UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
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September 20, 2000

MEMORANDUM

SUBJECT: Approval of the First Five-Year Review Report at the Prewitt Superfund Site NMD980622773

FROM: Greg J. Lyssy
Remedial Project Manager (6SF-LT)

THRU: Wren Stenger, Chief
LA/NM Branch (6SF-L)

TO: Myron O. Knudson, P.E., Director
Superfund Division (6SF)

This memorandum documents the approval of the September 2000 five-year review report for the Prewitt Superfund Site. The first five-year review report was prepared by the U.S. Environmental Protection Agency, Region 6 (EPA). Based on the five-year review report, the remedial actions are protective of human health and the environment.

This first five-year review for the Site is required by statute. This five-year review was conducted pursuant to the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Section 121(c), 42 U.S.C. § 9621(c), the National Contingency Plan (NCP) (40 CFR § 300.430 (f)(4)(ii)), Office of Solid Waste and Emergency Response (OSWER) Directive 9355.7-02 (May 23, 1991), OSWER Directive 9355.7-02A (July 26, 1994), OSWER Directive 9355.7-03A (December 21, 1995), and draft OSWER Directive 9355.7-03B-P (draft Comprehensive Five-Year Review Guidance).

Section 121(c) of CERCLA requires that, "*If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each 5 years after initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented.*" Under the NCP, the Federal regulations which implement CERCLA, EPA is required to conduct five-year reviews of a remedial action whenever, under the remedial action, "*hazardous substances, pollutants, or contaminants are remaining at the site above levels that allow unlimited use and unrestricted exposure.*"

This five-year review has been approved by the Director of the Superfund Division, U.S. EPA Region 6. Although CERCLA Section 121(c) authorizes "the President" to undertake five year reviews, the President's authority was delegated to the Administrator of the EPA by Executive Order 12580 (52 Fed. Reg. 2926, January 29, 1987), and this authority was further delegated to the EPA's Regional Administrators on September 13, 1987, by EPA Delegation No. 14-8-A. Finally, the authority was delegated to the Director of the Superfund Division by EPA Region 6 Delegation No. R6-14-8-A on August 4, 1995.

This is the first five-year review for the Site. This review has been conducted in accordance with Section 121 (c) of CERCLA. This review is required because hazardous substances, pollutants, or contaminants remain in the subsurface at concentrations that are above levels that allow for unlimited use and for unrestricted exposure.

Summary of Five-Year Review Findings

This five-year review report covers the period from May 1995 to May 2000 at the Prewitt Superfund Site (Site) in Prewitt, New Mexico. The results of the review indicate that the remedy has been, and is expected to continue to be, protective of human health and the environment. The surface and subsurface remedial actions have been functioning as designed, and have been operated and maintained in an appropriate manner. On-going optimization of the remedial system is continuing.

Both the EPA-approved Health and Safety Plan and the Contingency Plan are in place. These plans have been properly implemented, and are sufficient to control risks that may arise due to the implementation of the Remedial Action. Because the remedial actions for the surface and subsurface media are protective of human health and the environment, the remedy for the Site is protective of both human health and the environment.

The surface media remedy is protective of human health and the environment. Remedial actions for the surface media were successful in attaining the remedial action objectives for: (1) lead-, asbestos-, and hydrocarbon-contaminated surface soils; (2) the West Pits contents; and (3) the Separator and its contents, in accordance with the health-based cleanup levels as specified in the ROD. The EPA deleted the surface portion of the Site from the National Priorities List (NPL) on January 29, 1998. No hazardous substances, pollutants, or contaminants remain in the surface media at the Site at concentrations above levels that allow for unlimited use of the surface media and for unrestricted exposure to the surface media.

The subsurface remedies for the Site have been, and are expected to continue to be, protective of human health and the environment. The subsurface remedies are operating and functioning as designed. The Phase I subsurface remedy was successful in attaining the remedial action objectives for the NAPL extraction in the North NAPL Area. The groundwater containment component of the Phase I subsurface remedy for the E Sandstone unit exceeded expectations as the BTEX concentrations in the leading edge plume declined below the MCLs. The NAPL extraction in the South and Miscellaneous NAPL Areas is meeting expectations, considering the difficulties involved in removing NAPL absorbed in the complex, heterogeneous fractured bedrock. The Phase I and Phase II subsurface remedies have reduced the groundwater BTEX concentrations in the NAPL source areas.

There are no residential wells completed in the impacted aquifer units (E, F, and G Sandstone Units of the Sonsela Aquifer). Institutional controls, consisting of: 1) controls to eliminate the installation of water supply wells on-site; 2) installation of water treatment units at nearby residential wells; and 3) monitoring of the residential wells, were implemented and are being maintained. The institutional controls are effective, and are expected to remain effective, under current or anticipated changes in the land use at the Site. The remediation areas at the Site are fenced and secured to prevent unauthorized entry. Hazardous substances remain in the subsurface at the Site at concentrations levels that are above levels that allow for unlimited use of the groundwater and unlimited exposure to groundwater.

Although the results of the review concluded that the overall remedy is protective of human health and the environment, the following recommendations have been made pursuant to the review.

Actions Needed

The only potential deficiency in the implementation of the remedy that was noted during the review is that appropriate steps are not in-place to ensure that supply wells are not installed in the impacted aquifer. It is therefore recommended that appropriate steps be implemented to ensure that supply wells will not be drilled in an impacted aquifer. No other technical deficiencies of the remedy, or the implementation of the remedy, were noted during the five-year review.

Determinations

I have determined that the remedies for the Prewitt Superfund Site are expected to be protective of human health and the environment, and will remain so provided the actions identified in the five year review report are addressed as described above.

Pamela Phillips, Acting

Myron O. Knudson, P.E.
Director
Superfund Division
U.S. Environmental Protection Agency
Region 6

9/20/00
Date

First Five-Year Review Report

Prewitt Superfund Site
Prewitt, New Mexico

September 2000

Prepared by:

U.S. Environmental Protection Agency
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Concurred by: [signature] Greg Lyssy, U.S. EPA Remedial Project Manager	9/17/00 Date
Concurred by: [signature] Don Williams, U.S. EPA Team Leader, Technical Support Team	9/15/00 Date
Concurred by: [signature] James Costello, U.S. EPA Office of Regional Counsel	9/19/00 Date
Concurred by: [signature] Wren Stenger, U.S. EPA Chief, Louisiana/New Mexico Branch	9/19/00 Date
Concurred by: [signature] Mark A. Peycke, U.S. EPA Office of Regional Counsel	09/20/00 Date
Concurred by: June Buzzell June Buzzell, U.S. EPA Writer Editor, Superfund Division	9-20-00 Date
Concurred by: Pamela Phillips Pamela Phillips, U.S. EPA Deputy Director, Superfund Division	9/20/00 Date
Approved by: Pamela Phillips, Acting Myron O. Knudson, P.E. Director, Superfund Division U.S. EPA Region 6	9/20/00 Date

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ACRONYMS AND ABBREVIATIONS

This document utilizes the following organization abbreviations. Abbreviations used in the Contract Documents shall be interpreted according to their recognized and well-known technical or trade meanings; such abbreviations include but are not limited to the following:

ARCO	Atlantic Richfield Company
AT&SF	Atcheson, Topeka and Santa Fe Railroad
USACE	U.S. Army Corps of Engineers
EPA (or U.S. EPA)	U.S. Environmental Protection Agency
EPNG	El Paso Natural Gas Company
NMED	New Mexico Environment Department
NSP	Navajo Superfund Program

Common technical abbreviations, which may be found in this report, are listed below:

ACM	Asbestos-containing Material
AI	Air Injection
AQCR	Air Quality Control Regulation
ARARs	Applicable or Relevant and Appropriate Requirements
AS/NI	Air Sparging/Nutrient Injection
BTEX	Benzene, toluene, ethylbenzene and total xylenes
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CPC	Chemical of Potential Concern
FS	Feasibility Study
GAC	Granular Activated Carbon
gpm	Gallons per Minute
GW	Groundwater
HASP	Health and Safety Plan
Hg	Mercury
HRS	Hazard Ranking System
I&CS	Instrumentation and Control System
lbs	Pounds
MCLs	Maximum Contaminant Levels
mg	Milligrams

ACRONYMS AND ABBREVIATIONS
(Continued)

mg/L	Milligrams per Liter
NAPL	Non-Aqueous Phase Liquid
NI	Nutrient Injection
NIS	Nutrient Injection System
NMAQR	New Mexico Air Quality Regulation
NMWQCCR	New Mexico Water Quality Control Commission Regulations
NPL	National Priorities List
NPDWR	National Primary Drinking Water Regulations
O&M	Operation and Maintenance
O&M Plan	Remedial Action Operation & Maintenance Plan
Order	Unilateral Administrative Order
OSWER	Office of Solid Waste and Emergency Response
PAHs	Polynuclear Aromatic Hydrocarbons
PLC	Program Logic Controller
ppb	Parts Per Billion
ppm	Parts Per Million
ppmv	Parts Per Million by Volume
PRPs	Potentially Responsible Parties
psi	Pounds Per Square Inch
QA/QC	Quality Assurance/Quality Control
QAP	Quality Assurance Plan
RA	Remedial Action
RA HASP	Remedial Action Health and Safety Plan
RA SAP	Remedial Action Sampling and Analysis Plan
RA WMP	Remedial Action Waste Management Plan
RA QAP	Remedial Action Quality Assurance Plan
RD	Remedial Design
RD/RA	Remedial Design/Remedial Action
RI	Prewitt Refinery Site Remedial Investigation (February 21, 1992)
ROD	Record of Decision

ACRONYMS AND ABBREVIATIONS
(Continued)

RI/FS	Remedial Investigation/Feasibility Study
RPM	EPA Remedial Project Manager
SAP	Sampling and Analysis Plan
SC/QAO	Supervising Contractor and Quality Assurance Official
SDWA	Safe Drinking Water Act
Site	Prewitt Superfund Site
SOP	Standard Operating Procedure
SVE	Soil Vapor Extraction
SVE/GW	Soil Vapor Extraction/Groundwater
TOC	Total Organic Carbon
TOU	Thermal/Catalytic Oxidizer Unit
TWS	Treated Water Storage Tank
UAO	Unilateral Administrative Order
VOCs	Volatile Organic Compounds
WMP	Waste Management Plan

EXECUTIVE SUMMARY

This five-year review report covers the period from May 1995 to May 2000 at the Prewitt Superfund Site (Site) in Prewitt, New Mexico. The results of the review indicate that the remedy has been, and is expected to continue to be, protective of human health and the environment. The surface and subsurface remedial actions have been functioning as designed, and have been operated and maintained in an appropriate manner. On-going optimization of the remedial system is continuing.

Both the EPA-approved Health and Safety Plan and the Contingency Plan are in place. These plans have been properly implemented, and are sufficient to control risks that may arise due to the implementation of the Remedial Action. Because the remedial actions for the surface and subsurface media are protective of human health and the environment, the remedy for the Site is protective of both human health and the environment.

Surface Media

The surface media remedy is protective of human health and the environment. Remedial actions for the surface media were successful in attaining the remedial action objectives for: (1) lead-, asbestos-, and hydrocarbon-contaminated surface soils; (2) the West Pits contents; and (3) the Separator and its contents, in accordance with the health-based cleanup levels as specified in the ROD. The EPA deleted the surface portion of the Site from the National Priorities List (NPL) on January 29, 1998.

No hazardous substances, pollutants, or contaminants remain in the surface media at the Site at concentrations above levels that allow for unlimited use of the surface media and for unrestricted exposure to the surface media.

Subsurface Media

The Phase I and Phase II subsurface remedies for the Site have been, and are expected to continue to be, protective of human health and the environment. The subsurface remedies are operating and functioning as designed. The Phase I subsurface remedy was successful in attaining the remedial action objectives for the NAPL extraction in the North NAPL Area. The groundwater containment component of the Phase I subsurface remedy for the E Sandstone unit exceeded expectations as the BTEX concentrations in the leading edge plume declined below the MCLs. The NAPL extraction in the South and Miscellaneous NAPL Areas is meeting expectations, considering the difficulties involved in removing NAPL absorbed in the complex, heterogeneous fractured bedrock. The Phase I and Phase II subsurface remedies have reduced the groundwater BTEX concentrations in the NAPL source areas.

The groundwater monitoring results of the Willcox well, which is completed in the B Sandstone Unit of the Sonsela Formation, show benzene concentrations varying from less than the 0.0002 mg/l detection limit to a maximum of 0.024 mg/l, with no apparent upward trend. The source of the benzene in this well appears to be from the migration of contaminants through the gravel-packed annular space around the casing of the former Willcox residential well. This former residential well was over drilled and properly closed in 1992. All of the existing Site wells that had inadequate seals were properly decommissioned as part of the RI activities to prevent them from acting as potential conduits for contamination to the lower aquifer units. Although removal of the old Willcox well has eliminated this pathway, low levels of benzene continue to persist in the deeper units of the Sonsela in the vicinity of the former Willcox residential well. Monitoring results of the new well support the interpretation that there is residual benzene contamination around an unsealed well casing that is the source of this contamination. The replacement Willcox well is no longer used as a domestic supply well, but continues to be monitored on a monthly basis.

There are no residential wells completed in the impacted aquifer units (E, F, and G Sandstone Units of the Sonsela Aquifer). Institutional controls, consisting of: 1) controls to eliminate the installation of water supply wells on-site; 2) installation of water treatment units at nearby residential wells; and 3) monitoring of the residential wells, were implemented and are being maintained. The institutional controls are effective, and are expected to remain effective, under current or anticipated changes in the land use at the Site. The remediation areas at the Site are fenced and secured to prevent unauthorized entry.

Hazardous substances remain in the subsurface at the Site at concentrations levels that are above levels that allow for unlimited use of the groundwater and unlimited exposure to groundwater.

I. Introduction

This report provides information gathered during the first five-year review of the Prewitt Superfund Site (Site) remedial action, covering the period between May 1, 1995, and April 30, 2000. This five-year review was conducted pursuant to the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Section 121(c), 42 U.S.C. § 9621(c), the National Contingency Plan (NCP) (40 CFR § 300.430 (f)(4)(ii)), Office of Solid Waste and Emergency Response (OSWER) Directive 9355.7-02 (May 23, 1991), OSWER Directive 9355.7-02A (July 26, 1994), OSWER Directive 9355.7-03A (December 21, 1995), and draft OSWER Directive 9355.7-03B-P (draft Comprehensive Five-Year Review Guidance).

Section 121(c) of CERCLA requires that "*If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each 5 years after initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented.*" Under the NCP, the Federal regulations which implement CERCLA, EPA is required to conduct five-year reviews of a remedial action whenever, under the remedial action, "*hazardous substances, pollutants, or contaminants are remaining at the site above levels that allow unlimited use and unrestricted exposure.*"

The Director of the Superfund Division, U.S. EPA Region 6, has approved this five-year review. Although CERCLA Section 121(c) authorizes "the President" to undertake five year reviews, the President's authority was delegated to the Administrator of the EPA by Executive Order 12580 (52 Fed. Reg. 2926, January 29, 1987), and this authority was further delegated to the EPA's Regional Administrators on September 13, 1987, by EPA Delegation No. 14-8-A. Finally, the authority was delegated to the Director of the Superfund Division by EPA Region 6 Delegation No. R6-14-8-A on August 4, 1995.

This review is required because hazardous substances, pollutants, or contaminants remain in the subsurface at concentrations that are above levels that allow for the unrestricted use of groundwater and for the unrestricted exposure to groundwater.

This first five-year review has been conducted in accordance with Section 121(c) of CERCLA. The information in this report is presented in accordance with the EPA's October 1999 Draft Comprehensive Five-Year Review Guidance (OSWER Directive 9355.7-03B-P).

This five-year report summarizes:

- Background information;
- Remedial action activities;
- Performance and operational monitoring results;
- Data review; and
- Progress and status remediation for the Site.

Most of the information summarized in this five-year review was obtained from the monthly progress reports and Annual Remedial Action Reports for the Site. Attachment 1 lists all of the documents that were reviewed for the compilation of this report. The monthly progress reports have been submitted to the EPA since the implementation of remedial action in May 1995. These reports describe the remedial action activities conducted, the results of sampling and tests, the activities planned for the next three months, and the problems encountered and their resolution. Five Annual Remedial Action Reports have been submitted, starting with the first annual report for the period May 1, 1995, through April 30, 1996. The Annual Remedial Action Reports provide a summary of the remedial action activities conducted, the NAPL extraction evaluation results, and the groundwater extraction, treatment, and re-injection results for the report period.

II. Site Chronology

Table 1 contains the Site chronology, listing milestones from initial discovery to present.

Table 1: Site Chronology

Date	Event
May 26, 1981	NMED sampled and confirmed groundwater hydrocarbon detection in a nearby resident well
December 15, 1982	EPA (FIT) Site Inspection
August 31, 1983	EPA (FIT) conducted groundwater, soil and waste sampling
June – Dec 1985	NMED conducted further groundwater and soil sampling
May 5 – 7, 1986	NMED performed test borings and sampling
May – December, 1987	EPA (FIT) Expanded Site Inspection
September 14 – 18, 1987	PRPs conducted localized hydrogeologic study
December 13, 1988	EPA (FIT) Residential Well Sampling
January 18, 1989	NMED performed residential well sampling
March 23, 1989	EPA issued UAO to PRPs to install Site fence and activated carbon filtration treatment system on five residential wells adjacent to the Site.
July 26, 1989	EPA issued an AOC to PRPs for RI/FS
August 30, 1990	Site placed on NPL
August 8, 1991	RI completed
February 21, 1992	FS completed
April 29, 1992	NAPL Extraction Pilot Test & Supplemental FS completed
July 16, 1992	EPA published proposed Plan of Action
September 30, 1992	EPA issued ROD for the Site RD/RA
May 14, 1993	EPA issued UAO for RD/RA
January 6, 1994	Final RD Work Plan completed
December 19, 1994	Remedial Design Reports (Surface and Subsurface) completed
February 21, 1995	Remedial Action Work Plan completed
May 4, 1995	Remedial action construction activities start (Pre-construction conference)
March 7, 1996	EPA final certification completion for asbestos-containing material, lead-contaminated soil and Separator remediation
March 7, 1996	EPA pre-final certification inspection for Phase I Subsurface Remedy construction and start-up completed
March 8, 1996	Phase I Subsurface Remedy O&M start
March 19, 1996	EPA certification of asbestos-containing material, lead-contaminated soil and Separator remediation completion
October 10, 1995	Remedial Design Report completion for surface hydrocarbon soils and Waste pits contents
May 7, 1996	Construction activities start for Landfarm Remedy for surface hydrocarbon soils
October 22, 1996	Attained Landfarm Performance Standard
November 22, 1996	EPA pre-certification inspection for completion of hydrocarbon soils remediation and Landfarm closure.
February 7, 1997	Landfarm remedial action completion report
January 29, 1998	EPA de-listed surface portion of the Site from NPL
July 22, 1998	EPA approved Completion of Phase I Subsurface Remediation for North NAPL Area and Plan for Phase II Subsurface Remediation for E-Sandstone Unit (North NAPL Area)
September 15, 1998	E-Sandstone Unit Phase II Subsurface Remedy construction completion, and implementation start-up phase
January 5, 1999	EPA final inspection of Phase II Subsurface Remedy start-up phase completion and O&M implementation

III. Background

The Site is a former crude oil refinery located on approximately 70 acres near the town of Prewitt in McKinley County, New Mexico. The Site is located approximately 20 miles northwest of Grants, New Mexico, as shown in Figure 1 of Attachment 2. The Site is bounded on the south by Interstate Highway 40, and on the north by The Burlington Northern and Santa Fe Railway Company (BNSF) Railroad. Old U. S. Highway 66 divides the Site into two tracts, as shown in Figure 2 of Attachment 2. The PRPs, Atlantic Richfield Company (ARCO) and El Paso Natural Gas Company (EPNG) own the two Site tracts. The area in which the Site is located is rural, with two residences located approximately 500 feet east of the Site. Approximately 50 people live within a one-mile radius of the Site. The Site is located near the southwest edge of the Rio San Jose Basin. A linear valley floor to the north and rocky uplands to the south typify the topography of the area at the Site. There are three major stratigraphic units. These are, in ascending order, the San Andres/Glorieta Formations, the Lower Chinle Member, and the Sonsela Sandstone Unit Bed.

The refinery was in operation from 1938 to 1957. In July 1957, the refinery was shut down, and the refinery and accompanying structures were subsequently dismantled. Remnants remaining after the refinery were dismantled included piping, pits, a separator, and other structural material. The Site was covered with scattered demolished structures and foundations, sparse desert vegetation, and exposed fill.

The Site was brought to the attention of the U. S. Environmental Protection Agency (EPA) by a citizen's complaint in 1980. On April 16, 1984, the Site was scored by the EPA using the Hazard Ranking System (HRS) MITRE model. In June 1989, EPA issued an Administrative Order to both EPNG and ARCO. The order required EPNG and ARCO to fence the Site, and to install and maintain an activated carbon filtration treatment system on five residential wells adjacent to the Site. On August 30, 1990, (55 Fed. Reg. 33502, 33508), the EPA added the Prewitt Abandoned Refinery Site to the National Priorities List (NPL), pursuant to Section 105 CERCLA, 42 U.S.C. § 9605, qualifying the Site for remediation under CERCLA, more commonly known as Superfund. On January 25, 1989, EPA issued a Special Notice letter to both ARCO and EPNG regarding the Remedial Investigation/Feasibility Study (RI/FS) activities at the Site. On June 22, 1989, ARCO and EPNG's parent company, The El Paso Company (TEPCO), signed an Administrative Order on Consent with EPA, which authorized ARCO and TEPCO to initiate RI/FS activities at the Site.

The Remedial Investigation (RI) was conducted in two Phases during 1990 and 1991 to determine the nature and extent of the problem presented by the release of hazardous substances at the Site. Phase I was the initial sampling and analysis phase. Phase II activities were conducted to resolve outstanding issues, and to fill data gaps remaining at the conclusion of Phase I. During the RI, contamination (lead, asbestos and hydrocarbon) was detected in the surface soils. Figure 1, which was extracted from the RI Report, shows the Site conceptual model and presents a general summary of the RI findings. The RI findings are also summarized as follows:

Surface Contamination

- Hydrocarbon-contaminated soils, primarily consisting of tarry/polynuclear aromatic hydrocarbons (PAHs) material mixed with soil, were found in scattered localized concentrations at the Site, with the greatest concentrations located in the West Pits area. The concentrations of PAHs generally diminish two feet below ground surface (bgs). Approximately 3,000 cubic yards of hydrocarbon-contaminated soils, with PAHs at concentration levels that exceeded Site remediation goals were identified.

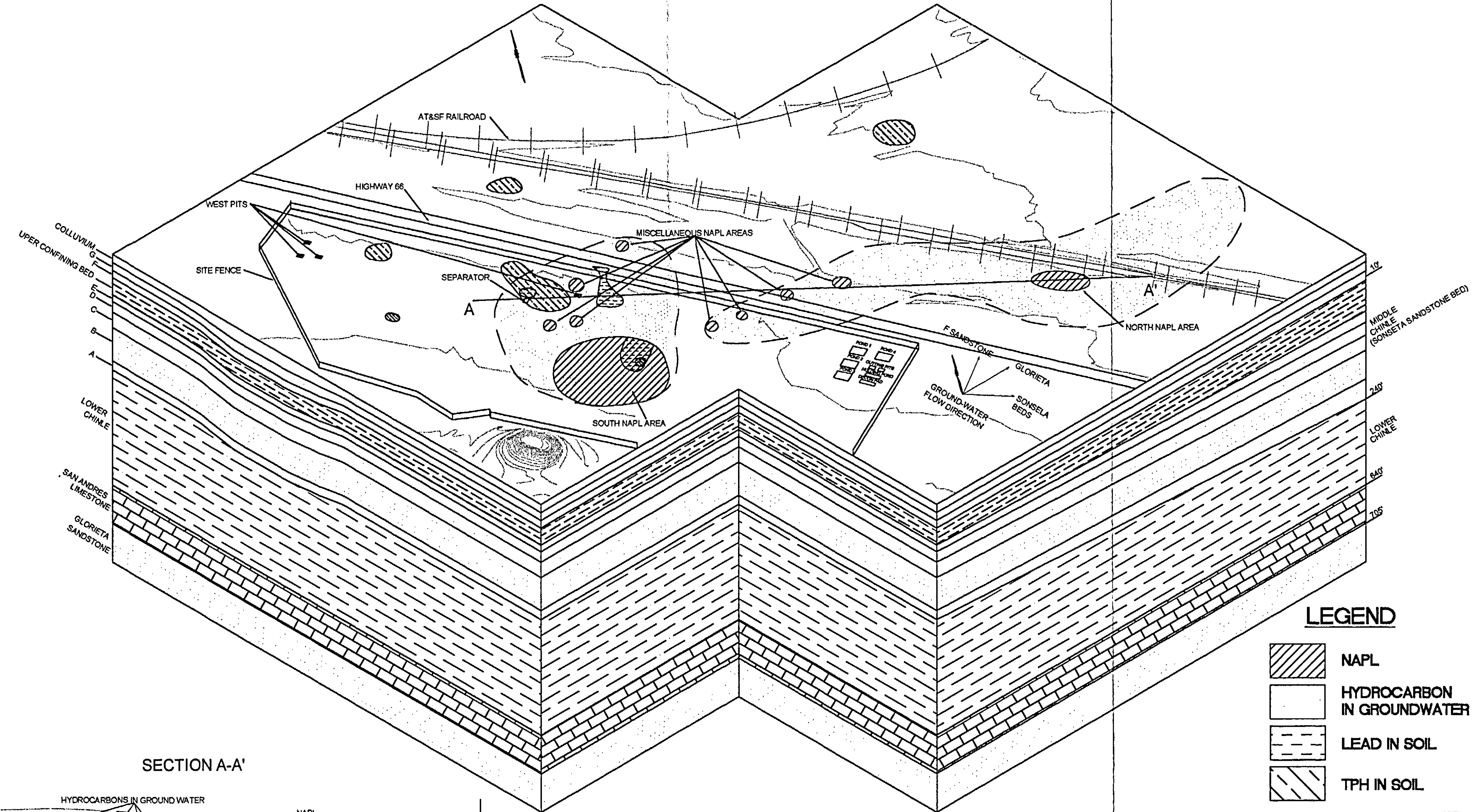
- The Separator unit contained approximately 83 cubic yards of a viscous liquid/sediment mixture or sludge, which is listed as FO37 hazardous waste (refinery oil/water separator sludge) under the Resource Conservation and Recovery Act (RCRA). Approximately 280 cubic yards of soils were impacted with hydrocarbon contamination around and underneath the Separator.

- Approximately 1,900 cubic yards of soils with lead concentrations greater than 500 ppm were identified in several locations at the Site. This lead was found to come from, in large part, leaded tank bottoms, which is listed RCRA hazardous waste KO52.

- Approximately 1,000 tons (800 cubic yards) of asbestos-containing material was removed from the Site during an asbestos abatement program performed prior to the RI. Approximately 15 cubic yards of additional asbestos-containing material were identified during the investigation.

Subsurface Contamination

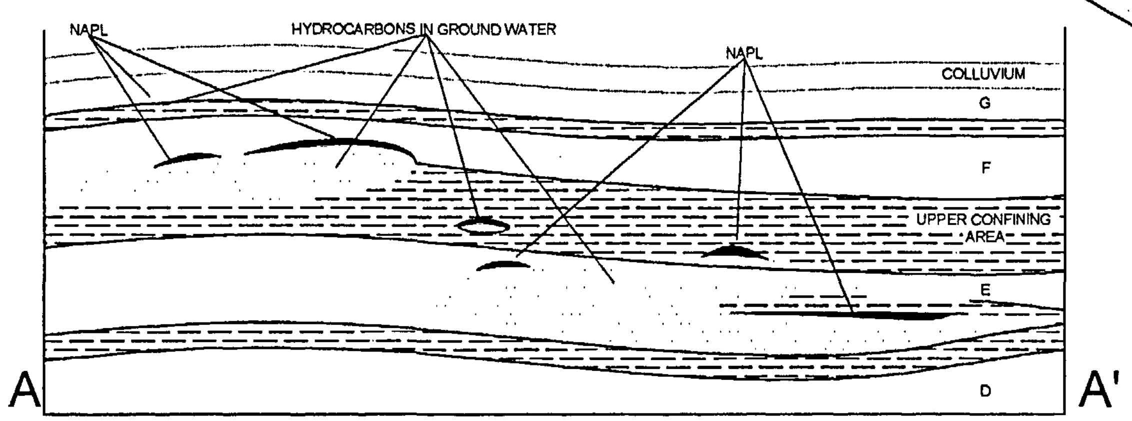
Shallow groundwater underlying the Site has been contaminated with RCRA listed wastes including slop tank contents (KO49), primary separator sludge (FO37), and secondary separator floats (FO38) mixed with petroleum hydrocarbon products from past refinery-related activities. Four distinct hydrostratigraphic units underlie the Site. The uppermost water-bearing zone is a shallow perched zone of limited areal extent. This water-bearing zone is divided into the F and G Sandstone Units, with the G Unit being the uppermost unit. The F and G Units are separated hydraulically from the A through E Units of the Sonsela Aquifer by the upper confining bed. The deeper San Andres/Glorieta aquifer is separated from the Sonsela Aquifer by approximately 400 feet of indurated, fine-grained sediments. The stratigraphy of the subsurface below the Site is illustrated in Figure 1.



LEGEND

- NAPL
- HYDROCARBON IN GROUNDWATER
- LEAD IN SOIL
- TPH IN SOIL

SECTION A-A'



Applied Hydrology Associates, Inc.

PREWITT REFINERY SITE
PREWITT, NEW MEXICO

FIGURE 1
SUBSURFACE CONCEPTUAL MODEL PRE REMEDIAL ACTION

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- Non Aqueous Phase Liquid (NAPL) from RCRA-listed hazardous wastes mixed with petroleum products was accumulated in the E, F, and G Sandstone Units and the upper confining bed. Staining noted during core logging indicated that bedrock fractures have been a significant transport mechanism for NAPL in the unsaturated zone. NAPL moved downward from the surface under the influence of gravity and pumping through the bedrock fracture systems. Seven NAPL areas were identified at the Site during the RI. The NAPL at the Site consists of sludges, including KO49, FO37, and FO38, mixed with weathered gasoline, diesel or gasoline/diesel mixtures. A total of 43,500 gallons of NAPL was estimated in the E, F and G Sandstone Units.

- Groundwater contamination at the Site is generally confined to uppermost portions (E, F and G Sandstone Units) of the Sonsela Aquifer. Groundwater in the F & G Sandstone Units, which are separated hydrogeologically from the lower sandstones (A through E) by the upper confining bed, is perched above the upper confining bed. The contaminants of concerns for the shallow groundwater are benzene, toluene, ethylbenzene, xylenes, lead, and dichloroethane (1,2-DCA). The source of these contaminants is generally spilled petroleum products intermingled with sludges, including FO37, FO38, and KO49.

One of the activities that took place as part of the RI was the abandonment of the existing Site wells having inadequate well casing seals. These wells were abandoned or modified to prevent them from remaining as potential conduits for contamination of the lower ground water units. Also, the former Willcox residential well was abandoned and replaced with a new well in 1992 because the annular space around the casing was packed with gravel permitting cross contamination from the E Sandstone to the deeper units of the Sonsela Aquifer.

Utilizing the findings of the RI, the Feasibility Study (FS) was initiated to develop and assess various remediation measures for the areas of contamination at the Site. The FS process and the detailed evaluations of the alternatives are presented in the FS Report for the Site, which is part of the Administrative Record. The remedial alternatives were evaluated based on health risks assuming residential use of the Site. The FS was completed in April 1992.

The Site is currently used solely for remedial activities. With exception of a rural residential area located east of the Site, the surrounding areas are utilized for grazing purposes; however, the Site may potentially be used for residential purposes.

IV. Remedial Actions

A. Remedy Selection

The Record of Decision (ROD) for the Site was signed on September 30, 1992. The remedial action objectives for the Site are:

1. *Removal of, or containment of, Non Aqueous Phase Liquid (NAPL) to prevent further contamination of groundwater in the A-G units of the Sonsela aquifer. Since NAPL impacts groundwater, remediation goals for subsurface areas contaminated with NAPL are as described below in the discussion of groundwater remediation goals.*

2. *Prevent future exposure to the contaminated groundwater through the G, F, and E units, and restore the G, F, and E units of the Sonsela Aquifer to their beneficial use, which is at this site a drinking water aquifer.*

3. *Excavation and treatment of wastes in the West Pits Area to prevent or reduce carcinogenic and noncarcinogenic risk to human health and the environment and to eliminate the physical hazard posed by the waste pits as they exist.*

4. *Control or eliminate the exposure to contaminated soils including the North Pit contents, contaminated with lead, asbestos or hydrocarbons.*

5. *Eliminate risk and hazards associated with exposure to the separator unit and its contents. The separator and its contents shall be removed such that there is no future risk to human health and the environment.*

The Site is addressed in the ROD as one operable unit, in which all surface and subsurface contamination is addressed, including: the West Pits; lead-, asbestos- and hydrocarbon-contaminated soils; the Separator and its contents; and NAPL extraction and groundwater remediation (subsurface contamination). For remedial design and actions, the contaminated media were divided into two categories, surface and subsurface media.

The remedial actions for surface media were:

- Excavation and off-site disposal of asbestos-containing materials.

- Excavation and off-site disposal of lead-contaminated soils.

- Excavation and off-site disposal of Separator contents, and removal and disposal of the Separator structure.

- Excavation and on-site treatment of:
  - West Pits contents;
  - Hydrocarbon-contaminated surface soils; and
  - Hydrocarbon-contaminated soils beneath the Separator with hydrocarbon concentration levels above the cleanup levels specified in the ROD.

The remedial actions for the subsurface media are:

- Soil Vapor Extraction (SVE) of NAPL.

- Contaminated groundwater migration control.

- Groundwater remediation by extraction, treatment, and re-injection.

B. Remedy Implementation

In May 1993, the EPA issued a Unilateral Administrative Order (UAO) to the PRPs. The UAO required the PRPs to implement remedial design/remedial action (RD/RA) for remedies specified in the ROD. The RD Work Plan was prepared by the PRPs, and was approved by the EPA on January 6, 1994. The RD report for surface remediation (lead-contaminated and asbestos-contaminated soils, and the Separator and its contents) was submitted to the EPA on November 18, 1994. The subsurface remediation was planned in two phases. The objectives of the Phase I Subsurface remediation were to: (1) remove or contain NAPL by Soil Vapor Extraction (SVE) to prevent further contamination of groundwater; (2) remediate groundwater in NAPL source areas; (3) control migration of contaminated groundwater; and (4) collect data during Phase I Subsurface Remedy implementation to be utilized to design Phase II Subsurface Remediation. The objective of the Phase II Subsurface Remediation was to remediate groundwater in the E, F, and G Sandstone Units. The Phase I Subsurface Remediation RD report was submitted on December 19, 1994. The EPA approved the surface and Phase I subsurface RD reports on January 17, 1995. An RA Work Plan was prepared and submitted to the EPA on February 21, 1995. The EPA approved the RA Work Plan on February 28, 1995.

The PRPs implemented the remedial action construction activities for the surface (lead-contaminated and asbestos-contaminated soils, and the Separator and its contents) and the Phase I Subsurface Remediation. The PRPs undertook overall project management, financial control, contract management, and continued interface communication with EPA and NMED. A qualified construction contractor was selected by the PRPs. The PRPs retained an outside party to serve as Supervising Contractor and Quality Assurance Official (SC/QAO). Remedial action construction activities started on May 4, 1995, with a pre-construction conference among the Construction Contractor, the PRPs, the SC/QAO, the EPA, the NMED and the Navajo Superfund Program (NSP). The following two subsections describe remedial action activities for surface and subsurface remediation.

B1. Surface Remediation

The remedial action objective for surface media was to control or eliminate risks and hazards to human health and the environment associated with lead-, asbestos-, and hydrocarbon-contaminated soils; Separator sludge; and the West Pits contents. The remedial action activities for the surface media were completed with a pre-certification and pre-final inspection on November 28, 1995. The RA activities included the following:

- A total of 377 cubic yards of asbestos-containing material (ACM) was excavated and disposed of off-site. The ACM removal was performed to meet the remediation goal in the ROD, and cleanup was verified with confirmatory sampling as specified in the Remedial Action Sampling and Analysis Plan (RASAP).

- A total of 3,830 tons of lead-contaminated soil was excavated and disposed off-site. The soil was cleaned up to the ROD-specified remediation goal, and was verified with confirmatory sampling.

- A total of 111 tons of hazardous (F037) Separator sludge was stabilized and transported off-site for thermal desorption treatment. An additional 91 tons of concrete from the Separator structure and 5.2 tons of debris, including piping and a secondary tank, were profiled and transported off-site for disposal as hazardous (F037) debris.

All excavated areas were backfilled with clean soils obtained from an off-site borrow area. The backfilled areas were graded and vegetated with a native vegetation seed blend as specified in the RD Report.

Following the March 7, 1996, final EPA certification inspection, on March 19, 1996, the EPA issued a certification of completion for the surface remedy components. A final remedial action completion report for the surface remedy components was submitted to the EPA on April 18, 1996.

Once the EPA approved the RD Report and the RA Work Plan, remedial action construction activities for the Landfarm Remedy, the last component of the surface remediation, began on May 7, 1996. The remedial actions for the Landfarm Remedy included:

- Construction of the Landfarm.
- Excavation, homogenization, and placement of approximately 4,300 cubic yards of hydrocarbon-contaminated soils and West Pits contents in the landfarm for treatment.
- Backfilling with clean soils in the excavated areas.
- Grading and re-vegetation of the backfilled areas.

The landfarm O&M activities began on July 15, 1996. The landfarm O&M consisted of maintaining optimum soil moisture rate, maintaining optimum nutrient ratio, and tilling the soil as specified in the remedial design in order to maintain efficient bidegradation of PAHs. The landfarm remediation goals were attained on October 22, 1996. The landfarm was closed in November 1996. The landfarm closure involved decommissioning of the landfarm, placement of a soil cap over the treated soils, and re-vegetation of the soil cap. Following the final certification inspection, the EPA issued a certification of completion on January 23, 1997. A final remedial action construction and completion report for the Landfarm Remedy was submitted to the EPA on February 7, 1997. With completion of the Landfarm Remedy, all surface media remedial action objectives were met in accordance with the ROD and the UAO. On January 29, 1998, the EPA published a notice in the Federal Register deleting the surface portion of the Site from the NPL.

B2. Subsurface Remediation

Remedial action construction and start-up activities for the Phase I Subsurface Remedy were completed in March 1996. The subsurface remediation was implemented in phases consistent with the EPA-approved RA Work Plan. The specified objectives of the Phase I Subsurface Remedy were to contain or remove NAPL, control migration of contaminated groundwater, remediate groundwater in the NAPL source areas, and to collect data and information for the Phase II remediation plan. The Phase I Subsurface Remedy, as initially constructed, included:

- 35 SVE/GW pumping wells and three air injection wells in the South NAPL Area;
- Ten SVE/GW pumping wells and three air injection/air sparging wells in the North NAPL Area;
- Eight SVE/GW pumping wells in the Miscellaneous NAPL Areas;
- Two liquid ring vacuum pumps for SVE;

- A compressed air system for operation of pneumatic groundwater pumps, for air injection and sparging, and for instrumentation system air;

- An oil/water separator to separate pumped NAPL and groundwater;

- An air stripping system for groundwater treatment;

- A thermal/catalytic oxidizer unit (TOU) to treat extracted soil vapor and to treat air stripper treatment off-gases;

- Granular Activated Carbon (GAC) scrubbing units for final polishing of treated groundwater;

- Shallow injection discharge system for reinjection of treated water; and

- Instrumentation and Control System (I&CS) and Programmable Logic Controller (PLC) to allow unattended operation and to coordinate and interlock operation of each equipment component system. The system functions as a completely integrated unit, and shuts down the entire system in the event of a malfunction or in the event of any equipment failure.

The Phase I Subsurface Remediation system was designed and constructed to provide substantial groundwater remediation, in addition to the NAPL extraction. The Phase I System included a total of 53 SVE/GW wells installed in the NAPL source areas to extract groundwater for treatment and reinjection at a rate of up to 5,000 gallons per day. The Phase I System is also consistent with the groundwater pumping, treatment, and reinjection remedy selected in the ROD for the groundwater remedy. The System, as designed, constructed, and operated, has incorporated remedies selected in the ROD for both the NAPL and groundwater remediation. The Phase I System also included air injection at South NAPL Area wells and air sparging at North NAPL Area wells. While these components were designed to enhance SVE NAPL extraction, they also provide oxygen to the subsurface, which serves to enhance in situ biodegradation of residual NAPL and dissolved BTEX in the subsurface.

The Phase I System was started on December 11, 1995, and operated until March 7, 1996, as a start-up phase to determine if the System was operational and functional. Following the pre-final inspection by EPA on March 7, 1996, EPA determined that the Subsurface Remediation System was operational and functional. A final remedial action construction report was submitted to the EPA on August 30, 1996.

C. Phase I Subsurface Remediation System Operation and Maintenance

The PRPs selected an operation and maintenance (O&M) contractor and the O&M activities started in March 1996. The O&M activities are performed in accordance with the RA O&M Plan, RA Health and Safety Plan (RA HASP), RA Sampling and Analysis Plan (RA SAP), RA Waste Management Plan (RA WMP), and RA Quality Assurance Plan (RA QAP), all of which have been approved by EPA.

C.1 Routine Operation and Maintenance, and Troubleshooting

The O&M Plan describes procedures and schedules for inspection and maintenance of the operating remediation system. Activities include operating data collection and inspections to facilitate preventive maintenance and to insure that the system continues to operate with minimal problems. Manufacturer's specifications regarding performance of the system wells and equipment during the operation were also utilized to develop a preventive maintenance program to maintain efficient operation of the system. The O&M work for system operation included the following activities:

- System Inspections During Routine Operations
- Shallow Injection System Inspections and Maintenance
- Maintenance of SVE/Groundwater Pumping, and Air Injection/Sparging Wells
- Control System Operation Check
- Inspection and Maintenance of Compressed Air System
- Inspection and Maintenance of Oil/Water Separator
- Maintenance of the Equalization Tank and Air Stripper Feed Pump
- Maintenance of NAPL Tank
- Maintenance of Granular Activated Carbon Absorption System and Pre-Filter
- Maintenance of the Vacuum Pumps and SVE System
- Maintenance of the Thermal/Catalytic Oxidizer and Propane Supply
- Maintenance of Vapor Phase Granular Activated Carbon Drum
- Waste Management
- Well Abandonment
- Routine Air Monitoring for Health and Safety

Details of the routine O&M activities performed to date, including system operation, downtime, and actions taken for operation and maintenance, are described in monthly progress reports and annual remedial action reports submitted to EPA as required by the Order. Overall, the System operated at an average of 94.3% of the time through April 2000.

C.2 Operational and Performance Monitoring

The following methods were used to monitor performance in accordance with the RD Report and the RA SAP during Phase I Subsurface Remediation:

- Groundwater monitoring at the leading edge plume wells to determine the extent and degree to which plume containment is achieved.

- SVE performance monitoring and NAPL thickness measurements to: 1) estimate SVE contaminant mass removal rates and changes over time at each extraction well, 2) determine optimum air sparging pressure and rates for air sparge wells, 3) determine optimum vacuum levels on SVE wells, 4) determine when system modifications are required to enhance contaminant mass removal rates and attainment of NAPL extraction performance standards, 5) evaluate the degree to which system modifications have enhanced contaminant mass removal rates and the attainment of NAPL extraction performance standards, and 6) determine when NAPL extraction performance standards have been attained in a particular area.

- Groundwater monitoring of the NAPL source area monitoring wells and monitoring of concentrations in the treatment plant groundwater headers to estimate changes in BTEX concentrations in groundwater in the NAPL source areas.

- Monitoring of groundwater extraction flows and concentrations to estimate dissolved BTEX mass removal due to vacuum enhanced pumping during Phase I Subsurface Remediation. Monitoring of NAPL accumulation in the NAPL recovery tank to quantify the removal of liquid NAPL due to groundwater pumping.

- Sampling of treated water discharge to monitor the operational performance of the air stripper and to demonstrate compliance with groundwater treatment standards and discharge criteria.

- Monitoring of the TOU feed and stack to monitor operational performance of the soil vapor treatment and demonstration of air emission requirements. Routine monitoring of organic vapor at the Site boundaries, inside the treatment plant, vapor scrubber, and remediation well vaults to assure emission requirements and for the health and safety to workers and the public.

C.3 System and Operational Modifications

Based on the results of operational and performance monitoring, the SVE System operational modifications were implemented as specified in the remedial design to improve SVE mass recovery rates and maximize efficiency of the SVE System. The modifications included:

- Lowering of groundwater pumps in the South NAPL Area remediation to increase the vadose zone thickness for improved SVE flows and SVE mass recovery, and to improve NAPL removal;

- Reduction of SVE flows from wells, which had significantly high SVE flows with very low BTEX and hydrocarbon concentration resulting in insignificant mass recoveries. This modification was implemented to increase SVE vacuums at the other South Header wells.

- Conversion of selected SVE wells to air injection (AI) wells. The conversion was performed on wells that featured very low SVE mass recoveries, and on the surrounding SVE wells having fairly high SVE concentrations and low SVE flows.

- SVE vacuum manipulations to reduce the SVE flow rate in order to allow a higher air to NAPL contact time, thus increasing SVE concentration at the wells;

- Pulsed SVE to allow water level recovery and subsequent drawdown to smear any residual NAPL so it is more efficiently removed by the SVE;

- Pulsed air sparging to avoid short-circuiting of the airflow at remediation wells which still had a relatively higher mass recovery rate; and

- Utilization air injection in nearby monitoring wells to change the distribution of subsurface air movement.

During the O&M activities, four new SVE/GW remediation wells were constructed to address NAPL thickness levels in monitoring wells, where the nearby remediation wells were not capable of extracting NAPL due to the heterogeneity of the formation. In addition, six monitoring wells were converted to temporary SVE or SVE/GW remediation wells in order to enhance NAPL extraction. Although NAPL thickness levels initially declined in these monitoring wells following the start of remediation, the remediation system was not able to achieve complete extraction of liquid NAPL from the vicinity of these wells, apparently due to the heterogeneity of the fractures in the target formation.

C.4 Reporting

Details of the O&M activities listed above were reported in the monthly and annual progress reports that were sent to the EPA. Monthly progress reports have included a description of the remedial action activities conducted at the Site, the results of sampling and tests, including the quarterly Groundwater Monitoring Form, the activities planned for the next three months, and any problems encountered and their resolution. Annual Remedial Action Reports have included a summary of remedial action activity, an annual soil vapor and NAPL extraction evaluation, and an annual groundwater extraction, treatment and re-injection report.

D. Phase II Subsurface Remediation

Based on the performance monitoring results, performance standards for the Phase I Subsurface Remediation in the North NAPL Area were attained by the end of 1997. The NAPL thickness measurements in the North NAPL Area monitoring wells indicated that free NAPL was removed. The SVE performance monitoring results showed that the SVE mass recovery of the volatile fraction of NAPL had declined to low asymptotic levels. The leading edge plume containment component of Phase I Remedy had more than exceeded its specified containment objective. The BTEX concentrations in the leading edge plume area wells have declined below the MCLs, which exceeds the specified objective of: (1) controlling migration of contaminated groundwater beyond the existing leading edge plume boundary; and (2) maintaining groundwater benzene concentrations in the leading edge plume area at a steady state.

Therefore, in accordance with the RD, the Phase I Subsurface Remediation in the North NAPL Area was concluded and a plan for Phase II Subsurface Remediation was developed. The air-sparging component of the Phase I Remedy was found to be capable of supplying oxygen to support in-situ biodegradation of dissolved BTEX constituents. However, BTEX concentrations in groundwater extracted from the North NAPL Area did not decline as expected. A bioremediation evaluation study for the North NAPL Area indicated that nutrients, nitrogen, and phosphorus, were limiting factors in the biodegradation of dissolved BTEX constituents in groundwater in the North NAPL Area. Therefore, the Phase II Subsurface Remediation Plan for the E-Sandstone Unit included a water and nutrient injection component along with the air sparging and vacuum enhanced groundwater extraction components of the Phase I remedy. The final North NAPL Area Phase I Subsurface

Remediation Completion Report and Phase II Subsurface Remediation Plan for E-Sandstone Unit was submitted to the EPA and approved on July 22, 1998.

The Phase II Subsurface Remedy construction and start-up was completed in January 1999. At the final inspection on January 5, 1999, the EPA notified the PRPs at the Site that the Phase II Subsurface Remedy, as constructed, was operational and functional. Details of the Phase II Subsurface Remedy construction, remedy description and start-up data are included in the Remedial Action Construction Report for the E-Sandstone Unit for the Phase II Subsurface Remedy, which was submitted to the EPA on February 19, 1999.

The Phase II Subsurface Remediation for the E-Sandstone Unit consists of batch injection of nutrients, initially at six wells, to enhance in-situ biodegradation of BTEX constituents in groundwater using a nutrient injection system (NIS) constructed within an enclosed trailer. The Phase II Subsurface Remedy also includes continued groundwater extraction at remediation wells as necessary to support in-situ bioremediation and to maintain containment of the leading edge of the plume in the E-Sandstone Unit. Treated water and nutrient feed stock are used for preparing nutrient injection batches as specified in the RD and modified based on operational monitoring.

In addition to the continued Phase I Subsurface Remediation O&M activities in South and Miscellaneous NAPL Areas, the O&M activities for E-Sandstone Unit Phase II Subsurface Remediation include:

- Scheduled batch injection of nutrients using the NIS.

- Maintenance of the NIS, including inspection and repair of equipment and controls on the NIS and maintenance in accordance with the equipment specifications; treatment of the injection wells for biofouling and nutrient precipitation, as needed, to remedy any significant declines in injection flow rates.

- Servicing and cleaning of pumps in SVE/GW wells as performed during Phase I Subsurface Remediation.

- Operational and performance monitoring, including: monthly monitoring of field parameters and nutrient levels; quarterly monitoring of TOC, BTEX, and inorganic constituents; and continued quarterly monitoring of BTEX and total hydrocarbon in soil vapor at the North NAPL Area SVE remediation wells.

- Reporting nutrient injection activities, NIS operating parameters, and results of sampling and monitoring in monthly and annual reports.

Occasional planned and unplanned shutdowns of the system occurred as part of the routine O&M activities. All circumstances related to unplanned system shutdowns have been resolved. No operational or maintenance problems were encountered during the O&M, except for the July 30, 1999, system shutdown due to the TOU high temperature alarm. Water from an extensive rainstorm during the evening of July 29, 1999, entered the knockout tank through a crack in the South Area buried SVE line. Excess water from the knockout tank entered the vacuum pump air/oil Separator and displaced some of the vacuum pump oil, which entered the TOU Feed line. The vacuum pump oil in the TOU line became additional fuel to the TOU. This uncontrolled additional fuel caused the TOU chamber to over heat and shutdown due to the TOU high temperature alarm. The cracked SVE line was repaired. In order to avoid any future accidental vacuum pump oil discharge to the TOU, a 500-gallon TOU Feed knockout tank was installed to collect any routine or accidental oil discharged from the vacuum pumps.

In the ROD, the annual O&M cost was estimated at $430,444 for NAPL extraction, and $367,200 for the groundwater remediation. The Phase I Subsurface Remedy is a combined remedy as it includes groundwater containment, groundwater pump, treat, and re-injection in the source areas, and NAPL extraction. The annual O&M cost estimated in 1996 following construction of the Phase I Remedy construction was approximately $625,000, including utilities. Also, an additional annual O&M cost of $40,000 was estimated for Phase II Subsurface Remediation of the E-Sandstone Unit following completion of construction in September 1998. These ROD cost estimates were for O&M and performance monitoring of the Phase I and Phase II Subsurface Remediation O&M, and did not include administrative, project management, additional remedial action construction/system modification, and EPA oversight costs. Table 2 lists the actual annual O&M costs, not including costs incurred by PRPs for project management and administration, and EPA oversight:

Table 2: Annual O&M Costs

Period		Total Annual O&M Cost
From	To	
April 1996	March 1997	$525,500
April 1997	March 1998	$568,100
April 1998	March 1999	$623,300
April 1999	March 2000	$572,100

Based on the actual costs incurred over the past five years, EPA's ROD cost estimates are within the range of +50 to –30 percent of the actual O&M costs.

Progress Since the Last Five-Year Review

The remedial action activities were implemented in May 1995. This is the first five-year review.

V. Five-Year Review Process

The Prewitt Site five-year review was led by Mr. Greg Lyssy, the EPA Remedial Project Manager (RPM) for the Site. The following team members assisted in the review:

- Ms. Dana Bahar, NMED representative
- Mr. Brian Jordan, U.S. Army Corps of Engineers (USACE) representative

VI. Five-Year Review Finding

A. Interview

Because this is a site with an ongoing presence, and the EPA and NMED are actively involved in, and are knowledgeable of, Site activities, issues, concerns and status, interviews were not performed for this five-year review.

B. Site Inspection

Mr. Greg Lyssy of the EPA and Mr. Brian Jordan of USACE, EPA's oversight contractor, conducted a Site inspection on August 21, 2000. Vegetation over the remediated areas associated with surface remediation was inspected. Vegetative cover of native species over the backfilled areas where surface soil excavation was performed was thorough and abundant. The soil cap over the former landfarm area was in good condition with abundant vegetative growth. No depressions, cracks, odors, or other deficiencies were noted.

Inspection of the shallow injection system, including the pipeline from the Treatment Building and the casement under the railroad was also performed. The treated water discharge pipeline was found to be in proper condition. No groundwater mounding in the shallow injection system area was noticed. Abundant vegetative growth was observed in the treated water shallow injection area.

C. Risk Information Review

All components of the surface remediation have been completed in accordance with the ROD and the Order requirements. The surface portion of the Site was deleted from the NPL in January 1998.

Standards for the surface contaminants of concerns have not become more stringent since the signing of the ROD in September 1992.

For the subsurface media, the following standards were identified in the ROD as applicable or relevant and appropriate requirements (ARARs) for groundwater and NAPL:

- MCLs per Safe Drinking Water Act (SDWA)
- New Mexico Water Quality Control Commission Regulations, Part 3, Section 3-10 (NMWQCCR)

Table 3 lists the groundwater contaminants of concern, maximum concentrations detected at the Site, and remediation goals specified in the ROD.

Table 3: Groundwater COCs, Maximum Concentrations and Chemical-specific Standards

Contaminant	Maximum Contaminant Concentration (mg/l)	Chemical-specific Standards (Remediation Goal) ROD (mg/l)	Basis for Goal
Benzene	3.9	0.005	MCLs per SDWA
Ethylbenzene	1.8	0.700	MCLs per SDWA
Toluene	6.21	0.750	NM Water Control Commission Regulation
Xylene	9.6	0.620	NM Water Control Commission Regulation
1,2 DCA	0.51	0.005	MCLs per SDWA
Lead	0.167	0.015	Note 1

Note (1): The lead cleanup Action level in the ROD was selected from the June 21, 1990, Memorandum from Henry L Longest, office of Emergency and Remedial Response of EPA, Washington DC

Standards for contaminants of concern have not become more stringent since the ROD was signed in 1992. The other potential chemical-specific ARAR is the lead action level of 0.015 mg/l in the National Primary Drinking Water Regulations (NPDWR) for Lead and Copper, 40 CFR Parts 141 and 142, promulgated in 1991. This is the same level as selected in the ROD from the June 21, 1990, memorandum.

Approximately 43,500 gallons of NAPL were identified in the ROD. The remedial action goal for NAPL, as stated in the ROD, is removal or containment of the NAPL by SVE to prevent further contamination of groundwater. Because the SVE NAPL removal goal was based on its potential impact to groundwater, site-specific target levels for BTEX constituents in soil vapors in equilibrium with residual NAPL were developed using a thermodynamic equilibrium analysis. The determination of that target level as measured by benzene concentration in the vapor stream is described in Sections 3.1.1 and 3.1.2 in the "Feasibility Report Supplement, NAPL/Groundwater Remedial Action Alternative" that was submitted to the EPA on April 29, 1992. The alternative presented in the Feasibility Report Supplement was the alternative selected in the ROD for NAPL extraction. The primary target was based on benzene due to its high solubility and low MCL. The NAPL extraction equilibrium based target levels are summarized in Table 4.

Table 4: NAPL Extraction Target Levels

Formation Unit	Benzene Soil Vapor Concentration, ppmv	Xylene Soil Vapor Concentration, ppmv
E-Sandstone Unit	2.5	39.0
F&G Sandstone Unit	25.0	390.0

The remedial objective for the NAPL, as specified in the ROD, is to prevent the exposure of potential receptors to contamination in amounts that are above human health-based standards and to restore the ground water quality to MCLs. The performance standard for the NAPL extraction, as specified in the RD Report, is to remove as much of the volatile BTEX fraction of the NAPL as is technically feasible. Attainment of the performance standard is to be determined from an operational data analysis. The performance standard for containment of the leading edge of the groundwater plume in the RD Report is to maintain no statistical significant increase in the benzene concentrations within the leading edge plume.

New Mexico air quality regulations are action-specific ARARs for emission of VOCs into the atmosphere. The remediation system consists of SVE of VOCs and air stripping treatment of groundwater to remove VOCs. Based on the Pilot Test results, the initial untreated non-methane hydrocarbon emission from the full-scale subsurface remediation system was projected to exceed 100 lbs/hr. The New Mexico Air Quality Control Regulation (AQCR) 702 regulations apply to any stationary source that has a potential emission rate greater than 10 lbs/hr or 25 tons/yr. of any regulated air contaminant for which there is a National or New Mexico Ambient Air Quality Standard. Therefore, the RD the EPA approved in January 1995 addressed the requirements of AQCR 702.

In November 1995, New Mexico promulgated new air quality regulations applicable to construction permits, which is similar to AQCR 702 for hydrocarbon and benzene emission into the atmosphere as summarized in Table 5. The remedy has been designed to meet the requirements of AQCR 702.

Table 5: Hydrocarbon Emission ARARs

Contaminant	Action-specific Standard		Source
Non Methane Hydrocarbon Emission	Previous	10 lbs/hr or 25 tons/yr	NM Air Quality Regulation Part 702 & NESHAPs
	New	10 lbs/hr or 25 tons/yr	NM Air Quality Regulations, Chapter 2, Part 70 & 72
Benzene	Previous	10 tons/yr	NM Air Quality Regulation Part 702 & NESHAPs
	New	10 tons/yr	NM Air Quality Regulations, Chapter 2, Part 70 & 72

The Remediation System includes a TOU to treat the emissions from the vapor extraction and air stripper units to meet the action-specific emission requirements of AQCR 702.

New Mexico Water Quality Control Commission Regulations are action-specific ARARs for discharge of treated groundwater onto or below the surface of the ground (including re-injection of treated water). Table 6 lists the action-specific standards for discharge of treated water.

Table 6: Water Treatment and Discharge Standards

Constituent	Maximum Concentration Permitted for Discharge mg/l
Benzene	0.010
Toluene	0.750
Ethylbenzene	0.750
Xylenes	0.620
1,2 DCA	0.010
Lead	0.050
Napthalenes	0.030

There has been no change in these action-specific standards for water treatment and discharge, and the remedy is meeting all of these standards.

D. Data Review

As discussed previously, extensive operational and performance monitoring is being performed for the subsurface remediation. Results of all operational and performance monitoring are submitted to the EPA in monthly progress reports and are also summarized in annual remedial action reports. No data review of the surface media remedial activities is discussed in this five-year review report, because all components of the surface remediation were completed in accordance with the ROD and the UAO requirements, and were approved by the EPA. Details regarding surface remediation completion, including confirmatory sampling and data, are included in remedial action completion reports submitted to the EPA. The EPA deleted the surface portion of the Site from the NPL in January 1998.

A review of records and monitoring reports through April 30, 2000, (end of five years of remedial action implementation) was performed.

D.1. Phase I Subsurface Remediation

The objectives of the Phase I Subsurface Remediation are:

- To remove or contain NAPL to prevent further groundwater contamination,
- Control migration of contaminated groundwater,
- Remediate groundwater in NAPL source areas, and collect data to design Phase II Subsurface Remediation.

D.1.1 NAPL Extraction

Approximately 43,500 gallons of NAPLs were identified in the ROD for the E, F, and G Sandstone Units at the Site. NAPL extraction is achieved through both the soil vapor extraction (SVE) and liquid NAPL recovery. As of April 2000, and as summarized in Table 7, a total quantity of NAPL greater than the estimated NAPL quantity identified in the ROD has been extracted from the Site. The NAPL extraction monitoring data summary is included in Attachment 3. Recovered liquid NAPL is accumulated in the NAPL Recovery Tank located next to the Treatment Plant and the NAPL Storage Tank. Both NAPL tanks are vented to the SVE Header for headspace fume recycling as a supplemental fuel for the TOU. In addition, venting of these NAPL tanks to the vacuum headers minimizes potential for hydrocarbon emission into the atmosphere from the tanks.

Table 7: NAPL Extraction Summary

NAPL Area	Total NAPL Volume Estimated In ROD (gallons)	NAPL Extracted as Soil Vapor (gallons)	Liquid NAPL Extracted by Pumping (gallons)	Total (gallons)
North NAPL Area (E Sandstone Unit)	11,400	2,683	1,398	4,081
South NAPL Area (F&G Sandstone Units)	29,700	38,673	4,150	50,655
Miscellaneous NAPL Areas (E, F and G Sandstone Units)	2,300	7,832		
Total	43,400	49,188	5,548	54,736

The extracted soil vapors are treated with the Thermal/catalytic Oxidizer Unit (TOU). Table 8 summarizes TOU emission monitoring performed during the start-up of the System and in 1999.

Table 8: TOU Emission Monitoring Results

Constituent	Date	TOU Feed		TOU Emission	
		Concentration ppmv	TOU Feed Rate lbs/hr	Concentration Ppmv	Emission Rate lbs/hr
Total Hydrocarbon	3/21/96	586.0	10.76	166.5	3.058
	8/26/99	275	3.03	60.0	0.660
Benzene	3/21/96	6.7	0.10	0.69	0.010
	8/26/99	4.94	0.04	0.47	0.004
Toluene	3/21/96	8.9	0.15	1.2	0.020
	8/26/99	5.23	0.05	0.48	0.005
Ethylbenzene	3/21/96	1.6	0.03	0.20	0.004
	8/26/99	<0.20	<0.002	<0.10	<0.001
Xylenes	3/21/96	7.9	0.15	1.3	0.025
	8/26/99	4.83	0.06	0.20	0.002

The monthly monitoring data show that after June 1996, when the TOU Feed monitoring was initiated, the total hydrocarbons in the TOU Feed from the subsurface remediation system never approached the levels estimated from the Pilot Tests as shown in Figure 2, and the monitoring data summary included in Attachment 3. Nevertheless, treatment of extracted soil vapor has been continued. The emission stack monitoring data in Table 8 indicate that the TOU treatment efficiency is approximately 90% in catalytic mode, as expected. Furthermore, with the rapid decline in total hydrocarbon contribution from the subsurface remediation system, the potential (without treatment) emission of non-methane hydrocarbons has been below the 10-lbs/hr threshold criteria of AQCR 702 since June 1996. During 1999, the potential emission of non-methane hydrocarbons has averaged 2.5 lbs/hr, compared to the 10-lbs/hr exempt level. Thus, the potential emissions at the TOU Feed is exempt from the requirements in Title 20, Chapter 2, Part 72 of the New Mexico Air Quality Regulations, which replaced AQCR 702. Therefore, the catalytic operating temperature requirement of the TOU was reduced from 600°F to 200°F in September 1999 to reduce propane consumption yet still insure that remediation activities at the Site contribute no measurable increase in contaminant concentrations in ambient air. Since September 1999, the TOU has operated at an average temperature approximately 250°F, well above the 200°F requirement.

The NAPL thickness level measurements in monitoring wells show that the available liquid NAPL extraction has been completed in the North NAPL Area, and is nearing completion in the South and Miscellaneous NAPL Areas. Table 9 summarizes the NAPL thickness levels in the monitoring wells.

Figure 2

TOU Feed (Untreated Vapor Influent) Data

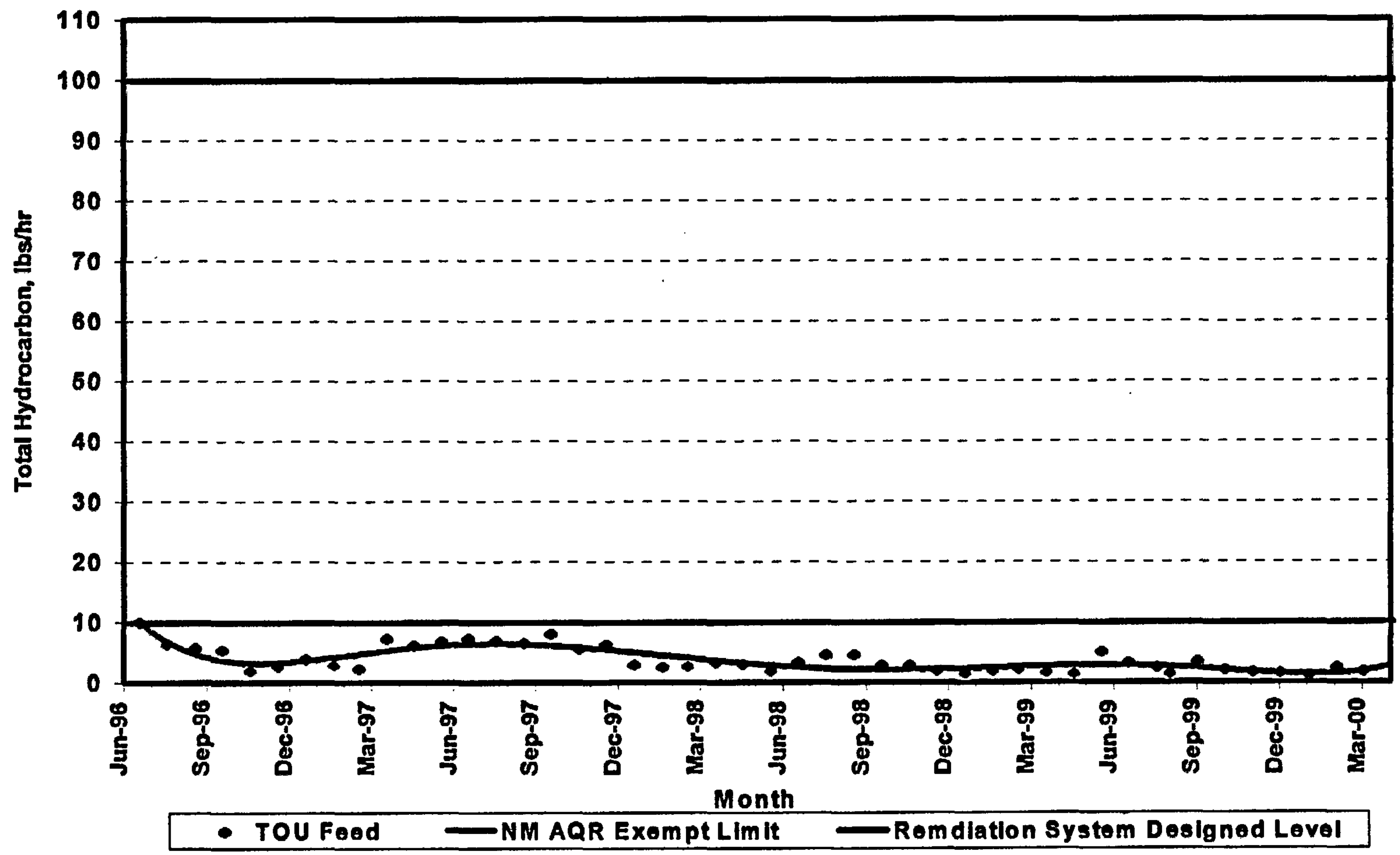


Table 9: NAPL Thickness Levels in Monitoring Wells

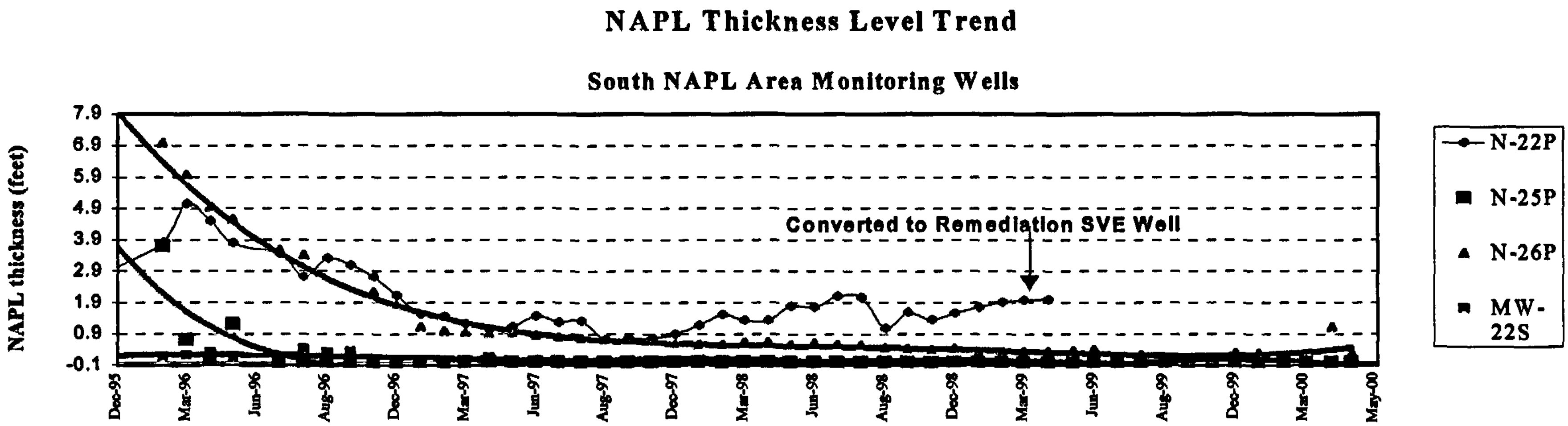
NAPL Area	Monitoring Well	NAPL Thickness Level, Feet		
		May 1995 (Initial)	May 1999	April 2000 (current)
North NAPL Area	N-14P	3.72	0	0
	N-16P	1.28	0	0
	MW-8S	17.91	0	0
	MW-E8E	5.02	0	0
	AS/OBS-1	0.01	(1)	(1)
South NAPL Area	N-22P	3.04	2.01	(1)
	N-25P	3.59	0	0
	N-26P	7.2	0.36	0.01 (3)
	MW-22S	0.21	0.03	(2)
Miscellaneous NAPL Area	MW-4S	0.14	0.99	(3)
	MW-20S	20.78	0.54	(2)
	N-1P	4.42	<0.01	<0.01
	N5P	4.62	2.06	(1)
	MW-21S	0.56	0.04	(2)
	MW-31E	0.13	0.01	(2)
	N6P	6.99	0.10	(3)
	N8P	4.05	0	0

Note: (1) Converted to permanent SVE/GW Well
(2) Converted to temporary SVE/GW Well
(3) Converted to temporary SVE Well

The monthly NAPL thickness levels are plotted in Figures 3 and 4. Figures 5 and 6 summarize the SVE System performance based on the SVE mass recovery rates over time. For the North NAPL Area, the NAPL extraction (Phase I Subsurface Remediation) was determined to be complete based on NAPL thickness levels, SVE mass recovery measurements, and the residual soil vapor concentration, which was approved by the EPA.

As shown in Figure 3 and Table 9, NAPL thickness levels in most of the South and Miscellaneous NAPL Areas wells are at less than detection level, indicating removal of most available liquid NAPL. Approximately 18 months following the start of the remediation, the NAPL thickness levels in Well N-5P (Miscellaneous NAPL Area) and N-22P (South NAPL Area), declined 55% and 34%, respectively. However, SVE in nearby remediation wells, located approximately 10 feet from these wells, was not able to completely extract NAPL from these areas due to the heterogeneity of the fractured bedrock formation. Therefore, the monitoring wells were converted to remediation wells to

Figure 3


NAPL Thickness Level Trend
South NAPL Area Monitoring Wells
NAPL thickness (feet)
7.9
6.9
5.9
4.9
3.9
2.9
1.9
0.9
-0.1
Converted to Remediation SVE Well
Dec-95
Mar-96
Jun-96
Aug-96
Dec-96
Mar-97
Jun-97
Aug-97
Dec-97
Mar-98
Jun-98
Aug-98
Dec-98
Mar-99
Jun-99
Aug-99
Dec-99
Mar-00
May-00
N-22P
N-25P
N-26P
MW-22S

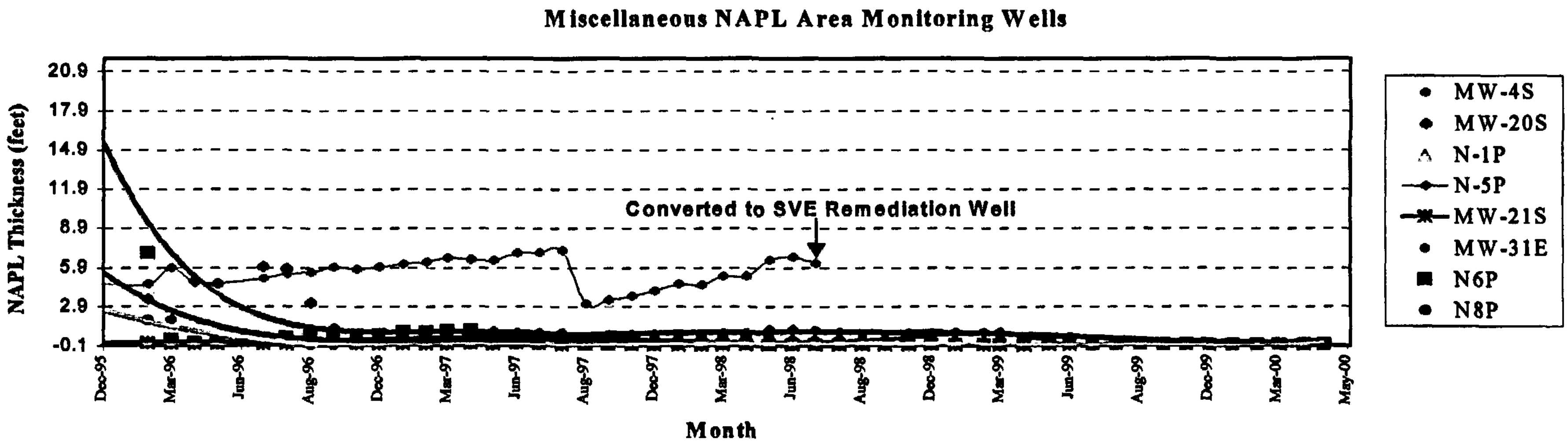

Miscellaneous NAPL Area Monitoring Wells
NAPL Thickness (feet)
20.9
17.9
14.9
11.9
8.9
5.9
2.9
-0.1
Converted to SVE Remediation Well
Dec-95
Mar-96
Jun-96
Aug-96
Dec-96
Mar-97
Jun-97
Aug-97
Dec-97
Mar-98
Jun-98
Aug-98
Dec-98
Mar-99
Jun-99
Aug-99
Dec-99
Mar-00
May-00
Month
MW-4S
MW-20S
N-1P
N-5P
MW-21S
MW-31E
N6P
N8P

Figure 4

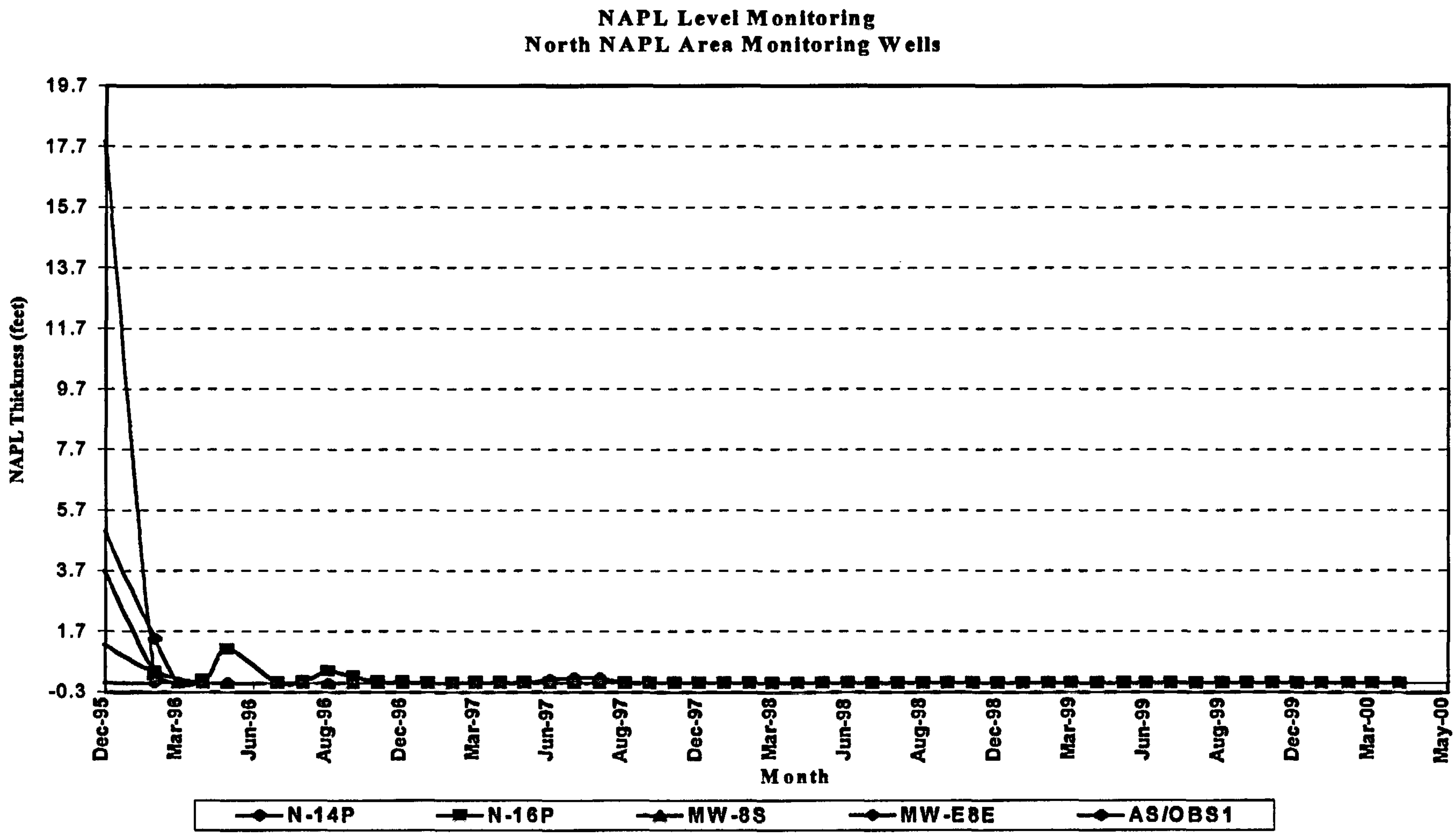

NAPL Level Monitoring
North NAPL Area Monitoring Wells
NAPL Thickness (feet)
19.7
17.7
15.7
13.7
11.7
9.7
7.7
5.7
3.7
1.7
-0.3
Dec-95
Mar-96
Jun-96
Aug-96
Dec-96
Mar-97
Jun-97
Aug-97
Dec-97
Mar-98
Jun-98
Aug-98
Dec-98
Mar-99
Jun-99
Aug-99
Dec-99
Mar-00
May-00
Month
N-14P
N-16P
MW-8S
MW-E8E
AS/OBS1

Figure 5

SVE Mass Recovery Rate, North NAPL Area Wells, Total

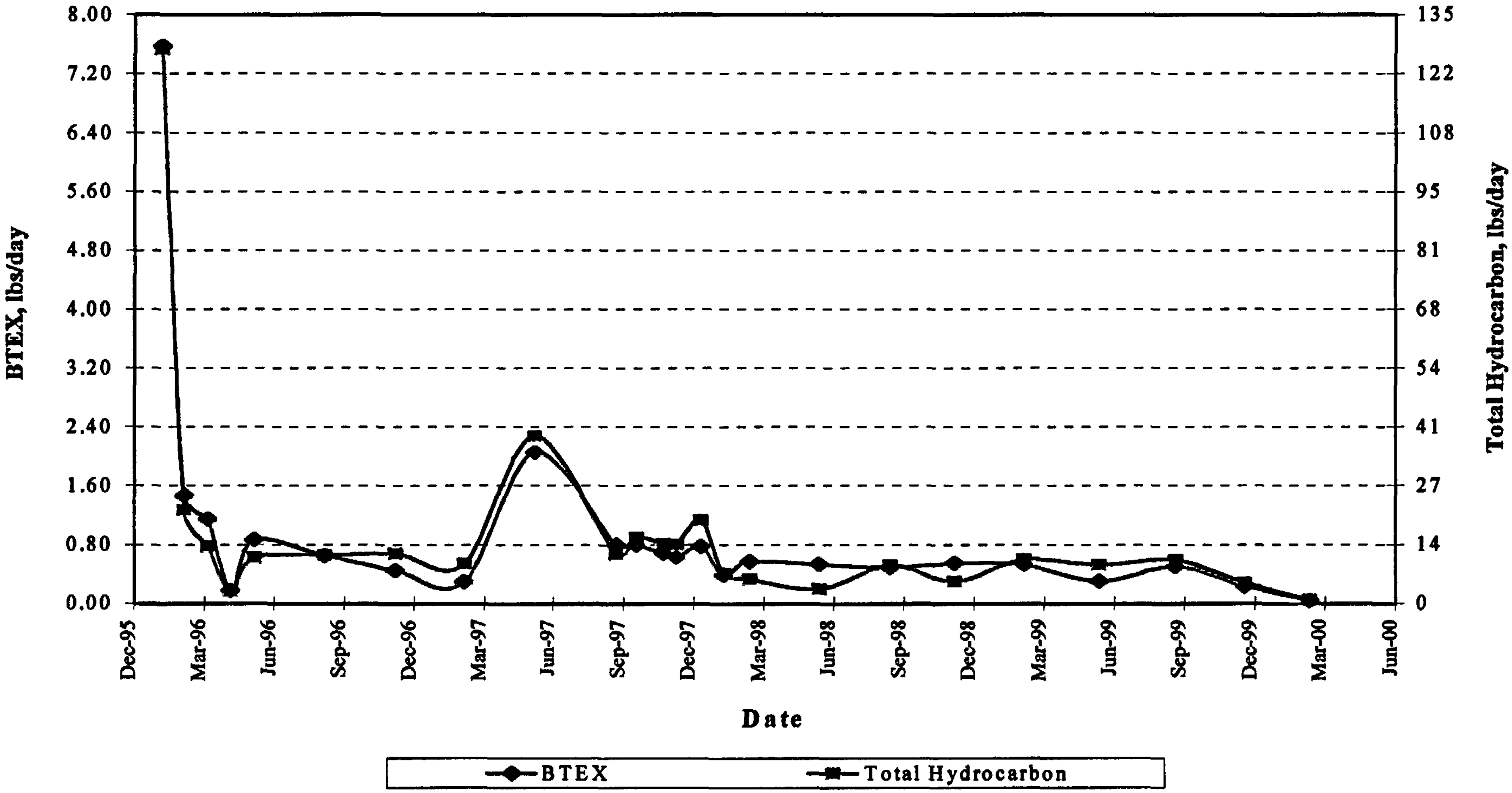
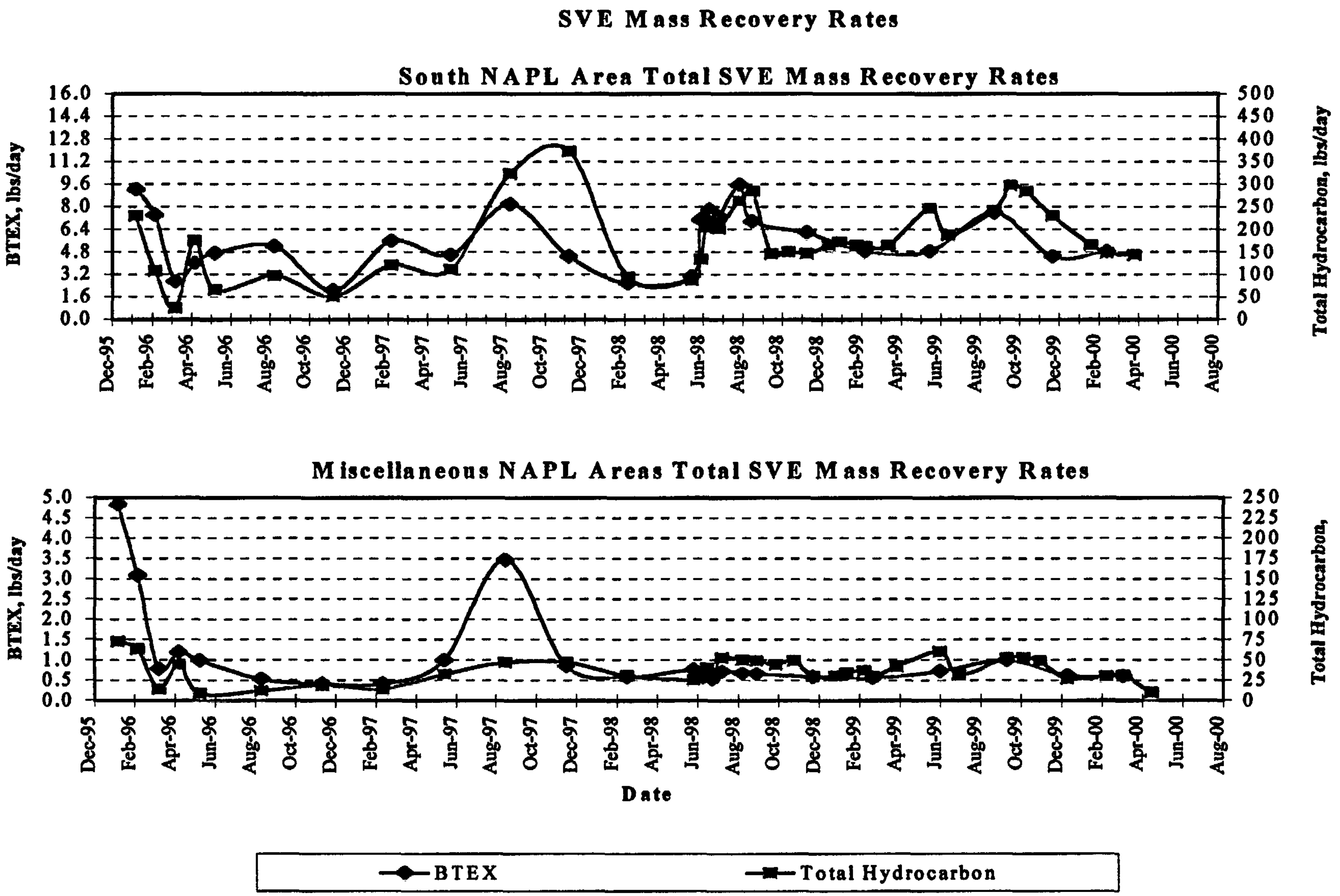


Figure 6


SVE Mass Recovery Rates
South NAPL Area Total SVE Mass Recovery Rates
BTEX, lbs/day
16.0
14.4
12.8
11.2
9.6
8.0
6.4
4.8
3.2
1.6
0.0
Total Hydrocarbon, lbs/day
500
450
400
350
300
250
200
150
100
50
0
Dec-95 Feb-96 Apr-96 Jun-96 Aug-96 Oct-96 Dec-96 Feb-97 Apr-97 Jun-97 Aug-97 Oct-97 Dec-97 Feb-98 Apr-98 Jun-98 Aug-98 Oct-98 Dec-98 Feb-99 Apr-99 Jun-99 Aug-99 Oct-99 Dec-99 Feb-00 Apr-00 Jun-00 Aug-00
Miscellaneous NAPL Areas Total SVE Mass Recovery Rates
BTEX, lbs/day
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Total Hydrocarbon, lbs/day
250
225
200
175
150
125
100
75
50
25
0
Dec-95 Feb-96 Apr-96 Jun-96 Aug-96 Oct-96 Dec-96 Feb-97 Apr-97 Jun-97 Aug-97 Oct-97 Dec-97 Feb-98 Apr-98 Jun-98 Aug-98 Oct-98 Dec-98 Feb-99 Apr-99 Jun-99 Aug-99 Oct-99 Dec-99 Feb-00 Apr-00 Jun-00 Aug-00
Date
BTEX
Total Hydrocarbon

extract residual NAPL from these small isolated locations. In addition, as shown in Figure 3 and in Table 9, some NAPL remained in several other monitoring wells. SVE and vacuum enhanced NAPL recovery in remediation wells located next to each of these monitoring wells were not capable of completely extracting all of the NAPL due to the heterogeneity of the fractured bedrock formation. Therefore, these monitoring wells were converted to temporary SVE wells to remove residual NAPL.

Given the NAPL extraction progress in the South and Miscellaneous NAPL Areas, preliminary equilibrium soil vapor sampling was performed on April 24, 2000, in order to compare the benzene and xylene concentrations with the equilibrium soil vapor target concentration levels specified in the Feasibility Report Supplement (April 1992). These equilibrium target concentration levels are estimated VOC levels in residual NAPL that may safely remain in the subsurface without significant risk of further groundwater contamination above the MCLs. Sampling results, included in Attachment 3, are summarized in Table 10.

Table 10: Soil Vapor Equilibrium Concentration Sampling Results

NAPL AREA	Pre-Remediation Estimated NAPL Volume (Gallons)	# of SVE Wells	Benzene SV Concentration, (ppmv)		Xylene SV Concentration, (ppmv)	
			Target Level	Sampling Results	Target Level	Sampling Results
South NAPL Area (F & G Sandstone Units)	29,700	36	25.0	5.0	390.0	14.8
Miscellaneous NAPL Area (F&G Sandstone Units)	800	10(1)	25.0	8.9	390.0	11.1
Miscellaneous NAPL Area (E Sandstone Unit)	1,640	4(1)	2.5	5.7	39.0	6.5

Note: (1) including the nearby monitoring well converted to temporary remediation well

The equilibrium sampling results for F and G Sandstone Unit wells in South and Miscellaneous NAPL Areas show the benzene and xylene concentrations below the appropriate target levels determined in the Feasibility Report Supplement. The flow-weighted average benzene equilibrium soil vapor concentrations for the three E Sandstone Unit Miscellaneous NAPL Area wells is above the target level, due to elevated concentration in only one well, RW-East. The soil vapor concentrations at the other two E-Sandstone wells, RW-31E and RW-GAS, are below the target level. Due to the complexity and heterogeneity of the fractured bedrock formation, target level attainment in this isolated RW-East well area may not be technically practicable. However, this equilibrium soil vapor target level comparison is based on preliminary testing. A final equilibrium soil vapor testing should be performed at the end of this year to determine the status of NAPL extraction. A Phase I Subsurface Remediation performance standard based on System operational data analysis was specified in the Phase I Subsurface RD Report. Extensive System and operational modifications were implemented during O&M activities, as described in Section IV.C.3, to maintain or enhance efficient SVE recovery. These modifications helped sustain and improve SVE mass recoveries. However, practical modifications have been exhausted and the recent declines, as shown in Figure 6, indicate that the recoveries are beginning to approach asymptotic limits and are not as efficient.

Based on the progress determined from monitoring well NAPL thickness level measurements, SVE mass recovery rate performance, and operational analysis of the System following past practical and reasonable operational modifications, most of the available NAPL from the North & South NAPL Area and from the Miscellaneous NAPL Areas has been removed. Further extraction of the residual NAPL, absorbed in the bedrock formation, will be inefficient due to extensive heterogeneity and low permeability of the fractured bedrock matrix. Furthermore, based on the preliminary equilibrium soil vapor sampling results, the majority of the volatile fraction of the NAPL that would cause groundwater contamination above the MCLs has been extracted. The residual NAPL remaining in the subsurface appears to be fairly immobile as it is absorbed into a very low permeability bedrock formation; however, the partitioning of the NAPL into groundwater will still occur over time.

D1.2 Groundwater Containment at Leading Edge Plume

A time trend plot of benzene concentrations in leading edge plume wells is provided in Figure 7. The benzene concentrations in wells MW-27S and MW-10S appeared to increase prior to the start of remedial action. It was suspected that the increase in benzene concentrations in these two wells was due either to contaminant migration toward the wells by well purging during sampling or to natural plume migration. Wells MW-38ER and MW-37E were installed during the Remedial Design to define the limits of the benzene plume. Five leading edge plume monitoring wells (MW-27S, MW-10S, MW-34E, MW-38ER and MW-37E) are sampled quarterly to determine whether the benzene plume was migrating. Furthermore, a micro-purge sampling program was adopted for the quarterly sampling program during 1995 to minimize the influence of well purging on contaminant migration in the fractured formation.

The groundwater pumping in the North NAPL Area was included in the Phase I Subsurface Remediation to control the migration of the leading edge plume. As indicated in Figure 7, benzene concentrations have declined significantly in wells MW-27S, MW-10S, and MW-38ER since the start of the remedial action. Benzene concentrations in wells MW-34E and MW-37E have remained at or below the detection limits. The leading edge plume containment component of the Phase I remedy has more than exceeded its specified objective. The benzene concentrations in the leading edge of the plume have declined below the MCLs in all of the groundwater monitoring wells.

Figure 7

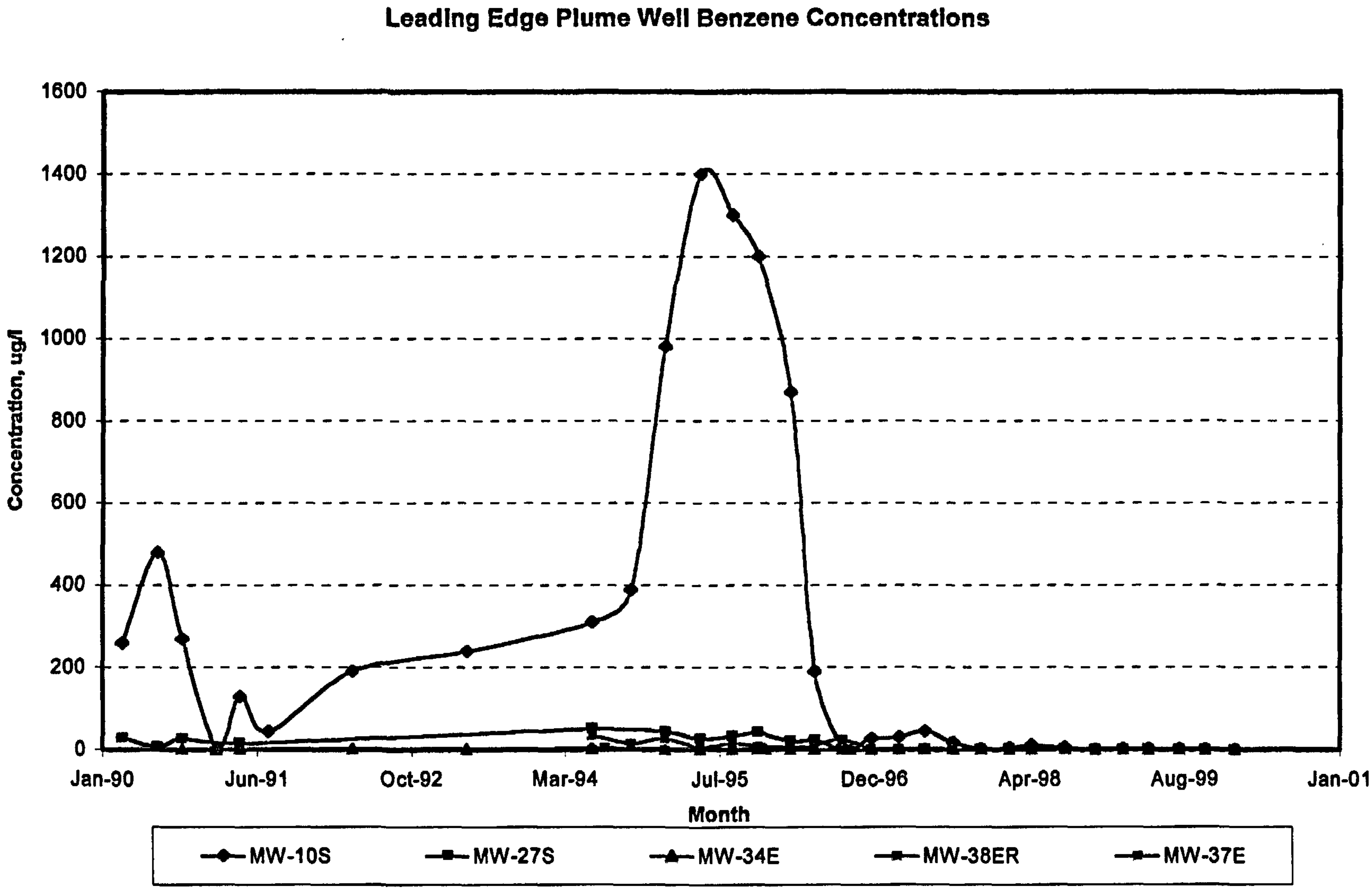

Leading Edge Plume Well Benzene Concentrations
Concentration, ug/l
1600
1400
1200
1000
800
600
400
200
0
Jan-90
Jun-91
Oct-92
Mar-94
Jul-95
Dec-96
Apr-98
Aug-99
Jan-01
Month
MW-10S
MW-27S
MW-34E
MW-38ER
MW-37E

Table 11 summarizes the current benzene concentration monitoring results at leading edge plume wells. The quarterly benzene monitoring result summary for each well is included in Attachment 3.

Table 11: Leading Edge Plume Well Benzene Monitoring Results

Sampling Period	Benzene Concentrations in Leading Edge Plume Wells				
	MW-10S (mg/l)	MW-27S (mg/l)	MW-34E (mg/l)	MW-38ER (mg/l)	MW-37E (mg/l)
Pre-Remedial Action 1995 Quarterly Average	1.220	0.037	0.0005 U	0.015	0.0005 U
Current February 2000	0.0012	0.0002 U	0.0002 U	0.0002 U	0.0002 U

U indicates that the compound was not detected at the method detection limit.

Groundwater draw down resulting from pumping in the North NAPL Area during Phase I Subsurface Remediation was not projected to capture the leading edge plume in the E Sandstone in the vicinity of leading edge plume monitoring wells located to the northeast of the North NAPL Area. However, after start-up of the Phase I groundwater pumping in the North NAPL Area, drawdown influences were observed in wells MW-10S, MW-38ER, and MW-27S. In the year 2000 annual monitoring, the water levels had recovered in wells MW-10S and MW-38ER, perhaps due to recharge from the shallow injection system. The observation that the benzene levels in these wells continue to remain at concentrations below the MCLs following recovery of the water levels, indicates the effectiveness of the leading edge plume containment component of the Phase I remedy to control the migration of the leading edge of the plume.

D.1.3 Groundwater Remediation

In addition to the NAPL extraction, the Phase I Subsurface Remediation system was designed and constructed to provide substantial groundwater remediation consistent with the groundwater pumping, treatment, and reinjection remedy selected in the ROD. The volume of groundwater extracted/treated, weighted average BTEX concentrations, and dissolved BTEX mass removed from the NAPL source areas based on the monitoring data during the O&M are included in Attachment 3, and are summarized in Table 12.

Groundwater potentiometric maps of the E Sandstone for 1996, 1998, 1999, and 2000 are presented in Attachment 4. These maps provide a graphical representation of the potentiometric groundwater level, as well as a baseline comparison to 1994 levels.

Table 12: Groundwater Extraction and Concentration Data for NAPL Source Areas

	North NAPL Area (E Sandstone Unit)	South NAPL Area (F&G Sandstone Units)	Miscellaneous NAPL Areas [1] (E, F and G Sandstone Units)	Total
Volume of Water Pumped and Treated (gallons)	1,720,448	290,351	677,486	2,688,285
Average Pumping Rate (gpm)	0.75	0.13	0.29	1.17
Average Benzene Concentration, mg/l	2.610	3.240	3.240	--
Average Toluene Concentration, mg/l	3.110	5.620	5.620	--
Average Ethylbenzene Concentration, mg/l	0.520	0.680	0.680	--
Average Xylenes Concentration, mg/l	3.232	4.790	4.790	--
BTEX Mass Removed (lbs)	135.9	34.7	80.9	251.5

Note: (1) Five F&G Sandstone Unit NAPL Areas and three E Sandstone Unit NAPL Areas

The groundwater is treated using an air stripping system and filtered through 5-micron bag filters prior to discharge to the Shallow Injection System. The monthly sampling results of the stripper effluent indicate that the air stripper is efficient in removing all of the BTEX and naphthalenes to well below the discharge limit. Therefore, further treatment of the discharge water with Granular Activated Carbon (GAC) was suspended, as approved by the EPA in January 1997. However, one GAC unit is maintained as standby, if needed in the future. A total of 2,112,466 gallons of treated water was either discharged to the shallow injection system or re-injected with NIS operations. The total treated water discharged and injected is less than the total groundwater extracted because of evaporative loss of water during the air stripping treatment. A monthly monitoring data summary of contaminant concentrations in extracted groundwater and treated water discharged is included in Attachment 3. Table 13 presents an overall summary of major contaminant concentrations in extracted groundwater and treated water.

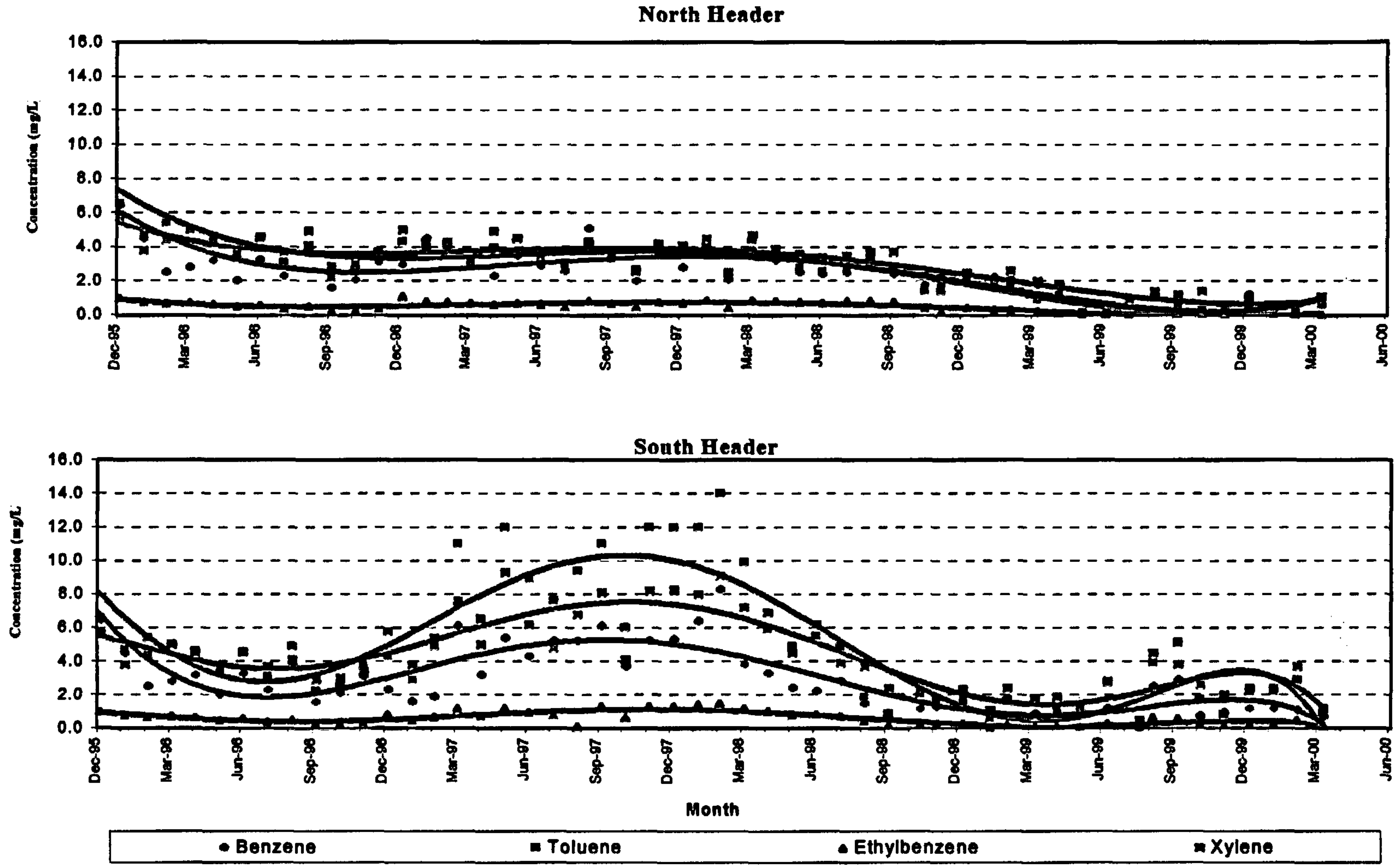
Table 13: Contaminant Concentration in Extracted Groundwater and Treated Water

Constituent	Air Stripper Influent (Extracted Groundwater)			Air Stripper Effluent (Treated Groundwater) Concentration		Treatment/ Discharge Limit	ROD Cleanup Level
	Dec 95 (Pre-Remedial	Weighted Average	Apr 00 (Current)	Maximum	Mean (Std Dev)		
Benzene (mg/l)	9.6	2.9	0.66	0.0075	0.0006 (0.0012)	0.010	0.005
Toluene (mg/l)	11.0	4.0	0.66	0.0051	0.0019 (0.0041)	0.750	0.700
Ethylbenzene (mg/l)	1.10	0.58	0.08	0.0055	0.0016 (0.0026)	0.750	0.750
Xylenes (mg/l)	6.10	3.8	1.12	0.049	0.0083 (0.0086)	0.620	0.620
1,2-DCA (mg/l)	<0.005	<0.005 (1)	(1)	<0.050	<0.050	0.010	0.005
Naphthalenes (mg/l)	2.02(2)	0.42	<0.023(3)	<0.020	<0.020	0.030	N/A
Lead (mg/l)	<0.02(4)	--	--	0.031	.013 (0.0092)	0.050	0.015

Note: (1) 1,2-DCA monitoring was discontinued after EPA approval in February 1997 because it was never detected in groundwater headers flow in twelve monthly samples.
(2) Highest concentration measured in March 1996 groundwater headers sample
(3) Discontinued naphthalenes monitoring in groundwater headers in July 1997 because naphthalenes were less than detection limit in the stripper effluent
(4) January 1996 sampling results for combined North & South Header sample.

The concentrations of BTEX, total lead, and naphthalenes in monthly samples (original and the sample duplicate) of the treated water discharge continue to meet the effluent limits. Monthly monitoring of BTEX concentrations in the groundwater extracted from the NAPL source areas was also performed to provide an indication of the progress of groundwater remediation in the NAPL source areas. BTEX concentrations from monthly monitoring of the North and South Groundwater Headers are plotted in Figure 8. These results show concentration reductions in extracted groundwater since start-up of the Phase I Subsurface Remediation in the North NAPL Area. However, the concentrations in the North NAPL Area have remained elevated above the ROD cleanup levels. The BTEX concentrations in the extracted groundwater in the South NAPL Area have remained essentially the same as start-up of the Phase I Subsurface Remediation, except periodic fluctuations from April 1997 to July 1998. The increase in South Header extracted groundwater during this period was due to the presence of NAPL in the header flow, resulting from the implementation of the System operating modification to improve NAPL recovery.

Figure 8



Groundwater Headers BTEX Concentration Trend

Likewise, the periodic fluctuations are also due to the presence of free NAPL in the header flow from flushing of the header piping

Semi-annual groundwater monitoring is performed to provide an indication of groundwater remediation progress. Time series plots for BTEX concentrations in the semi-annual monitoring wells, provided in Attachment 3, show a decline in the BTEX concentrations in most of the E Sandstone Unit wells, except a slight increase in two E Sandstone Unit wells (MW-24S and N-10P). Nevertheless, no overall trend for E Sandstone Unit source areas is observed.

Ineffectiveness of the groundwater extraction and treatment remedy to improve groundwater concentrations at the Site is attributed to the heterogeneity and very low hydraulic conductivity of the fractured bedrock formation. The lack of progress in groundwater remediation by pumping and treating, and air sparging in the North NAPL Area is due largely to the technical limitations in remediating NAPL-impacted groundwater, especially in heterogeneous fractured rock as occurs at the Site. The slow groundwater remediation progress at the Site is further exacerbated by the low permeability of the Sandstone units and the long time interval that NAPL has been present in the subsurface and the extremely slow rate of desorption of contaminants from the formation matrix to water. Figures 9 and 10 show average groundwater extraction rates from the inception of the remedy (December 1995) to present (April 2000).

The data show very low groundwater pumping rates, even though the groundwater is pumped with vacuum of over 15" Hg applied to the remediation wells, because the groundwater extraction is performed in conjunction with the SVE. The low rates are due to very poor hydraulic conductivity of the formation. The very wide range of pumping rates indicate significant heterogeneity of the fractured bedrock formation at the Site, as the average distance between remediation wells is only about 10 to 15 feet within well fields. Figure 11 shows the SVE flow and groundwater extraction rates for the North NAPL Area remediation wells. This figure not only shows significant horizontal heterogeneity, but also demonstrates significant vertical heterogeneity with depth based on the relative rates of groundwater and SVE flow at each well.

A volume of contaminated groundwater within the E Sandstone Unit was determined in the FS Report (1992) based upon the delineation of the 5 ppb benzene contour in this unit and a porosity of 22% as determined in the laboratory from rock cores. Based on these calculations, approximately 12 million gallons of contaminated groundwater occur within the E Sandstone Unit in the vicinity of the North NAPL Area (excluding the leading edge plume and the relevant miscellaneous NAPL area well locations). Groundwater recovery by vacuum enhanced pumping from the North NAPL Area average about 0.75 gpm. Assuming the extraction rate could be sustained, it would take over 35 years to extract approximately one pore volume of 12 million gallons of contaminated groundwater.

Figure 9

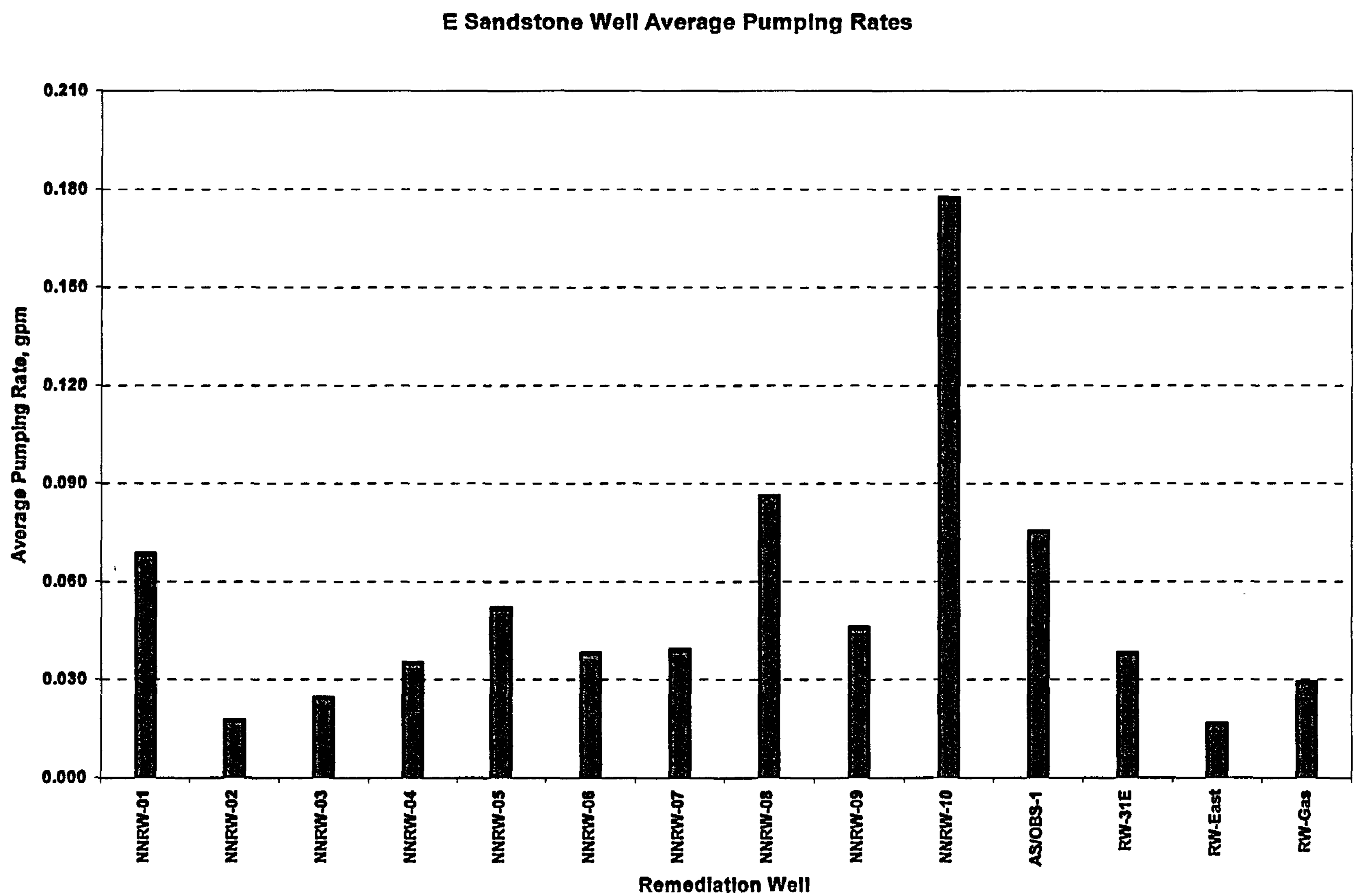

E Sandstone Well Average Pumping Rates
Average Pumping Rate, gpm
0.210
0.180
0.150
0.120
0.090
0.060
0.030
0.000
NNRW-01
NNRW-02
NNRW-03
NNRW-04
NNRW-05
NNRW-06
NNRW-07
NNRW-08
NNRW-09
NNRW-10
AS/OBS-1
RW-31E
RW-East
RW-Gas
Remediation Well

Figure 10

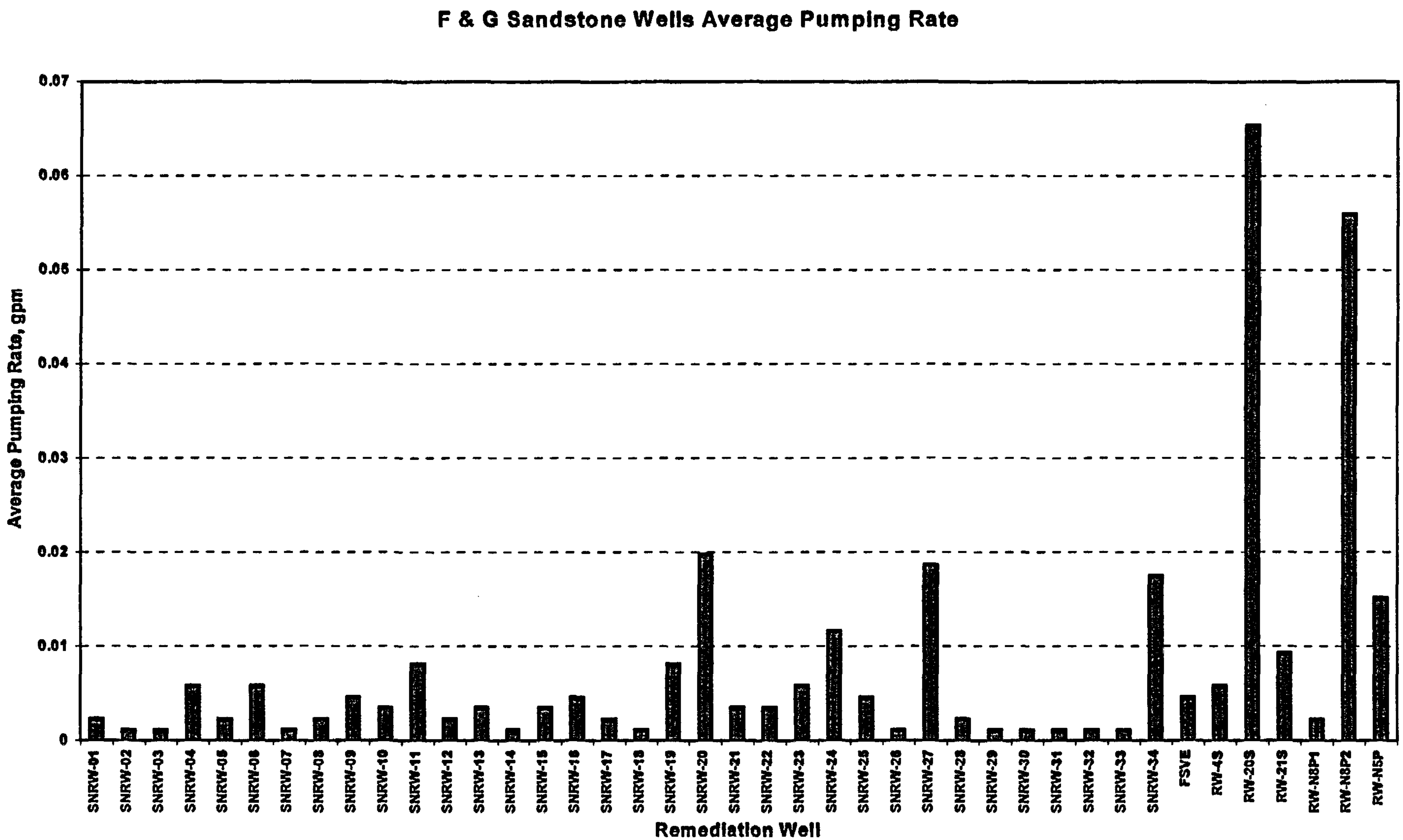
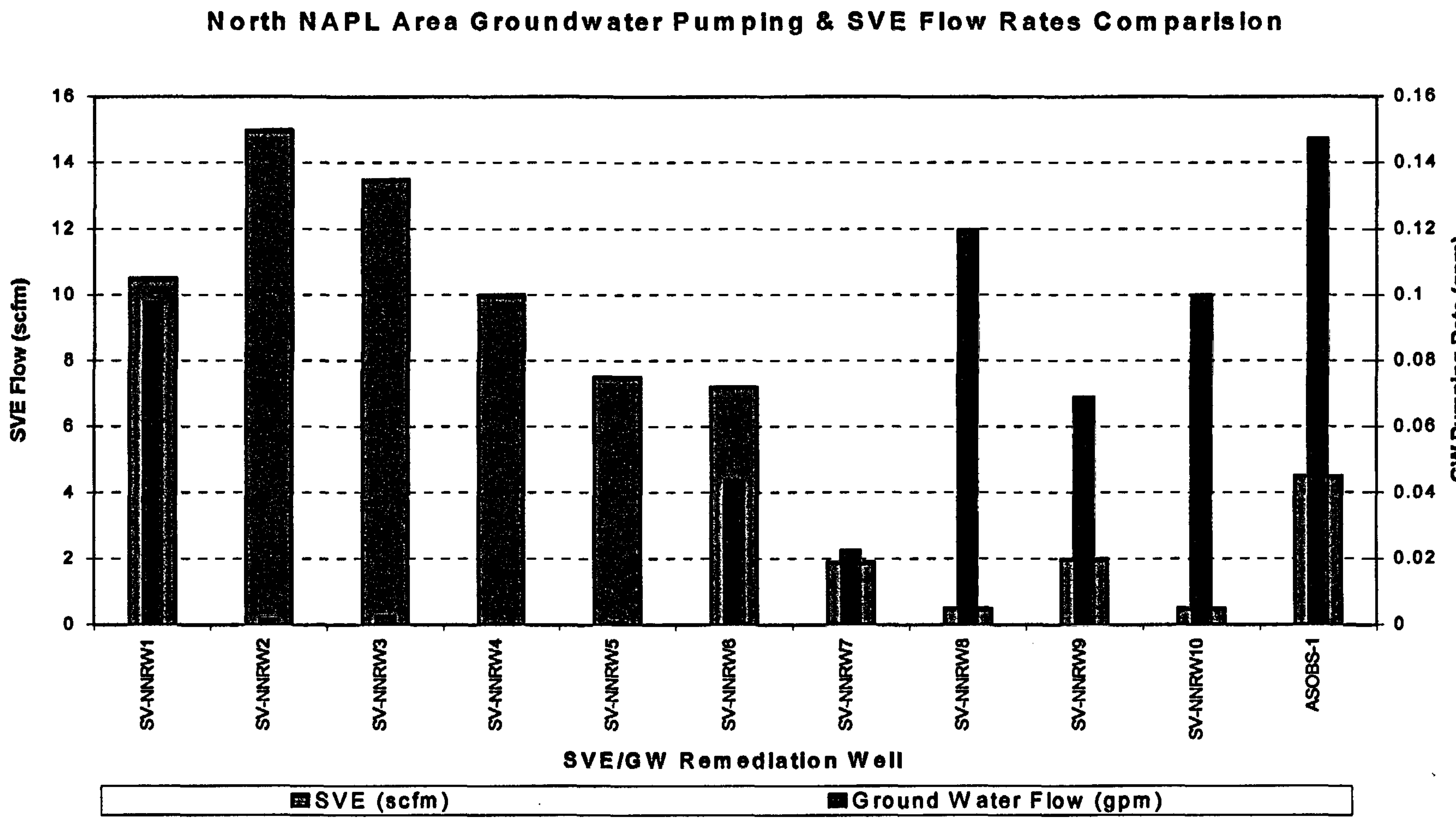

F & G Sandstone Wells Average Pumping Rate
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
Average Pumping Rate, gpm
SNRW-01
SNRW-02
SNRW-03
SNRW-04
SNRW-05
SNRW-06
SNRW-07
SNRW-08
SNRW-09
SNRW-10
SNRW-11
SNRW-12
SNRW-13
SNRW-14
SNRW-15
SNRW-16
SNRW-17
SNRW-18
SNRW-19
SNRW-20
SNRW-21
SNRW-22
SNRW-23
SNRW-24
SNRW-25
SNRW-26
SNRW-27
SNRW-28
SNRW-29
SNRW-30
SNRW-31
SNRW-32
SNRW-33
SNRW-34
FSVE
RW-4S
RW-20S
RW-21S
RW-N8P1
RW-N8P2
RW-N5P
Remediation Well

Figure 11


North NAPL Area Groundwater Pumping & SVE Flow Rates Comparision
SVE Flow (scfm)
GW Pumping Rate (gpm)
16
14
12
10
8
6
4
2
0
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
SV-NNRW1
SV-NNRW2
SV-NNRW3
SV-NNRW4
SV-NNRW5
SV-NNRW6
SV-NNRW7
SV-NNRW8
SV-NNRW9
SV-NNRW10
ASOBS-1
SVE/GW Remediation Well
SVE (scfm)
Ground Water Flow (gpm)

Furthermore, organic constituents that have adsorbed in the rock matrix and diffused from the fractures into the rock will significantly increase the number of pore volumes and time required to flush contaminants from the NAPL-impacted rock formations. Heterogeneity in the fractured rock formations further decreases groundwater-flushing efficiency. Nevertheless, the dissolved BTEX mass recovery rate resulting from groundwater extraction in North NAPL Area has declined, as summarized in Attachment 3, and shown in Figure 12, to the current (April 2000) rate estimated at 0.02 lbs/day. The decline is due to removal of NAPL, flushing of some of the fractures, and some dilution with nutrient injected water. The lack of improvement in the North NAPL Area is due to the very low dissolved BTEX mass recovery rate of 0.02 lbs/day and the estimated 1200 pounds of BTEX dissolved in North NAPL Area E Sandstone Unit groundwater, not including the BTEX adsorbed in the formation matrix. Therefore, groundwater flushing will be somewhat inefficient for achieving the groundwater remediation goals.

The FS Report (1992) determined that approximately 16 million gallons of contaminated perched groundwater occurred within the F Sandstone Unit based on the delineation of the 5 ppb benzene contour and a porosity of 25%. As shown in Table 12, the total average groundwater-pumping rate, enhanced with applied vacuum of over 15" Hg, from 35 South NAPL Area F Sandstone Unit wells is 0.13 gpm. Assuming this groundwater extraction rate could be sustained, it would take over 200 years to extract the estimated 16 million gallons of groundwater. Groundwater does not move through the sandstone uniformly. Considerably more time would be required to remove one pore volume from some of the bedrock formation and less time for other portions of the bedrock formation. Furthermore, organic constituents, which have sorbed in the rock matrix and diffused from the fractures into the rock, will significantly increase the significant number of pore volumes and the time required to flush contaminants from the NAPL-impacted rock formations.

The dissolved BTEX mass recovery rate resulting from groundwater extraction is declining, as summarized in Attachment 3, and shown in Figure 13, with the current (April 2000) rate estimated at 0.02lbs/day. This dissolved BTEX mass recovery rate is inefficient for groundwater remediation considering that there is an estimated 37,000 pounds of BTEX dissolved in North NAPL Area E Sandstone Unit groundwater, which does not include the BTEX adsorbed in the formation matrix.

Based on groundwater pumping data for more than four years, the F & G Sandstone perched Units at the Site yield only a total of 0.13 gpm, or approximately 190 gallons per day, from continuously pumping 35 wells with applied vacuum of over 15" Hg. This equates to a pumping yield rate of about 0.004 gpm per well, or about five gallons per day per well from continuous pumping. Moreover, the groundwater pumping yield without applied vacuum will probably be significantly less.

Figure 12

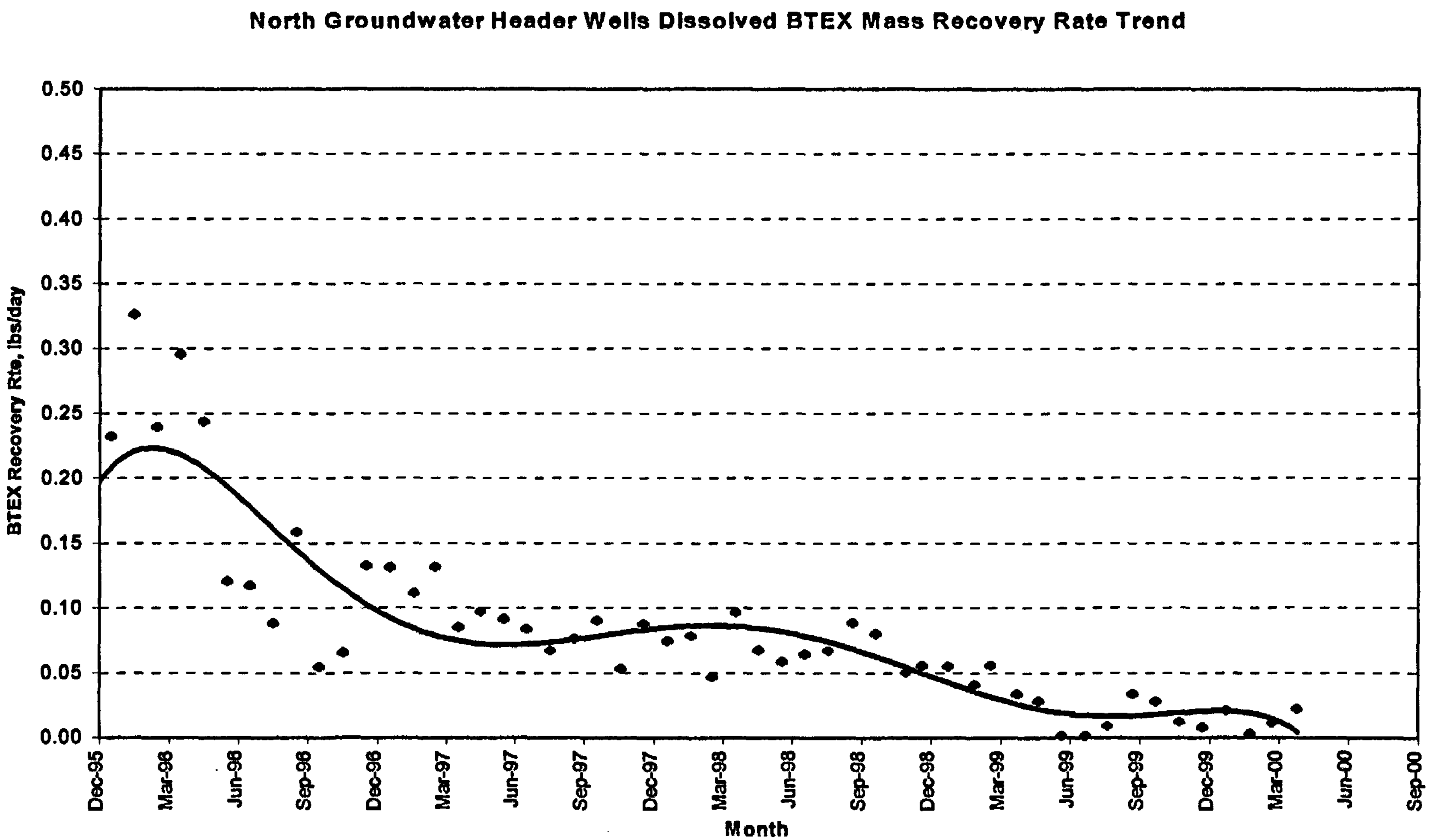
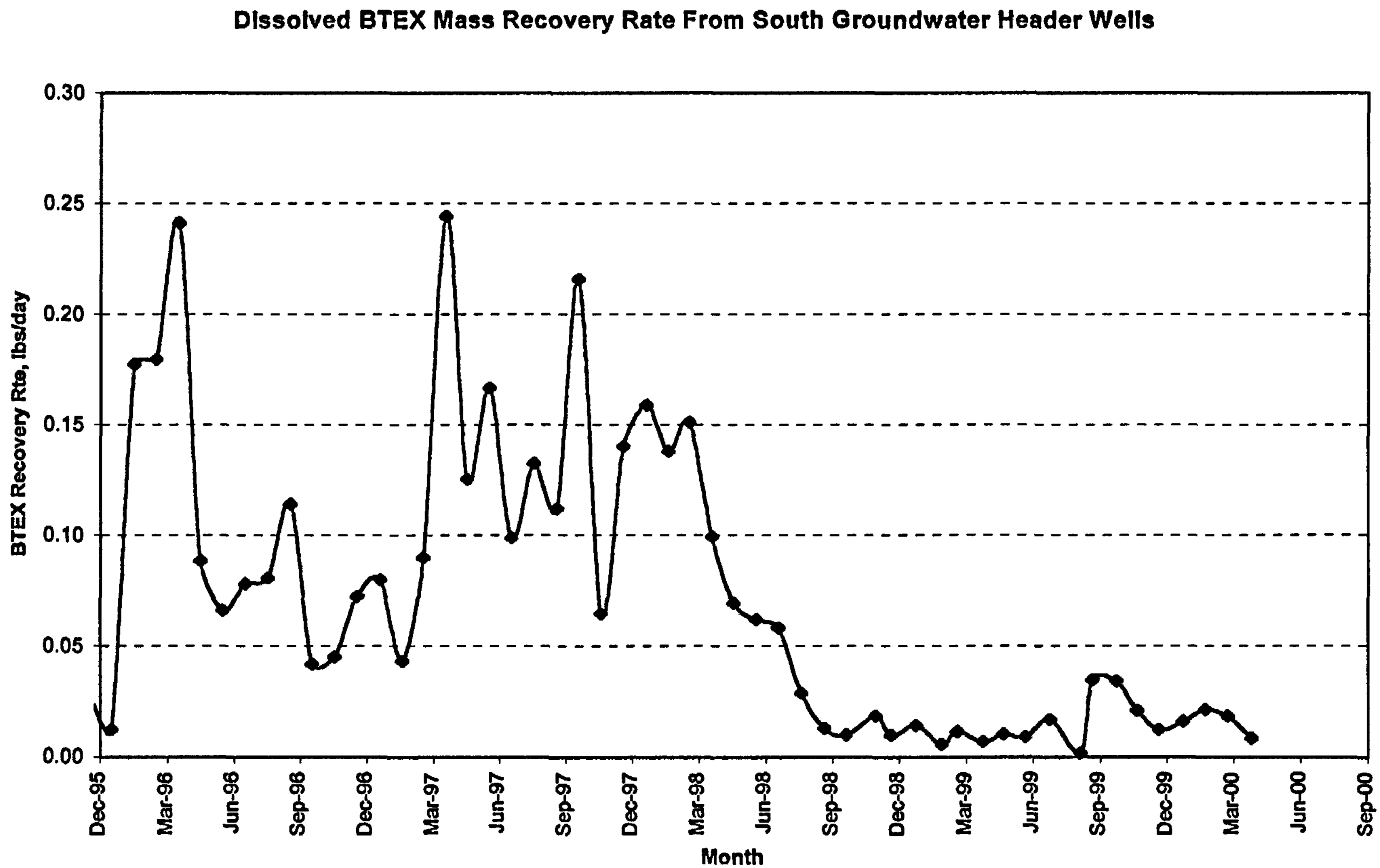

North Groundwater Header Wells Dissolved BTEX Mass Recovery Rate Trend
BTEX Recovery Rte, lbs/day
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
Dec-95
Mar-96
Jun-96
Sep-96
Dec-96
Mar-97
Jun-97
Sep-97
Dec-97
Mar-98
Jun-98
Sep-98
Dec-98
Mar-99
Jun-99
Sep-99
Dec-99
Mar-00
Jun-00
Sep-00
Month

Figure 13


Dissolved BTEX Mass Recovery Rate From South Groundwater Header Wells
BTEX Recovery Rte, lbs/day
0.30
0.25
0.20
0.15
0.10
0.05
0.00
Dec-95
Mar-96
Jun-96
Sep-96
Dec-96
Mar-97
Jun-97
Sep-97
Dec-97
Mar-98
Jun-98
Sep-98
Dec-98
Mar-99
Jun-99
Sep-99
Dec-99
Mar-00
Jun-00
Sep-00
Month

Phase II Subsurface Remediation

Because the North NAPL Area (E Sandstone Unit) Phase I Subsurface Remediation performance standards were attained in December 1997, and the groundwater extraction and treatment was not efficient in improving groundwater concentrations, a Phase II Subsurface Remediation Plan for the E Sandstone Unit, consisting of batch injection of nutrient to enhance in situ biodegradation of BTEX in groundwater was prepared. The EPA approved the Plan on July 22, 1998. The Phase II Subsurface Remedy construction was completed, and the O&M activities started in September 1998 as discussed in Section IV.D. Table 14 summarizes the nutrient injection activities:

Table 14: Nutrient Injection Summary

		Nutrient Injection			Fresh Water Injected Gallons	Amount of Nutrients Injected, lbs		
Injection Well	# of NI Cycles	Max. Pressure, psi	Avg. Flow Rate, gpm	Total Volume, Gallons		NO_3-N	NH_3-N	PO_4-P
AS/NI – 1	36	10.0	0.61	18,995	2,840	0.855	5.286	3.919
AS/NI – 2	23	15.0	0.26	10,534	1,537	0.503	2.924	2.153
AS/NI – 3	36	10.0	0.83	19,171	2,845	0.855	5.286	3.919
MW-2S	19	15.0	0.06	5,732	822	0.290	1.599	1.174
MW-6S	33	15.0	0.37	15,697	2,313	0.718	4.319	3.234
MW-7S	30	15.0	0.32	15,232	2,155	0.698	4.176	3.132
MW-24S	2	15.0	0.08	444	70	0.018	0.126	0.089
N-10P	2	15.0	0.06	335	70	0.006	0.043	0.030
TOTAL	181	15	0.30	86,140	12,652	3.942	23.758	17.649

A review of nutrient injection operation data indicates that the formation injection acceptance rates are fairly low. These poor acceptance rates are attributed to very low and heterogeneous permeability of the fractured bedrock formations. Moreover, the nutrient injection rates have declined over time as shown in Figure 14.

A review of the North NAPL Area Groundwater Header (11 extraction wells combined) monitoring data, included in Attachment 3, and summarized in Table 15, show a reduction in BTEX concentrations following implementation of Phase II nutrient injection activities in September 1998.

Figure 14

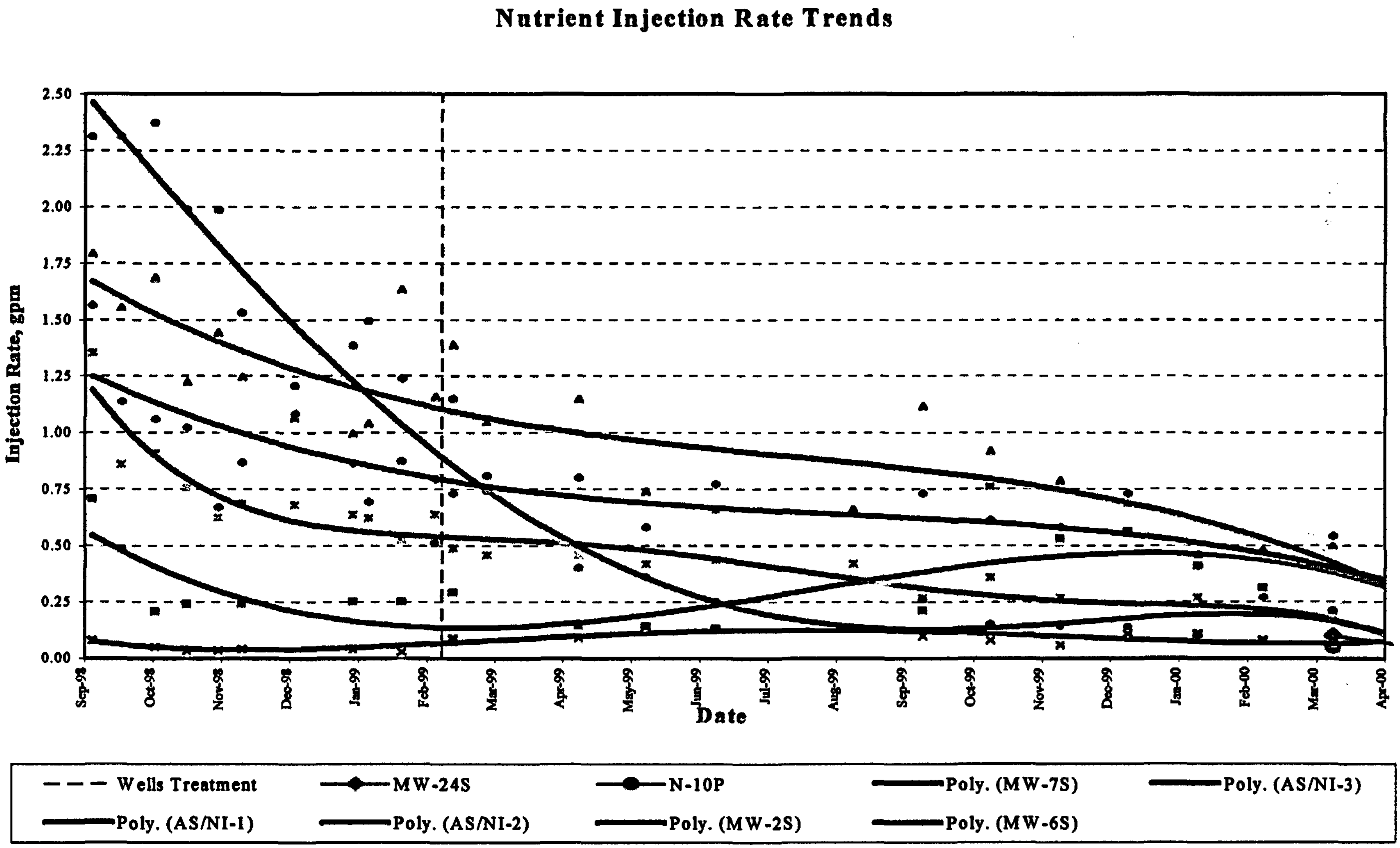

Nutrient Injection Rate Trends
Injection Rate, gpm
2.50
2.25
2.00
1.75
1.50
1.25
1.00
0.75
0.50
0.25
0.00
Sep-98
Oct-98
Nov-98
Dec-98
Jan-99
Feb-99
Mar-99
Apr-99
May-99
Jun-99
Jul-99
Aug-99
Sep-99
Oct-99
Nov-99
Dec-99
Jan-00
Feb-00
Mar-00
Apr-00
Date
Wells Treatment
MW-24S
N-10P
Poly. (MW-7S)
Poly. (AS/NI-3)
Poly. (AS/NI-1)
Poly. (AS/NI-2)
Poly. (MW-2S)
Poly. (MW-6S)

Table 15: North NAPL Area Groundwater Concentrations Summary

Constituent	Pre Phase II (September 1998) North Groundwater Header Concentration	Current (April 2000) North Groundwater Header Concentration	ROD Cleanup Level
Benzene, mg/l	3.300	0.640	0.005
Toluene, mg/l	3.100	0.590	0.750
Ethylbenzene, mg/l	0.830	0.058	0.700
Xylenes, mg/l	3.700	1.100	0.620
Total BTEX, mg/l	10.930	2.388	—

The above data indicate an overall decline in BTEX concentration since the Phase II Subsurface Remediation implementation, although, there is a considerable fluctuation in the BTEX concentrations as shown in Figure 8. The nutrient injection activities appear to improve the groundwater BTEX concentrations; however, part of the reduction may be due to dilution by nutrient and fresh water injection. Furthermore, Figure 8 shows that the BTEX concentrations have approached asymptotic levels for nearly a year.

D.1.4 Institutional Control & Residential Well Monitoring

The remedy includes the following institutional controls, which are being implemented, and maintained:

1. Institutional control to eliminate installation of water supply wells on-site.

2. The ROD required installation of water treatment units (activated carbon treatment) on existing domestic wells that exceed MCLs. Nevertheless, the treatment units were installed on all five nearby residential wells, even though none of them exceeded the MCLs at that time.

3. Quarterly sampling of residential wells at the point of consumption. A quarterly sampling of residential well water prior to the treatment units, and after the treatment unit is performed at all wells.

4. The carbon treatment units are serviced quarterly by a local Culligan vendor.

At the start of the remedial actions, five nearby houses were occupied. The three closest houses have been vacated since then. Two of these houses were demolished, and the third vacated house, at the former Willcox property, is used as an office by the PRPs. Currently, only two houses are occupied. Analytical results of the quarterly sampling were reported in appropriate monthly reports. The data show that BTEX concentrations in filtered (treated) water were below the detection limits. The BTEX concentrations were also below the detection limits in pre-filtered water from all residential wells, except the Willcox well, which is no longer a residential well. Benzene in the pre-filtered sample from the Willcox well was first detected at concentrations above the MCL in the groundwater sample from April 22, 1998. Since then, BTEX analysis of pre-filtered samples from this well has been performed monthly to verify the presence of benzene in the well water and to track any changes in BTEX concentrations over time.

The source of the benzene in the Willcox well appears to be from contaminant migration through the unsealed annular space in the old well at the property. Even though the old well was overdrilled and properly closed in 1992, BTEX constituents have apparently migrated into lower units of the Sonsela Aquifer through the annular space during the time that the old well was in place. A plot of the monthly BTEX monitoring results for the pre-filtered samples in the Willcox well is presented as Figure 15, and shows historic fluctuations in benzene concentrations in this well.

Air Monitoring

Monitoring of the vapor phase GAC canister (Vapor Scrub) outlet for organic vapor emissions was performed semi-monthly. The monitoring data summary is included in Attachment 3. The air at the Site perimeter was monitored at the same time. The reading at the South boundary fence was used to represent background. Results, which are summarized in Table 16, were provided in monthly progress reports.

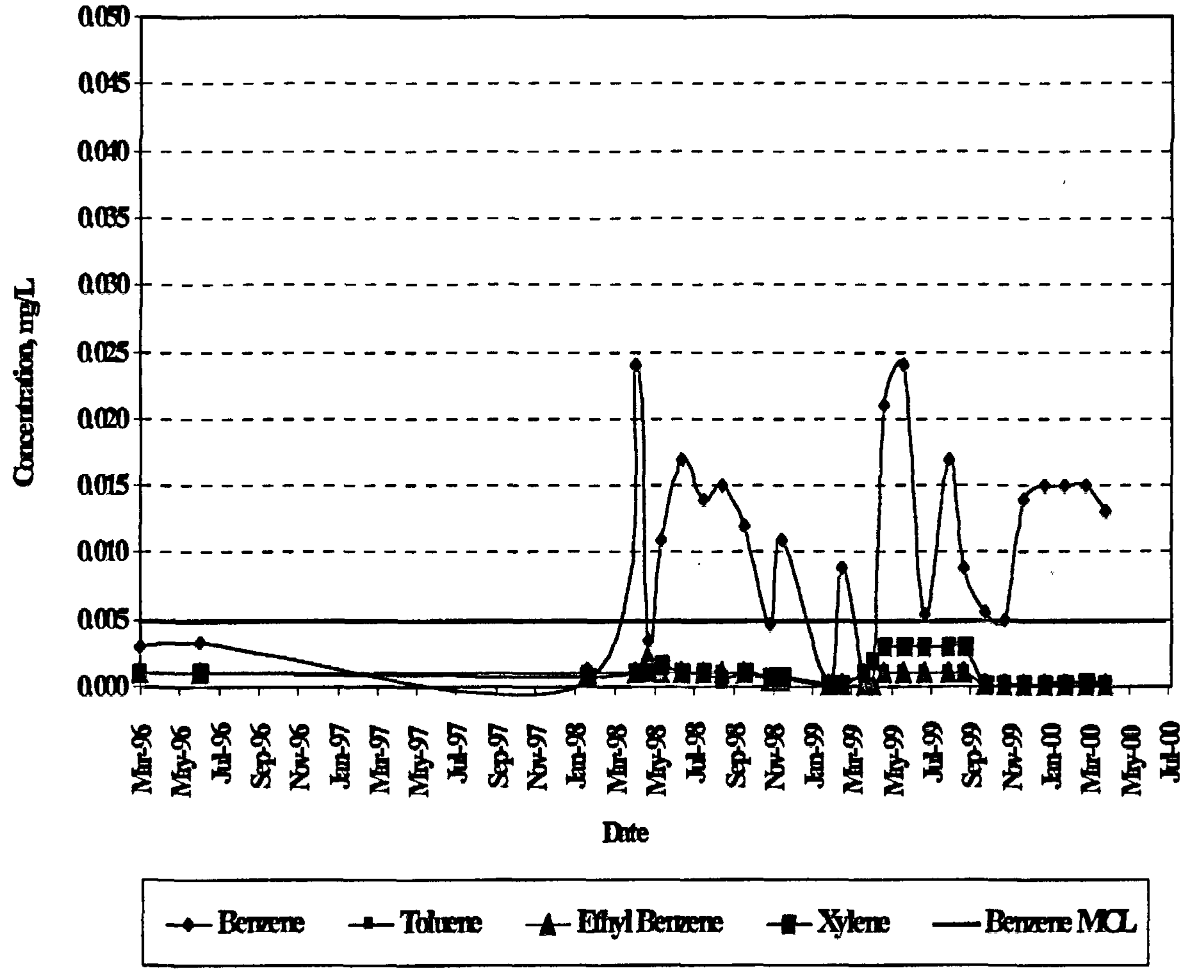
Table 16: Site Boundary Organic Vapor Concentration Monitoring Results Summary

Area	Maximum Measured Organic Vapor Concentration	Mean Organic Vapor Concentration (Std Dev)
Background	1.0 ppm	0.5 ppm (0.2)
Vent Scrub	1.4 ppm	0.6 ppm (0.2)
Inside Treatment Plant	0.9 ppm	0.7 ppm (0.1)
Treatment Plant Area Downwind Boundary	1.3 ppm	0.6 ppm (0.2)

Figure 15

Willcox Well Sampling Results				
	Benzene	Toluene	Ethyl Benzene	Xylene
Apr-96	0.0030	0.001	0.001	0.001
Jul-96	0.0033	0.001	0.001	0.001
Feb-98	0.0005	0.001	0.001	0.00078
Apr-98	0.0240	0.001	0.001	0.001
May-98	0.0034	0.001	0.0022	0.001
Jun-98	0.0110	0.001	0.001	0.0017
Jul-98	0.0170	0.001	0.001	0.001
Aug-98	0.0140	0.001	0.001	0.001
Sep-98	0.0150	0.001	0.0011	0.00063
Oct-98	0.0120	0.001	0.001	0.001
Nov-98	0.0047	0.0004	0.0004	0.0008
Dec-98	0.0110	0.0004	0.0004	0.0008
Feb-99	0.0003	0.0002	0.0002	0.0002
Mar-99	0.0089	0.0002	0.0002	0.0002
Apr-99	0.0003	0.0002	0.0002	0.0011
Apr-99	0.0002	0.0002	0.0002	0.002
May-99	0.0210	0.001	0.001	0.003
Jun-99	0.0240	0.001	0.001	0.003
Jul-99	0.0054	0.001	0.001	0.003
Aug-99	0.0170	0.001	0.001	0.003
Sep-99	0.0088	0.001	0.001	0.003
Oct-99	0.0056	0.0002	0.0002	0.0002
Nov-99	0.0050	0.0002	0.0002	0.0002
Dec-99	0.0140	0.0002	0.0002	0.0002
Jan-00	0.0150	0.0002	0.0002	0.0002
Feb-00	0.0150	0.00023	0.0002	0.0002
Mar-00	0.0150	0.00023	0.0002	0.00037
Apr-00	0.0130	0.0002	0.0002	0.0002

BTEX Concentration vs Time in Willcox Well Pre-Filter Samples



The vent scrub and perimeter measurements are fairly similar to the background measurements. Furthermore, the low standard deviation of semi-monthly measurements indicates minimal fluctuations in the organic vapor levels. Also, there is no upward trend in measured concentrations, which indicate no breakthrough of organic vapors through the vent scrub system.

VII. Assessment

The following conclusions support the determination that the remedy at the Prewitt Site is protective of human health and the environment:

- **HASP/Contingency Plan**: Both the EPA-approved Health and Safety Plan and the Contingency Plan are in place. These plans have been properly implemented, and are sufficient to control risks.

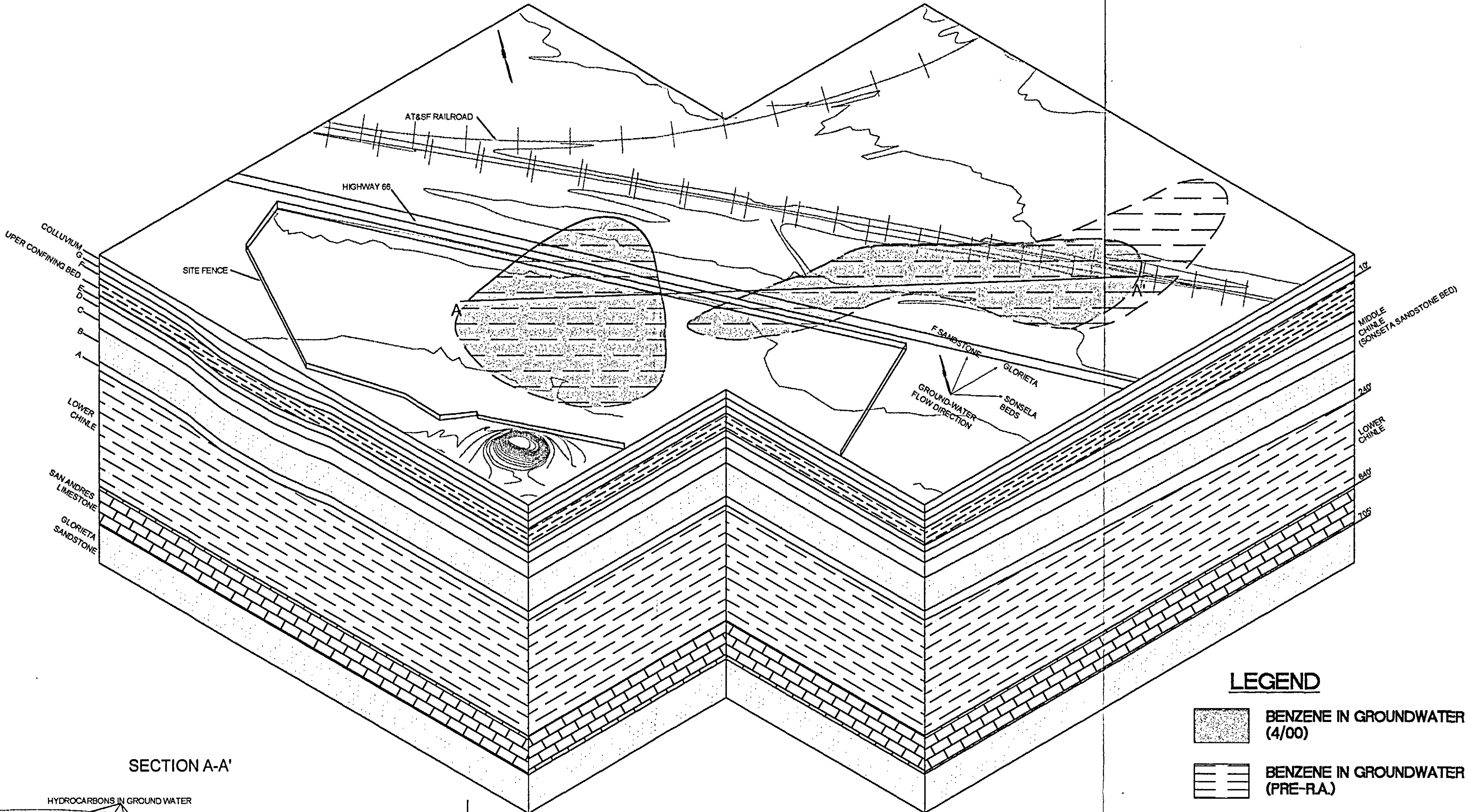
- **Implementation of Institutional Controls and Other Measures:** Institutional controls, consisting of controls to eliminate installation of water supply wells on-site, installation of water treatment units at nearby residential wells, and monitoring of the residential wells were implemented and are being maintained. As discussed in Section VI D.1.4, BTEX and nitrate-nitrogen concentrations in both filtered (GAC treated) and unfiltered water samples from residential wells continue to meet all MCLs except for benzene concentrations in the pre-filtered Willcox well samples. The source of the benzene in this well appears to have come from migration of BTEX constituents from the E Sandstone unit into deeper units of the Sonsela through the unsealed annular space around the casing of the old residential well at the Willcox Property.

  The old residential well at the Willcox residence was over-drilled and properly closed in 1992 and replaced with a new well. Although removal of this pathway has eliminated the risk of further contamination of the deeper units of the Sonsela, low levels of benzene continue to persist in the deeper units of the Sonsela vicinity of the old well. However, monitoring of the new Willcox well, which has been performed monthly since April 22, 1998, show benzene concentrations varying from less than 0.0002 mg/L to as high as 0.024 mg/L with no upward trend. These results support the interpretation of residual benzene contamination around an unsealed well casing that has since been removed as a pathway for benzene migration. The replacement Willcox well is no longer used as a domestic supply well, but continues to be monitored on a monthly basis.

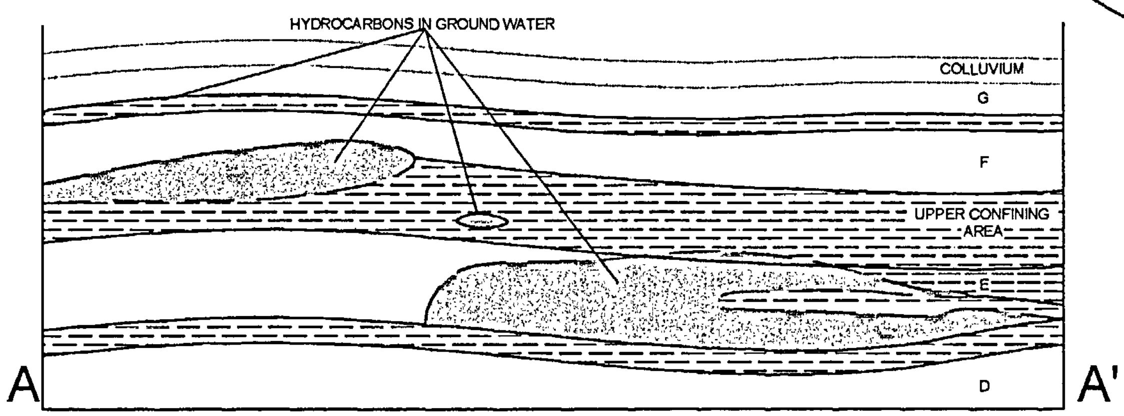
The fact that there are no current or planned changes in the land use at the Site suggest that the assumptions on which the institutional controls are based are sound. The remediation areas at the Site are fenced and secured to prevent unauthorized entry.

- **Remedial Action Performance:** The remedial actions have been effective at the Site. The surface remedial action, which addressed the lead-, asbestos-, and hydrocarbon-contaminated soils, the West Pits, and the Separator and its contents, was completed in accordance with the ROD requirement. EPA deleted the Surface portion of the Site from NPL in January 1998. The Site conceptual model shown in Figure 16 reflects completion of the surface remedial actions.

  The Phase I subsurface remediation system is effective in containing, extracting, and treating the contaminants. As discussed earlier, the leading edge plume containment component of the Phase I Subsurface Remedy has more than exceeded its specified objective. BTEX concentrations in the leading edge plume have declined below the MCLs, as depicted in the current site conceptual model shown in Figure 16. The liquid NAPL in the North NAPL Area was removed to less than measurable levels in the monitoring wells. Performance standards for NAPL extraction by SVE were attained in the North NAPL Area. NAPL thickness level measurements in the South and Miscellaneous NAPL Area monitoring wells indicate the liquid NAPL extraction is approaching completion, as shown in current site conceptual site model in Figure 16.



SECTION A-A'



Applied Hydrology Associates, Inc.

PREWITT REFINERY SITE
PREWITT, NEW MEXICO

FIGURE 16
CURRENT SITE CONCEPTUAL MODEL YEAR 2000

DESIGN: APO	DATE: 6/22/00	FILE REFERENCE: CONCEPT-MOD2.DWG	
DRAWN: JLS	SCALE:		
CHECKED:	APPROVED:	PROJECT NO. 54-01F	PAGE NO.

The equilibrium soil vapor sampling results indicate that the NAPL soil vapor concentrations are below the target levels in all areas, except one well. The estimated volume of NAPL identified in the ROD has been removed. Groundwater concentrations have declined in extracted groundwater since startup of the Phase I Subsurface Remediation in the North NAPL Area. The Phase II Subsurface Remediation appears to be effective in further reducing the groundwater BTEX concentrations in the North NAPL Area; however, concentrations have reached apparent asymptotic levels and remain elevated above the ROD cleanup levels. The slow progress in groundwater remediation is due largely to the technical limitations in remediating NAPL-impacted groundwater, especially in the heterogeneous fractured bedrock that occurs at the Site. The slow groundwater remediation progress at the Site is further exacerbated by the low permeability of the sandstone units, the long time interval that NAPL has been present in the subsurface, and the extremely slow rate of desorption of contaminants from the formation matrix to groundwater.

The nutrient injection activities of Phase II Subsurface Remedy appear to have been effective in reducing BTEX concentrations in the North NAPL Area (E Sandstone Unit) Area. The data indicate an overall decline in BTEX concentration since the Phase II Subsurface Remediation implementation, although, the BTEX concentrations appear to have reached asymptotic levels. Furthermore, some of the decline in BTEX concentrations could be due to dilution by nutrient and fresh water injection.

The air stripping water treatment system is operating efficiently as it exceeds the treatment and discharge levels specified in the ROD. The TOU is effective in destruction of hydrocarbons in extracted soil vapors. Only a fraction of the shallow injection system for discharging the treated groundwater is used, indicating that it is operating efficiently.

System Operations/O&M: System operation procedures are implemented in accordance with the RA O&M Plan. The O&M Plan describes procedures and schedules for inspection and maintenance of the remediation system. Activities include data collection and inspections to facilitate preventive maintenance and to insure that the system continues to operate with minimum problems. Difficulties that occurred during the O&M were addressed and resolved immediately.

The Site subsurface remediation system operation is automated to allow for unattended operation. The Instrumentation & Control (I&C) system coordinates and interlocks the operation of each equipment component so that the system functions as a completely integrated unit. An auto dialer contacts the remote dispatcher in the event of system shutdown. All System shutdown calls were responded to immediately. Most of the unplanned shutdowns occurred due to power interruptions. Overall, the System operation was maintained 94.3% of the time during the entire O&M.

Cost of System Operations/O&M: As noted in Section IV, costs have generally been within the estimated range.

- **System Optimization:** The System optimization was maintained continuously during O&M activities. As discussed in Section IV.C.3, based on results of ongoing performance monitoring of the SVE System, various operational modifications were implemented to maintain efficient operation and improve contaminant mass recovery rates. The monitoring and assessment of the modifications indicated that they were effective following implementation. During O&M, new SVE/GW remediation wells were constructed to address NAPL thickness levels in the monitoring wells, in which: (1) the nearby existing remediation wells were not capable of extracting NAPL due to heterogeneity of the formation; and (2) the NAPL thickness levels initially declined following the start of remediation but remained at a steady state thereafter. The monitoring wells were converted to temporary SVE or SVE/GW remediation wells to extract NAPL.

- **Indication of Potential Remedy Failure:** No indication of potential remedy failure was noted during the review. Cost and maintenance activities have been consistent with expectations. The surface remedy, consisting of lead-, asbestos-, and hydrocarbon-contaminated soils cleanup, the West Pits cleanup, and the Separator remediation, was successful in meeting the ROD cleanup levels. The surface portion of the Site was deleted from the NPL.

  The leading edge plume containment component of Phase I Subsurface Remediation has more than exceeded its specified containment objective. The BTEX concentrations in the leading edge plume area wells declined below the MCLs, compared to the specified objective of: (1) controlling migration of contaminated groundwater beyond the existing leading edge plume boundary; and (2) maintaining the benzene plume in the leading edge plume area E-Sandstone at a steady state. The NAPL extraction component of the Phase I Subsurface Remedy was successful in removing the NAPL from the North NAPL Area. The progress of the NAPL extraction system in the South and Miscellaneous NAPL Areas is within expectations, especially since the NAPL is distributed in a very complex, heterogeneous fractured rock matrix.

  Groundwater BTEX concentration initially declined in extracted groundwater following the start-up of Phase I Subsurface Remediation in the North NAPL Area. However, the concentrations reached a steady state as expected. The Phase II Subsurface Remediation appears to be effective in further reducing the groundwater BTEX concentrations in the North NAPL Area; however, concentrations have reached apparent asymptotic levels and remain elevated above the ROD cleanup levels. The slow progress in groundwater remediation is due largely to the technical limitations of remediating NAPL-impacted groundwater, especially in the heterogeneous fractured rock that occurs at the Site.

The following discussions provide the assumptions used at the time of remedy selection:

- **Changes in Exposure Pathways:** The cleanup levels in the ROD were established based on a residential scenario at the Site. The Site is not currently used for residential purposes. There are no current or planned changes in the land use by the PRPs, who own the Site; however, a potential future land use is still residential. Because remediation of contaminated surface soils has been completed to the ROD cleanup levels, the exposure and risk at the surface have been eliminated. No new contaminants, sources, or routes of exposure were identified as part of this five-year review. A comprehensive hydrologic/hydrogeologic characterization was performed during RI/FS. The constituent concentrations in the groundwater are consistent with levels identified in the ROD, and the groundwater plume has been successfully contained. In addition, the current closest residence to the groundwater plume is approximately 500 feet away, 300 feet further than during the remedy selection.

  The remedial action goal for groundwater, as stated in the ROD, is to prevent future exposure to contaminated groundwater through the G, F, and E Sandstone Units, and to restore the G, F, and E Sandstone Units to their beneficial use, which at this Site, according the ROD, is a drinking water aquifer. As discussed in Section VI.D.1.3, 35 groundwater extraction wells in the F & G Sandstone Units yield a combined total of only 0.13 gpm, or approximately 190 gallons per day. This yield is a result of continuously pumping 35 wells, with applied vacuum of over 15" Hg. This results in a pumping rate of about 0.004 gpm per well, or about five gallons per day per well from continuous pumping. The groundwater pumping data also indicate that a total of fourteen remediation wells in the E Sandstone Unit at the Site, with applied vacuum of over 15" Hg, yield a combined total of 0.75 gpm. This results in approximately 0.05 gpm, or approximately 77 gallons per day from each well.

  Currently, the groundwater in the G, F, and E Sandstone Units is not being used as a drinking water supply; however, this is a potential groundwater source that could be used as a drinking water aquifer in the future. As a result, there is a potential groundwater exposure pathway whereby future Site residents could be exposed to contaminants.

During the groundwater remedy, the EPA estimated a pumping rate of 0.2 gpm per well, or a total of approximately 5,000 gallons per day from the 20-groundwater extraction wells as specified in the remedy, without vacuum enhanced pumping. As indicated above, the groundwater-pumping yield from the F & G Sandstone Units is over 50 times lower than expected and about one third of expected yield from the E Sandstone Unit. The current average yield for the entire Site is only about 1,200 gallons per day from 55 wells, which is about one tenth of the 5,000 gallons from 20 wells considered in the ROD.

The low groundwater pumping rates are due largely to the technical limitations in remediating groundwater in very low permeability heterogeneous rock such as occurs at the Site.

- **Changes in Toxicity and Other Contaminant Characteristics:** Toxicity and other factors for contaminants of concerns associated with surface soils contaminated with lead, asbestos and hydrocarbon; West Pits; and the Separator and its contents have been eliminated as the they have been remediated to the ROD cleanup levels. Toxicity and other factors for contaminants of concern associated with the NAPL, and the dissolved constituents in the NAPL-impacted groundwater have not changed.

- **Changes in Risk Assessment Methodologies:** Any changes in risk assessment methodologies since the time of the ROD (September 1992), do not call into question the protectiveness of the remedy. The assumption of risk associated with potential exposure from drinking the impacted groundwater in the G, F, and E Sandstone Units is protective.

VIII. Deficiencies

The only potential deficiency in the implementation of the remedy that was noted during the review is that appropriate steps have not been implemented to ensure that supply wells are not installed in the impacted aquifer. No other technical deficiencies of the remedy, or the implementation of the remedy, were noted during the five-year review. Any difficulties observed during routine inspections and monitoring of the System were immediately addressed and corrected, as needed.

IX. Recommendations and Follow-up Actions.

Based on the review of the data collected during the first five years of remedial actions, and as discussed in Section VI, the following actions are recommended:

- Appropriate steps need to be implemented to ensure that supply wells will not be drilled in an impacted aquifer in off-site areas.

- With the current progress of NAPL extraction and results of preliminary equilibrium soil vapor sampling, a confirmatory equilibrium soil vapor sampling and operational analysis should be performed to determine if remedial action objectives of Phase I Subsurface Remediation in South and Miscellaneous NAPL Areas have been attained.

- The data indicate an overall decline in BTEX concentration in the E Sandstone Unit since the Phase II Subsurface Remediation implementation, and the BTEX concentrations appear to have reached apparent asymptotic levels. Therefore, testing for the magnitude of rebound in groundwater BTEX concentrations in the North NAPL Area and in the leading edge plume should be performed. This testing would also determine if the decline in BTEX concentrations has resulted from biodegradation or from dilution by injection of water during nutrient injection operations.

- Even though the groundwater BTEX concentrations in the E Sandstone Unit declined initially following implementation of the Phase I Subsurface Remedy (groundwater extraction, treatment and reinjection) and the Phase II Subsurface Remedy (components of Phase I and enhanced in situ biodegradation of BTEX by nutrient injection), the concentrations appear to have reached apparent asymptotic levels and remain elevated above the ROD cleanup levels. Based on the data obtained during the O&M implementation, the time frame to remediate the E Sandstone Unit would be over 100 years, significantly longer than the 30 years estimated in the ROD. The slow progress in groundwater remediation is due largely to the technical limitations in remediating NAPL-impacted groundwater, especially in very low permeability heterogeneous fractured rock such as occurs at the Site. The groundwater extraction and treatment, even with enhanced in situ biodegradation, may not be significantly more efficient than natural attenuation for this type of fractured bedrock formation. Therefore, it may be appropriate to consider a monitored natural attenuation (MNA) remedy for the Site. The Site meets relevant MNA selection criteria specified in the OSWER Directive Number 9200.4-17P (Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Actions, and Underground Storage tank Sites).

X. Protectiveness Statements

Both the EPA-approved Health and Safety Plan and the Contingency Plan are in-place. These plans have been properly implemented, and are sufficient to control risks that may arise due to the implementation of the remedial action.

Surface Media

The surface media remedy is protective of human health and the environment. Remedial actions for the surface media were successful in attaining the remedial action objectives for: (1) lead-, asbestos-, and hydrocarbon-contaminated surface soils; (2) the West Pits contents; and (3) the Separator and its contents, in accordance with the health-based cleanup levels as specified in the ROD. The EPA deleted the surface portion of the Site from the NPL on January 29, 1998.

No hazardous substances, pollutants, or contaminants remain in the surface media at the Site at concentrations above levels that allow for unlimited use of the surface media and for unrestricted exposure to the surface media.

Subsurface Media

The Phase I and Phase II subsurface remedies for the Site have been, and are expected to continue to be, protective of human health and the environment. The subsurface remedies are operating and functioning as designed. The Phase I subsurface remedy was successful in attaining the remedial action objectives for the NAPL extraction in the North NAPL Area. The groundwater containment component of the Phase I subsurface remedy for the E Sandstone unit exceeded expectations as BTEX concentrations in the leading edge plume in the E Sandstone declined below the MCLs. The NAPL extraction in the South and Miscellaneous NAPL Areas is meeting expectations, considering the difficulties involved in removing NAPL absorbed in the complex heterogeneous fractured bedrock. The Phase I and Phase II subsurface remedies have reduced groundwater BTEX concentrations in the NAPL source areas.

The groundwater monitoring results of the Willcox well, which is completed in the B Sandstone Unit of the Sonsela Formation, show benzene concentrations varying from less than the 0.0002 mg/l detection limit to a maximum of 0.024 mg/l with no upward trend. The source of the benzene in this well appears to be from the migration of contaminants through the gravel-packed annular space around the casing of the former Willcox residential well. This former residential well was over drilled and properly closed in 1992. All of the existing Site wells that had inadequate seals were properly decommissioned as a part of the RI activities to prevent them from acting as potential conduits for contamination to the lower aquifer units. Although removal of the old Willcox well has eliminated this pathway, low levels of benzene continue to persist in the deeper units of the Sonsela in the vicinity of the former Willcox residential well. Monitoring results of the new well support the interpretation that there is residual benzene contamination around an unsealed well casing that is the source of the contamination. The replacement Willcox well is no longer used as a domestic supply well, but continues to be monitored on a monthly basis.

There are no residential wells completed in the impacted aquifer units (E, F, and G Sandstone Units of the Sonsela Aquifer). Institutional controls, consisting of controls to eliminate installation of water supply wells on-site, installation of water treatment units at nearby residential wells, and monitoring of the residential wells, were implemented and are being maintained. Institutional controls are effective, and are expected to remain effective, under current or anticipated changes in the land use at the Site. A potential anticipated land use scenario includes residential land use. The remediation areas at the Site are fenced and secured to prevent unauthorized entry.

The groundwater air stripping system exceeds the specified treatment and discharge performance standards. The TOU is operated to treat and destroy extracted soil vapors, even though the untreated VOCs and benzene emissions would be below the specified ARARs.

Hazardous substances remain in subsurface media at the Site at concentration levels that are above levels that allow for unlimited use of the groundwater and unlimited exposure to the groundwater.

XI. Next Review

The next review will be conducted within five years of the completion of this five-year review. The completion date is the date of the signature shown on the signature cover attached to the front of this report.

ATTACHMENT 1

Documents Reviewed

Prewitt Site Documents Reviewed

Prewitt Refinery Site, Remedial Investigation/Feasibility Study, "*Remedial Investigation Report,*" prepared for U. S. Environmental Protection Agency, Region 6, submitted by El Paso Natural Gas Company & Atlantic Richfield Company, prepared by Morrison Knudsen Corporation, August 1991, Volume 1 to 7.

Prewitt Refinery Site, Remedial Investigation/Feasibility Study, "*Feasibility Report,*" prepared for U. S. Environmental Protection Agency, Region 6, submitted by El Paso Natural Gas Company & Atlantic Richfield Company, prepared by Morrison Knudsen Corporation, February 1992.

Prewitt Refinery Site, Remedial Investigation/Feasibility Study, "*NAPL Extraction Pilot Test Report,*" and Appendices, prepared for U. S. Environmental Protection Agency, Region 6, submitted by El Paso Natural Gas Company & Atlantic Richfield Company, prepared by Applied Hydrology Associates & VAPEX Environmental Technologies, April 1992.

Prewitt Refinery Site, Remedial Investigation/Feasibility Study, "*Feasibility Report Supplement-NAPL/Ground Water Remedial Action Alternative,*" prepared for U. S. Environmental Protection Agency, Region 6, submitted by El Paso Natural Gas Company & Atlantic Richfield Company, prepared by Applied Hydrology Associates & VAPEX Environmental Technologies, April 1992.

Proposed Plan for Remedial Action," for Prewitt Abandoned Refinery Site, Prewitt, New Mexico, published by U. S. Environmental Protection Agency, Region 6, July 18, 1992.

Record of Decision," for Prewitt Abandoned Refinery Site, Prewitt, New Mexico, issued by U. S. Environmental Protection Agency, Region 6, September 30, 1992.

Remedial Design Work Plan," for Prewitt Refinery Site, prepared for Atlantic Richfield Company and El Paso Natural Gas Company, prepared by ERM Rocky Mountain, Inc. and Applied Hydrology Associates, Revised January 6, 1994.

Prewitt Refinery Site, Remedial Design Report, Volume 1, Surface Media," prepared for Atlantic Richfield Company and El Paso Natural Gas Company, prepared by ERM Rocky Mountain Inc. and Applied Hydrology Associates, November 18, 1994.

Prewitt Refinery Site, Remedial Design Report, Volume 2, Subsurface Media," prepared for Atlantic Richfield Company and El Paso Natural Gas Company, prepared by ERM Rocky Mountain Inc. and Applied Hydrology Associates, December 19, 1994.

Prewitt Refinery Site, Remedial Design Report, Volume 3, Remedial Action Plans," prepared for Atlantic Richfield Company and El Paso Natural Gas Company, prepared by ERM Rocky Mountain Inc. and Applied Hydrology Associates, December 19, 1994.

Remedial Action Work Plan," for Prewitt Refinery Site-Prewitt, New Mexico, prepared for Atlantic Richfield Company and El Paso Natural Gas Company, prepared by Applied Hydrology Associates, February 1995.

Prewitt Refinery Site Remedial Design Report, Volume 4, Landfarm Design," prepared for Atlantic Richfield Company and El Paso Natural Gas Company, prepared by Brown & Root Environmental, Revised Final, October 10, 1995.

Remedial Action Completion Report "*Asbestos Containing Material, Lead-Contaminated Soil and Separator,*" Prewitt Refinery Site, Prewitt, New Mexico, prepared for Atlantic Richfield Company and El Paso Natural Gas Company, prepared by Applied Hydrology Associates, April 1996, Volume 1 to 3.

"*Remedial Action Construction Report, Phase I Subsurface Remedy,*"- Prewitt Refinery Site, Prewitt, New Mexico, prepared for Atlantic Richfield Company and El Paso Natural Gas Company, prepared by Applied Hydrology Associates, August 1996.

Prewitt Site Monthly Progress Reports, prepared for Atlantic Richfield Company and El Paso Natural Gas Company, submitted to U. S. Environmental Protection Agency, Region 6, prepared by Applied Hydrology Associates and AVM Environmental Services Inc., No. 1 through 61 – April 1995 to April 2000.

"*Annual Remedial Action Report, May 1995-April 1996,*" Prewitt Superfund Site, Prewitt, New Mexico, prepared for Atlantic Richfield Company and El Paso Natural Gas Company, prepared by Applied Hydrology Associates, May 13, 1996.

"*Annual Remedial Action Report, May 1996-April 1997*", Prewitt Superfund Site, Prewitt, New Mexico, prepared for Atlantic Richfield Company and El Paso Natural Gas Company, prepared by Applied Hydrology Associates and AVM Environmental Services Inc., May 14, 1997.

"*Annual Remedial Action Report, May 1997-April 1998,*" Prewitt Superfund Site, Prewitt, New Mexico, prepared for Atlantic Richfield Company and El Paso Natural Gas Company, prepared by AVM Environmental Services Inc. and Applied Hydrology Associates, June 10, 1998.

"*Annual Remedial Action Report, May 1998-April 1999,*" Prewitt Superfund Site, Prewitt, New Mexico, prepared for Atlantic Richfield Company and El Paso Natural Gas Company, prepared by AVM Environmental Services Inc. and Applied Hydrology Associates, June 14, 1999.

"*Remedial Action Construction and Completion Report, Landfarm Remedy,*" for Prewitt Refinery Site, Prewitt, New Mexico, Prewitt Superfund Site, Prewitt, New Mexico, prepared for Atlantic Richfield Company and El Paso Natural Gas Company, prepared by Applied Hydrology Associates and AVM Environmental Services Inc., February 1997, Volume 1 to2.

"*North NAPL Area Phase I Subsurface Remediation Completion Report and Phase II Subsurface Remediation Plan for E Sandstone,*" for the Prewitt Superfund Site, Prewitt, New Mexico, prepared for Atlantic Richfield Company and El Paso Natural Gas Company, prepared by AVM Environmental Services Inc. and Applied Hydrology Associates, April 30, 1998.

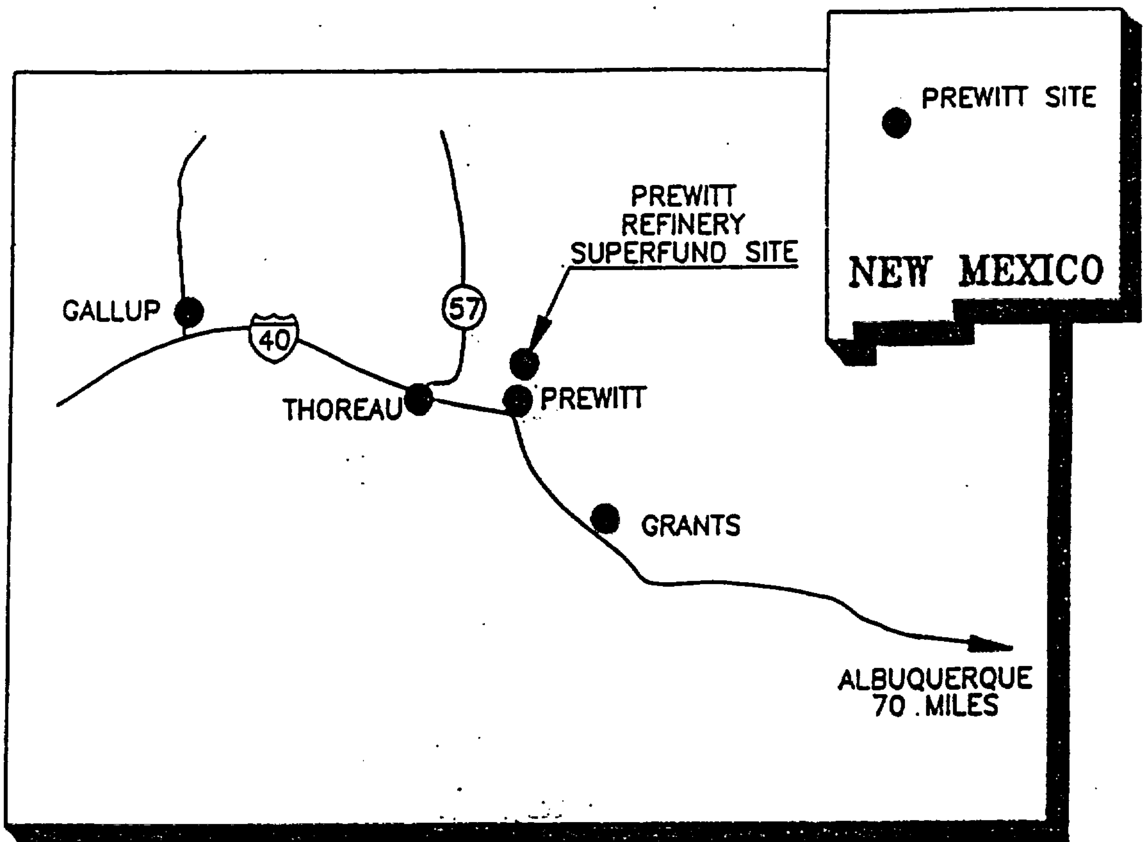
"*Remedial Action Construction Report for E Sandstone Phase II Subsurface Remedy,*" for Prewitt Superfund Site, Prewitt, New Mexico, prepared for Atlantic Richfield Company and El Paso Natural Gas Company, prepared by AVM Environmental Services Inc. and Applied Hydrology Associates, February 19, 1999.

ATTACHMENT 2

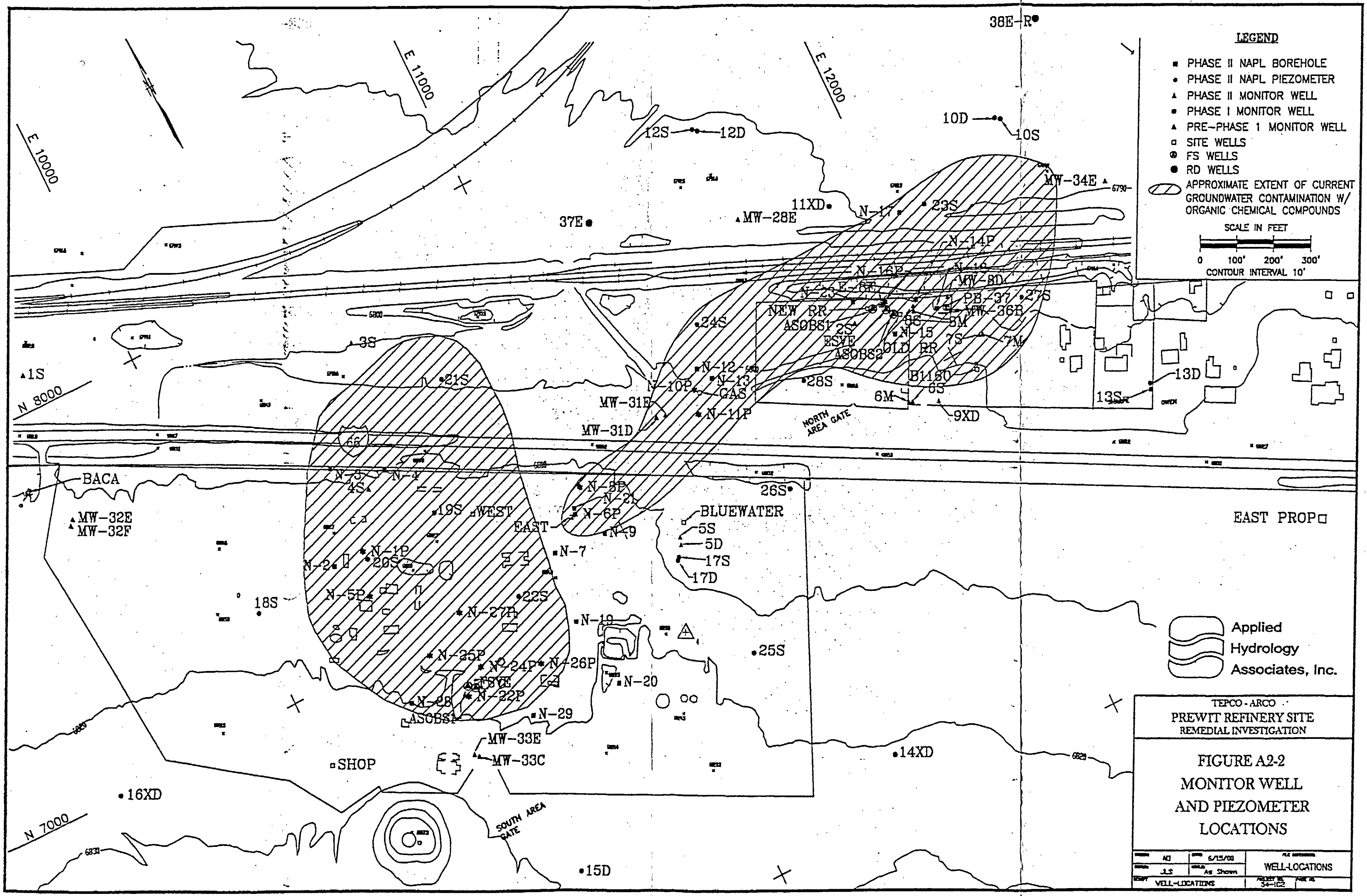
Site Maps

ATTACHMENT 2

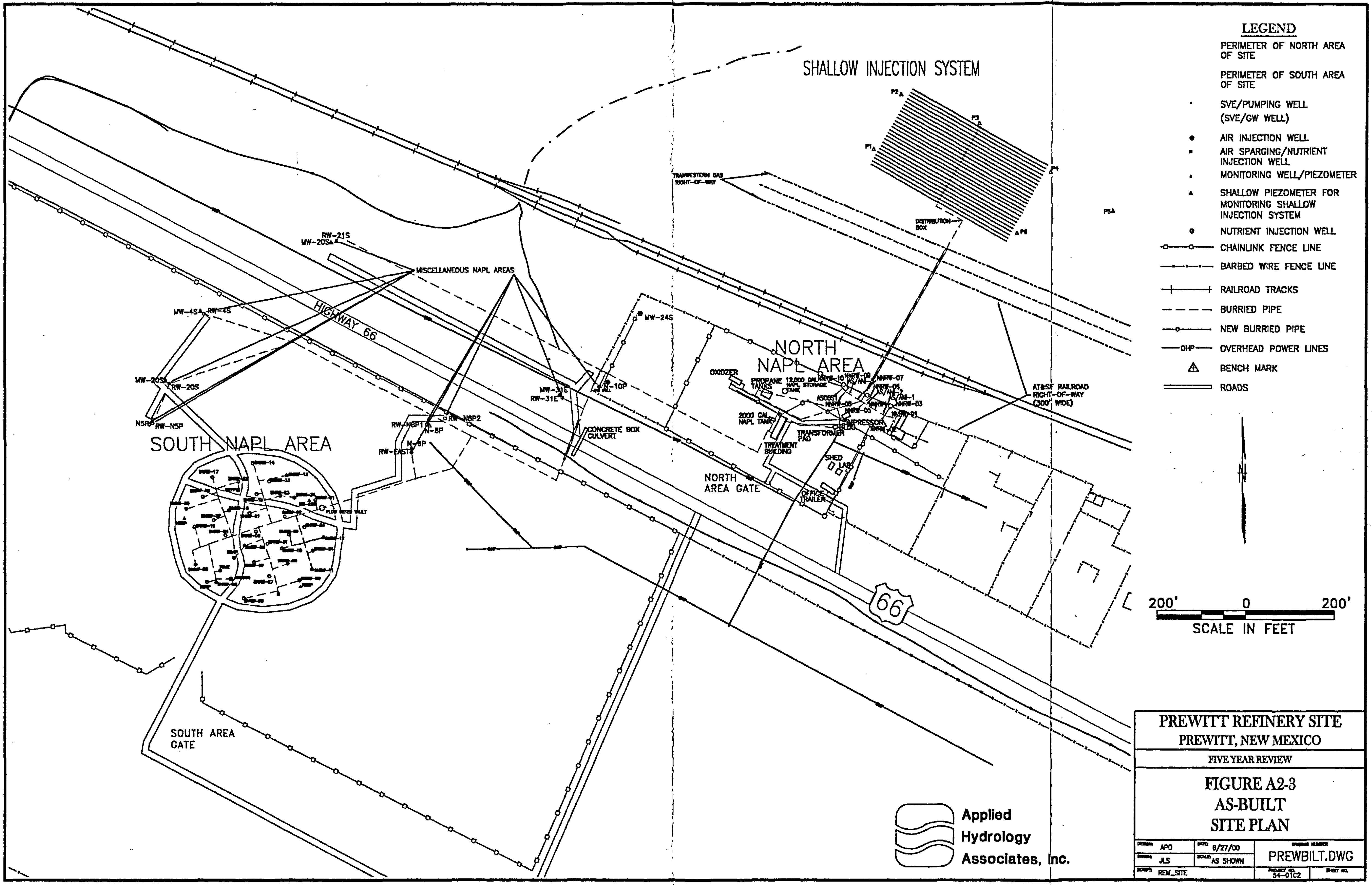
Figure A2-1
Site Location Map



MODIFIED FROM: CONCURRENCE DOCUMENTS FOR THE PREWITT ABANDONED REFINERY RECORD OF DECISION; EPA; 1992



LEGEND
PHASE II NAPL BOREHOLE
PHASE II NAPL PIEZOMETER
PHASE II MONITOR WELL
PHASE I MONITOR WELL
PRE-PHASE 1 MONITOR WELL
SITE WELLS
FS WELLS
RD WELLS
APPROXIMATE EXTENT OF CURRENT GROUNDWATER CONTAMINATION W/ ORGANIC CHEMICAL COMPOUNDS
SCALE IN FEET
0 100' 200' 300'
CONTOUR INTERVAL 10'
E 10000
E 11000
E 12000
N 8000
N 7000
38E-R
12S
12D
10D
10S
MW-34E
11XD
N-17
23S
37E
MW-28E
N-14P
N-16P
N-18
MW-8D
N-23
E-6E
PB-37
27S
NEW RR
MW-36B
ASOBS1
2S
8S
8M
ESVE
ASOBS2
N-15
OLD RR
7S
7M
24S
3S
1S
21S
N-12
N-13
N-10P
GAS
28S
B1150
6M
6S
9XD
13D
13S
MW-31E
N-11P
MW-31D
NORTH AREA GATE
66
BACA
N-3
N-4
4S
26S
N-8P
N-21
MW-32E
MW-32F
19S
WEST
N-6P
BLUEWATER
EAST
N-9
5S
5D
EAST PROP
N-1P
N-7
N-2
20S
17S
17D
18S
N-5P
22S
N-27P
N-19
25S
N-25P
N-24P
N-26P
ESVE
N-20
N-28
N-22P
ASOBS1
N-29
MW-33E
MW-33C
14XD
SHOP
16XD
SOUTH AREA GATE
15D
Applied Hydrology Associates, Inc.
TEPCO - ARCO
PREWIT REFINERY SITE
REMEDIAL INVESTIGATION
FIGURE A2-2
MONITOR WELL AND PIEZOMETER LOCATIONS
6/15/00
As Shown
WELL-LOCATIONS
34-IC2


SHALLOW INJECTION SYSTEM
LEGEND
PERIMETER OF NORTH AREA OF SITE
PERIMETER OF SOUTH AREA OF SITE
SVE/PUMPING WELL (SVE/GW WELL)
AIR INJECTION WELL
AIR SPARGING/NUTRIENT INJECTION WELL
MONITORING WELL/PIEZOMETER
SHALLOW PIEZOMETER FOR MONITORING SHALLOW INJECTION SYSTEM
NUTRIENT INJECTION WELL
CHAINLINK FENCE LINE
BARBED WIRE FENCE LINE
RAILROAD TRACKS
BURRIED PIPE
NEW BURRIED PIPE
OVERHEAD POWER LINES
BENCH MARK
ROADS
TRANSWESTERN GAS RIGHT-OF-WAY
DISTRIBUTION BOX
MISCELLANEOUS NAPL AREAS
HIGHWAY 66
NORTH NAPL AREA
SOUTH NAPL AREA
OXIDIZER
PROPANE TANKS
12,000 GAL NAPL STORAGE TANK
2000 GAL NAPL TANK
TRANSFORMER PAD
COMPRESSOR BLDG.
TREATMENT BUILDING
SHED
LAB
OFFICE TRAILER
NORTH AREA GATE
SOUTH AREA GATE
CONCRETE BOX CULVERT
FLOW METER VAULT
AT&SF RAILROAD RIGHT-OF-WAY (300' WIDE)
MW-24S
MW-21S
MW-20SA
RW-21S
MW-4SA
RW-4S
MW-20S
RW-20S
N5P
RW-N5P
MW-31E
RW-31E
N-10P
RW-N8PT
RW-N8P2
N-8P
RW-EAST
66
200' 0 200'
SCALE IN FEET
PREWITT REFINERY SITE
PREWITT, NEW MEXICO
FIVE YEAR REVIEW
FIGURE A2-3
AS-BUILT
SITE PLAN
APO
8/27/00
JLS
AS SHOWN
REM_SITE
PREWBILT.DWG
34-01C2
Applied Hydrology Associates, Inc.

ATTACHMENT 3

Sampling Data Results Summary

Attachment 3-1

NAPL Soil Vapor Extraction Mass Recovery Data

Month	North NAPL Area				South NAPL Area				Miscelleneous NAPL Areas				TOTAL	
	BTEX Recovery Rate (lbs/day)	BTEX Recovery (lbs)	Hydrocarbon Recovery Rate (lbs/day)	Hydrocarbon Recovery (lbs)	BTEX Recovery Rate (lbs/day)	BTEX Recovery (lbs)	Hydrocarbon Recovery Rate (lbs/day)	Hydrocarbon Recovery (lbs)	BTEX Recovery Rate (lbs/day)	BTEX Recovery (lbs)	Hydrocarbon Recovery Rate (lbs/day)	Hydrocarbon Recovery (lbs)	BTEX Recovery (lbs)	Hydrocarbon Recovery (lbs)
													0	0
Dec-95 & Jan-9		5.20		113.00		6.50		175.00		14.70		141.00	26	429
Feb-96	7.58	166.76	127.26	2800.00	9.24	186.20	230.46	5070.00	4.83	66.50	72.85	1043.00	419	8913
Mar-96	1.47	41.28	21.57	605.76	7.41	197.80	107.98	3033.00	3.06	85.70	63.78	1792.00	325	5431
Apr-96	1.15	32.29	13.22	371.26	2.40	65.90	25.39	713.00	0.79	22.10	13.96	392.00	120	1476
May-96	0.19	5.46	2.96	85.06	3.99	114.66	174.78	5022.65	1.20	34.48	44.95	1291.73	155	6399
Jun-96	0.86	22.52	10.58	277.09	4.75	124.40	65.80	1723.30	1.00	26.19	8.84	231.52	173	2232
Jul-96	0.79	21.31	10.78	290.83	4.91	132.42	75.99	2049.54	0.85	22.83	10.02	270.24	177	2611
Aug-96	0.72	18.21	10.99	277.92	5.07	128.25	86.19	2180.18	0.69	17.54	11.20	283.32	164	2741
Sep-96	0.65	18.33	11.19	315.56	5.23	147.49	96.38	2717.92	0.54	15.23	12.38	349.12	181	3383
Oct-96	0.59	16.37	11.28	314.71	4.18	116.72	81.47	2273.11	0.50	14.04	14.61	407.71	147	2996
Nov-96	0.52	14.92	11.37	324.05	3.14	89.40	66.57	1897.15	0.47	13.30	16.85	480.13	118	2701
Dec-96	0.46	13.62	11.46	339.27	2.09	61.87	51.66	1529.39	0.43	12.73	19.08	564.86	88	2434
Jan-97	0.41	11.46	10.71	299.38	3.26	91.06	74.75	2090.07	0.43	12.02	17.59	491.76	115	2881
Feb-97	0.36	10.08	9.95	278.69	4.42	123.85	97.83	2739.33	0.43	12.04	16.09	450.61	146	3469
Mar-97	0.31	9.48	9.20	281.21	5.59	170.86	120.92	3696.04	0.43	13.14	14.60	446.26	193	4424
Apr-97	0.31	8.93	9.20	264.96	5.59	160.99	120.92	3482.50	0.43	12.38	14.60	420.48	182	4168
May-97	1.48	44.59	28.76	868.36	4.93	148.86	115.11	3475.53	0.81	24.46	26.91	812.62	218	5157
Jun-97	2.06	58.90	38.54	1101.86	4.60	131.51	112.20	3207.80	1.00	28.59	33.07	945.47	219	5255
Jul-97	1.64	45.25	29.53	814.64	5.80	160.02	182.53	5036.09	1.82	50.21	37.08	1023.13	255	6874
Aug-97	1.22	36.53	20.51	614.29	7.00	209.62	252.87	7572.35	2.64	79.06	41.10	1230.68	325	9417
Sep-97	0.80	18.84	11.50	270.83	8.20	193.11	323.20	7611.36	3.46	81.48	45.11	1062.34	293	8945
Oct-97	0.74	22.54	12.18	369.17	6.97	211.22	339.80	10302.06	2.60	78.73	45.98	1394.02	312	12065
Nov-97	0.68	20.34	13.71	410.07	5.73	171.48	356.40	10659.92	1.73	51.84	46.85	1401.28	244	12471
Dec-97	0.63	19.30	13.53	414.40	4.50	137.83	373.00	11424.24	0.87	26.65	47.72	1461.57	184	13300
Jan-98	0.64	19.30	13.52	407.80	3.87	116.63	280.50	8460.72	0.78	23.53	42.94	1295.20	159	10164
Feb-98	0.59	16.14	8.30	226.96	3.23	88.45	188.00	5142.93	0.69	18.88	38.16	1043.90	123	6414
Mar-98	0.57	17.19	5.68	171.33	2.60	78.42	95.50	2880.57	0.60	18.10	33.38	1006.84	114	4059
Apr-98	0.57	16.71	5.68	166.48	2.60	76.21	95.50	2799.11	0.60	17.59	33.38	978.37	110	3944
May-98	0.37	11.08	4.13	123.78	2.91	87.04	90.55	2711.51	0.71	21.16	28.37	849.67	119	3685
Jun-98	0.27	8.06	3.36	100.30	3.06	91.34	88.07	2628.89	0.76	22.69	25.87	772.22	122	3501
Jul-98	0.34	10.29	5.17	155.08	7.33	219.73	202.79	6079.04	0.72	21.58	52.66	1578.59	252	7813
Aug-98	0.42	12.17	6.99	204.02	5.67	165.50	264.11	7712.54	0.67	19.66	53.48	1561.72	197	9478
Sep-98	0.49	14.57	8.80	261.62	6.97	207.25	284.92	8470.67	0.63	18.73	59.33	1763.88	241	10496
Oct-98	0.51	15.72	7.57	233.16	6.71	206.82	150.20	4628.26	0.62	19.07	56.74	1748.39	242	6610
Nov-98	0.53	15.90	6.33	190.00	6.45	193.59	155.02	4650.60	0.61	18.24	61.40	1842.00	228	6683
Dec-98	0.55	16.78	5.10	155.57	6.19	188.94	146.58	4471.28	0.60	18.21	30.37	926.41	224	5553
Jan-99	0.54	16.75	6.77	208.72	5.75	177.44	165.17	5094.67	0.59	18.08	30.68	946.32	212	6250
Feb-99	0.54	14.92	8.43	234.72	5.31	147.83	164.28	4572.24	0.58	16.00	36.60	1018.65	179	5826
Mar-99	0.53	16.30	10.10	311.22	4.87	150.06	162.30	5001.11	0.56	17.38	29.48	908.40	184	6221
Apr-99	0.53	15.81	10.10	301.79	4.87	145.52	164.17	4905.40	0.56	16.85	42.27	1263.03	178	6470
May-99	0.38	11.40	9.30	280.23	4.86	146.46	218.49	6583.44	0.67	20.15	50.09	1509.41	178	8373
Jun-99	0.30	8.93	8.90	262.19	4.86	143.06	246.58	7264.25	0.72	21.24	60.40	1779.38	173	9306
Jul-99	0.37	10.56	9.30	264.95	7.33	208.82	187.51	5341.97	0.72	20.51	32.14	915.64	240	6523
Aug-99	0.44	9.69	9.70	214.40	6.67	147.35	243.38	5379.43	0.90	19.93	54.97	1214.93	177	6809
Sep-99	0.51	15.00	10.10	299.36	7.57	224.43	241.78	7166.36	0.99	29.40	52.25	1548.69	269	9014
Oct-99	0.42	12.86	8.33	258.23	6.54	202.66	297.25	9211.06	0.88	27.33	53.02	1642.96	243	11112
Nov-99	0.32	8.59	6.57	174.15	5.51	146.07	284.39	7542.02	0.77	20.47	48.82	1294.71	175	9011
Dec-99	0.23	7.12	4.80	146.72	4.48	136.81	230.07	7032.32	0.66	20.23	26.94	823.45	164	8002
Jan-00	0.17	5.18	3.48	106.80	4.59	140.99	202.67	6220.04	0.64	19.68	28.35	870.16	166	7197
Feb-00	0.10	3.01	2.16	62.23	4.71	135.75	165.75	4775.03	0.62	17.88	30.42	876.36	157	5714
Mar-00	0.04	1.21	0.84	25.47	4.83	146.44	147.88	4483.43	0.60	18.19	31.18	945.32	166	5454
Apr-00	0.04	1.06	0.84	22.35	4.83	128.53	143.72	3824.39	0.60	15.97	10.03	266.90	146	4114
Total, lbs		1015		17672		7530		254715		1373		51578	9918	323965
Total, gallons				2683				38674				7831		49188

Attachment 3-2

Month	South Groundwater Header NAPL Recovery (gallons)	North Groundwater Header NAPL Recovery (gallons)	Total NAPL Recovery from Both Headers (gallons)
Dec-95	159	666	825
Jan-96	161	589	750
Feb-96	1286	12	1298
Mar-96	415	12	427
Apr-96	198	12	210
May-96	149	12	161
Jun-96	74	12	86
Jul-96	57	12	69
Aug-96	0	0	0
Sep-96	18	12	30
Oct-96	29	12	41
Nov-96	20	12	32
Dec-96	30	2	32
Jan-97	18	2	20
Feb-97	88	2	90
Mar-97	0	0	0
Apr-97	153	2	155
May-97	78	2	80
Jun-97	57	2	59
Jul-97	102	2	104
Aug-97	95	2	97
Sep-97	100	2	102
Oct-97	208	2	210
Nov-97	0	0	0
Dec-97	13	0	13
Jan-98	63	0	63
Feb-98	63	0	63
Mar-98	150	0	150
Apr-98	72	0	72
May-98	0	0	0
Jun-98	71	0	71
Jul-98	28	0	28
Aug-98	43	0	43
Sep-98	13	0	13
Oct-98	0	0	0
Nov-98	0	0	0
Dec-98	0	0	0
Jan-99	0	0	0
Feb-99	0	0	0
Mar-99	16	0	16
Apr-99	20	0	20
May-99	5	0	5
Jun-99	18	0	18
Jul-99	10	0	10
Aug-99	49	0	49
Sep-99	12	0	12
Oct-99	0	0	0
Nov-99	7	0	7
Dec-99	17	0	17
Jan-00	0	0	0
Feb-00	0	0	0
Mar-00	0	0	0
Apr-00	0	0	0
Total	4166	1382	5548

Vacuum Enhanced NAPL Pumping Monthly Data Summary

Attachment 3-3

Month	Air Flow scfm	Benzene ppmv	Toluene ppmv	Ethylbenzene ppmv	Xylenes ppmv	Total VOCs ppmv
Aug-99	660	4.94	5.23	0.10	4.83	225
Jul-99	490	4.65	6.14	1.23	5.44	400
Jun-99	603	5.44	6.95	1.86	6.59	500
May-99	389	4.75	6.27	1.34	5.68	225
Apr-99	427	4.70	8.07	1.46	6.76	240
Mar-99	543	3.21	4.37	1.63	3.77	250
Feb-99	479	3.49	3.97	0.25	3.11	250
Jan-99	377	6.45	8.59	0.20	9.61	240
Dec-98	421	5.74	8.80	2.05	4.57	270
Nov-98	485	7.47	11.46	1.17	4.99	350
Oct-98	513	5.53	8.17	1.27	6.71	330
Sep-98	646	7.00	10.64	0.10	12.13	425
Aug-98	412	11.33	17.40	2.63	13.28	660
Jul-98	425	10.90	15.09	1.78	11.10	470
Jun-98	428	4.77	7.26	1.36	5.39	275
May-98	501	4.97	6.65	1.03	4.99	355
Apr-98	510	5.54	7.37	0.20	7.36	390
Mar-98	546	5.01	6.77	0.78	3.83	300
Feb-98	295	4.86	6.67	0.10	6.63	525
Jan-98	341	7.20	10.37	1.02	5.12	525
Dec-97	750	6.96	12.51	1.21	6.84	500
Nov-97	635	9.45	13.22	1.43	7.31	525
Oct-97	606	12.09	18.88	1.87	10.45	800
Sep-97	520	14.95	22.98	1.96	11.88	755
Aug-97	587	13.65	21.55	1.88	9.18	700
Jul-97	520	15.41	23.00	2.05	11.83	850
Jun-97	541	9.88	16.22	1.38	8.99	755
May-97	565	4.65	8.21	0.71	7.69	650
Apr-97	513	4.26	7.22	0.71	6.27	850
Mar-97	304	6.10	5.58	0.71	3.99	450
Feb-97	530	2.71	5.91	0.71	4.84	333
Jan-97	647	5.03	8.53	0.71	8.83	363
Dec-96	492	3.48	6.24	0.71	5.13	333
Nov-96	488	2.71	5.91	1.42	5.13	248
Oct-96	670	5.03	12.80	1.99	13.10	484
Sep-96	670	5.42	16.74	2.56	16.24	514
Aug-96	664	5.81	15.43	2.85	17.94	577
Jul-96	660	12.00	29.21	2.79	15.38	907
Aug-99	389	4.94	5.23	0.1	4.83	225
Sep-99	687	3.57	4.61	0.1	2.92	300
Oct-99	705	3.62	4.28	1.15	5.14	175
Nov-99	807	3.25	4.97	1.03	4.15	125
Dec-99	915	1.07	1.26	0.2	2.91	100
Jan-00	552	5.04	5.24	0.2	5.53	125
Feb-00	386	6.06	7.7	1.11	5.16	375
Mar-00	535	3.48	5.05	0.66	3.16	200
Apr-00	536	4.27	4.58	0.2	5.38	275

TOU Feed (Influent) Monitoring Data Summary

Attachment 3-4
April 2000 Soil Vapor Equilibrium Concentration Sampling Results Summary

	Unit	Flow rate scfm	Measured ESV Concentrations, ppmv				Flow Weighted ESV Concentrations, ppmv			
			Benzene	Toluene	Ethylbenzene	Xylenes	Benzene	Toluene	Ethylbenzene	Xylenes
Target Level	F & G						25.0	N/A	N/A	390.0
Target Level	E						2.5	N/A	N/A	39.0
South NAPL Area @ 5.0 Min	F & G	N/A	4.7	9.9	2.3	14.2	4.7	9.9	2.3	14.2
South NAPL Area @ 15.0 Min		N/A	4.7	10.8	2.5	15.7	4.7	10.8	2.5	15.7
South NAPL Area @ 30.0 Min		N/A	5.0	11.2	2.6	14.8	5.0	11.2	2.6	14.8
Miscellaneous NAPL Area RW-4S	F & G	6.2	0.1	0.5	0.2	1.3	8.9	11.6	2.2	11.1
Miscellaneous NAPL Area RW-20S		7.0	5.0	7.6	2.3	8.5				
Miscellaneous NAPL Area RW-21S		1.0	3.3	7.2	3.4	16.0				
Miscellaneous NAPL Area RW-N8P2		20.0	13.6	16.4	2.3	14.0				
Miscellaneous NAPL Area RW-N5P		1.5	4.7	14.4	8.3	22.8				
Miscellaneous NAPL Area RW-East	E	6.0	17.8	15.8	3.1	17.7	5.7	4.8	1.1	6.5
Miscellaneous NAPL Area RW-31E		1.8	0.1	0.5	0.3	1.5				
Miscellaneous NAPL Area RW-GAS		14.0	1.3	0.6	0.3	2.4				

Note: (1) Samples analyzed by ACZ Laboratories, Inc. of Steamboat Springs, Colorado

Attachment 3-5

Leading Edge Plume Wells Quarterly Benzene Monitoring Data Summary

Month	Leading Edge Plume Monitoring Well Benzene Concentration (ug/l)									
	MW-10S		MW-27S		MW-34E		MW-38ER		MW-37E	
Apr-90	260		29							
Jul-90	480		8							
Oct-90	270		27		1	U				
Jan-91					3	JB				
Apr-91	130		15		1	U				
Jul-91	44									
Apr-92	190				0.5	U				
Apr-93	240				1	U				
Jun-94	310		51		4	U	35		0.4	U
Jul-94									5.4	
Oct-94	390						16			
Jan-95	980		44		0.4	U	27		0.9	U
May-95	1400		27		0.5	U	6.6		1.6	
Aug-95	1300		34		0.5	U	16		0.9	
Nov-95	1200		43		0.5	U	9		0.5	U
Dec-95					0.5	U			0.5	U
Mar-96	870		21		0.5	U	8		0.5	U
May-96	190		23		0.5	U	11		0.5	U
Aug-96	9.5		0.5	U	0.5	U	25		0.5	U
Sep-96					0.5	U			0.5	U
Nov-96	27		0.5		0.5	U	2.9		0.5	U
Feb-97	31		0.5	U	0.5	U	2.4		0.5	U
May-97	45		0.5	U	0.5	U	1.2		0.5	U
Aug-97	17		0.5	U	0.5	U	1.1		0.5	U
Nov-97	2.3		0.5	U	0.5	U	0.5	U	0.5	U
Feb-98	4.8		1.7		0.5	U	1.5		0.5	U
Apr-98	11		4.4		0.5	U	1.6		0.5	U
Aug-98	5.5		0.96		0.5	U	0.7		0.5	U
Nov-98	1.1		0.4	U	0.4	U	1.1		0.4	U
Feb-99	1.6		0.2	U	0.2	U	0.69		0.2	U
May-99	2.7		0.5	U	0.2	U	0.5		1	U
Aug-99	2.2		1	U	1	U	1	U	1	U
Nov-99	1.2		0.2	U	0.2	U	0.4	BJ	0.2	U
Feb-00	1.2		0.2	U	0.2	U	0.2	U	0.2	U

Q Format:
"U" Indicates compound was not detected above reporting limit
"J" Indicates compound detected below the method quantification limit
"B" Indicates compound was found in daily calibration blank

Attachment 3-6

MONTH	Groundwater Pumped South Header (Gallons)	Groundwater Pumped North Header (Gallons)	BTEX Concentrations in Groundwater Headers								BTEX Mass Recovery South Header	BTEX Mass Recovery North Header
			Benzene, mg/l		Toluene, mg/l		Ethylbenzene, mg/l		Xylenes, mg/l			
			South Header	North Header	South Header	North Header	South Header	North Header	South Header	North Header		
			mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	lbs/day	lbs/day
Dec-95	4,044	11,255	9.60	9.60	11.00	11.00	1.10	1.10	6.10	6.10	0.03	0.09
Jan-96	2,297	42,958	6.45	6.45	6.55	6.55	1.00	1.00	5.75	5.75	0.01	0.23
Feb-96	47,039	86,500	4.50	4.50	4.70	4.70	0.76	0.76	3.80	3.80	0.18	0.33
Mar-96	50,450	67,400	2.50	2.50	5.40	5.40	0.68	0.68	4.40	4.40	0.18	0.24
Apr-96	65,046	79,817	2.80	2.80	5.00	5.00	0.72	0.72	5.00	5.00	0.24	0.30
May-96	25,000	68,745	3.20	3.20	4.60	4.60	0.64	0.64	4.50	4.50	0.09	0.24
Jun-96	25,700	46,870	2.00	2.00	3.30	3.30	0.49	0.49	3.60	3.60	0.07	0.12
Jul-96	22,000	33,000	3.30	3.30	4.50	4.50	0.56	0.56	4.60	4.60	0.08	0.12
Aug-96	31,200	34,000	2.30	2.30	3.10	3.10	0.37	0.37	3.70	3.70	0.08	0.09
Sep-96	31,100	43,200	3.90	3.90	4.90	4.90	0.49	0.49	4.10	4.10	0.11	0.16
Oct-96	21,870	28,570	1.60	1.60	2.20	2.20	0.29	0.29	2.90	2.90	0.04	0.05
Nov-96	20,850	30,250	2.10	2.10	2.50	2.50	0.30	0.30	3.00	3.00	0.05	0.07
Dec-96	25,000	45,800	3.10	3.10	3.70	3.70	0.38	0.38	3.40	3.40	0.07	0.13
Jan-97	22,050	35,850	2.30	3.00	4.30	4.30	0.83	1.10	5.80	5.00	0.08	0.13
Feb-97	17,937	30,268	1.60	4.50	2.90	4.30	0.47	0.78	3.80	3.90	0.04	0.11
Mar-97	25,550	36,270	1.90	4.00	4.90	4.20	0.66	0.77	5.40	4.30	0.09	0.13
Apr-97	34,410	31,500	6.10	3.00	11.00	3.10	1.20	0.68	7.60	3.10	0.24	0.09
May-97	29,670	30,160	3.20	2.30	6.50	4.90	0.74	0.59	5.00	4.00	0.13	0.10
Jun-97	21,800	25,340	5.40	3.50	12.00	4.50	1.20	0.69	9.30	4.50	0.17	0.09
Jul-97	17,761	30,826	4.30	2.90	6.90	3.10	0.94	0.63	6.20	3.30	0.10	0.08
Aug-97	26,310	28,096	5.20	2.60	7.60	3.00	0.79	0.48	4.80	2.70	0.13	0.07
Sep-97	19,043	19,337	5.20	5.10	9.40	4.30	0.11	0.83	6.80	4.20	0.11	0.08
Oct-97	29,722	29,310	6.10	3.70	11.00	3.30	1.30	0.66	8.10	3.60	0.22	0.09
Nov-97	16,360	25,240	3.70	2.00	6.00	2.50	0.66	0.50	4.10	2.70	0.06	0.05
Dec-97	19,183	25,561	5.20	3.50	12.00	4.10	1.30	0.73	8.20	4.20	0.14	0.09
Jan-98	21,560	23,862	5.30	2.80	12.00	3.80	1.30	0.71	8.30	4.10	0.16	0.07
Feb-98	18,100	21,917	6.40	3.70	12.00	4.00	1.40	0.87	8.00	4.50	0.14	0.08
Mar-98	16,753	22,852	8.30	2.10	14.00	2.40	1.50	0.46	9.10	2.50	0.15	0.05
Apr-98	16,426	25,686	3.80	3.80	9.90	4.40	1.20	0.86	7.20	4.70	0.10	0.10
May-98	14,815	21,806	3.30	3.20	5.90	3.40	1.00	0.81	6.90	3.90	0.07	0.07
Jun-98	17,901	22,233	2.40	2.50	4.90	2.80	0.81	0.75	4.50	3.60	0.06	0.06
Jul-98	14,397	25,885	2.20	2.40	5.50	2.60	0.84	0.68	6.20	3.40	0.06	0.06
Aug-98	8,554	26,051	2.80	2.50	4.90	2.60	0.69	0.83	3.90	3.50	0.03	0.07
Sep-98	6,254	29,624	1.50	3.30	1.90	3.10	0.45	0.83	3.70	3.70	0.01	0.09
Oct-98	8,883	30,614	0.57	2.40	0.86	2.70	0.22	0.76	2.40	3.70	0.01	0.08
Nov-98	11,670	30,881	1.20	1.80	2.20	1.40	0.31	0.42	2.07	2.34	0.02	0.05
Dec-98	7,090	35,777	1.30	1.80	1.60	1.40	0.25	0.23	1.81	2.26	0.01	0.06
Jan-99	8,515	26,753	1.60	2.50	2.30	2.10	0.27	0.42	1.90	2.50	0.01	0.06
Feb-99	7,740	23,300	0.90	2.20	0.58	1.90	0.07	0.32	1.10	2.00	0.01	0.04
Mar-99	6,852	29,989	1.80	2.10	1.60	1.80	0.24	0.31	2.40	2.60	0.01	0.06
Apr-99	6,987	24,910	0.89	1.80	0.69	0.91	0.19	0.23	1.80	2.00	0.01	0.03
May-99	8,453	21,357	1.00	1.70	1.30	1.20	0.17	0.13	1.90	1.76	0.01	0.03
Jun-99	9,437	20,186	1.00	0.03	1.30	0.02	0.10	0.01	1.09	0.21	0.01	0.00
Jul-99	8,766	24,853	1.20	0.00	2.70	0.00	0.28	0.00	2.82	0.19	0.02	0.00
Aug-99	9,938	20,768	0.02	0.33	0.09	0.31	0.02	0.06	0.50	0.93	0.00	0.01
Sep-99	10,977	32,655	2.50	1.20	3.90	1.00	0.65	0.20	4.50	1.38	0.03	0.03
Oct-99	10,068	39,498	2.90	0.70	5.10	0.60	0.57	0.08	3.80	1.20	0.03	0.03
Nov-99	14,151	23,822	0.73	0.22	1.70	0.23	0.35	0.05	2.60	1.40	0.02	0.01
Dec-99	11,280	26,637	0.95	0.18	0.80	0.20	0.19	0.04	2.00	0.64	0.01	0.01
Jan-00	9,581	26,505	1.20	1.20	2.20	0.61	0.27	0.15	2.40	0.93	0.02	0.02
Feb-00	12,726	25,015	1.20	0.10	2.20	0.08	0.33	0.02	2.40	0.24	0.02	0.00
Mar-00	8,162	36,701	1.10	0.33	2.90	0.19	0.55	0.05	3.70	0.57	0.02	0.01
Apr-00	10,409	34,188	0.72	0.64	0.89	0.59	0.13	0.06	1.20	1.10	0.01	0.02
Total	967,837	1,720,448	3.24	2.61	5.62	3.11	0.68	0.52	4.79	3.23	115.64	135.86

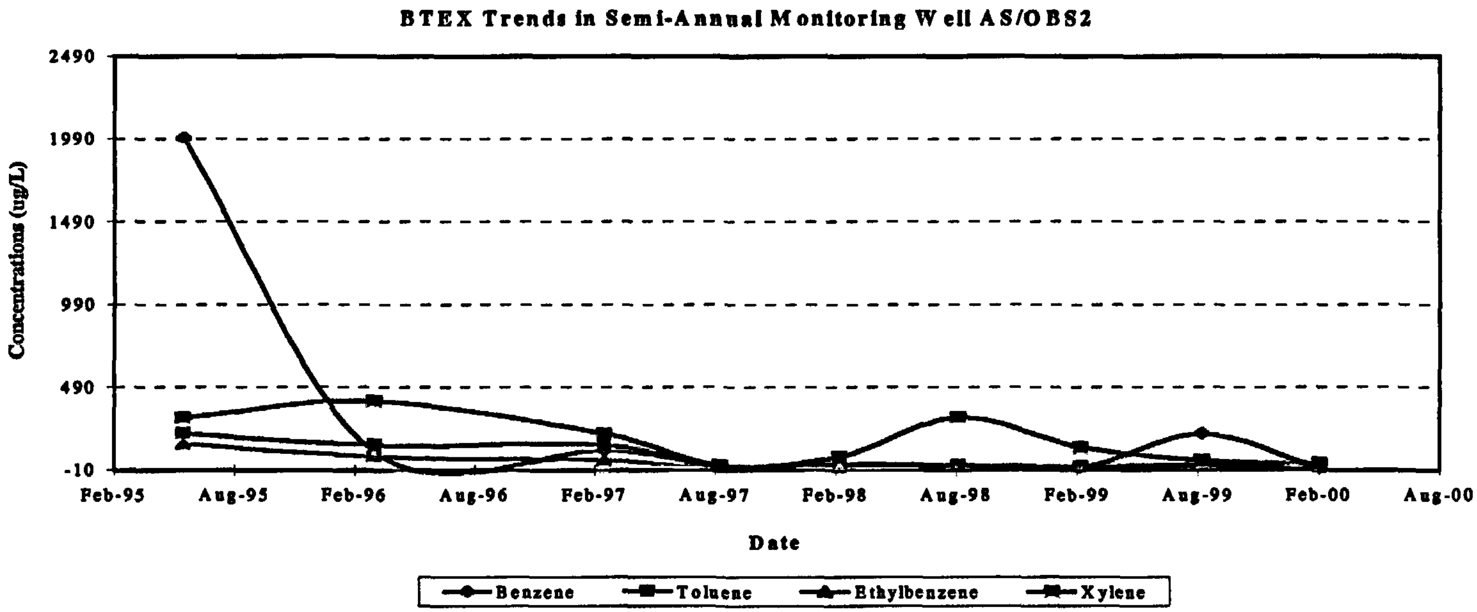
Ground Water Pumping and BTEX Concentration Monitoring Data Summary

DATE	Concentration (mg/l)						
	Benzene	Toluene	Ethylbenzene	Xylene	Lead	Total Naphthalene's	1,2-DCA
Jan-96	<0.0002	<0.0002	0.0020	0.0250	<0.001	<0.020	<0.005
Feb-96	<0.0002	<0.0002	<0.0002	<0.0002	<0.001	<0.020	<0.005
Mar-96	<0.0002	<0.0002	<0.0002	0.0030	0.0100	<0.020	<0.005
Apr-96	<0.0002	0.0008	<0.0002	0.0030	0.0300	<0.020	<0.005
May-96	<0.0002	0.0010	0.0010	0.0070	<0.001	<0.020	<0.005
Jun-96	<0.0002	<0.0002	<0.0002	0.0020	<0.001	<0.020	<0.005
Jul-96	0.0006	0.0021	0.0011	0.0062	<0.001	<0.020	<0.005
Aug-96	<0.0002	<0.0002	<0.0002	0.0040	<0.001	<0.020	<0.005
Sep-96	<0.0002	<0.0002	0.0010	0.0033	<0.001	<0.020	<0.005
Oct-96	<0.0002	<0.0002	<0.0002	0.0016	<0.001	<0.020	<0.005
Nov-96	<0.0002	<0.0002	<0.0002	0.0045	<0.001	<0.020	<0.005
Dec-96	<0.0002	0.0011	<0.0002	0.0045	<0.001	<0.020	<0.005
Jan-97	<0.0002	<0.0002	<0.0002	0.0045	<0.001	<0.020	<0.005
Feb-97	<0.0002	0.0010	<0.0002	0.0059	<0.001	<0.020	N/S
Mar-97	<0.0002	0.0010	<0.0002	0.0006	<0.001	<0.020	N/S
Apr-97	<0.0002	<0.0002	<0.0002	0.0053	0.0190	<0.020	N/S
May-97	<0.0002	0.0050	0.0023	0.0048	0.0220	<0.020	N/S
Jun-97	<0.0002	0.0058	<0.0002	0.0052	0.0290	<0.020	N/S
Jul-97	<0.0002	0.0011	<0.0002	0.0066	0.0250	<0.020	N/S
Aug-97	<0.0002	0.0016	<0.0002	0.0100	0.0250	<0.020	N/S
Sep-97	<0.0002	0.0014	<0.0002	0.0055	0.0180	<0.020	N/S
Oct-97	<0.0002	0.0014	<0.0002	0.0100	0.0190	<0.020	N/S
Nov-97	<0.0002	0.0021	0.0011	0.0072	0.0270	<0.020	N/S
Dec-97	<0.0002	0.0033	0.0010	0.0110	0.0200	<0.020	N/S
Jan-98	<0.0002	0.0021	<0.0002	0.0069	0.0190	<0.020	N/S
Feb-98	<0.0002	0.0046	0.0017	0.0130	0.0210	<0.020	N/S
Mar-98	<0.0002	0.0290	0.0160	0.0410	0.0200	<0.020	N/S
Apr-98	0.0009	0.0013	0.0092	0.0150	0.0140	<0.020	N/S
May-98	<0.0002	0.0020	0.0055	0.0091	0.0200	<0.020	N/S
Jun-98	<0.0002	0.0010	0.0024	0.0051	0.0170	<0.020	N/S
Jul-98	0.0028	0.0029	<0.0002	0.0140	0.0210	<0.020	N/S
Aug-98	<0.0002	<0.0002	0.0011	0.0094	0.0120	<0.020	N/S
Sep-98	<0.0002	<0.0002	0.0026	0.0083	0.0090	<0.020	N/S
Oct-98	<0.0002	<0.0002	<0.0002	0.0042	0.0080	<0.020	N/S
Nov-98	0.0009	0.0026	0.0024	0.0074	0.0090	<0.020	N/S
Dec-98	0.0022	0.0024	0.0044	0.0064	0.0070	<0.020	N/S
Jan-99	0.0027	<0.0002	<0.0002	0.0027	0.0080	<0.020	N/S
Feb-99	0.0011	<0.0002	<0.0002	0.0056	<0.001	<0.004	N/S
Mar-99	<0.0002	0.0014	0.0031	0.0120	0.0160	<0.004	N/S
Apr-99	<0.0002	0.0023	<0.0002	0.0071	0.0150	<0.004	N/S
May-99	<0.0002	0.0011	<0.0002	0.0035	0.0200	<0.004	N/S
Jun-99	<0.0002	0.0014	0.0022	0.0035	0.0140	<0.004	N/S
Jul-99	<0.0002	0.0027	<0.0002	0.0027	0.0200	<0.004	N/S
Aug-99	<0.0002	0.0022	0.0026	0.0113	0.0310	<0.004	N/S
Sep-99	0.0075	0.0051	0.0037	0.0490	0.0250	<0.004	N/S
Oct-99	<0.0002	<0.0002	<0.0002	0.0043	0.0150	<0.004	N/S
Nov-99	0.0026	0.0022	0.0032	0.0150	0.0150	<0.004	N/S
Dec-99	<0.0002	<0.0002	0.0018	0.0087	0.0140	<0.004	N/S
Jan-00	0.0008	0.0011	0.0010	0.0077	0.0100	<0.004	N/S
Feb-00	<0.0002	<0.0002	0.0022	0.0053	0.0100	<0.004	N/S
Mar-00	<0.0002	<0.0002	<0.0002	0.0038	0.0150	<0.004	N/S
Apr-00	<0.0002	<0.0002	0.0014	0.0064	0.0080	<0.004	N/S
Mean (1)	0.0006	0.0019	0.0016	0.0083	0.0129	0.0050	<0.005
Std. Deviation (1)	0.0012	0.0041	0.0026	0.0086	0.0092	0.0000	----
Treated Water Discharge Limits	0.010	0.750	0.750	0.620	0.050	0.030	0.010

Note : (1) When compound was not detected, method detection limit value was used for calculating mean and standard deviation

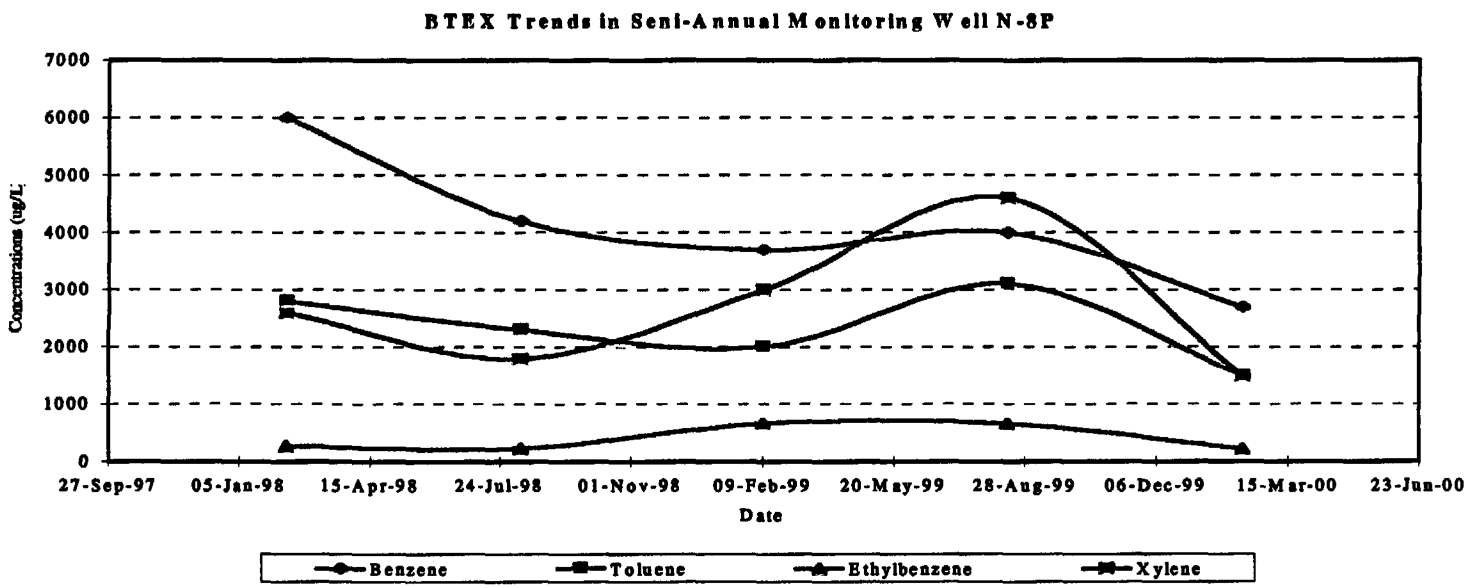
Attachment 3-7
Treated Ground Water Monitoring Data Summary

Attachment 3-8



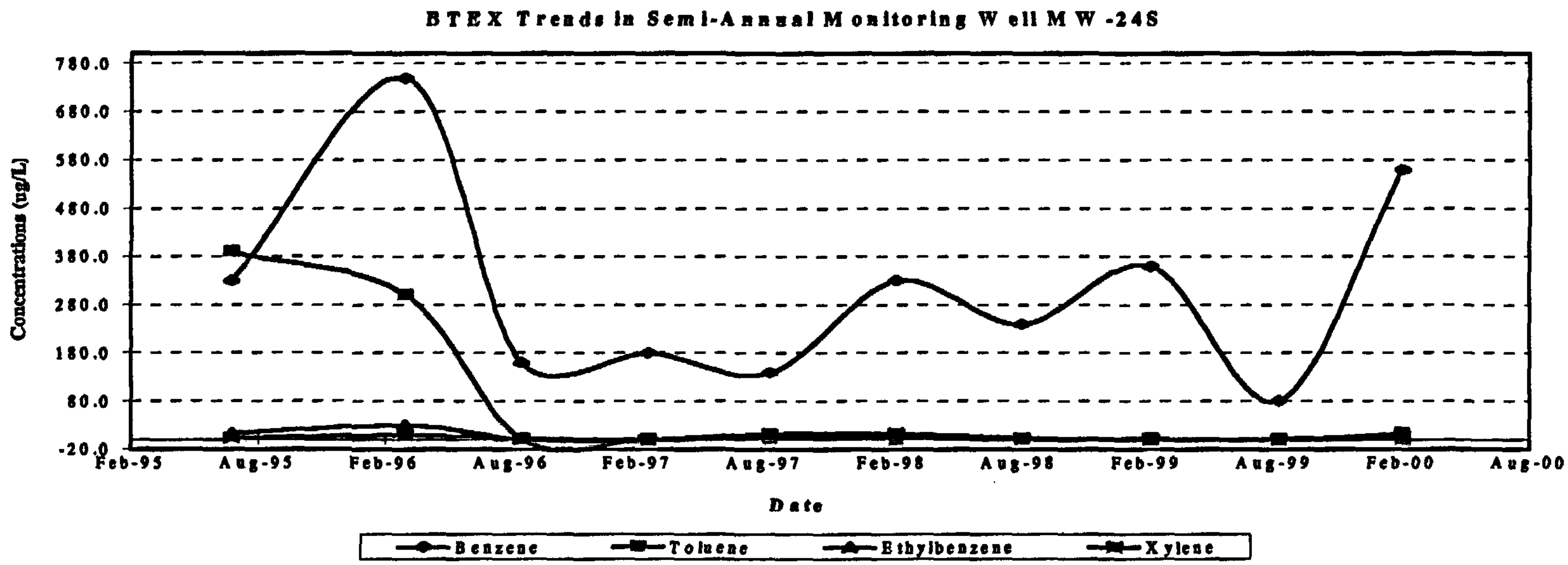
Well AS/OBS-2 Monitoring Data				
	Concentration, ug/L			
Date	Benzene	Toluene	Ethylbenzene	Xylene
21-May-95	2000	210	150	310
06-Mar-96	100	140	72	410
19-Feb-97	110	140	50	210
13-Aug-97	12	5.1	8.1	21
10-Feb-98	15	30	8.1	72
09-Aug-98	18	16	19	310
10-Feb-99	6	7.7	10	130
12-Aug-99	210	11	27	49
05-Feb-00	2.4	0.2	7.5	34

Attachment 3-9



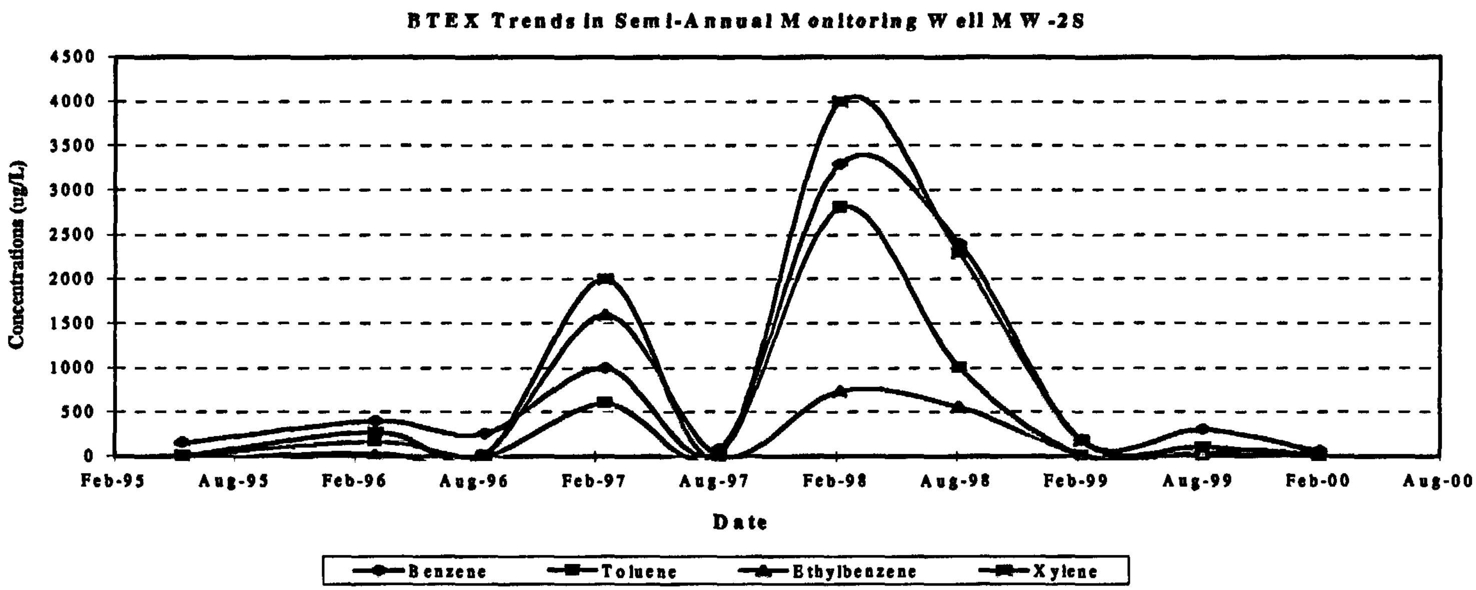
Well N-8P Monitoring Data				
	Concentration, ug/L			
Date	Benzene	Toluene	Ethylbenzene	Xylene
10-Feb-98	6000	2800	270	2600
09-Aug-98	4200	2300	230	1800
10-Feb-99	3700	2000	670	3000
15-Aug-99	4000	3100	660	4600
10-Feb-00	2700	1500	220	1500

Attachment 3-10



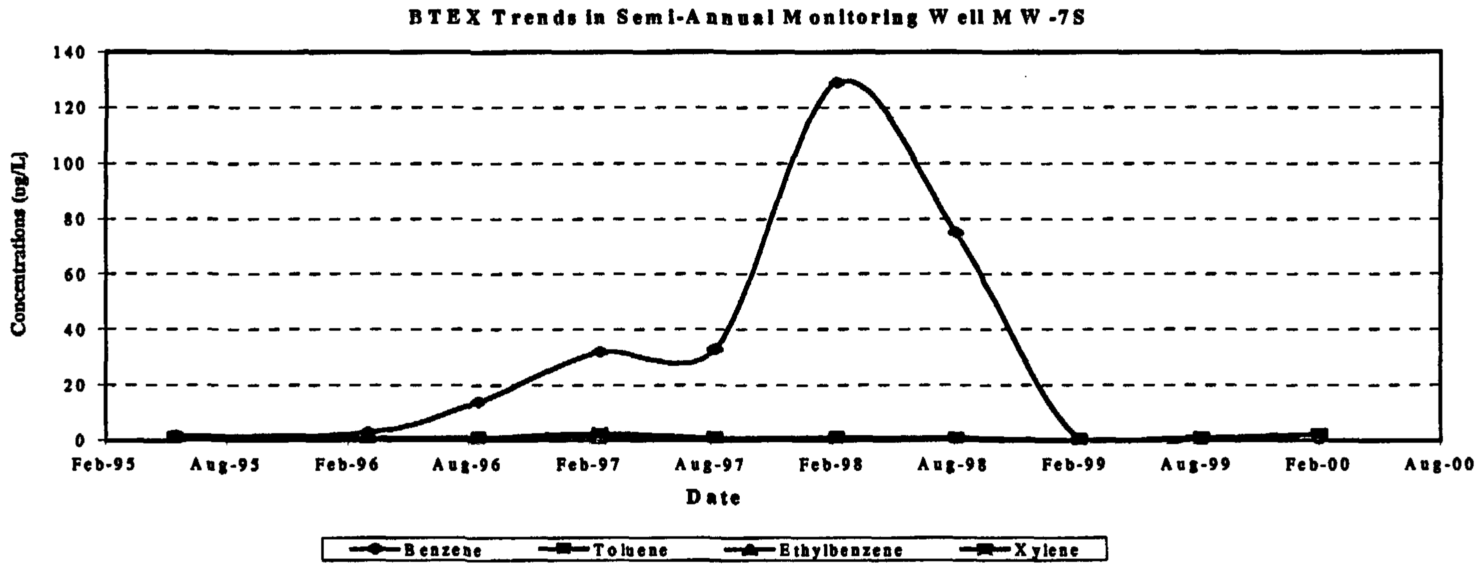
Well MW-24S Monitoring Data				
	Concentration, ug/L			
Date	Benzene	Toluene	Ethylbenzene	Xylene
30-Jun-95	330.0	390.0	14.0	5.0
06-Mar-96	750.0	300.0	31.0	10.0
19-Aug-96	160.0	1.1	1.8	3.7
19-Feb-97	180.0	0.6	1.0	0.7
13-Aug-97	140.0	5.9	4.0	13.0
10-Feb-98	330.0	8.4	2.5	13.0
09-Aug-98	240.0	1.6	1.3	4.4
10-Feb-99	360.0	2.4	1.0	1.7
12-Aug-99	81.0	1.0	1.0	2.0
05-Feb-00	560.0	12.0	1.3	9.0

Attachment 3-11



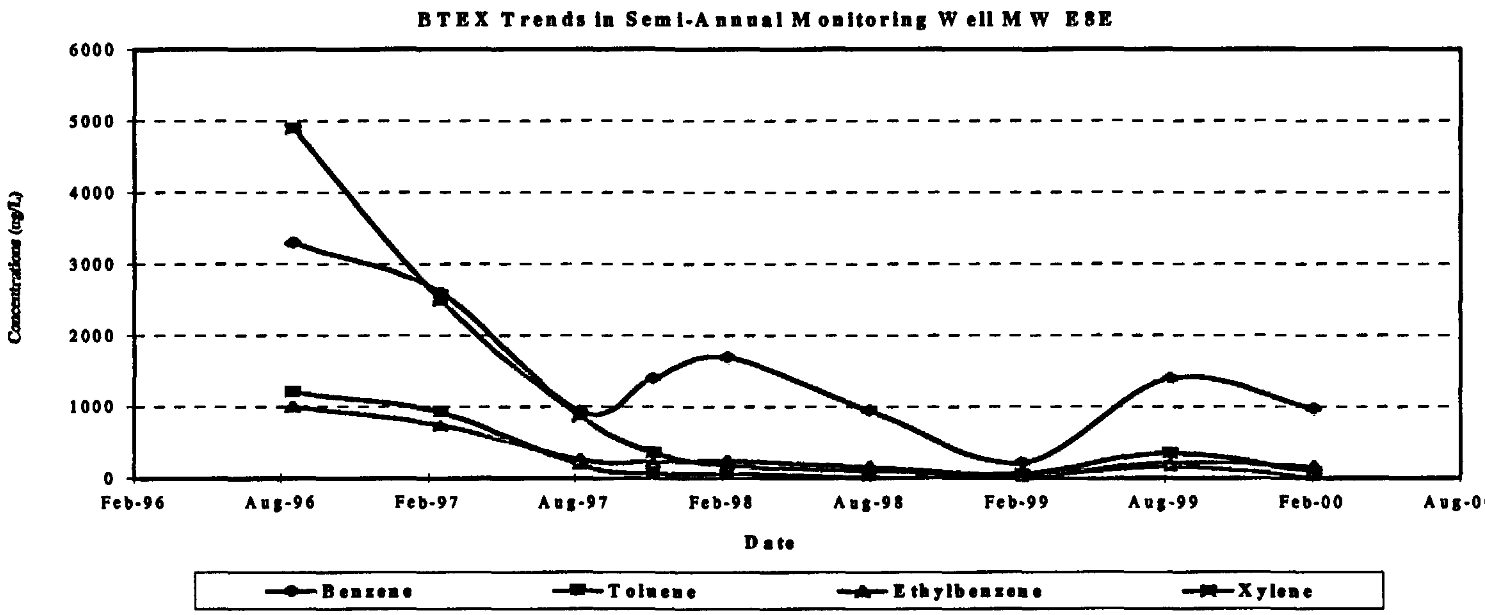
Well MW-2S Monitoring Data				
	Concentration, ug/L			
Date	Benzene	Toluene	Ethylbenzene	Xylene
5/20/95	160	5	22	8
3/6/96	400	170	38	280
8/20/96	260	9.2	12	15
2/19/97	1000	600	1600	2000
8/12/97	83	34	15	28
2/10/98	3300	2800	740	4000
8/9/98	2400	1000	560	2300
2/10/99	190	16	30	180
8/12/99	310	41	8.9	109
2/5/00	61	0.2	11	33

Attachment 3-12



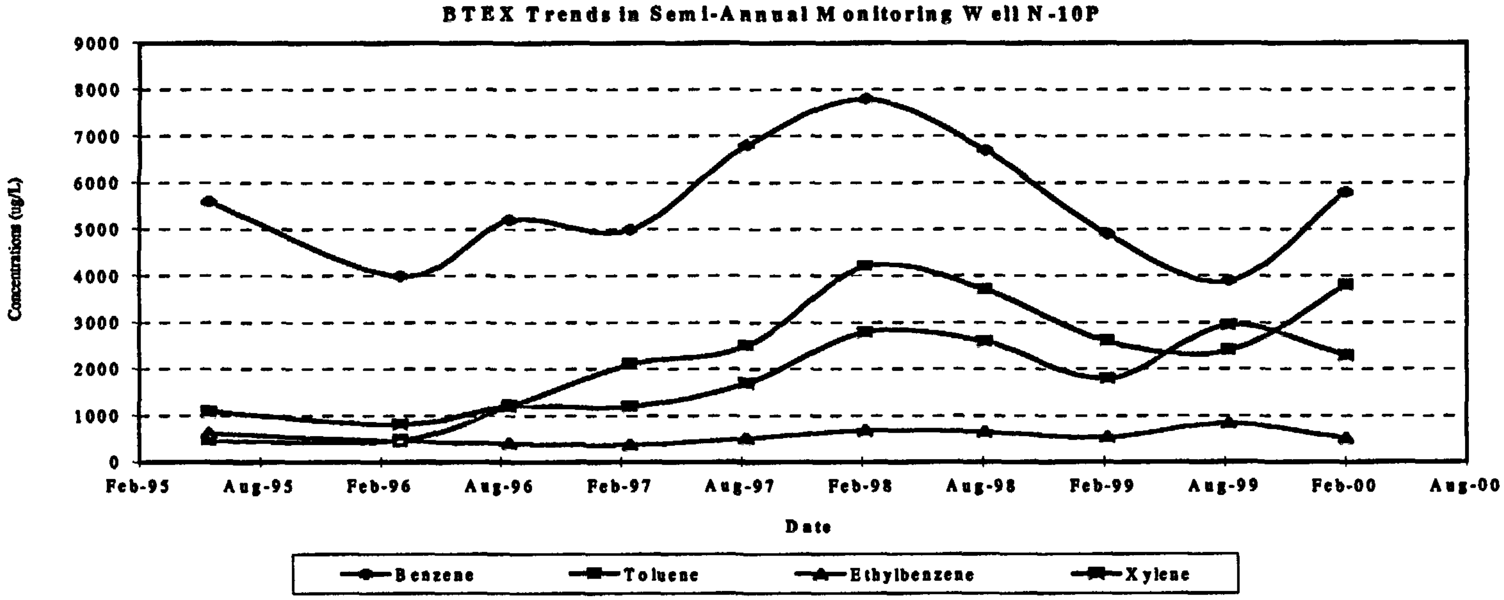
Well MW-7S Monitoring Data				
	Concentration, ug/L			
Date	Benzene	Toluene	Ethylbenzene	Xylene
20-May-95	1.7	1	1	1
6-Mar-96	3	1	1	1
20-Aug-96	14	1	1	1
19-Feb-97	32	1.1	0.49	2.6
12-Aug-97	33	1	1	1
10-Feb-98	129	1	1	1
9-Aug-98	75	0.5	1	1
10-Feb-99	0.2	0.2	0.2	0.2
12-Aug-99	0.5	0.5	0.5	1
5-Feb-00	0.33	1.9	2.2	2.4

Attachment 3-13



Well MW-E8E Monitoring Data				
	Concentration, ug/L			
Date	Benzene	Toluene	Ethylbenzene	Xylene
20-Aug-96	3300	1200	1000	4900
19-Feb-97	2600	920	740	2500
12-Aug-97	940	180	260	870
10-Nov-97	1400	65	230	360
10-Feb-98	1700	66	240	180
5-Aug-98	950	24	160	100
10-Feb-99	220	15	47	69
12-Aug-99	1400	160	220	350
5-Feb-00	980	18	160	86

Attachment 3-14

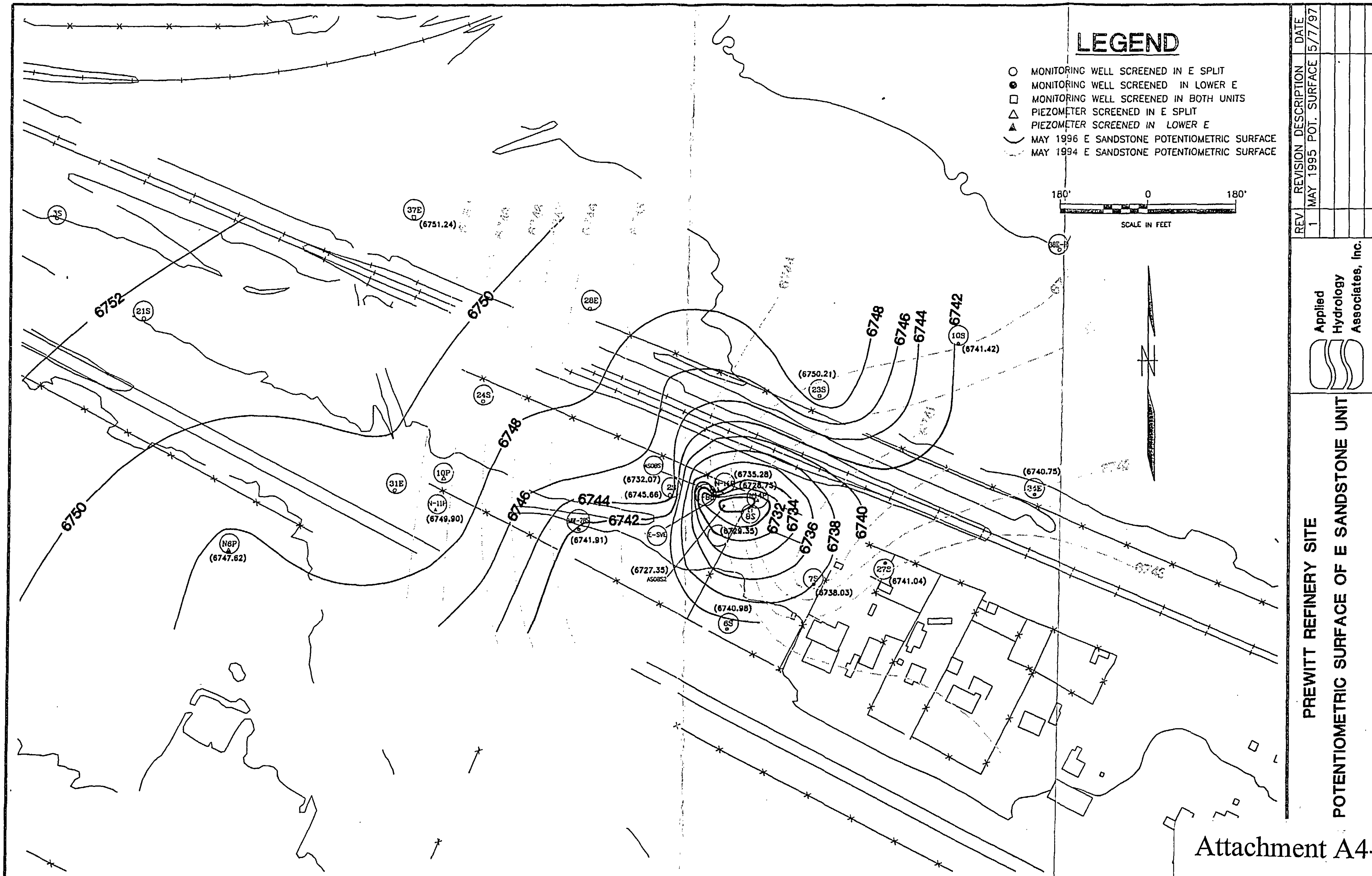


Well N-10P Monitoring Data				
	Concentration, ug/L			
Date	Benzene	Toluene	Ethylbenzene	Xylene
22-May-95	5600	460	620	1100
6-Mar-96	4000	470	450	820
20-Aug-96	5200	1200	400	1200
19-Feb-97	5000	2100	380	1200
13-Aug-97	6800	2500	510	1700
10-Feb-98	7800	4200	680	2800
9-Aug-98	6700	3700	650	2600
10-Feb-99	4900	2600	540	1800
12-Aug-99	3900	2400	840	2950
5-Feb-00	5800	3800	510	2300

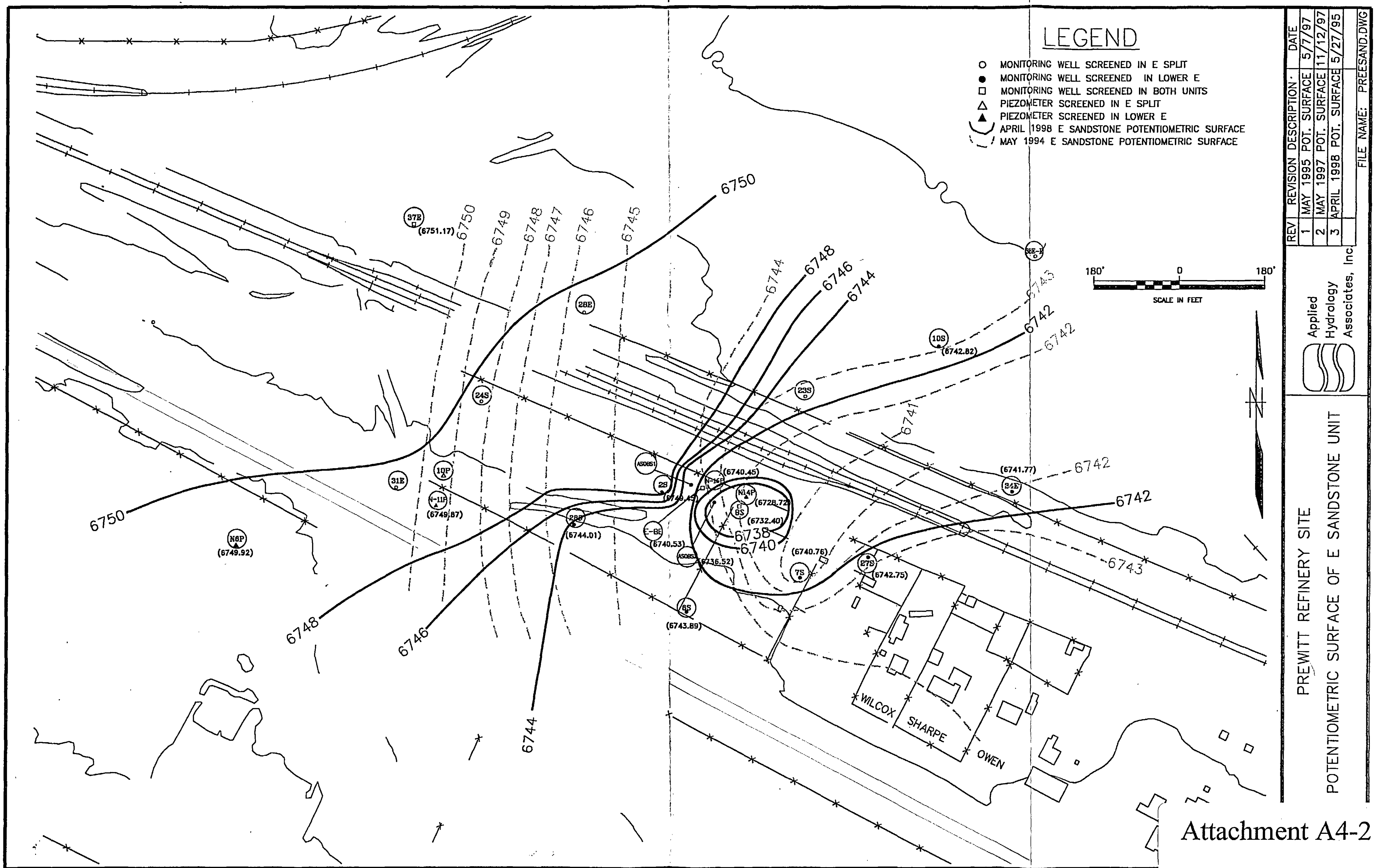
	Concentration (ppm)			
Date	Vent Scrub	South Boundary	Boundary	Treatment Building
Aug-96	1.4	1.0	1.3	-
Sep-96	1.3	1.2	1.3	-
Oct-96	0.8	0.5	0.5	-
Nov-96	0.6	0.5	0.5	-
Dec-96	0.7	0.4	0.6	-
Jan-97	0.6	0.5	0.6	-
Feb-97	0.6	0.5	0.6	-
Mar-97	0.6	0.5	0.5	-
Apr-97	0.6	0.5	0.5	-
May-97	0.6	0.5	0.5	-
Jun-97	0.8	0.6	0.6	0.8
Jul-97	0.7	0.6	0.7	0.7
Aug-97	0.7	0.6	0.6	0.7
Sep-97	0.7	0.5	0.7	0.7
Oct-97	0.7	0.6	0.7	0.7
Nov-97	0.7	0.6	0.7	0.7
Dec-97	0.7	0.6	0.7	0.7
Jan-98	0.7	0.6	0.9	0.7
Feb-98	0.7	0.6	0.8	0.7
Mar-98	0.7	0.6	0.7	0.7
Apr-98	0.9	0.5	0.9	0.9
May-98	0.6	0.5	0.5	0.6
Jun-98	0.6	0.5	0.5	0.5
Jul-98	0.6	0.5	0.5	0.6
Aug-98	0.5	0.3	0.5	0.6
Sep-98	0.6	0.5	0.7	0.6
Oct-98	0.6	0.5	0.7	0.8
Nov-98	0.5	0.4	0.5	0.6
Dec-98	0.4	0.4	0.4	0.7
Jan-99	0.4	0.4	0.4	0.7
Feb-99	0.5	0.4	0.4	0.7
Mar-99	0.4	0.4	0.4	0.7
Apr-99	0.4	0.4	0.4	0.7
May-99	0.4	0.4	0.4	0.8
Jun-99	0.4	0.4	0.4	0.7
Jul-99	0.5	0.4	0.5	0.8
Aug-99	0.5	0.4	0.5	0.8
Oct-99	0.6	0.4	0.6	0.8
Nov-99	0.4	0.4	0.4	0.7
Dec-99	0.5	0.4	0.5	0.7
Jan-00	0.5	0.4	0.4	0.8
Feb-00	0.4	0.4	0.4	0.8
Mar-00	0.4	0.4	0.4	0.7
Apr-00	0.4	0.4	0.4	0.7
Mean	0.6	0.5	0.6	0.7
Std. Deviation	0.2	0.2	0.2	0.1

Attachment 3-15
Air Monitoring Data Summary

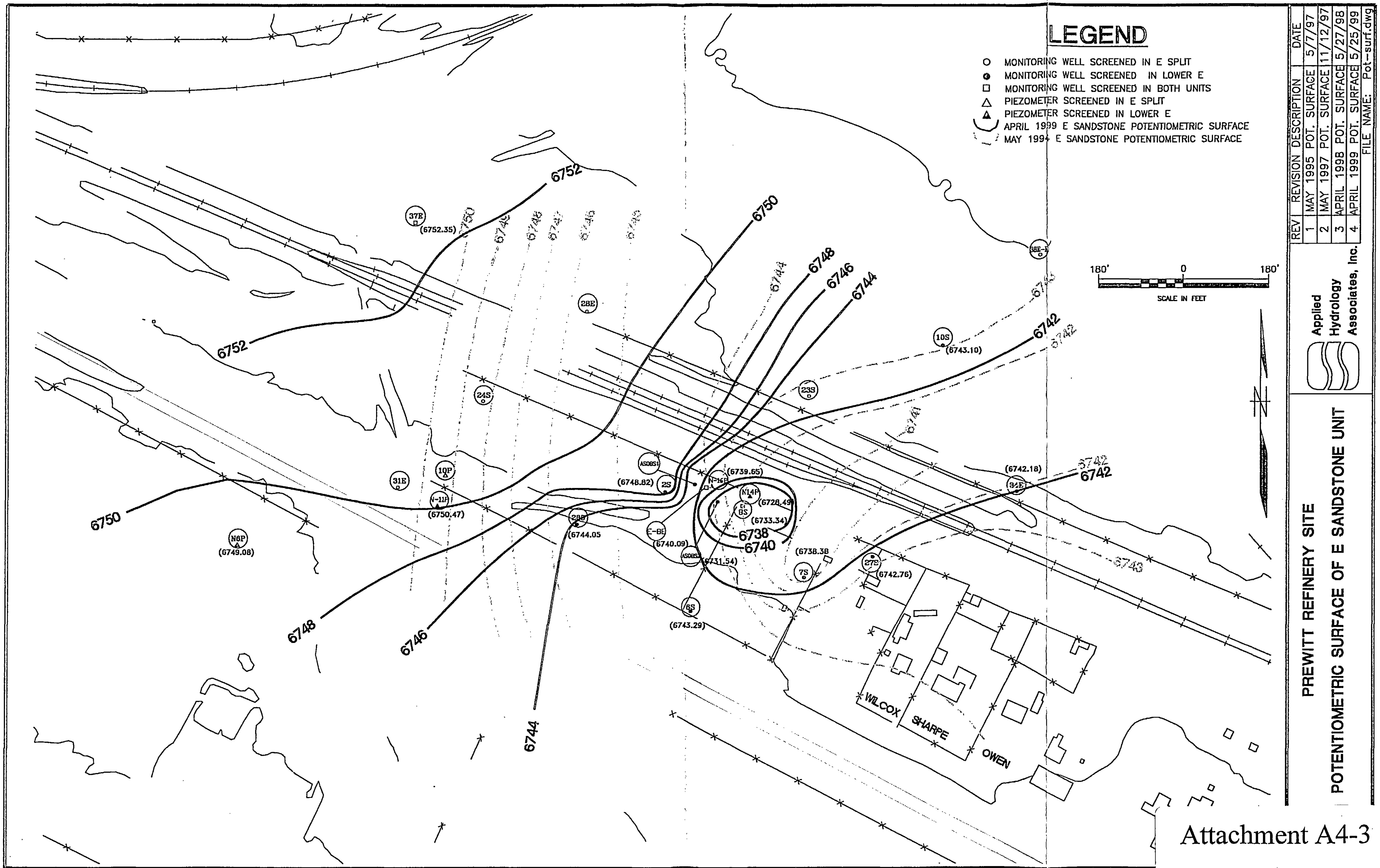
Attachment 4
Groundwater Potentiometric Maps



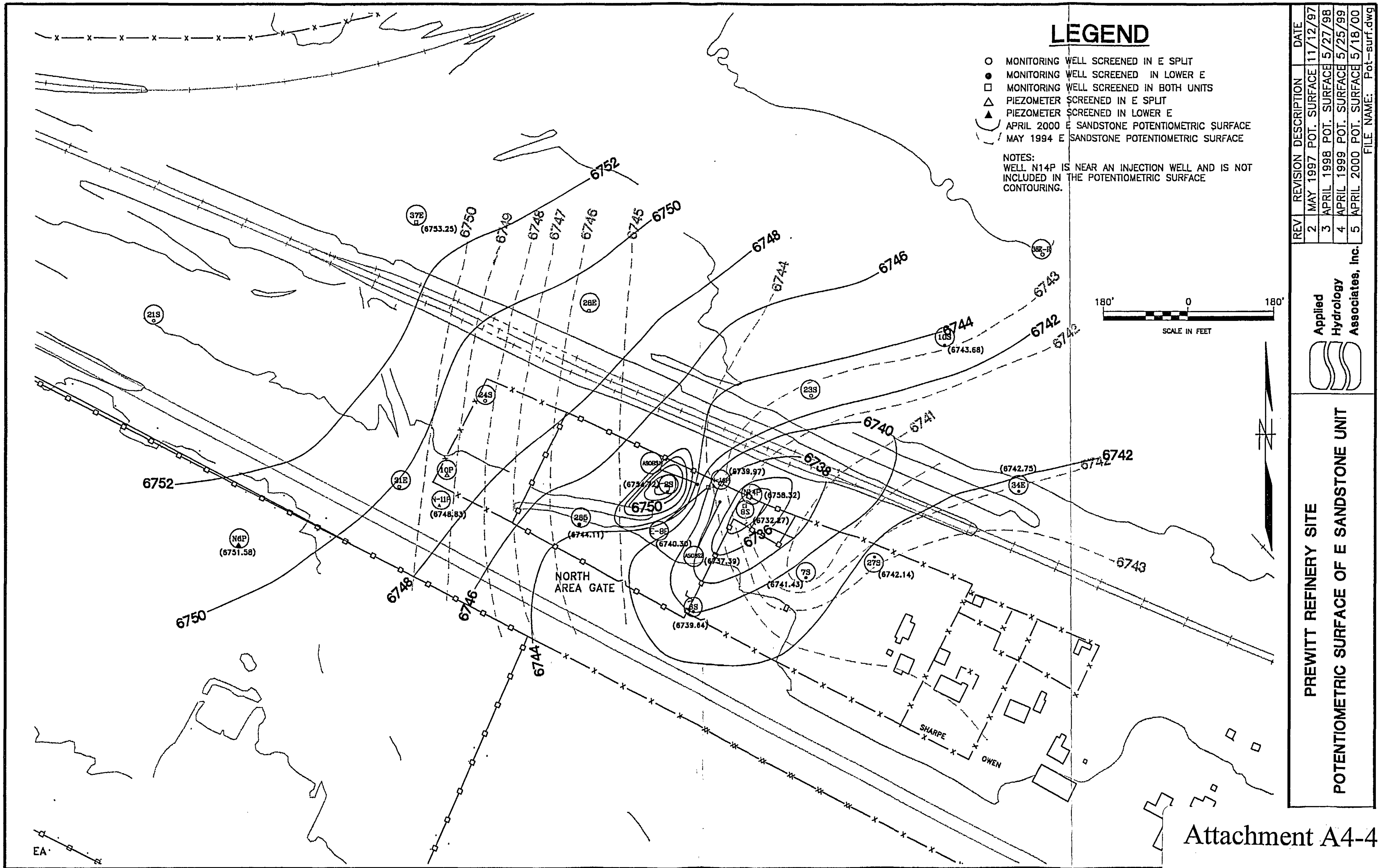
Attachment A4-1



Attachment A4-2



Attachment A4-3



Attachment A4-4