumped into the pits.

The composite surface water/liquid waste sample contained concentrations of heavy metals that were less than the lowest values of both applicable National Interim Primary and Secondary Drinking Water Standards, with the exception of boron (124 ug/L), chromium (73 ug/L), manganese (595 ug/L), and lead (168 ug/L). The concentrations of these metals in the solid waste sample did not exceed applicable EPA contract detection limits. The concentrations of these metals are higher than those previously reported by the N.M. EID.

A total organic halogen (TOH) concentration of 438 ug/L was detected in the surface water/liquid waste sample. The hazards of the TOH were not assessed due to its lack of chemical specificity.

Volatile Organic Compounds (VOCs) (Table 4-3B)

As shown in Table 4-3B, the composite waste sample contained elevated concentrations of:

- Benzene (553 ug/Kg)
- Ethylbenzene (1,060 ug/Kg)
- Methylene chloride (160 ug/Kg)
- Tetrachloroethylene (272 ug/Kg)
- Toluene (5,280 ug/Kg)
- Trichloroethylene (176 ug/Kg)
- Vinyl chloride (88 ug/Kg)
- Total xylenes (825 ug/Kg)

The surface water/liquid waste sample contained some of the same volatile organic compounds that were found in the waste sample, but at much lower concentrations. The presence of a grease-like layer between the solid and aqueous phases in the pits may have prevented the transfer of VOCs between the two media phases. In addition, it is most likely that once the VOCs transferred from the solid to the aqueous phase, they readily volatilized to the atmosphere.

The concentrations of these VOCs are consistent with those reported previously by the N.M. EID, especially for benzene, toluene, trichloroethylene, ethylbenzene, and various isomers of xylenes.

Acid Extractable Organic Compounds (Table 4-3C)

No acid extractable organic compounds were found in the composite waste sample. The presence of 2,4-dimethylphenol (96 ug/L), phenol (220 ug/L), 2-methylphenol (106 ug/L), and 4-methylphenol (2,200 ug/L) was confirmed in the aqueous medium.

Base/Neutral Extractable Organic Compounds (Table 4-3D)

Three base/neutral extractable organic compounds at concentrations below EPA contract detection limits were found in the composite waste sample. The same compounds within a factor of 2.5 of EPA contract detection limits were also found in the composite surface water/liquid waste sample. They are naphthalene, phenanthrene, and 2-methyl naphthalene.

Pesticides and PCBs (Table 4-3E)

Neither pesticides nor PCBs were found to be present in either the waste or the surface water/liquid waste sample. These results are consistent with earlier N.M. EID analytical findings.

4.6 Environmental Concentrations

4.6.1 Groundwater Quality

The results for the water samples collected from two residential wells (RW-A and RW-B) are presented below and compared with the data previously reported by the N.M. EID.

Hazardous Substance List (HSL) Metals and Total Organic Halogens (Tables 4-3A and 4-4)

The samples collected by the N.M. EID (Longmire, 1985) contained strontium at concentrations of 2.0 to 13 ug/L (Table 4-4). The highest concentration was found in RW-A (Reynold's well) downgradient from the landfill and the Giant Refining Co. facility.

During the recent SI, Well RW-A (Reynold's well) was found to contain an elevated concentration of boron (208 ug/L) (Table 4-3A). Concentrations of other HSL metals were well within the applicable National Interim Primary or Secondary Drinking Water Standards.

Volatile Organic Compounds (VOCs) (Tables 4-3B and 4-4)

As shown in Table 4-4, residential well water samples collected from the same wells by the N.M. EID showed that RW-A (Reynold's well) well water sample contained more number of VOCs including:

- Benzene (8 ug/L)
- Tetrachloroethene (10 ug/L)
- Trichloroethene or trichloroethylene (2 ug/L)
- 1,1-Dichloroethene (1 ug/L)
- 1,1-Dichloroethane (6 ug/L)
- 1,2-Dichloroethene (1 ug/L)
- 1,1,1-Trichloroethane (22 ug/L)

Most of these VOCs are also present at somewhat elevated concentrations in the wastes and surface water/liquid waste samples collected from Pits P-01 and P-04 in the landfill. This finding demonstrates that a strong source-to-receptor relationship may exist. The results of the N.M. EID's geophysical study also suggest the possibility that the landfill and possibly other source(s) within and/or near the site contributed to the contamination of Reynold's and Nace's wells.

During the SI, one VOC (1,1,1-trichloroethane) was detected at a concentration of 19 ug/L in the Reynold's well water sample (RW-A) (Table 4-3B). Five compounds (1,1-dichloroethane, 1,2-trans-dichloroethylene, 1,2-dichloropropane, tetrachloroethylene, and trichloroethylene) were also positively identified in this sample, however, at concentrations below EPA contract detection limits.

The sample of Nace's well water (RW-B) downgradient from Reynold's well contained only one VOC (1,1,1-trichloroethane) at a concentration of 12 ug/l, which is slightly less than that detected in Reynold's well. This finding indicates that the concentration of this VOC decreased downgradient from the landfill or the source(s).

TABLE 4-4

SUMMARY OR ENVIRONMENTAL CONCENTRATIONS
REPORTED BY N.M. ENVIRONMENTAL IMPROVEMENT DIVISION
LEE ACRES SITE, FARMINGTON, SAN JUAN COUNTY, N.M.

SITE: LEE ACRES SITE, FARMINGTON, SAN JUAN CO., N.M.
AEPCO SITE NO. 01, GROUP A
BLM SITE CODE: NM0000000000

SUBSTANCE ANALYZED	UNIT	SURFACE WATER*		RESIDENTIAL WELL WATER*			
		SW-A 18-Sep-85	SW-B 18-Sep-85	RW-A-01 22-Apr-85	RW-A-02 26-Apr-85	RW-B-01 01-May-85	RW-B-02 06-May-85
1. METALS AND OTHER ELEMENTS:							
Silver (Ag)	mg/L	<0.10	<0.10	----	----	----	<0.10
Aluminium (Al)	mg/L	<0.10	0.2	----	----	----	<0.10
Arsenic (As)	mg/L	----	----	----	----	----	----
Boron (B)	mg/L	110	<0.10	----	0.19	<0.10	----
Bsrium (Ba)	mg/L	0.2	0.2	----	----	----	<0.10
Beryllium (Be)	mg/L	<0.10	<0.10	----	----	----	<0.10
Calcium (Cs)	mg/L	<0.10	140	679	710	130	----
Cadmium (Cd)	mg/L	<0.10	<0.10	----	----	----	<0.10
Cobolt (Co)	mg/L	<0.10	<0.10	----	----	----	<0.10
Chromium (Cr)	mg/L	<0.10	<0.10	----	----	----	<0.10
Copper (Cu)	mg/L	<0.10	<0.10	----	----	----	<0.10
Iron (Fe)	mg/L	<0.10	0.8	----	<0.1	0.44	----
Mercury (Hg)	ug/L	----	----	----	----	----	----
Potassium (K)	mg/L	----	----	2.34	----	2.73	----
Magnesium (Mg)	mg/L	7.6	15	73.0	53	3.4	14
Manganese (Mn)	mg/L	<0.05	0.68	----	<0.05	2.1	----
Molybdenum (Mo)	mg/L	<0.10	<0.10	----	----	----	<0.10
Sodium (Ns)	mg/L	----	----	393	----	101.2	----
Nickel (Ni)	mg/L	<0.10	<0.10	----	----	----	<0.10
Lead (Pb)	mg/L	<0.10	<0.10	----	----	----	<0.10
Selenium (Se)	mg/L	----	----	----	----	----	----
Silicon (Si)	mg/L	3.7	4.3	----	6.6	6.7	----
Tin (Sn)	mg/L	<0.10	<0.10	----	----	----	<0.10
Stronium (St)	mg/L	1.6	2.3	----	13	2.0	----
Vanadium (V)	mg/L	<0.10	<0.10	----	----	----	<0.10
Yttrium (Y)	mg/L	<0.10	<0.10	----	----	----	<0.10
Zinc (Zn)	mg/L	<0.10	<0.10	----	1.1	0.13	----
2. ORGANIC COMPOUNDS:							
Aromatic Purgables Screen	ug/L	ND	----	----	----	ND	----
Halogenated Purgables Screen	ug/L	ND	ND	----	----	----	----
Benzene	ug/L	----	<5	8	<1	----	----
Toluene	ug/L	----	<10	----	----	----	----
CHCl3	ug/L	----	----	----	----	<1	----
CHCl2	ug/L	----	----	----	----	----	----
CHCl2Br	ug/L	----	----	----	----	----	----
CHClBr2	ug/L	----	----	----	----	----	----
Tetrachloroethene	ug/L	----	----	10	4	1	----
Trichloroethene	ug/L	----	----	2	2	----	----
1,1-Dichloroethene	ug/L	----	----	1	<1	----	----
1,1-Dichloroethane	ug/L	----	----	6	2	----	----
1,2-Dichloroethene	ug/L	----	----	1	<1	----	----
1,1,1-Trichloroethane	ug/L	----	----	22	20	----	----
3. CONVENTIONAL POLLUTANTS:							
Bicsrbonate	mg/L	----	----	171.6	----	151.4	----
Chloride	mg/L	----	----	1,002.9	----	13.2	----
Fluoride	mg/L	----	----	0.64	----	0.21	----
Ammonia-N	mg/L	0.24	1.3	----	----	0.07	----
Nitrate-N	mg/L	0.48	0.58	3.06	----	<0.01	----
Totsl Kjeldhsl Nitrogen	mg/L	0.88	1.67	----	----	<0.1	----
Phosphste (PO4-P)	mg/L	----	----	----	----	0.03	----
Sulfate	mg/L	----	----	1,231	----	471.9	----
4. OTHER PARAMETERS:							
pH	Std. Unit	----	----	6.85	----	6.60	----
Conductance	umhos/cm	405	2,200	4,200	----	905	----
Foaming Agents as LAS	mg/L	----	----	0.05	----	----	----
Hardness ss CsCO3	mg/L	----	----	1,990	----	----	----
Redox Potential (Eh)	mv	----	----	----	----	+160	----
Totsl Solids	mg/L	----	----	4,313	----	855	----
Alkslinity ss CaCO3	mg/L	----	----	141	----	----	----

NOTES:

SW-B: Surface Wster Sampling Ststory B
RW-B-01: Residentisl Well B, Sample No. 01
ND: Not Detected or Below Detection Limit.
---- Analysis Not Requested.
* These samples were collected and analyzed by N.M. Environmental Improvement Division.

No benzene was found in either RW-A or RW-B downgradient from the landfill.

Acid Extractable Organic Compounds (Table 4-3C)

Residential well water samples collected by the N.M. EID were not analyzed for acid extractable organic compounds.

During the SI, no acid extractable organic compounds were found to be present in the three residential wells.

No significant levels of acid extractable organic compounds were found in the wastes. Contamination by these organic compounds does not seem to be a problem at the landfill and its vicinity.

Base/Neutral Extractable Organic Compounds (Table 4-3D)

Residential well water samples collected by the N.M. EID were not analyzed for base/neutral extractable organic compounds.

During the SI, no base/neutral extractable organic compounds were found to be present in the two residential wells.

No significant levels of base/neutral extractable organic compounds were found in the wastes. Contamination by these organic compounds also does not seem to be a problem at the landfill and its vicinity.

Pesticides and PCBs (Tables 4-3E and 4-4)

The N.M. EID survey samples (Table 4-4) contained aldrin, DDT, and concentrations of siloxanes much greater than 2 ug/L in liquid waste collected in Pit P-01. Neither pesticides nor PCBs were found in the wastes in the landfill (Longmire, 1985). The surface liquid or water might have been incidentally contaminated by agricultural pesticides.

During the SI, neither pesticides nor PCBs were detected in the two residential wells (Table 4-3E), nor were they found in the wastes (solid or liquid) in the liquid waste pits in the landfill. Thus, pesticides and PCBs do not appear to constitute a contamination problem at the landfill.

4.6.2 Surface Water Quality

N.M. EID personnel collected two surface water samples (SW-A, and SW-B; one upgradient and one downgradient from the landfill). The laboratory results are shown in Table 4-4. The results indicate the presence of strontium (1.6-2.3 mg/L). No other hazardous organic or inorganic substances were identified in the two surface water samples collected.

No sampling of offsite surface water was performed by the SI team.

4.7 Terrain Electromagnetic (EM) Conductivity Survey

A terrain electromagnetic (EM) conductivity survey was conducted by N.M. EID personnel in April, 1985 (Longmire, 1985). Based on the raw terrain conductivity data provided by the N.M. EID, two iso-conductivity maps were drawn for the SI (Figures 4-1 and 4-2), for 20-meter and 40-meter vertical detection coil arrangements, respectively.

Factors that may result in high conductivity readings include the clay, moisture, and salt/mineral content of the soils; the inorganic and organic salt content of groundwater; groundwater table elevation; the presence of corroded underground metal containers; leachates from landfills or chemical spills; leaking and migration of inorganic and/or dissociable organic substances into the groundwater system; and other natural and manmade activities.

Basically, two major anomalies in high conductivity values (or conductive plumes) were found downgradient from the landfill. The first conductive plume seems to originate from the liquid waste pits in the landfill and follows a north-south pathway. The second conductive plume seems to originate from the Giant Refining Company area and also runs along a north-south path. Conductivity readings were highest at the liquid waste pits and in an area near or within the Giant Refining Co. property. Two conductive plumes seem to overlap in an area approximately 1,500 feet north of Bloomfield Highway (Route 64) between the arroyo and the Giant Refining Co. Terrain conductivity decreased in a direction away from these two suspected sources and resumed normal background values near the Lee Acres Subdivision immediately south of Bloomfield Highway.

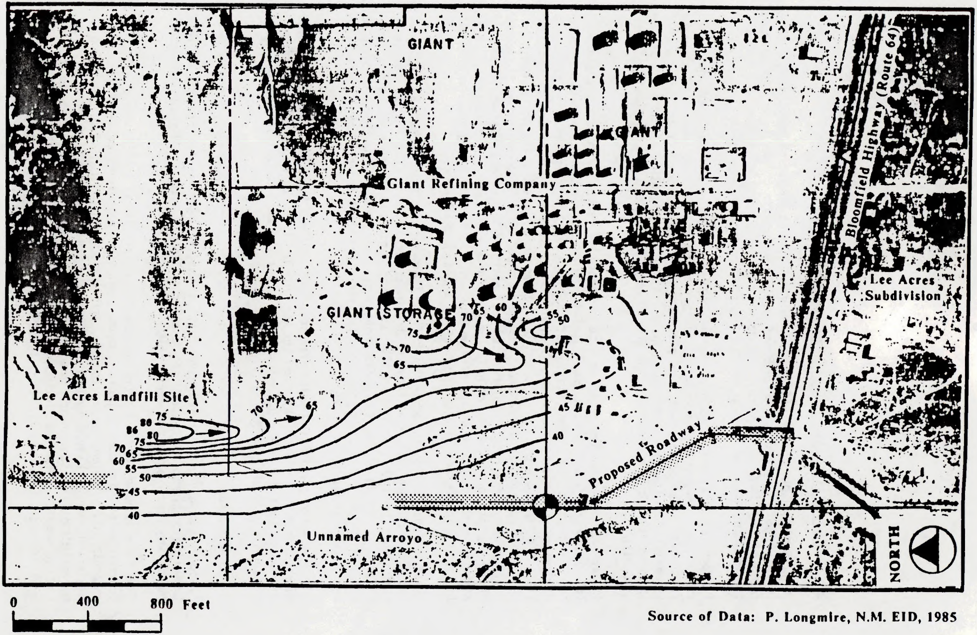
Since the natural shallow groundwater flows from north to south toward San Juan River at the site, these two plumes do indicate that there are at least two potential sources of contamination in and near the landfill and that contaminants have migrated from these sources. It should be noted that the geophysical study was conducted immediately outside of the Giant Refining Co.'s property. Therefore, the exact source(s) of the second conductive plume cannot be accurately determined.

The conductivity readings for the area near the Lee Acres Subdivision in the southern part of the site were within background conductivity levels. This further partially supports the hypothesis that the residential wells closest to the site are only at the leading edge of the conductive groundwater plumes.

4.8 Summary

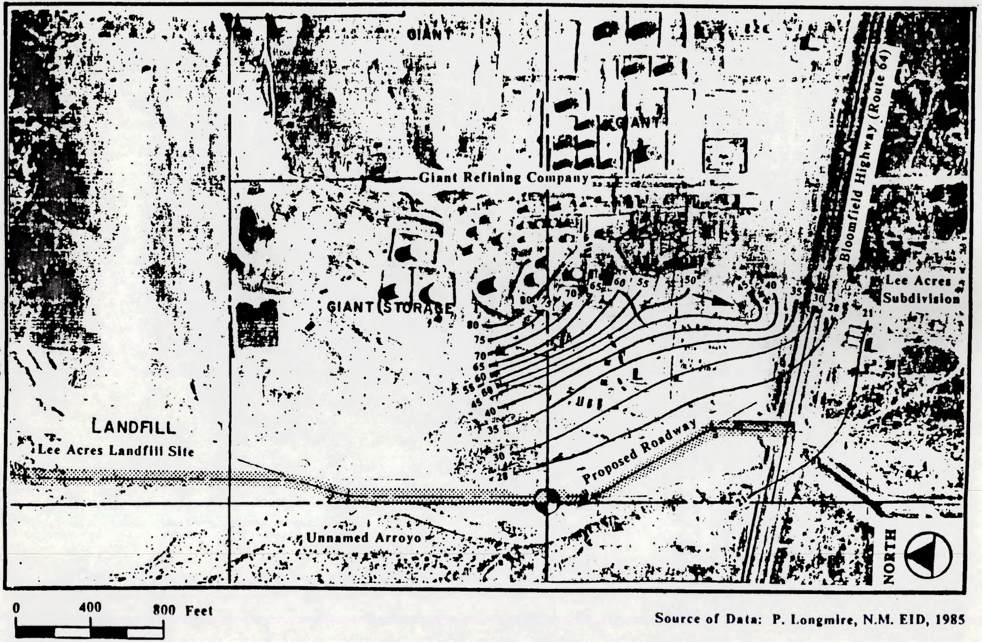
Based on the results of the SI ignitability, corrosivity, and reactivity tests, the wastes in the liquid waste pits in the landfill are considered slightly corrosive, slightly flammable, and potentially reactive and non-compatible.

The waste samples collected from the liquid waste pits in the landfill contain elevated concentrations of hazardous organic compounds including benzene, ethylbenzene, methylene chloride, tetrachloroethylene, toluene, trichloroethylene, vinyl chloride, and all three isomers of xylene. Liquid waste/surface water samples collected from these pits contained no volatile organic compounds; however, they did contain elevated concentrations of semi-volatile organic compounds including 2,4-dimethylphenol, phenol, 2-methylphenol, and 4-methylphenol. The wastes are considered volatile and potentially hazardous.



Source of Data: P. Longmire, N.M. EID, 1985

FIGURE 4-1. ISO-CONDUCTIVITY CONTOUR MAP (20-METER VERTICAL COIL)
(Terrain conductivity is expressed in mmho/meter)



Source of Data: P. Longmire, N.M. EID, 1985

FIGURE 4-2. ISO-CONDUCTIVITY CONTOUR MAP (40-METER VERTICAL COIL)
(Terrain conductivity is expressed in mmho/meter)

The two wells sampled in the Lee Acres Subdivision downgradient from the landfill are documented to be contaminated. Laboratory analyses showed that shallow groundwater in the subdivision contained low levels of benzene, tetrachloroethene, trichloroethene or trichloroethylene, 1,1-dichloroethene, 1,1-dichloroethane, 1,2-dichloroethene, and 1,1,1-trichloroethane.

Two groundwater plumes of high terrain conductivity anomalies were identified. Both plumes flow southward toward the Lee Acres Subdivision. The first plume is believed to originate at the liquid waste pits in the landfill. The potential source(s) for the second conductive plume are near or within the Giant Refining Co. property.

5.0 PUBLIC HEALTH CONCERNS

The available data on landfill contamination presented in the previous sections indicate that there could be considerable health risks associated with the potentially multiple sources of contamination from volatile and semi-volatile organic compounds, some of which are carcinogenic and toxic. Potential public health concerns discussed in this section are air pollution, direct contact with wastes and contaminated soils, consumption of contaminated groundwater, direct contact with contaminated surface waters/sediments, and the ignition of wastes. Due to the lack of specific information, these potential health risks cannot be precisely quantified. A more complete site remedial investigation (RI) is needed to provide additional information on the multiple sources of contamination, contaminants, environmental concentrations, and the pathways and extent of pollutant migration from various sources.

5.1 Air Pollution

Air monitoring conducted by AEPCO, Inc. in the landfill revealed the presence of total organic vapors in headspaces at levels ranging from 1.0-25 ppm benzene equivalent, with one instantaneous reading in the 100 ppm range. The ambient air background in the normal breathing zones, however was consistently measured at 0.3 ppm.

In April, 1985, releases of hydrogen sulfide and possibly other toxic gases from the waste storage pits (primarily Pit P-01) sickened several people within a distance of 0.5-1 mile of the pits in the landfill.

The wastes in Pit P-01 have since been stabilized by treatment with ferric chloride. No air pollution incidents have been reported since this in-situ treatment. The lack of low background hNu readings in the normal breathing zones suggests a low hazard or health risk at the landfill from airborne contamination. However, the possibility of future occurrences cannot be effectively ruled out owing to the potential noncompatibility of substances in the landfill. For example, high hNu readings were still measured when the wastes were disturbed during the field SI activities. If excavation of the wastes is to be conducted at the landfill as one of the source control remedial measures or if the wastes are to be disturbed as part of any remedial measures, emissions of volatile organic substances and particulates would be inevitable. During this remedial action period, onsite workers and nearby residents or transient populations may be affected.

Due to lack of specific information, the potential air pollution from sources other than the landfill cannot be addressed at this stage of the study.

For the purpose of ranking the site in accordance with the EPA's Hazardous Ranking System (HRS), it is estimated that approximately 25,000 people within a 4-mile radius (encompassing the entire Farmington area) are potential contamination receptors by site conditions via air pollution.

5.2 Soil Contamination

Some hazardous substances, especially those with high environmental mobilities such as benzene and toluene, might have migrated from the waste storage pits and contaminated the soils beneath and surrounding the pits. The fencing of the landfill and the waste pits, and the posting of warning signs at the landfill, to limit access, have made the possibility of direct contact with and ingestion of contaminated soils fairly remote. Recent information obtained by BLM personnel (14 April 1986) indicates that much of the landfill fencing has since been removed or damaged. Immediate repair or replacement of the landfill fencing and introduction of a routine surveillance and maintenance program are desirable to minimize risk exposure through direct contact with the wastes and contaminated soils.

When the western dike of Pit P-01 was breached in April, 1985, some wastes migrated to the nearby arroyo. This might have caused contamination of sediments and soils in the arroyo bed. The extent of contamination, which is dependent on the scouring velocity of runoff, is difficult to assess accurately. The potential of direct contact with these escaped wastes exist. Although vegetation on the stream bed of the arroyo is sparse, direct contact with the wastes or consumption of contaminated flora by cattle and other terrestrial animals cannot be ruled out. The existing cattleguards surrounding the pits and the landfill minimize this environmental risk to a large extent.

Dermal contact with some of the substances in the soils or the wastes could cause contact dermatitis; however, no discernible effects on human health or wildlife would be expected as a direct result of contact at the low concentrations detected thus far.

For the purpose of ranking the site in accordance with the EPA's Hazardous Ranking System (HRS), it is estimated that approximately 1,000 people within a 1-mile radius of the center of the landfill could potentially be affected by the site conditions via direct contact as a result of the erosion of contaminated soil from the landfill. The population potentially at risk through direct contact was estimated as follows:

- 30-50 workers or transient population (e.g., scavengers and disposers) at the landfill;
- 631 people in the Lee Acres Subdivion;
- 50 permanent or transient population at the Giant Refining Co. and the El Paso Natural Gas Co. facilities; and
- several hundred residents along Route 64 within a 1-mile radius of the landfill.

The possibility of the transient population at San Juan Downs could be exposed to the wastes and contaminated soils through direct contact exists, but is quite remote period.

5.3 Groundwater Contamination

Analyses of groundwater samples from 2 downgradient residential wells revealed that one well (Sample RW-A) is contaminated to some extent with strontium and trace amounts of volatile organic compounds (benzene, 1,1,1-trichloroethane, 1,1,2-trichloroethane, 1,1-dichloroethene, 1,1-dichloroethane, 1,2-dichloroethene, 1,2-dichloropropane, tetrachloroethylene, and trichloroethylene); and the second well (Sample RW-B) is contaminated with 1,1,1-trichloroethane. Some of these compounds, (e.g., trichloroethylene), are known human and/or animal carcinogens. Although some acid and base/neutral extractable organic compounds (e.g., 2-methylphenol and 4-methylphenol) were found to be present in the wastes in the liquid waste pits of the landfill, none of them were detected in the residential well waters. No pesticides or PCBs were found to be present in the groundwater samples collected.

The concentrations of hazardous substances in the shallow aquifer seems to decrease with increasing distance downgradient from the landfill. The shallow groundwater movement may be quite slow, and the residential wells downgradient from and closest to the landfill may only be at the leading edge of the contaminated groundwater plume(s). These possibilities are partially supported by the results of a terrain electromagnetic (EM) conductivity survey conducted by N.M. EID personnel. The survey results are discussed in Section 4.7. The results of the N.M. EID's geophysical study suggest the possibility that contamination of these wells may also be contributed by other source(s) (e.g., within or near the Giant Refining Co.) in addition to the landfill.

Since this well contamination problem is evidently not solely caused by conditions at the landfill, it is further suggested that a followup investigation of the entire site be conducted to determine the total number of sources involved and the magnitude of the problems associated with each source. Because of the potential involvement of other sources of contamination in the study area, EPA, State of New Mexico, San Juan County authorities, and other affected parties should be called upon to participate to ensure that a concerted effort is undertaken during the follow-up investigations and remedial actions.

The N.M. EID terrain electromagnetic (EM) conductivity survey results indicate that two conductive underground plumes have originated from the landfill and from the nearby Giant Refining Company. This evidence partially confirms the possibility that contaminants have migrated from these potential sources. Judging from the low concentrations of the above hazardous substances, the leading edge of the contaminated shallow underground plumes has probably made contact with the downgradient residential wells. Therefore, the shallow groundwater aquifer may be moving slowly possibly owing to its flat hydraulic gradient. The level of groundwater contamination could increase with time, as the full contaminated plume gradually widens and eventually arrives at the downgradient residential wells.

A more comprehensive groundwater monitoring program covering the landfill, the Giant Refining Co. and the El Paso Natural Gas Co. facilities, and residential wells in the Lee Acres Subdivision is necessary to accurately delineate the multiple sources of contamination and zone(s) of contaminant migration.

Continuous consumption of the unconsolidated shallow groundwater in the area, especially near and downgradient from the multiple sources of contaminants would most likely pose a significant health risk.

The high permeability of soils and the fractured bedrock at the site suggests the possibility of existing or eventual contamination of bedrock aquifers. This risk potential cannot be assessed without field testing to determine the status of the intercommunication capabilities between the unconsolidated shallow and bedrock aquifers.

A total of 136 houses in the Lee Acres Subdivision are connected to the public water system managed by the Lee Acres Water Users Association. Some of the houses that are on the public water system still use well water for lawn watering, car washing, gardening, filling of swimming pool(s), and/or possibly other non-sanitary, non-food preparation purposes.

Based on a population density of 3.8 persons per dwelling unit as suggested by the EPA's Uncontrolled Hazardous Waste Site Ranking System (HRS), the total population served by the public water system is estimated to be approximately 516. A row-by-row house survey by the BLM Farmington Resource Area indicated that there are approximately 166 dwelling units in the Lee Acres Subdivision area downgradient from the landfill, which equates to a population of approximately 631. The balance of approximately 30 houses (115 people) not connected to the Lee Acres Water Users Association main is assumed to continue to depend on the shallow groundwater aquifer for water supply.

The sources of water supply to the Giant Refining Co., the El Paso Natural Gas Co., and the San Juan Down facilities are unknown.

If any of the existing residential plumbing systems are not completely segregated from the individual wells, the possibility of cross-contamination of the public water by the shallow groundwater exists. A house-to-house survey of individual plumbing systems would be necessary to accurately assess this problem.

For the purpose of ranking the site in accordance with the EPA's Hazardous Ranking System (HRS), it is estimated that approximately 115 people within a 1- to 1.5-mile radius of the landfill potentially could be affected by the landfill conditions and other onsite source(s) via the groundwater route. This estimated population potentially at risk does not include the permanent or transient populations at San Juan Downs, the Giant Refining Co., and the El Paso Natural Gas Co. facilities.

5.4 Surface Water and Sediment Contamination

Samples of onsite surface water/liquid waste in the liquid waste pits within the landfill contain localized concentrations of hazardous substances. Whether the surface water in the nearby arroyo has been contaminated as a result of leaking of wastes from Pit P-01 cannot be assessed due to the lack of samples from this area. Becasue the arroyo is dry for long periods each year, the potential for the surface water contamination to effect humans and animals adversely is considered to be minimal.

The San Juan River, a perennial body of water and the immediate receiving stream for the unnamed arroyo, provides great dilution power for discharges from the arroyo. The health and environmental effects of any contaminant releases from the site is therefore considered insignificant.

No sediment samples were taken from the arroyo.

5.5 Fire and Explosions

Limited data are available on the flammability of wastes at the landfill. SI field monitoring of the landfill using an explosimeter showed no flammable gas. No known incidents of explosions or fires have been reported.

The flash point of 130°C for the composite waste sample from Pits P-01 and P-04 indicates that the ignition of fires is unlikely. However, the composite sample did contain inert materials, such as soils, that may have obscured the true flash point of the wastes. Field observations confirmed the presence of oil- and grease-like materials under soil cover, and SI field data from the hNu meter survey did show a buildup of ignitable organic vapors within the waste pits. The uncovering of these materials could pose a fire hazard.

It is unknown whether there are any buried ignitable drums or containers at the site.

For the purpose of ranking the site in accordance with the EPA's Hazardous Ranking System (HRS), it is estimated that approximately 15,000 people and 4,000 structures within a 2-mile radius (encompassing parts of Farmington) potentially could be affected, should there be a fire or an explosion on site.

5.6 General Risk Assessment and Recommendations

The quality and concentrations of substances detected at the landfill indicate that there is no immediate threat to humans from acute exposure. However, samples of wastes in the landfill pits do to contain carcinogenic and toxic substances in concentrations, which, although they are low, could act as threats to health if persons are chronically exposed to them. The primary, but unlikely, routes of exposure would be by direct contact or ingestion. Removal or total containment of landfill wastes and contaminated soils would lower the risk of health effects from direct contact, inhalation, or leaching via water routes.

As an initial remedial measure (IRM) to effectively minimize potential exposure of the public to the wastes and health risks of landfill workers; and also prevent future dumping of hazardous wastes onto the landfill, three alternatives in increasing order of reliability and effectiveness are available for consideration:

Alternative 1: Restrict the access to the landfill by installing a security gate at the entrance and establishing a permit system to regulate waste disposers and types of wastes acceptable at the landfill. Repair or replace the landfill fencing and introduce a routine surveillance and maintenance program.

Alternative 2: In addition to Alternative 1, temporarily suspend the landfill operations pending findings of a follow-up remedial investigation.

Alternative 3: In addition to Alternative 1, permanently close the landfill to the public.

Although the wastes in Pit P-01 was stabilized once as an emmergency measure, it cannot be sure that incidents similar to those in April 1985 would not occur in the future, especially unrestrict access to the landfill continues. For the reason of protecting the health and safety of landfill workers (e.g., scavengers and disposers), it is recommended that either Alternative 2 or 3 be implemented.

Groundwater samples were reported to contain low levels of carcinogenic and toxic substances that do not immediately threaten the public health via ingestion. Assuming that the terrain conductivity anomalies are an indication of shallow groundwater contamination possibly containing those volatile organic substances identified in the downgradient residential wells, the level of groundwater contamination will increase if the two underground conductive plumes migrate from their sources and widen. This increase would pose a serious threat to the health of persons who are chronically exposed to the substances. Extension of the existing public water supply system to potentially affected residents would reduce this health risk. Source controls, such as removal, total containment, and/or fixation of the wastes and contaminated soils, would reduce the strengths of the sources and thus the amount of hazardous substances available to migrate outward and further contaminate the groundwater aquifers.

If the bedrock aquifer is contaminated, the threat to public health would be even greater than that posed by contaminated unconsolidated shallow aquifer because of the potentially more rapid migration of contaminants in bedrock aquifers.

Consequently, the performance of a hydrogeologic evaluation, including groundwater quality monitoring, is recommended to assess the status of the potential risks associated with both the shallow and bedrock aquifers. A more detailed geophysical study, including magnetometer and terrain resistivity surveys covering the entire site and its surroundings, is also recommended to determine whether any metallic objects (e.g., drums and containers) are present, and to delineate accurately the contaminated plumes and their migration patterns.

As stated, since the shallow groundwater contamination is not solely caused by the landfill conditions, it is suggested that a followup investigation of the entire site be conducted to determine the total number of sources involved and the magnitude of the problems associated with each source.

6.0 EVALUATION OF EXISTING INFORMATION

6.1 Adequacy of Existing Data for Use in a Followup Remedial Investigation (RI) and Feasibility Study (FS)

The existing data were assessed in terms of their adequacy for use in a followup remedial investigation and feasibility study. The evaluation criteria consisted of currency, consistency, completeness, representativeness, accuracy, and comparability. Table 6-1 summarizes the results of this evaluation.

6.2 Additional Data Needs for Follow-Up Investigations

Additional data to be obtained during the remedial investigation (RI) and to be used for feasibility studies (FS) of remedial alternatives will be outlined in Section 9.0. Topics to be addressed are:

- o other source(s) of contamination resulting in the second conductive groundwater plume apparently originating from an area within or near the Giant Refining Co.'s property,
- o topographic and boundary survey data,
- o geologic conditions by subsurface exploration technique(s),
- o groundwater characteristics,
- o groundwater quality,
- o surface water quality,
- o hazardous waste characteristics at source(s) other than the landfill, and
- o general and specific environmental risks.

TABLE 6-1. ADEQUACY OF EXISTING DATA FOR USE IN A FOLLOWUP REMEDIAL INVESTIGATION AND FEASIBILITY STUDY

Category of Data	Adequacy of Data (For Remedial Investigation & Feasibility Study)	Comment
Air Quality	Adequate	-----
Surface Water Quality	Partially adequate	More data regarding San Juan River water quality conditions are required.
Groundwater Quality	Inadequate	More well water quality data to accurately define zone(s) of contamination and pattern of groundwater movement.
Soil Contamination	Partially adequate	More sampling stations and data are required to determine extent of onsite and offsite soil contamination.
Waste Characteristics	Partially adequate	More sampling stations and data are required to estimate the quantity and quality of onsite wastes other than those at the landfill
Contamination Zone(s)	Partially adequate	A well designed geophysical study consisting of magnetometer and terrain resistivity/conductivity surveys is required to define presence of buried metallic objects and zone(s) of contamination.
Hydrogeological Conditions	Inadequate	More monitoring wells are required to determine the behavior of both shallow and deeper bedrock aquifers.
Site Survey	Inadequate	Accurate mapping of the site is required.
General and Specific Environmental Risks	Inadequate	-----
Community Relations	Potentially inadequate	-----

7.0 HEALTH AND SAFETY PROCEDURES

7.1 Level of Protection Used In Previous Investigation

In April, 1985, several people in or near the landfill and unprotected by any health and safety equipment were sickened from the inhalation of hydrogen sulfide and possibly other toxic fumes. At the same time, the fire fighters responding to the incidents, who wore self-contained breathing apparatus, developed skin rashes.

In November, 1985, AEPCO field personnel performed the landfill investigations using Level C protection. Constant monitoring of air with an hNu organic vapor analyzer was performed to alert the field personnel so that necesary additional protective actions could be taken, such as use of full-face self-purifying respirators. During the entire field investigation period, the hNu readings in the normal breathing zones were at the ambient background level. However, hNu headspace readings in the waste pits did show elevated concentrations (1.0-25 ppm benzene equivalent) of organic vapors with one instantaneous reading in the 100 ppm range. Besides the hNu meter, other modified Level C monitoring instruments were also used (including a methane detector, hydrogen sulfide sensitive badges, a gross radioactivity radiometer, and an explosimeter/oxygen meter). Personnel were also protected by steel-shank steel-toe boots, inner/outer gloves, and Tyvac chemical resistant suits.

Appropriate Level C protection procedures were used to decontaminate personnel and equipment before exiting the waste areas.

7.2 Level of Protection Recommended for Existing Site Workers and Future Work on the Site

Although the wastes in Pit P-01 was stabilized as an emergency measure, the likelihood of reoccurrence of incidents similar to those occurred in April 1985 cannot be ruled out, especially if unrestricted access to the landfill continues. Therefore, to protect the health and safety of landfill scavengers or disposers, it is recommended that either (1) the landfill operations be suspended temporarily pending further findings from a follow-up remedial investigation or (2) the landfill be permanently closed to the public.

For remedial workers at or visitors to the landfill, initial onsite monitoring should be conducted using Level C respiratory protection. If no changes in present conditions are detected, Level D protection is recommended for site work activities. Excavation, sampling, or other activities, where contact with the wastes can be expected will require dermal protection. Excavation of wastes or contaminated soils, drilling and installing monitoring wells in the waste areas at the landfill, opening of monitoring wells, and other tasks which expose wastes to the air can be expected to produce respiratory hazards. Use of appropriate respiratory protection and air monitoring are required.

7.3 Site Monitoring Recommendations for Future Work

No modifications to personnel monitoring procedures are proposed unless landfill conditions change and other hazardous situations arise.

8.0 STUDY FINDINGS, AND SITE RANKING AND CLASSIFICATION

8.1 Major Study Findings

A Site Investigation (SI) of the Lee Acres Site was performed by AEPCO, Inc. under a contract with the Department of the Interior, Bureau of Land Management (BLM). The study objectives were to use existing available information as supplemented by new limited sampling and analysis to:

- o Define the type and estimate the quantities of hazardous wastes on site;
- o Determine the status of contaminant migration and its compliance with federal and State regulations and permits; and
- o Facilitate site classification for subsequent site remedial action(s) including no-action.

The Lee Acres Site, covering an area of approximately 960 acres, is located approximately 2 miles east-southeast of Farmington, San Juan County, New Mexico. It contains the Lee Acres Modified Sanitary Landfill, the Giant Refining Co. facility, the Lee Acres Subdivision, and the El Paso Natural Gas Corporation facilities.

The landfill, covering approximately 20 acres, has been leased by BLM to the San Juan County Public Works Department to operate as a sanitary landfill. In April, 1985, a series of incidents occurred, during which approximately 15 people at or near the landfill experienced acute toxic effects. These incidents resulted in the implementation of an initial remedial measure (in-situ treatment of the wastes in Pit P-01 with ferric chloride); and the initiation of this SI.

Air monitoring during the landfill reconnaissance generally revealed negligible contamination of air at and near the landfill. However, 1.0-25 ppm benzene equivalent concentrations of volatile organic vapor, including an instantaneous reading in the 100 ppm range, were detected in the headspace of the wastes below the surface in the liquid waste pits (primarily Pits P-01 and P-04). This finding indicates a potential of exposure of the public to the vapor via the air route.

Because of the unrestricted access to the landfill, the potential for direct contact and risk exposure for onsite personnel (e.g., waste disposers, scavengers, landfill workers, site remediation workers, and other transient population) via the air route cannot be effectively ruled out.

The unlined liquid waste pits were reportedly used for the disposal of septic wastes, sludges, oily wastes, and petroleum production water. Approximately 8,800 cubic yards of wastes were estimated to be present in these pits as a result of unrestricted dumping. A portion of the dike in Pit P-01 was breached in April, 1985 resulting in the release of some of these wastes into the nearby unnamed arroyo and possibly the San Juan River, downgradient from the landfill.

Wastes in the liquid waste pits within the landfill are in solid, semi-solid, and liquid forms. The analytical findings for waste samples collected previously by the N.M. EID personnel and during the SI indicate that the wastes contain elevated concentrations of highly volatile and mobile organic compounds. Some of compounds are toxic and/or carcinogenic, including: toluene, benzene, trichloromethane (or methylene chloride), 1,1,1-trichloroethane, trichloroethylene (or trichloroethene, a positive human carcinogen), dichloromethane, ethylbenzene, and all three isomers of xylene. High concentrations of sulfide and strontium and trace amounts of naphthalene, phenanthrene, and 2-methyl naphthalene were also detected in the solid medium of the wastes. Compounds detected in the aqueous phase of the wastes are quite similar to those in the solid wastes. The liquid phase of the wastes also contained 2,4-dimethylphenol, phenol, 2-methylphenol, and 4-methylphenol.

Residential well water samples collected downgradient from the landfill contained low but detectable concentrations of benzene, tetrachloroethene, trichloroethylene, 1,1-dichloroethene, 1,1-dichloroethane, 1,2-dichloroethene, 1,1,1-trichloroethane, and dichlorobromomethane. This finding is indicative of the existence of source(s) of contamination at the landfill.

A terrain electromagnetic (EM) conductivity survey performed by the N.M. EID personnel revealed two conductive groundwater plumes: one originating from the landfill and the other from an area within or near the nearby Giant Refining Co.'s property. Besides the landfill, it is likely that there are other source(s) of contamination in the site area. The precise number and locations of these other sources cannot be assessed due to lack of specific information. It was determined, however, that the wastes in the liquid waste pits in the landfill have conductivities higher than the levels normally encountered in the study area. Hence, it is likely the liquid waste pits are the sources of the high conductivity anomalies in the first conductive plume.

Nevertheless, the geophysical survey results preliminarily confirm the hypothesis that these plumes have not migrated far enough to reach the residential wells nearest to and downgradient from the above mentioned sources. The northern part of the Lee Acres Subdivision is probably within the leading edge of these plumes.

Based on available hydrogeologic information, the site including the landfill is basically underlayed by a shallow alluvial aquifer under groundwater table conditions (approximately 35 to 40 feet thick). This aquifer is reportedly highly vulnerable to contamination from surface discharges (e.g., leachates or septic effluent). No impervious layer that would serve to protect the shallow aquifer from contamination was evident.

Bedrock in the area is fractured and its aquifer may be communicating with the upper shallow aquifer. Potential cross-contamination of bedrock aquifer by the upper shallow aquifer cannot be effectively ruled out unless an in-depth hydrogeologic study is conducted.

To quantitatively define the potential multiple sources involved, zone(s) of contamination and contaminant migration rates in the study area, including the site, a systematic follow-up investigation is recommended, consisting, at a minimum, of comprehensive groundwater monitoring and geophysical magnetometer, terrain conductivity, and subsurface resistivity surveys.

To minimize the health risks of the existing landfill contamination conditions, it is also recommended either that the landfill operations be temporarily suspended pending findings of a follow-up remedial investigation or that the landfill be permanently closed to the public. The existing fences should be repaired or replaced; and a routine surveillance and maintenance program should be introduced.

8.2 SITE RANKING AND CLASSIFICATION

8.2.1 Site Ranking

Using available information and field data collected and laboratory analysis of representative landfill samples during this SI, the site was ranked based on the EPA's Uncontrolled Hazardous Waste Site Ranking System (U.S.EPA, 1984).

The Hazardous Ranking System (HRS) is designed to evaluate the relative potential of uncontrolled hazardous substance facilities to cause human health or safety problems, or ecological or environmental damage. Uniform application of the ranking system will permit EPA or other agencies to identify those releases of hazardous substances that pose the greatest hazard to humans or the environment. The HRS by itself cannot establish priorities for the allocation of funds for remedial action. It is a means for applying uniform technical judgement regarding the potential hazards presented by a facility relative to other facilities. It does not address the feasibility, desirability, or degree of cleanup required.

The HRS assigns three scores to a hazardous facility or site:

- S_M reflects the potential for harm to humans or the environment from migration of a hazardous substance away from the facility by routes involving groundwater, surface water, or air. It is a composite of separate scores for each of the three routes. It is entirely possible that one route (e.g., groundwater) for a specific site yields a relatively high score and other routes give insignificantly minimum scores. Under these circumstances, the low-scored routes would tend to obscure the health and environmental consequences resulting from hazardous substance migration via the high-scored route.

- S_{FE} reflects the potential for harm from substances that can explode or cause fires.

- S_{DC} reflects the potential for harm from direct contact with hazardous substances at the facility (i.e., no migration need be involved).

The score for each hazard mode (migration, fire and explosion, and direct contact) or route is obtained by considering a set of factors that characterize the potential of the facility to cause harm. Each factor is assigned a numerical value (on a scale of 0 to 3, 5 or 8) according to prescribed guidelines. This value is then multiplied by a weighting factor yielding the factor score. The factor scores are then combined: scores within a factor category are added; then the total scores for each factor category are multiplied together to develop a score for groundwater, surface water, air, fire and explosion, and direct contact.

In computing S_{FE} or S_{DC}, or an individual migration route score, the product of its factor category scores is divided by the maximum possible score, and the resulting ratio is multiplied by 100. The last step puts all scores on a scale of 0 to 100.

The HRS does not quantify the probability of harm from a facility or the magnitude of the harm that could result, although the factors have been selected in order to approximate both those elements of risk. It is only a procedure for ranking facilities in terms of the potential threat they pose by describing:

- o the manner in which the hazardous substances are contained,
- o the route by which they would be released,
- o the characteristics and amount of the harmful substance, and
- o the likely targets of harm.

In accordance with the guidelines in the Federal Facilities Program Manual for Implementing CERCLA Responsibilities for Federal Agencies, all non-Federally-owned sites scoring at least 28.5 are eligible for inclusion on the National Priority List (NPL).

Considering only the groundwater, surface water, and air exposure routes, a composite score (S_M) of 36.04 was calculated for the site. Individual scores for each route of exposure and other health/environmental risks (e.g., fire/explosion and direct contact) are listed below:

Groundwater route (S_{gw}): 39.72

Surface water route (S_{sw}): 9.65

Air route (S_a): 47.18

Composite (S_M) of S_{gw}, S_{sw}, and S_a: 36.04

Fire and explosions (S_{FE}): 11.67

Direct contact (S_{DC}): 16.67

Details on the actual calculations of these scores are provided in Appendix A. In accordance with the EPA rules cited previously, the total score on the HRS of 36.04, exceeding the cut-off score of 28.5, technically qualifies the site as a National Priority List (NPL) site. Section 300.66(e) (2) of the National Contingency Plan (NCP), as promulgated July 18, 1982, specifies that the NPL will not include Federally-owned facility sites. Although CERCLA prevents the use of the Trust Fund ("Superfund") for remedial action at Federal facilities, it does not prevent the listing of such sites. EPA is in the process of amending this section of the NCP to eliminate the restriction against promulgation of Federal facility sites on the NPL. Since the site includes both Federally-owned and privately owned land, it is possible that the site may be qualified as a NPL site. The exact portions of the site remediation work eligible for CERCLA funding has yet to be determined among all parties involved.

Not addressed in the Hazardous Ranking System due to its limitations but discussed elsewhere in this report, the site potentially involves more than one source of contamination besides the landfill. For example, the second conductive shallow groundwater plume possibly originates from or near the Giant Refining Co. area within the site.

Because of the potential existence of multiple sources of contamination located in non-Federally-owned facilities, a concerted and cooperative effort among the affected agencies and parties (e.g., EPA, BLM, State of New Mexico, San Juan County, and other potentially responsible parties) must be made to achieve complete and cost-effective cleanup of the site problems. It is further emphasized that unilateral action (e.g., BLM only) will only result in partial solution to the problems at hand.

8.2.2 Site Classification

As stated in the study contract and based on information obtained through the investigation, each site investigated as part of this project shall be classified into one of the following BLM's categories and criteria:

Class I. There is no significant reason to believe that hazardous wastes or other hazardous substances have been generated, treated, stored, or disposed of on the site, or alternatively that hazardous wastes were disposed but in such quantities, forms, or under such conditions that there is negligible hazard to human health or the environment.

Class II. Hazardous wastes or other hazardous substances are present but there is small risk of onsite contact or release of contaminants to the environment in such form and quantity that would constitute a significant hazard to human health or to the environment.

Class III. Hazardous wastes or other hazardous substances exist on the site in such form and quantity and under such conditions that there is specific reason to believe that a potentially significant hazard to human health or the environment may exist and that further definitive investigations must be undertaken.

Class IV. Hazardous wastes or other hazardous substances exist on the site in such form and in such quantity and under such conditions, including offsite considerations, as to constitute an imminent and substantial endangerment to human health or the environment.

For the subject site, hazardous wastes or other hazardous substances were documented to be disposed or present at the landfill. Some of the wastes were released to the nearby surface waters. Airborne emissions of hydrogen sulfide and possibly other toxic gases caused some acute toxicity to about 15 persons at or near the landfill. Hazardous wastes at the landfill have migrated from the source and have caused contamination of the shallow groundwater aquifer and potentially the deeper bedrock aquifer. This situation poses an imminent threat to those nearby residents who currently rely on groundwater for drinking, food preparation, and other domestic and sanitation purposes.

Most of these substances are highly volatile and toxic. However, the quantity, form, degree of containment, and the partial in-situ treatment of the wastes in the liquid waste pits of the landfill suggest that instances of acute toxicity from short-term exposure are currently unlikely to occur. Nevertheless, chronic health effects may result from long-term exposure to the substances by:

(1) Nearby residents via groundwater and air routes;

(2) Onsite personnel (e.g., waste disposers, scavengers, trespassers, landfill workers, on-site remediation workers, and other transient population) via the air route and, to a lesser extent, direct contact;

(3) Workers at or visitors of the Giant Refining Co. and the El Paso Natural Gas Co. facilities; and

(4) The general public via direct contact with potentially contaminated sediments in the nearby unnamed arroyo.

The above considerations justify the classification of the Lee Acres Site as a Class IV site, requiring further definitive investigations and additional initial remedial measures (IRMs). The recommended investigations and IRMs are presented in Section 9.0.

9.0 REMEDIAL PLANNING ACTIVITIES

This section identifies the types of and specific alternative remedial activities recommended to be implemented at the site.

9.1 Objectives and Criteria

Remedial activities will mitigate or eliminate the impact on public health and the environment of the wastes present at a site. Due to the lack of essential data for the potential multiple sources at the site (see **Sections 4.0** and **6.0**), a remedial investigation and feasibility study should be conducted to further quantify the exact number of sources and the associated wastes; characterize the type and extent of air, soil, groundwater, surface water, and sediment contamination; and identify and evaluate alternative long-term source controls, and onsite and offsite remedial responses.

In general, long-term remedial responses comprise source control and offsite remedial measures. Source control remedial measures for the hazardous substances which remain at a site could include waste collection and disposal or treatment, in-situ waste stabilization or detoxification, contaminated soil and waste removal and disposal, waste containment, and surface controls. Offsite remedial measures, applicable when contamination has migrated beyond the boundaries of the sources or a site, which might be examined include treatment of a contaminated aquifer. A preliminary list of source control and offsite remedial measures will be modified, based on the findings of the remedial investigations.

The exact specifications for the design, implementation, and maintenance and monitoring of remedial measures will be drafted following the cooperative selection by the BLM and other affected parties (e.g., EPA, State of New Mexico, San Juan County, and affected parties) of a cost-effective remedial action.

As stated previously, since the contamination problem is evidently not entirely caused by the landfill conditions, it is further suggested that a followup investigation of the entire site, which includes the landfill, be conducted to determine the total number of sources and the magnitude of the problems associated with each source. Because of the potential involvement of other sources of contamination besides the landfill, EPA, State of New Mexico, and San Juan County authorities should be called upon to participate to ensure that a concerted effort is undertaken during the followup investigations and remedial actions.

9.2 Identification of Remedial Responses

Remedial measures may be categorized as either initial remedial measures (IRMs), source control remedial measures, or offsite remedial measures. These remedial measures will be developed, analyzed, and selected in a three-step process. Elements of IRMs and source control remedial measures are discussed in the following.

9.2.1 Initial Remedial Measures (IRMs)

Generally, IRMs can begin before final selection of an appropriate remedial action if such measures are determined to be necessary, feasible, and cost effective ways of limiting exposure or the threat of exposure to a significant health or environmental hazard. Examples of conditions which might be considered justifiable for introducing IRMs at a site include actual or potential direct contact with hazardous substances by trespassers, site workers, and scavengers; an ineffective drainage control system; contaminated groundwater; hazardous substances in containers above the surface posing a serious threat to public health or the environment; a serious threat of fire or explosion or other serious threats to public health or the environment; or weather conditions that may cause substances to migrate so as to pose a serious threat to public health or the environment (P. 31216 of the NCP).

For the site, one IRM is recommended to effectively minimize potential exposure of the public to the wastes in the landfill and the health risks of landfill workers; and also to prevent future dumping of hazardous wastes at the landfill. The IRM would either consist of the (1) temporary suspension of all current landfill operations pending findings from the followup remedial investigation; or (2) permanent closure of the landfill to the public. As an integral part of the IRM, the damaged landfill fences would be repaired or replaced and a routine fence surveillance and maintenance program would be introduced.

For source(s) other than the landfill within the site, IRMs currently cannot be effectively identified due to lack of information. A preliminary assessment or site investigation and possibly a follow-up remedial investigation must be conducted to address the problems related to these other source(s) at the site.

9.2.2 Source Control Remedial Measures for the Landfill

Source control remedial measures that should be considered include:

- Waste Collection and Disposal or Treatment -- This measure involves collection of the wastes in the landfill. Onsite excavation, staging, containerization, temporary storage, and handling requirements would be defined. Disposal or treatment methods also would be defined based on results of analytical testing and treatability studies.
- In-Situ Waste Stabilization or Detoxification -- A substance would be injected into the waste disposal area or contaminated area to immobilize or destroy residual pollutants. Area hydrology and hydrogeology would be taken into consideration.
- Contaminated Soil and Waste Removal and Disposal -- Contaminated soil and waste would be removed from the landfill. Disposal methods would depend on the type and extent of contamination.
- Waste Containment -- Low permeability barriers might be installed to prevent liquid percolation into and out of the existing waste areas, and slurry walls might be installed along the perimeters of the existing waste pits. Both horizontal and vertical barriers might be necessary for total containment. Bentonite-type slurry walls, grout curtains, natural soil, soil admixures, and synthetic membrane-topseals are among the available barrier design options. The existence of an appropriate clay layer between the shallow and confined aquifers would be necessary for this option to be feasible. Because of the likely lack of such a natural clay layer beneath the landfill, this alternative is less feasible than the others.
- Leachate Collection and Disposal or Treatment -- Leachate might be collected and be safely disposed or treated. Collection methods include vertical cutoff drains, dewatering wells, and horizontal drains. Collection points might be at the source or

downgradient from the source. Surface controls such as regrading might be required. This option may not be as feasible due to the infrequency of leachate generation.

- o Surface Controls -- Surface controls would reduce surface water filtration and control runoff at the landfill. Capping, grading, revegetation, or runoff diversion/collection would be accomplished as appropriate.

9.2.3 Offsite Remedial Measures

The existing data would be augmented with additional environmental data to determine the extent of groundwater contamination in the shallow water aquifer and the current status of contamination in deeper bedrock aquifers; and the environmental effects of potential sources of contaminants other than the landfill at the site.

Additional sampling is required to determine the extent of sediment contamination.

The following remedial measures outside the landfill are proposed for evaluation based on the potential migration pathways of the contaminants:

- o Treatment of a Contaminated Aquifer -- Contaminated groundwater might be pumped to the surface and treated; or treated in-situ by biological degradation.

- o Dredging of Contaminated Sediments -- The presence of gross contamination or environmentally persistent contaminants in some parts of the unnamed arroyo, if found, might necessitate the dredging and removal of the contaminated sediments.

9.3 Remedial Investigation (RI)

The proposed remedial investigation (RI) will comprise a complete site assessment to produce a comprehensive data base, which would be augmented by the existing data base, for the preparation of the engineering feasibility study. The area to be studied should cover the entire site including the landfill, the Lee Acres Subdivision, and the Giant Refining Co. and El Paso Natural Gas Co. facilities. The objectives of the RI will be to:

- o Determine the locations and total quantity of wastes.
- o Document the physical and chemical characteristics of wastes at sources other than the landfill using additional data developed during the RI.
- o Document the extent of groundwater contamination in the shallow aquifer including the two conductive plumes identified in this report.
- o Document the exact extent of groundwater contamination in the deep bedrock aquifer.
- o Document the hydrogeologic properties of both the shallow and deeper aquifers using existing and additional data.
- o Determine and document the extent of surface water and sediment contamination.
- o Detect the presence or absence of buried metallic objects (e.g., drums and containers).

For the site, it is recommended that an initial remedial investigation be conducted. The scope of work, at a minimum, should include an areawide groundwater sampling and monitoring program and a comprehensive geophysical study employing magnetometer, terrain conductivity, and subsurface resistivity techniques. Because the site qualifies as an

NPL site in terms of its HRS score and in consideration of the potential involvement of contamination sources in privately owned land, it is suggested that EPA, BLM, State of New Mexico, and/or San Juan County undertake an initial monitoring of areawide groundwater wells for the presence of hazardous substances. It is further recommended that several strategic test borings and groundwater monitoring wells be installed to gain a better understanding of the site geology and hydrogeology, including the potential for intercommunication between shallow and bedrock aquifers.

The results of the above initial remedial investigation will facilitate the formulation of more comprehensive and responsive follow-up RI activities; the determination of the need and scope of a feasibility study (FS); the identification of potentially responsible parties (PRP's); and the development of additional IRMs (e.g., connection of those residences that exclusively rely on shallow groundwater for their water supply to the Lee Acres Water Users Association's public water system) and long-term cost-effective remedial actions, when and if they are considered necessary.

Because of the involvement of multiple sources of contamination at the site, it is necessary that a concerted and cooperative effort among EPA, BLM, State of New Mexico, San Juan County, and other affected parties be orchestrated to develop a systematic technical and institutional approach; define the scope of mutually agreed upon follow-up remedial investigations and feasibility studies; and yield acceptable and cost-effective solution(s) to the problems encountered at the site.

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APPENDIX A

UNCONTROLLED HAZARDOUS WASTE SITE RANKING SYSTEM
LEE ACRES SITE, FARMINGTON, SAN JUAN COUNTY, N.M.

BLM SITE CODE: NM 0000000000
AEPCO SITE NO. 01 GROUP A

BLM HAZARDOUS MATERIALS MANAGEMENT PROJECT
AEPCO PROJECT NO: 1200.1721

SITE NAME: LEE ACRES SITE
CITY: FARMINGTON
COUNTY: SAN JUAN COUNTY
STATE: NEW MEXICO

BLM SITE CODE: NM 0000000000
AEPCO SITE NO. 1
GROUP: A
EPA REGION: VI

CRITERIA	Sm (MIGRATION)			Sfe (FIRE & EXPLOSION)	Sdc (DIRECT CONTACT)
	Sgw (GROUND-WATER)	Ssw (SURFACE WATER)	Sa (AIR)		
1. OBSERVED RELEASE/INCIDENCE	45	45	45	-----	45
2. ROUTE CHARACTERISTICS/ACCESSIBILITY	10	12	-----	-----	2
3. CONTAINMENT	3	3	-----	1	15
4. WASTE CHARACTERISTICS	23	23	16	12	10
5. TARGETS	22	6	23	15	8
6. TOTAL SCORE	39.72	9.65	47.18	11.67	16.67
7. MAXIMUM POSSIBLE SCORE	100	100	100	100	100
8. SQUARE OF TOTAL SCORE (SQUARE OF LINE 6)	1577	93	2,226		
9. SQUARE ROOT OF SUM OF LINE 8	62.42				
10. OVERALL SCORE (LINE 9 DIVIDED BY 1.732)	Sm = 36.04				

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GROUP: A
EPA REGION: VI

Sgw (GROUNDWATER)

CRITERIA	UNIT/ GUIDE	INPUT	ASSIGNED VALUE	MULTI- PLIER	SCORE	MAX. SCORE
1. OBSERVED RELEASE (0 or 45)	Y or N	Y	45	1	45	45
If observed release is given a score of 45, proceed to Line 4. If observed release is given a score of 0, proceed to Line 2.						
2. ROUTE CHARACTERISTICS					10	15
A) Depth of Aquifer of Concern	feet	30-40	2	2	4	6
B) Net Precipitation			0	1	0	3
a) Natural Precipitation	inches	(42.0)				
b) Lake Evaporation	inches	7.0				
	inches	49.0				
C) Permeability of Unsaturated Zone			3	1	3	3
a) Clay, Compact Till; Unfractured Metamorphic and Igneous Rocks (Permeability < 10E-7 cm/sec)	Y or N	N	---			
b) Silt, Loesss, Silty Clays, Silty Loams, Clay Loams; Less Permeable Limestone, Dolomites, and Sandstone; Moderately Permeable Till (Permeability between 10E-5 and 10E-7 cm/sec)	Y or N	N	---			
c) Fine Sand and Silty Sand; Sandy Loams; Loamy Sands; Moderately Permeable Limestone, Dolomites, and Sand-stone (no karst); Moderately Fractured Igneous and Metamorphic Rocks, Some Coarse Till (Permeability between 10E-3 and 10E-5 cm/sec)	Y or N	N	---			
d) Gravel, Sand; Highly Fractured Igneous and Metamorphic Rocks; Permeable Basalt and Lavas; Karst Limestone and Dolomite (Permeability > 10E-3 cm/sec)	Y or N	Y	3			
D) Physical State of Hazardous Substances			3	1	3	3
a) Solid, Consolidated, or Stabilized	Y or N	N	---			
b) Solid, Unconsolidated, or Unstabilized	Y or N	Y	1			
c) Powder or Fine Material	Y or N	N	---			
d) Liquid, Sludge, or Gas	Y or N	Y	3			
3. CONTAINMENT (See Table 3 on Page 17 for Scoring)			3	1	3	3
A) Surface Impoundment	-----	---	3			
B) Containers	-----	Unknown	Unknown			
C) Piles	-----	---	---			
D) Landfill	-----	---	3			
4. WASTE CHARACTERISTICS						
A) Toxicity/Persistence			15	1	23	26
a) Toxicity (see Tables on Pages 18 to 23)	-----	---	3		15	18
b) Persistence (see Tables on Pages 18 to 23)	-----	---	2			
B) Hazardous Waste Quantity	tons/cubic yards	8,800	8	1	8	8
5. TARGETS						
A) Groundwater Use			2	1	22	49
				3	6	9
a) Unusable (e.g., extremely saline aquifer, extremely low yield, etc.)	Y or N	N	---			
b) Commercial, Industrial or irrigation and another water source presently available; not used, but usable	Y or N	N	---			
c) Drinking water with municipal water from alternate unthreatened sources presently available (i.e., minimal hookup requirements); or commercial, industrial or irrigation with no other water source presently available	Y or N	Y	2			
d) Drinking water; no municipal water from alternate unthreatened sources presently available	Y or N	N	---			
B) Distance to Nearest Well and Population Served			16	1	16	40
a) Distance to the Nearest Well	miles	0.5	3			
b) Population Served by Groundwater	persons	115	2			
6. If Line 1 is 45, multiply Lines 1 x 4 x 5 If Line 1 is 0, multiply Lines 2 x 3 x 4 x 5					22,770	57,330
7. Divide Line 6 by 57,330 and multiply by 100				Sgw =	39.72	

Note: Y = Yes; N = No

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BLM SITE CODE: NM 0000000000
AEPCO SITE NO. 1
GROUP: A
EPA REGION: VI

Ssw (SURFACE WATER)

CRITERIA	UNIT/ GUIDE	INPUT	ASSIGNED VALUE	MULTI-PLIER	SCORE	MAX. SCORE
1. OBSERVED RELEASE (0 or 45)	Y or N	Y	45	1	45	45
If observed release is given a value of 45, proceed to Line 4. If observed release is given a value of 0, proceed to Line 2.						
2. ROUTE CHARACTERISTICS					12	15
A) Facility Slope and Intervening Terrain (see Table 8 on p. 31)			2	1	2	3
a) Intervening Terrain Average Slope <3%; or Site Separated from Water Body by Areas of Higher Elevation	Y or N	N	---			
b) Intervening Terrain Average Slope 3-5%	Y or N	N	---			
c) Intervening Terrain Average Slope 5-8%	Y or N	Y	2			
d) Intervening Terrain Average Slope >8%	Y or N	N	---			
e) Site in surface water	Y or N	N	---			
B) One-Year 24-Hour Rainfall	inches	1.2	1	1	1	3
C) Distance to the Nearest Surface Water	miles	<0.2	3	2	6	6
D) Physical State of Hazardous Substances			3	1	3	3
a) Solid, Consolidated, or Stabilized	Y or N	N	--			
b) Solid, Unconsolidated, or Unstabilized	Y or N	Y	1			
c) Powder or Fine Material	Y or N	N	---			
d) Liquid, Sludge, or Gas	Y or N	Y	3			
3. CONTAINMENT (See Table 9 on Page 35 for Scoring)			3	1	3	3
A) Surface Impoundment	-----	---	3			
B) Containers	-----	Unknown	Unknown			
C) Waste Piles	-----	---	---			
D) Landfill	-----	---	3			
4. WASTE CHARACTERISTICS					23	26
A) Toxicity/Persistence			15	1	15	18
a) Toxicity (see Tables on p. 18 to 23)	-----	---	3			
b) Persistence (see Tables on p. 18 to 23)	-----	---	2			
B) Hazardous Waste Quantity	tons/cubic yards	8,800	8	1	8	8
5. TARGETS					6	55
A) Surface Water Use (Fresh or Salt Water)			2	3	6	9
a) Not currently used	Y or N	N	---			
b) Commercial or Industrial	Y or N	N	---			
c) Irrigation, Economically Important Resources (e.g., shellfish), Commercial Food Preparation, or Recreation (e.g., fishing, boating, swimming)	Y or N	Y	2			
d) Drinking Water	Y or N	Unknown	Unknown			
B) Distance to a Sensitive Environment (see Table 10 on p. 37)			0	2	0	6
a) Distance to Coastal Wetlands (>5 Acres)	miles	>2 mi.	0			
b) Distance to Fresh Water Wetlands (>5 Acres)	miles	>2 mi.	0			
c) Distance to Critical Habitat (of Endangered Species)	miles	>1 mi.	0			
C) Population Served by Surface Water with Water Intake within 3 Miles Downstream from Facility (or Site) or 1 Mile within Static Surface Water Such as a Lake	persons	>3 mi.	0	1	0	40
6. If Line 1 is 45, multiply Lines 1 x 4 x 5 If Line 1 is 0, multiply Lines 2 x 3 x 4 x 5					6,210	64,350
7. Divide Line 6 by 64,350 and multiply by 100				Ssw =	9.65	

Note: Y = Yes; N = No

BLM HAZARDOUS MATERIALS MANAGEMENT PROJECT
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AEPCO SITE NO. 1
GROUP: A
EPA REGION: VI

Sa (AIR)

CRITERIA	UNIT/ GUIDE	INPUT	ASSIGNED VALUE	MULTI-PLIER	SCORE	MAX. SCORE
1. OBSERVED RELEASE (0 or 45)	Y or N	Y	45	1	45	45
If Line 1 is 0, the Sa = 0. Enter on Line 5. If Line 1 is 45, then proceed to Line 2.						
2. WASTE CHARACTERISTICS					16	20
A) Reactivity and Incompatibility			2	1	2	3
a) Reactivity (see Table 11 on p. 41 and Table 4 on p. 20)	----	---	1			
b) Incompatibility (see Table on p.42 and Table 12 on p.43)						
i) No incompatible substances are present	Y or N	N	---			
ii) Presence but do not pose a hazard	Y or N	N	---			
iii) Present and may pose a future hazard	Y or N	Y	2			
iv) Present and posing an immediate hazard	Y or N	N	---			
B) Toxicity (see Tables 4, 6, and 7 on p. 20, 22, and 23, respectively; and Table on p. 42)	----	Y	2	3	6	9
C) Hazardous Waste Quantity	tons/cubic yards	8,800	8	1	8	8
3. TARGETS					23	39
A) Population within a Four-Mile Radius	persons	25,000	21	1	21	30
B) Distance to Sensitive Environment (see Table 10 on p. 37)	-----		0	2	0	6
a) Distance to Coastal Wetlands (>5 Acres)	miles	>2 mi.	0			
b) Distance to Fresh Water Wetlands (>5 Acres)	miles	>2 mi.	0			
c) Distance to Critical Habitat (of Endangered Species)	miles	>1 mi.	0			
C) Land Use	-----		2	1	2	3
a) Distance to Commercial-Industrial Land	miles	0.7	1			
b) Distance to National/State Parks, Forests, Wildlife Reserves, and Residential Areas	miles	0.5	2			
c) Distance to Agricultural Lands (in production within 5 years):						
i) Agricultural Land	miles	>1	0			
ii) Prime Agricultural Land	miles	>2	0			
d) Distance to Historic/Landmark Sites(National Register of Historic Places and National Natural Landmarks)	miles	No	0			
4. Multiply Lines 1 x 2 x 3					16,560	35,100
5. Divide Line 4 by 35,100 and multiply by 100				Sa =	47.18	

Note: Y = Yes; N = No

BLM HAZARDOUS MATERIALS MANAGEMENT PROJECT
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EPA REGION: VI

Sfe (FIRE AND EXPLOSION)

CRITERIA	UNIT/ GUIDE	INPUT	ASSIGNED VALUE	MULTI-PLIER	SCORE	MAX. SCORE
1. CONTAINMENT (1 or 3)					1	3
No hazardous substances that are individually ignitable or explosive are present; and those that may be hazardous in combination are segregated and isolated so that they cannot come together to form incompatible mixtures.	Y or N	N	1	1	1	3
2. WASTE CHARACTERISTICS					12	20
A) Direct Evidence Direct evidence of ignitability or explosion potential may exist in the form of measurements with appropriate instruments.	Y or N	N	0	1	0	3
B) Ignitability (see Table 14 on p. 51 and Table on p. 52)			1	1	1	3
a) Very flammable gases, very volatile flammable liquids and materials that in the form of dusts or mists readily form explosive mixtures when dispersed in air.	Y or N	N	---			
b) Liquids which can be ignited under all normal temperature conditions. Any material that ignites spontaneously at normal temperatures in air.	Y or N	N	---			
c) Liquids which must be moderately heated before ignition will occur and solids that readily give off flammable vapors.	Y or N	N	---			
d) Materials that must be preheated before ignition can occur. Most combustible solids have a flammability rating of 1.	Y or N	N	---			
e) Materials that will not burn.	Y or N	Y	1			
C) Reactivity (see Table 11 on p. 41)	---	---	1	1	1	3
D) Incompatibility (see Table on p. 42 and Table 12 on p. 43)			2	1	2	3
a) No incompatible substances are present	Y or N	N	---			
b) Present but do not pose a hazard	Y or N	N	---			
c) Present and may pose a future hazard	Y or N	Y	2			
d) Present and posing an immediate hazard	Y or N	N	---			
E) Hazardous Waste Quantity	tons/cubic yards	8,800	8	1	8	8
3. TARGETS					14	24
A) Distance to Nearest Population	feet	1,500	2	1	2	5
B) Distance to Nearest Building	feet	1,500	0	1	0	3
C) Distance to Nearest Sensitive Environment			0	1	0	3
a) Distance to Wetlands	feet	>100	0			
b) Distance to Critical Habitat	feet	>0.5 mi	0			
D) Land Use			2	1	2	3
a) Distance to Commercial-Industrial Land	miles	0.7	1			
b) Distance to National/State Parks, Forests, Wildlife Reserves, and Residential Areas	miles	0.5	2			
c) Distance to Agricultural Lands (in production within 5 years):			0			
i) Agricultural Land	miles	>1	0			
ii) Prime Agricultural Land	miles	>2	0			
d) Distance to Historic/Landmark Sites(National Register of Historic Places and National Natural Landmarks)	miles	No	0			
E) Population Within a Two-Mile Radius	persons	15,000	5	1	5	5
F) Number of Buildings Within a Two-Mile Radius	units	4,000	5	1	5	5
4. Multiply Lines 1 x 2 x 3					168	1,440
5. Divide Line 4 by 1,440 and multiply by 100				Sfe =	11.67	

Note: Y = Yes; N = No

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GROUP: A
EPA REGION: VI

Sdc (DIRECT CONTACT)

CRITERIA	UNIT/ GUIDE	INPUT	ASSIGNED VALUE	MULTI-PLIER	SCORE	MAX. SCORE
1. OBSERVED INCIDENT (0 or 45)	Y or N	Y	45	1	45	45
If Line 1 is 45, proceed to Line 4. If Line 1 is 0, proceed to Line 2.						
2. ACCESSIBILITY to Hazardous Substance			2	1	2	3
A) A 24-hour surveillance system(e.g., television monitoring or surveillance by gaurds or facility personnel) which continuously monitors and controls entry onto the facility, or an artificial or natural barrier (e.g., a fence combined with a cliff), which completely surrounds the facility; and a means to control entry, at all times, through the gates or other entrances to the facility (e.g., an attendant, television monitors, locked entrances, or controlled roadway access to the facility).	Y or N	N	---			
B) Security guard, but no barrier	Y or N	N	---			
C) A barrier, but no seperate means to control entry	Y or N	Y	2			
D) Barriers do not completely surroud the facility	Y or N	N	---			
3. CONTAINMENT (see Section 8.3 on p. 59) (0 or 15)	Y or N	Y	15	1	15	15
4. WASTE CHARACTERISTICS			2	5	10	15
A) Toxicity (see Tables on Pages 18 to 23)	-----	---	2			
5. TARGETS					8	32
A) Population Within One-Mile Radius	persons	1,000	2	4	8	20
B) Distance to the Nearest Critical Habitat	miles	>1	0	4	0	12
6. If Line 1 is 45, multiply Lines 1 x 4 x 5 If Line 1 is 0, multiply Lines 2 x 3 x 4 x 5					3,600	21,600
7. Divide Item 6 by 21,600 and multiply by 100				Sdc =	16.67	

Note: Y = Yes; N = No