GW - 1

WORK PLANS

1985

Bloomfield Refining
Company
A Gary Energy Corporation Subsidiary

August 5, 1985

Mr. William H. Taylor, Jr.
Chief, Enforcement Section (5A-HE)
Region VI, U.S. Environmental Protection Agency
1201 Elm Street
Dallas, TX 75270

Dear Mr. Taylor:

Attached is our modified detailed workplan for monitoring, testing, analysis and reporting at the Bloomfield Refinery as required per 3013 Administrative Order, Docket No. RCRA-3013-00-185. The plan was prepared for us by our consultant, Engineering-Science, Inc. to incorporate the revisions specified in your letter of July 5, 1985. I trust this will now meet with your approval.

If you or any of your staff have any questions regarding this proposal, they should be addressed to Mr. Harry F. Mason, Turner, Mason and Company, 400 N. Olive - L.B. 264, Dallas, Texas 75201, or Mr. Joseph F. Guida, Gardere & Wynne, 1500 Diamond Shamrock Tower, Dallas, Texas 75201. Mr. Mason can be reached at (214) 754-0898 and Mr. Guida at (214) 748-7211.

Very truly yours,

BLOOMFIELD REFINING COMPANY

A. Joe Warr

A. Joe Warr
Vice President Supply,
Refining and Marketing

attachment

✓ cc: Mr. Peter Pache, Manager
Hazardous Waste Section
Groundwater and Hazardous Waste Bureau
Environmental Improvement Division
New Mexico Health and Environmental Department
P. O. Box 968
Santa Fe, NM 87504-0968

RECEIVED
AUG 09 1985
HAZARDOUS WASTE SECTION

AJW:dam

115 Inverness Drive East • Englewood, Colorado 80112-5116 • 303/799-3800 • TWX 910-935-0791

A WORK PLAN FOR MONITORING, TESTING, ANALYSIS, AND REPORTING AT THE BLOOMFIELD REFINERY

Prepared by

Engineering-Science, Inc.
2901 North Interregional
Austin, Texas 78722

July 1985

SECTION 1

INTRODUCTION

This workplan for monitoring, testing, analysis, and reporting of the subsurface hydrocarbons at the Bloomfield Refining Company, Inc. refinery in Bloomfield, New Mexico has been prepared to address the Administrative Order issued to Gary Energy Corporation and Bloomfield Refining Company, Inc., pursuant to Section 3013 of the Resource Conservations and Recovery Act (RCRA), 42 U.S.C. §6934 (Docket No. RCRA-3013-00-185). Background information on the refinery, including the environmental setting, a comprehensive summary of the geohydrology of the site, and a summary and evaluation of past investigative efforts at the site has been previously presented to the State of New Mexico Environmental Improvement Division and EPA in a January 1985 report entitled "A Review of Subsurface Petroleum Hydrocarbons at the Bloomfield Refinery." This report is presented with the workplan as Exhibit 1.

The workplan consists of three sections, including this introduction. Following the introduction is a description of the proposed field investigation in Section 2, including groundwater and surface water sampling and analysis, determination of water level measurements, and an electrical resistivity survey, as well as quality assurance/quality control and health and safety considerations. The project schedule is presented as Section 3.

SECTION 2

PROPOSED FIELD INVESTIGATION

The proposed field investigation at the Bloomfield Refinery consists of the following elements: 1) an electrical resistivity survey of potentially contaminated areas of the refinery; 2) additional groundwater monitoring and water level measurements; and 3) additional sampling and analysis of surface waters. These elements, as well as health and safety considerations and procedures which well be followed to ensure data integrity, are described in more detail in the following paragraphs.

ELECTRICAL RESISTIVITY SURVEY

An electrical resistivity survey is proposed for those areas of the refinery which are potentially impacted by subsurface petroleum hydrocarbons. The survey will be conducted with a Bison Model 2350B Electrical Resistivity Meter or equivalent instrument which is capable of obtaining measurements of the earth's resistivity at various depths. This survey is expected to be useful in several areas. First, considering the probable major differences in resistivity between the upper alluvial cobble layer and the massively-bedded Nacimiento Formation, the top of the Nacimiento Formation should be easily determined in most areas. This information will be used to determine the subsurface slope or dip of the Nacimiento Formation and the probable directions of petroleum hydrocarbon movement along the contact between the two formations. In particular, the resistivity measurements are expected to be useful in determining whether an east-west trending depression exists along the Nacimiento subcrop beneath the refinery. Secondly, the survey should provide information useful in locating any additional groundwater monitoring wells which may be necessary to define the extent of subsurface hydrocarbons.

Approximate locations of the survey lines proposed for the electrical resistivity survey are shown on Figure 2.1. The resistivity survey data will be correlated with existing known elevations of the Nacimiento Formation near monitoring wells and boreholes prior to the examination of other areas, primarily between the Hammond Ditch and the San Juan River, in the

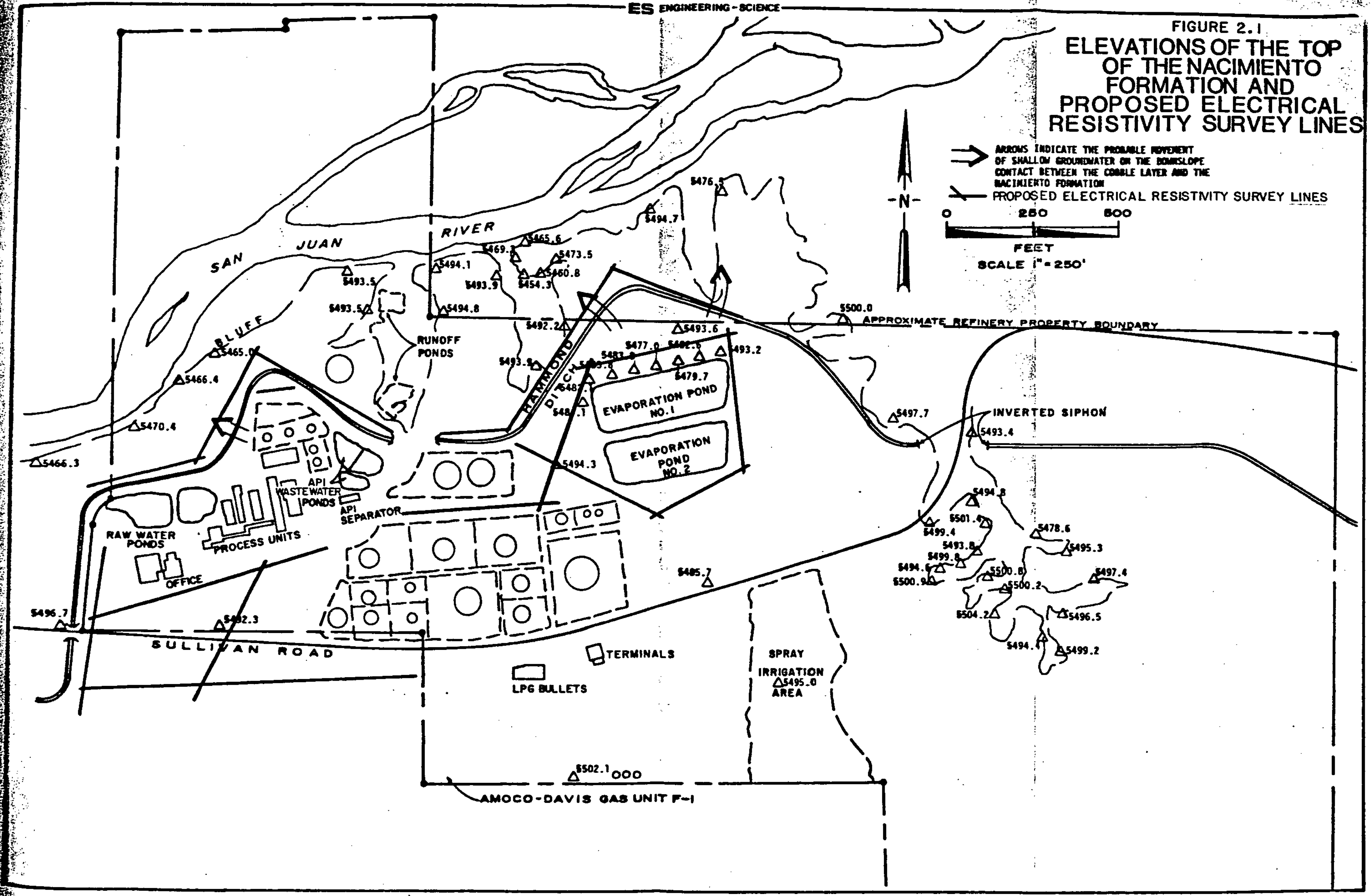


FIGURE 2.1

ELEVATIONS OF THE TOP OF THE NACIMIENTO FORMATION AND PROPOSED ELECTRICAL RESISTIVITY SURVEY LINES central portion of the refinery, and in the vicinity of MW-4. Electrode spacings will vary depending upon the desired information in each area but generally will include the upper alluvial layer. Additional survey points or lines may be included to develop additional information depending on the data developed in the field.

GROUNDWATER MONITORING WELLS

Four additional monitoring wells are proposed to provide information on the extent of petroleum hydrocarbons in the subsurface at the refinery. These proposed wells will be completed in the general areas shown on Figure 2.2.

Well Construction

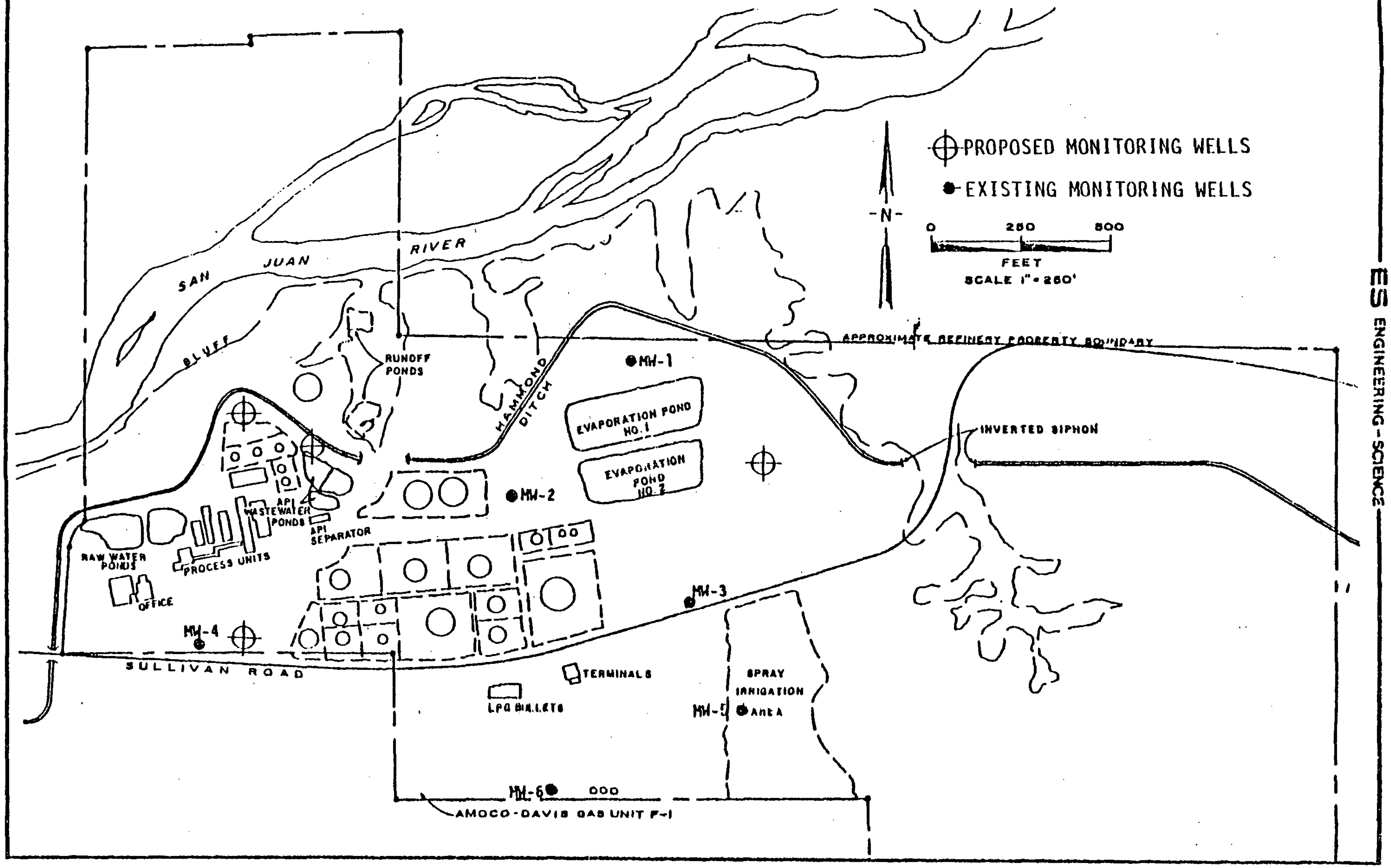
The monitoring wells will be drilled using air rotary methods if possible. Otherwise mud rotary drilling will be employed. The borehole into the Nacimiento Formation will be advanced into the top 15 to 20 feet of the Nacimiento Formation as identified through cuttings. The well will be cased with stainless steel screening in the saturated zone followed by six-inch schedule 40 PVC casing. Sand will then be placed in the well annulus, and the height of the sand will be checked by a tremie pipe. The sand will extend five feet above the top of the screen. A five-foot bentonite seal then will be placed above the screen, and its position will be verified with the tremie pipe. The annulus will then be grouted from the top of the bentonite seal to the surface. This will ensure that any water in the well is from the Nacimiento Formation and not the overlying alluvial cobble layer. The well will be developed by using a bailer to surge the well and break up any well bore mud cake. The well will be considered fully developed when three consecutive conductivity readings are the same. The three remaining wells will be completed in the cobble layer and will be constructed and developed in a similar manner.

Equipment Cleaning and Decontamination

All drilling equipment and materials (i.e., drill bits, subs, drill collars, drill pipe, tremie pipe, portable mud pits, Kelly casing, screens, and caps) shall be cleaned and void of any external oils or grease prior to each use. All hoses, mud pits, drill string, mud pumps, water tanks, etc.

FIGURE 2.2

LOCATIONS OF EXISTING AND PROPOSED MONITORING WELLS



shall be flushed with water before well drilling. All decontamination water and development water will be collected and routed to the refinery wastewater treatment system. All drilling mud and cuttings will be disposed off-site at an approved landfill.

Sampling Equipment and Procedures

Groundwater samples will be collected from each of the six existing wells and the proposed wells on a quarterly basis, using a stainless steel bailer. To minimize the potential for cross-contamination, the wells will be sampled in the order of probable hydrocarbon concentrations, progressing from lowest to highest. The bailer will be cleaned between samples with methanol or acetone, followed by a detergent (Alconox) cleaning, followed by a deionized water final rinse. The samples will be collected after at least two casing volumes have been removed from each well, and pH, conductivity and temperature readings indicate true formation water is being sampled.

Samples from both MW-4 and the proposed wells will be analyzed for the acid and base/neutral priority pollutants, cyanide, phenols, priority pollutant metals, and volatile organic priority pollutants, plus TOC, TDS, chloride, and sulfate. The five remaining wells will be sampled and analyzed for a shorter list of indicator parametars, including the priority pollutant metals, cyanide, phenols, TOC, TDS, chloride, sulfate, benzene, toluene, xylene, and ethylbenzene. All volatile priority pollutant samples will be collected in 40 ml septum vials, and the other samples will be collected in 1/2 gallon clean amber glass containers.

Water Level Measurements

Water levels will be measured in each of the wells on a monthly basis. Due to the complicated hydrogeology resulting from the seasonal impact of the Hammond Ditch, it will be necessary to monitor water levels for at least one full cycle, i.e. one year, to obtain data on the movement of groundwater in the subsurface. All water level measurements will be recorded in a field notebook with the date and time, name of person making the measurement, method of determination, and other observations. This information will be incorporated into a water table contour map and submitted to EPA on a quarterly basis.

Determination of Aquifer Hydraulics

A slug test will be performed on MW-1, MW-2, or MW-4 for the purpose of estimating the hydraulic characteristics of the upper cobble layer. This test is more likely to yield usable data than a pump test given the thin saturated zone in the upper alluvial layer. The test is performed by adding a known volume of liquid to the well and monitoring the change in water level over time. The change in water level can then be related to aquifer characteristics such as the hydraulic conductivity, transmissivity, and storage coefficient using standard mathematical relationships. These data will be used to evaluate possible contamination transport in the subsurface, and will be submitted to EPA for review upon completion of the test.

Documentation

A field logbook will be maintained to document all activities related to ground water monitoring and water level measurement. The following type of information will be recorded as appropriate for each sample collected or measurement made:

1) date and time of logbook entries;
2) date and time of samples collected or measurements made;
3) description of all sampling or measurement activities in chronological order;
4) name of sampler and observers, if any;
5) field conditions (weather, etc.);
6) identification numbers and name of samples collected;
7) any field measurements made, such as temperature, pH, conductivity, etc., referenced to a time and location;
8) identification of any photographs taken; and
9) reference to the sample log sheet

SURFACE WATER SAMPLING

Surface water sampling of the Hammond Ditch and San Juan River is proposed to provide additional information on the potential off-site migration of petroleum hydrocarbons. The sampling will be scheduled to coincide with "worst-case" receiving water conditions: i.e. low flow conditions in the San Juan River and the beginning of irrigation season for the Hammond Ditch (normally mid-April).

Sampling Equipment and Procedures

The sampling of the San Juan River will be conducted during low flow conditions, at a flow of 300 cfs if possible, or during the last four months of 1985 if low-flow conditions do not occur prior to this time. The flow rate of the river will be determined and documented at the time of sampling by direct measurement or by subtracting the reading at the USGS Animas River Station (09364500) from the reading at Navajo Dam (09365000). Three composite samples, composed of depth-integrated portions collected at three locations across the San Juan River, will be analyzed for base/neutral and acid priority pollutants fractions, priority pollutant metals, cyanide, phenols, TOC, sulfate, and pH. Individual samples which will be composited will be collected approximately two-tenths, one-half, and eight-tenths of the distance across the San Juan River in the vicinity of the Hwy 44 Bridge, at the surface and approximately two-tenths and eight-tenths of the total river depth. These samples will be collected in clean glass containers and composited by volume into a single 1/2 gallon clean amber container. A single sample will be collected in duplicate in 40 ml. septum vials at the water surface, two-tenths of the distance across the San Juan from the refinery. These samples will be analyzed for the volatile priority pollutants and should indicate whether floating hydrocarbons are migrating downstream from the river terrace deposits.

Sampling of the Hammond Ditch will be conducted at the start of the irrigation season (normally in mid-April), when the potential for flushing hydrocarbons downstream is greatest. Immediately prior to the summer irrigation season, when the berms are removed and water begins to flow in the ditch, the potential for downstream impacts is greatest.

The Hammond Ditch samples will be collected at two locations: just downstream of the refinery property south of Sullivan Road, and just downstream of the API wastewater ponds. Composite depth-integrated samples will be collected in clean glass containers from the bank nearest the process area at the surface and two-tenths and eight-tenths of total ditch depth, and will be composited by volume in a 1/2 gallon clean amber glass container. These samples will be analyzed for base/neutral and acid priority pollutant fractions, priority pollutant metals, pH, cyanide, and phenols. Grab volatile priority pollutant samples will be collected from the surface at the same locations in 40 ml septum vials. These samples will be collected within 24 hours of the initial release of irrigation water to the Hammond Ditch.

Documentation

Notes will be recorded during all sampling activities in a field logbook so that a permanent record of activities can be maintained. The following information will be recorded for each surface water sample collected:

1) date and time of logbook entries;
2) description of all sampling activities in chronological order;
3) name of sampler and observers, if any;
4) field conditions (weather, etc.);
5) date and time of samples collected;
6) identification number and name of samples collected;
7) any field measurements made, such as temperature, pH, flow, etc., referenced to a time and location;
8) identification of any photographs made; and
9) reference to the sample log sheet.

DATA INTEGRITY

The integrity of the data collected will be maintained through the maintenace of adequate chain-of-custody procedures as well as the laboratory quality assurance/quality control program.

Chain of Custody

All samples will be appropriately preserved and delivered to the laboratory within EPA recommended holding times. The samples will normally be iced and placed in an insulated cooler for shipment. The Chain of Custody Record will serve to document that no unauthorized handling of the samples occurred enroute to the laboratory. It also contains a record of parameters requested for analysis. Relevant information about each sample container will be written on the form. Preservation methods will also be indicated. The form will be signed and dated by the individual who actually collected the sample. The names of any commercial delivery services used will also appear on the Chain of Custody Record.

Quality Assurance/Quality Control

All samples will be delivered to a qualified laboratory such as the Rocky Mountain Analytical Laboratory in Arvada, Colorado, Assaigai Analytical Laboratories in Albuquerque, New Mexico, or other qualified laboratory for analysis. These laboratories have elaborate quality assurance/quality control procedures to ensure data integrity.

Analytical Techniques

All samples testing will be conducted in accordance with approved methods. The methods commonly utilized by the Rocky Mountain Analytical Laboratory are presented as an example in Exhibit 2.

HEALTH AND SAFETY PLAN

The purpose of this plan is to establish personnel protection standards and mandatory safety practices and procedures, and provide for contingencies that may arise during monitoring well construction and sampling activities at the Bloomfield Refinery. All personnel who engage in investigative activities at this site will be required to be familiar with the plan and comply with its requirements.

Heat Stress Monitoring

Strenuous work and high summer temperatures combined with the requirements for personal protective equipment may create heat stress. It is likely that, given conditions existing at the site during the summer months, heat stress will be the major health hazard. For monitoring the body's recuperative abilities to excess heat, the following techniques will be used. Monitoring of personnel wearing impervious clothing should commence when the ambient temperature is 70 degrees F or above. Monitoring frequency should increase as the ambient temperature increases or as slow recovery rates are observed. When temperatures exceed 85 degrees F, workers would be monitored for heat stress after every work period. Monitoring should be performed by a person who is trained to recognize the symptoms of heat stress.

1) Heart rate (HR) should be measured by the radial pulse for 30 seconds as early as possible in the resting period. The HR at the beginning of the rest period should not exceed 110 beats per minute. If the HR is higher, the next work period should be shortened by 10 minutes (or 33 percent), while the length of the rest period stays the same. If the pulse rate is 100 beats per minute or higher at the beginning of the next rest period, the following work cycle should be shortened by 33 percent.

2) Good hygienic standards must be maintained by frequent change of clothing and daily showering. Clothing should be permitted to dry during rest periods. Persons who notice skin problems should immediately consult medical personnel.

Contaminant Monitoring

Contaminant monitoring during the drilling and monitoring well construction using direct-reading field instruments will be required for the following purposes:

(1) to detect gases and vapor created by monitoring well installation, and

(2) to measure the total atmosphere vapor/gas concentration to select the appropriate level of personal protection.

Monitoring of potential vapor/gas sources and breathing zone during monitoring well installation will employ a Bachrach TLV Meter organic vapor detector, model number 23-7350, or equivalent instrument for monitoring organic vapors.

Air Monitoring Procedures

Continuous contaminant monitoring using the direct-reading instrument described above will be performed during work operations. The purpose of this monitoring is to detect changes in site conditions which require evacuation of an area or adjustment of level of personal protection. Specifically, monitoring will be required during monitoring well installation. The gas/vapor detection instruments will be used to measure the total gas/vapor concentration in the breathing zone of the work team. A level of personnel protection will be chosen based on the measured total gas/vapor concentration.

Level D protection has been specified for all site activiites. No respiratory protection is provided by Level D. Likewise, chemical cartridge respirators (Level C) afford adequate respiratory protection only when a number of conditions are met. Therefore, monitoring of the total gas/vapor concentration is required during operations in areas where the potential for air contamination exists. Level C and D protection equipment is listed in Table 2.1. Use of the Bachrach TLV meter for air monitoring only provides measurement of organic vapors and some other gases in the air. Respirable paticulates are not detected by these instruments. Under conditions where the work party is working under dusty conditions in potentially contaminated areas, respirators providing protection from dust will be required.

The following guidelines will be used for selecting the level of protection based on total atmospheric vapor/gas concentrations in the work space:

Background Concentration of Vapor/Gas to 20 ppm Above Background

Level D personnel protection equipment will be required at concentrations of organic vapor of less than 20 ppm above background as measured by the Bachrach TLV meter.

20 ppm Above Background to 50 ppm Above Background

Level C protection, including half-face air purifying masks equipped with an organic vapor cartidge (or a combined organic vapor/particulate cartridge) will be worn. Eye protection (chemical splash goggles) must be worn with half-face respirators. Alternatively, a full-face cartridge respirator may be used.

Greater than 50 ppm Above Background

If the organic vapor concentration in the work space exceeds 50 ppm above background, drilling will cease until the nature of the organic vapor concentration can be determined and evaluated.

TABLE 2.1

LEVEL C AND LEVEL D PROTECTION

Level C Protection

1. Full-face piece, air purifying, canister-equipped respirator or half-face respirators with chemical splash goggles
2. Chemical-resistant clothing, long sleeves, one or two pieces
3. Gloves
4. Steel toe and shank boots
5. Hard hat
6. Options as required
   a. Inner chemical-resistant gloves
   b. Disposal outer boots
   c. Escape mask

Level D Protection

1. Coveralls
2. Leather or chemical-resistant boots or shoes, steel toe and shank
3. Hard hat
4. Options as required
   a. Gloves
   b. Disposable outer boots
   c. Safety glasses or chemical splash goggles
   d. Escape mask or respirator

Area Monitoring

The site inspection activiites are not expected to have a significant effect on off-site air quality. Therefore, area monitorig of off-site air quality will not be required.

Cleanup

Cleanup of personnel and equipment is necessary to prevent potentially harmful materials from being transferred from work areas to other areas. Cleanup procedures must be appropriate for the types of compounds present, the personal protective equipment being used, and the operations taking place in the work area. A work zone will be set up to provide for personnel and equipment cleanup. Heavy equipment will be cleaned in a specially designated area within the work zone.

Emergency Procedures

In general, while at the refinery, the procedures outlined in the Bloomfield Contingency Plan and Emergency Procedures will be in effect. However, in the event that an emergency develops on site, the procedures delineated herein are to be followed immediately. Emergency conditions are considered to exist if:

(1) any member of the field crew is involved in an accident or experiences any adverse effects or symptoms of exposure while on-site; or

(2) a condition is discovered that suggests the existence of a situation more hazardous than anticipated.

Personal Injury

In case of personal injury at the site, the following procedures should be followed:

(a) An on-site employee trained in first aid should administer immediate treatment to an ill or injured worker and decide if the worker can be moved.

(b) The injured worker should be taken immediately to a medical facility for follow-up care and observation. The staff at the medical facility should be advised that the patient's clothing and skin might be contaminated with chemicals.

(c) In the event that an accident occurs, the Facility Coordinator is to complete an Accident Report Form for submittal to the EPA project officer, and should assure that follow-up action is taken to correct the situation that caused the accident.

Chemical Exposure

If a member of the field crew is exposed to chemicals, the procedures outlined below should be followed:

(a) Another team member (buddy) should remove the individual from the immediate area of contamination.

(b) Precautions should be taken to avoid exposure of other individuals to the chemical.

(c) If the chemical is on the individuals clothing, the clothing should be removed if it is safe to do so.

(d) If the chemical has contacted the skin, the skin should be washed with copious amounts of water, preferably under a shower.

(e) In case of eye contact, an emergency eye wash should be used. Eyes should be washed for at least 15 minutes.

Fire or Explosion

A hazard of fire or explosion exists when flammable materials are being used or handled, when there is the possibility that a combustible atmosphere may be generated by operations such as excavation in areas contaminted with combustible materials. Under these conditions, the following precautions must be taken:

(a) Continuous monitoring of work areas with a combustible gas detector will be conducted if the potential for fire or explosion exists.

(b) If monitoring indicates the existence of a combustible atmosphere (25 percent of the lower explosive limit), there area will be evacuated immediately and emergency personnel will be contacted.

Re-entry will not take place until it can be determined that it can be done safely.

During operations involving a high hazard of fire or explosion, fire fighting and other emergency personnel will be on hand while the operation is taking place.

Emergency Contacts

Should any situation or unplanned occurrence require outside assistance or support services, the appropriate contact from the following list should be made:

EMERGENCY PHONE NUMBERS

Bloomfield Fire Department	632-8011
Bloomfield Police Department	632-8011
San Juan County Sheriff	334-6107
State Police	325-7547
Ambulance (dispatched through Farmington Fire)	325-3501
County Fire Department (dispatched through Farmington Fire)	325-3501
Poison Control	1-800-432-6866
Bomb Personnel (State Police Office)	325-7547
ETHYL CORP (T.E.L. Emergencies)	504-344-7147
CHEMTREC (Chemical Emergencies)	1-800-424-9300
City of Farmington (Electric Utility)	327-7701
Kay-Ray	312-259-5600
E.I.D. Radiation Protection Bureau	505-984-0020
Mobile Inspection (Radiography Assistance	327-9473
Contact of New Mexico (Call out Assistance)	327-4666

EQUIPMENT RESOURCES

Water Tankers & Vacuum Trucks	
Chief Transport	325-2396
C & J Trucking	325-7770
Dawn Trucking Co.	327-0416
Delgarno	327-0461 or 327-6871
Triple F	334-6193
Sunco Trucking	327-0416
Earth Moving Equipment	
Adobe Construction (Ernie Motto)	334-6696
Rosenbaum	325-6367
Coffey Construction	632-3663
Atchison Construction	327-6276
Gas Co. of New Mexico	325-2889
W & C Contractors	325-1991

Welding & Cutting	
Henry Vigil	632-3045
Willie Soloman	632-3797
Justis Supply	325-3551
Wrecker or Rig Up Trucks	
Sandia Detroit	325-5071
Drake Well Service	327-7301 or 327-6847
ODECO Inc.	632-3392
Dawn Trucking	327-6316
Aerial Ladder or Basket	
City of Farmington Utility	327-7701
Farmington Fire	325-3501
Foam Supplies	
Seagull Roosevelt Refinery	801-722-5128
Thunderbird Sales	505-881-6222
Boots & Coots Fire Protection	713-999-0276

Training

On-site work personnel will have formal or prior on-the-job training for the tasks they are assigned to perform. Special training will be required for operations such as monitoring well installation. Personnel responsible for air monitoring and site safety will be qualified for these responsibilities.

On-Site Orientation

An on-site orientation session will be required for all on-site personnel and will include the following:

(1) Health effects and hazards of the chemical identified or suspected to be on-site.

(2) Personnel protection including the use, care, and fitting of personnel protective equipment, and the necessity for personnel protection, effectiveness, and limitations of equipment.

(3) Decontamination procedures.

(4) Prohibitions in areas and zones including:
  (a) site layout,
  (b) procedures for entry and exit of areas and zones, and
  (c) standard safe work practices.

(5) Emergency procedures.

(6) Medical requirements.

SECTION 3

PROJECT SCHEDULE

Due to the complex hydrogeology at the site as influenced by the Hammond Ditch, it is totally unrealistic to complete a thorough investigation of the subsurface petroleum hydrocarbons at the refinery in the four-month time frame referenced in the Administrative Order. Since the subsurface groundwater movement in the area south of the ditch appears to be dependent on the seasonal use of the ditch for irrigation, any findings in this area on the direction and rate of groundwater movement would be totally dependent on whether or not the ditch was being used to transport irrigation water. Furthermore, the "worst case" conditions of the receiving waters (the Hammond Ditch and the San Juan River) would in all likelihood not occur during this time period. It seems most prudent to proceed with the investigation of the refinery in a manner which will reflect the greatest potential for off-site impacts and allow the seasonal changes in groundwater movement to be quantified. Therefore, a more realistic time schedule of twelve months has been proposed to complete the elements of the workplan, with an additional month to complete a final, comprehensive project report.

A schedule for individual project workplan tasks is presented on Figure 3.1. As shown, the proposed electrical resistivity survey would be conducted during the initial month of the project. Following the survey, the proposed groundwater monitoring well and any other necessary wells will be completed during the next month. Groundwater monitoring of all wells will commence after completion of the well(s), and will be conducted quarterly. However, water level measurements will be made on a monthly basis. A surface water sampling schedule cannot be determined in terms of project months since it will depend on low flow conditions in the San Juan River and the startup of irrigation season for sampling in the Hammond Ditch. However, all sampling and measurements will be completed in a twelve month period. As shown on Figure 3.1, the final project report will be prepared during the thirteenth month.

FIGURE 3.1

PROPOSED PROJECT SCHEDULE

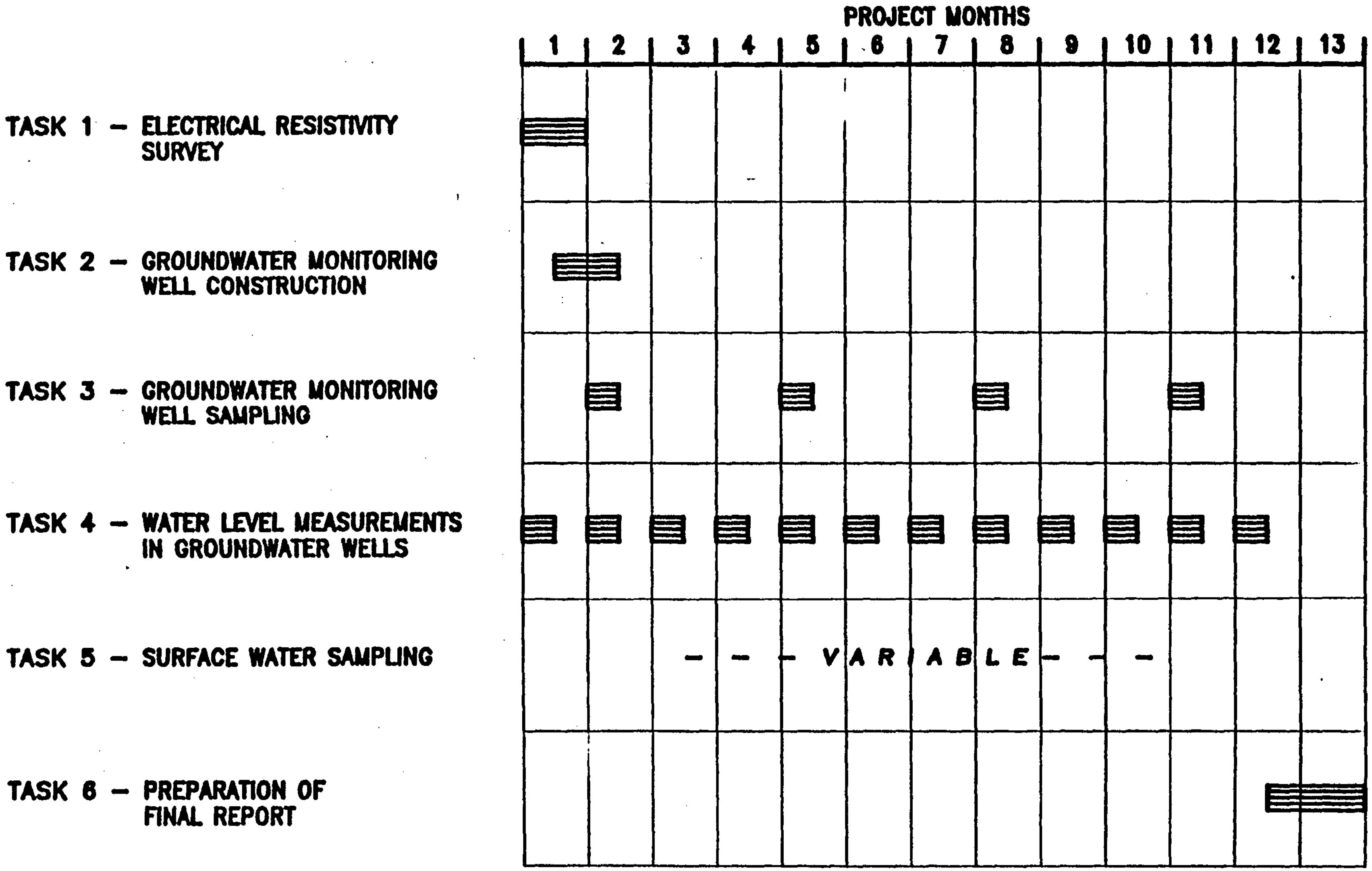


Exhibit 1

A REVIEW OF
SUBSURFACE PETROLEUM HYDROCARBONS
AT THE BLOOMFIELD REFINERY

Prepared for

BLOOMFIELD REFINING COMPANY

by

Engineering-Science, Inc.
2901 North Interregional
Austin, Texas 78722

January 1985

Bloomfield Refining Company
A Gary Energy Corporation Subsidiary

RECEIVED
OIL CONSERVATION
SANTA FE

April 26, 1985

Mr. William H. Taylor, Jr.
Chief, Enforcement Section (6AW-HE)
Region VI, U.S. Environmental Protection Agency
1201 Elm Street
Dallas, TX 75270

Dear Mr. Taylor:

Attached is the proposed detailed workplan for the monitoring, testing, analysis and reporting of any hazardous waste contamination associated with our Bloomfield refining facility located east of Sullivan Road, Bloomfield, New Mexico 87413. The plan was prepared for us by our consultant, Engineering-Science, Inc. I trust that this will meet with your approval. We, of course, will proceed to implement the program immediately upon receipt of notification of your agreement with the proposal.

If you or any of your staff have any questions regarding this proposal, they should be addressed to Mr. Harry F. Mason, Turner, Mason and Company, 400 N. Olive - L.B. 264, Dallas, Texas 75201, or Mr. Joseph F. Guida, Gardere & Wynne, 1500 Diamond Shamrock Tower, Dallas, Texas 75201. Mr. Mason can be reached at (214) 754-0898 and Mr. Guida at (214) 748-7211.

Very truly yours,

David J. Youngggren

David J. Youngggren
Vice President Finance and
Administration

attachment

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April 1985

A WORKPLAN FOR

MONITORING, TESTING, ANALYSIS, AND REPORTING AT THE BLOOMFIELD REFINERY

PREPARED FOR

BLOOMFIELD REFINING COMPANY

ENGINEERING-SCIENCE
DESIGN • RESEARCH • PLANNING
2901 NORTH INTERREGIONAL, AUSTIN, TEXAS 78722 • 512/477-9901
OFFICES IN PRINCIPAL CITIES
ES

MONITORING, TESTING, ANALYSIS,
AND REPORTING
AT THE BLOOMFIELD REFINERY

Prepared by

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Austin, Texas 78722

April 1985

SECTION 1

INTRODUCTION

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SECTION 2

PROPOSED FIELD INVESTIGATION

The proposed field investigation at the Bloomfield Refinery consists of the following elements: 1) an electrical resistivity survey of potentially contaminated areas of the refinery; 2) additional groundwater monitoring and water level measurements; and 3) additional sampling and analysis of surface waters. These elements, as well as health and safety considerations and procedures which well be followed to ensure data integrity, are described in more detail in the following paragraphs.

ELECTRICAL RESISTIVITY SURVEY

An electrical resistivity survey is proposed for those areas of the refinery which are potentially impacted by subsurface petroleum hydrocarbons. The survey will be conducted with a Bison Model 2350B Electrical Resistivity Meter or equivalent instrument which is capable of obtaining measurements of the earth's resistivity at various depths. This survey is expected to be useful in several areas. First, considering the probable major differences in resistivity between the upper alluvial cobble layer and the massively-bedded Nacimiento Formation, the top of the Nacimiento Formation should be easily determined in most areas. This information will be used to determine the subsurface slope or dip of the Nacimiento Formation and the probable directions of petroleum hydrocarbon movement along the contact between the two formations. In particular, the resistivity measurements are expected to be useful in determining whether an east-west trending depression exists along the Nacimiento subcrop beneath the refinery. Secondly, the survey should provide information useful in locating any additional groundwater monitoring wells which may be necessary to define the extent of subsurface hydrocarbons.

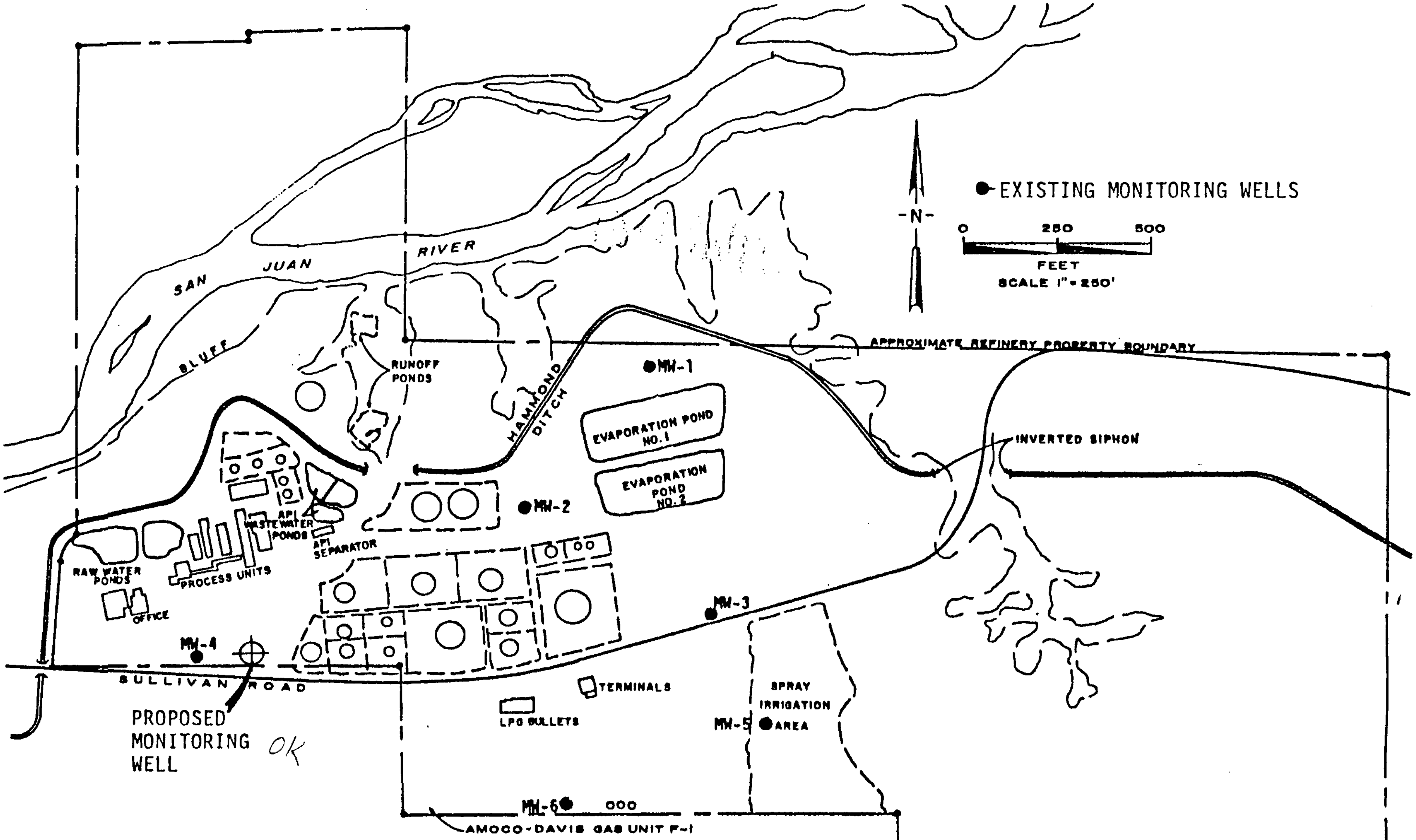
Good

GROUNDWATER MONITORING WELLS

At present, a single groundwater monitoring well is proposed in the approximate location shown on Figure 2.1. This well will penetrate the

FIGURE 2.1

LOCATIONS OF EXISTING AND PROPOSED MONITORING WELLS



OK

ES ENGINEERING-SCIENCE

Nacimiento Formation and will be used to determine whether the subsurface hydrocarbons have entered the formation.

Well Construction

The monitoring well will be drilled using air rotary methods if possible. Otherwise mud rotary drilling will be employed. The borehole will be advanced into the top 15 to 20 feet of the Nacimiento Formation as identified through cuttings. The well will be cased with 10 feet of six-inch PVC mill slotted Schedule 40 screen, followed by six-inch schedule 40 PVC casing. Sand will then be placed in the well annulus, and the height of the sand will be checked by a tremie pipe. The sand will extend five feet above the top of the screen. A five-foot bentonite seal then will be placed above the screen, and its position will be verified with the tremie pipe. The annulus will then be grouted from the top of the bentonite seal to the surface. This will ensure that any water in the well is from the Nacimiento Formation and not the overlying alluvial cobble layer. The well will be developed by using a bailer to surge the well and break up any well bore mud cake. The well will be considered fully developed when three consecutive conductivity readings are the same.

How to
Keep water
from cobbles
out while
drilling?

Equipment Cleaning and Decontamination

All drilling equipment and materials (i.e., drill bits, subs, drill collars, drill pipe, tremie pipe, portable mud pits, Kelly casing, screens, and caps) shall be cleaned and void of any external oils or grease prior to each use. All hoses, mud pits, drill string, mud pumps, water tanks, etc. shall be flushed with water before well drilling. All decontamination water and development water will be collected and routed to the refinery wastewater treatment system. All drilling mud and cuttings will be disposed with the refinery API separator solids.

OK

Sampling Equipment and Procedures

Groundwater samples will be collected from each of the six existing wells and the new proposed well on a quarterly basis, using a stainless steel bailer. To minimize the potential for cross-contamination, the wells will be sampled in the order of probable hydrocarbon concentrations, progressing from lowest to highest. The bailer will be cleaned between samples with methanol or acetone, followed by a detergent (Alconox) cleaning, followed by a deionized water final rinse. The sample will be collected after at least two casing volumes have been removed from each well, and pH, conductivity and temperature readings indicate true formation water is being sampled.

Samples from both MW-4 and the proposed well will be analyzed for the acid and base/neutral priority pollutants, cyanide, phenols, priority pollutant metals, and volatile organic priority pollutants, plus TOC, TDS, chloride, and sulfate. The five remaining wells will be sampled and analyzed for a shorter list of indicator parametars, including the priority pollutant metals, cyanide, phenols, TOC, TDS, chloride, sulfate, benzene, and toluene. All volatile priority pollutant samples will be collected in 40 ml septum vials, and the other samples will be collected in 1/2 gallon clean amber glass containers.

may be OK?

Water Level Measurements

Water levels will be measured in each of the wells on a monthly basis. Due to the complicated hydrogeology resulting from the seasonal impact of the Hammond Ditch, it will be necessary to monitor water levels for at least one full cycle, i.e. one year, to obtain data on the movement of groundwater in the subsurface. All water level measurements will be recorded in a field notebook with the date and time, name of person making the measurement, method of determination, and other observations.

Documentation

A field logbook will be maintained to document all activities related to ground water monitoring and water level measurement. The following type of information will be recorded as appropriate for each sample collected or measurement made:

1) date and time of logbook entries;
2) date and time of samples collected or measurements made;
3) description of all sampling or measurement activities in chronological order;
4) name of sampler and observers, if any;
5) field conditions (weather, etc.);
6) identification numbers and name of samples collected;

7) any field measurements made, such as temperature, pH, conductivity, etc., referenced to a time and location;
8) identification of any photographs taken; and
9) reference to the sample log sheet

SURFACE WATER SAMPLING

Surface water sampling of the Hammond Ditch and San Juan River is proposed to provide additional information on the potential off-site migration of petroleum hydrocarbons. The sampling will be scheduled to coincide with "worst-case" receiving water conditions: i.e. low flow conditions in the San Juan River and the beginning of irrigation season for the Hammond Ditch (normally mid-April).

OK

Sampling Equipment and Procedures

The sampling of the San Juan River will be conducted during low flow conditions, at a flow of 300 cfs (as measured upstream at Navajo Dam) if possible, or during the last four months of 1985 if low flow conditions do not occur prior to this time. A single composite sample, composed of depth-integrated samples collected at three locations across the San Juan River, will be analyzed for base/neutral and acid priority pollutants fractions, priority pollutant metals, cyanide, and phenols. Individual samples which will be composited will be collected approximately two-tenths, one-half, and eight-tenths of the distance across the San Juan River in the vicinity of the Hwy 44 Bridge, at approximately two-tenths and eight-tenths of the total river depth. These samples will be collected in clean glass containers and composited by volume into a single 1/2 gallon clean amber container. A single sample will be collected in duplicate in 40 ml. septum vials at two-tenths of total depth, two-tenths of the distance across the San Juan from the refinery. These samples will be analyzed for the volatile priority pollutants.

Purgeable aromatics?

upstream?

Sampling of the Hammond Ditch will be conducted at the start of the irrigation season (normally in mid-April), when the potential for flushing hydrocarbons downstream is greatest. Immediately prior to the summer irrigation season, when the berms are removed and water begins to flow in the ditch, the potential for downstream impacts is greatest.

The Hammond Ditch samples will be collected at two locations: just downstream of the refinery property south of Sullivan Road, and just downstream of the API wastewater ponds. Composite depth-integrated samples will be collected in clean glass containers from the bank nearest the process area at two-tenths and eight-tenths of total ditch depth, and will be composited in a 1/2 gallon clean amber glass container. These samples will be analyzed for base/neutral and acid priority pollutant fractions, priority pollutant metals, cyanide, and phenols. Grab volatile priority pollutant samples will be collected at the same locations in 40 ml septum vials.

Purgeable aromatics?

Documentation

Notes will be recorded during all sampling activities in a field logbook so that a permanent record of activities can be maintained. The following information will be recorded for each surface water sample collected:

1) date and time of logbook entries;
2) description of all sampling activities in chronological order;
3) name of sampler and observers, if any;
4) field conditions (weather, etc.);
5) date and time of samples collected;
6) identification number and name of samples collected;
7) any field measurements made, such as temperature, pH, flow, etc., referenced to a time and location;
8) identification of any photographs made; and
9) reference to the sample log sheet.

DATA INTEGRITY

The integrity of the data collected will be maintained through the maintenace of adequate chain-of-custody procedures as well as the laboratory quality assurance/quality control program.

Chain of Custody

All samples will be appropriately preserved and delivered to the laboratory within EPA recommended holding times. The samples will normally be iced and placed in an insulated cooler for shipment. The Chain of

Custody Record will serve to document that no unauthorized handling of the samples occurred enroute to the laboratory. It also contains a record of parameters requested for analysis. Relevant information about each sample container will be written on the form. Preservation methods will also be indicated. The form will be signed and dated by the individual who actually collected the sample. The names of any commercial delivery services used will also appear on the Chain of Custody Record.

Quality Assurance/Quality Control

All samples will be delivered to a qualified laboratory such as the Rocky Mountain Analytical Laboratory in Arvada, Colorado, Assaigai Analytical Laboratories in Albuquerque, New Mexico, or other qualified laboratory for analysis. These laboratories have elaborate quality assurance/quality control procedures to ensure data integrity.

Analytical Techniques

All samples testing will be conducted in accordance with approved methods. The methods commonly utilized by the Rocky Mountain Analytical Laboratory are presented as an example in Exhibit 2.

HEALTH AND SAFETY PLAN

The purpose of this plan is to establish personnel protection standards and mandatory safety practices and procedures, and provide for contingencies that may arise during monitoring well construction and sampling activities at the Bloomfield Refinery. All personnel who engage in investigative activities at this site will be required to be familiar with the plan and comply with its requirements.

Heat Stress Monitoring

Strenuous work and high summer temperatures combined with the requirements for personal protective equipment may create heat stress. It is likely that, given conditions existing at the site during the summer months, heat stress will be the major health hazard. For monitoring the body's recuperative abilities to excess heat, the following techniques will be used. Monitoring of personnel wearing impervious clothing should commence when the ambient temperature is 70 degrees F or above. Monitoring frequency should increase as the ambient temperature increases or as slow recovery rates are observed. When temperatures exceed 85 degrees F, workers would be monitored for heat stress after every work period. Monitoring should be performed by a person who is trained to recognize the symptoms of heat stress.

1) Heart rate (HR) should be measured by the radial pulse for 30 seconds as early as possible in the resting period. The HR at the beginning of the rest period should not exceed 110 beats per minute. If the HR is higher, the next work period should be shortened by 10 minutes (or 33 percent), while the length of the rest period stays the same. If the pulse rate is 100 beats per minute at the beginning of the next rest period, the following work cycle should be shortened by 33 percent.

2) Good hygienic standards must be maintained by frequent change of clothing and daily showering. Clothing should be permitted to dry during rest periods. Persons who notice skin problems should immediately consult medical personnel.

Contaminant Monitoring

Contaminant monitoring during the drilling and monitoring well construction using direct-reading field instruments will be required for the following puposes:

(1) to detect gases and vapor created by monitoring well installation, and

(2) to measure the total atmosphere vapor/gas concentration to select the appropriate level of personal protection.

Monitoring of potential vapor/gas sources and breathing zone during monitoring well installation will employ a Bachrach TLV Meter organic vapor detector, model number 23-7350, or equivalent instrument for monitoring organic vapors.

Air Monitoring Procedures

Continuous contaminant monitoring using the direct-reading instrument described above will be performed during work operations. The purpose of this monitoring is to detect changes in site conditions which require evacuation of an area or adjustment of level of personal protection.

Specifically, monitoring will be required during monitoring well installation. The gas/vapor detection instruments will be used to measure the total gas/vapor concentration in the breathing zone of the work team. A level of personnel protection will be chosen based on the measured total gas/vapor concentration.

Level D protection has been specified for all site activiites. No respiratory protection is provided by Level D. Likewise, chemical cartridge respirators (Level C) afford adequate respiratory protection only when a number of conditions are met. Therefore, monitoring of the total gas/vapor concentration is required during operations in areas where the potential for air contamination exists. Level C and D protection equipment is listed in Table 2.1. Use of the Bachrach TLV meter for air monitoring only provides measurement of organic vapors and some other gases in the air. Respirable paticulates are not detected by these instruments. Under conditions where the work party is working under dusty conditions in potentially contaminated areas, respirators providing protection from dust will be required.

The following guidelines will be used for selecting the level of protection based on total atmospheric vapor/gas concentrations in the work space:

Background Concentration of Vapor/Gas to 20 ppm Above Background

Level D personnel protection equipment will be required at concentrations of organic vapor of less than 20 ppm above background as measured by the Bachrach TLV meter.

20 ppm Above Background to 50 ppm Above Background

Level C protections, including half-face air purifying masks equipped with an organic vapor cartidge (or a combined organic vapor/particulate cartridge) will be worn. Eye protection (chemical splash goggles) must be worn with half-face respirators. Alternatively, a full-face cartridge respirator may be used.

TABLE 2.1

LEVEL D AND LEVEL C PROTECTION

Level D Protection

1. Coveralls
2. Leather or chemical-resistant boots or shoes, steel toe and shank
3. Hard hat
4. Options as required
    a. Gloves
    b. Disposable outer boots
    c. Safety glasses or chemical splash goggles
    d. Escape mask or respirator

Level C Protection

1. Full-face piece, air purifying, canister-equipped respirator or half-face respirators with chemical splash goggles
2. Chemical-resistant clothing, long sleeves, one or two pieces
3. Gloves
4. Steel toe and shank boots
5. Hard hat
6. Options as required
    a. Inner chemical-resistant gloves
    b. Disposal outer boots
    c. Escape mask

Greater than 50 ppm Above Background

If the organic vapor concentration in the work space exceeds 50 ppm above background, drilling will cease until the nature of the organic vapor concentration can be determined and evaluated.

Area Monitoring

The site inspection activiites are not expected to have a significant effect on off-site air quality. Therefore, area monitorig of off-site air quality will not be required.

Cleanup

Cleanup of personnel and equipment is necessary to prevent potentially harmful materials from being transferred from work areas to other areas. Cleanup procedures must be appropriate for the types of compounds present, the personal protective equipment being used, and the operations taking place in the work area. A work zone will be set up to provide for personnel and equipment cleanup. Heavy equipment will be cleaned in a specially designated area within the work zone.

Emergency Procedures

In general, while at the refinery, the procedures outlined in the Bloomfield Contingency Plan and Emergency Procedures will be in effect. However, in the event that an emergency develops on site, the procedures delineated herein are to be followed immediately. Emergency conditions are considered to exist if:

(1) any member of the field crew is involved in an accident or experiences any adverse effects or symptoms of exposure while on-site; or

(2) a condition is discovered that suggests the existence of a situation more hazardous than anticipated.

Personal Injury

In case of personal injury at the site, the following procedures should be followed:

(a) An on-site employee trained in first aid should administer immediate treatment to an ill or injured worker and decide if the worker can be moved.

(b) The injured worker should be taken immediately to a medical facility for follow-up care and observation. The staff at the medical facility should be advised that the patient's clothing and skin might be contaminated with chemicals.

(c) In the event that an accident occurs, the Facility Coordinator is to complete an Accident Report Form for submittal to the EPA project officer, and should assure that follow-up action is taken to correct the situation that caused the accident.

Chemical Exposure

If a member of the field crew is exposed to chemicals, the procedures outlined below should be followed:

(a) Another team member (buddy) should remove the individual from the immediate area of contamination.

(b) Precautions should be taken to avoid exposure of other individuals to the chemical.

(c) If the chemical is on the individuals clothing, the clothing should be removed if it is safe to do so.

(d) If the chemical has contacted the skin, the skin should be washed with copious amounts of water, preferably under a shower.

(e) In case of eye contact, an emergency eye wash should be used. Eyes should be washed for at least 15 minutes.

Fire or Explosion

A hazard of fire or explosion exists when flammable materials are being used or handled, when there is the possibility that a combustible atmosphere may be generated by operations such as excavation in areas margin contaminted with combustible materials. Under these conditions, the following precautions must be taken:

Drilling thru product plume — must take care

(a) Continuous monitoring of work areas with a combustible gas detector will be conducted if the potential for fire or explosion exists.

(b) If monitoring indicates the existence of a combustible atmosphere (25 percent of the lower explosive limit), there area will be evacuated immediately and emergency personnel will be contacted. Re-entry will not take place until it can be determined that it can be done safely.

During operations involving a high hazard of fire or explosion, fire fighting and other emergency personnel will be on hand while the operation is taking place.

Emergency Contacts

Should any situation or unplanned occurrence require outside assistance or support services, the appropriate contact from the following list should be made:

EMERGENCY PHONE NUMBERS

Bloomfield Fire Department	632-8011
Bloomfield Police Department	632-8011
San Juan County Sheriff	334-6107
State Police	325-7547
Ambulance (dispatched through Farmington Fire)	325-3501
County Fire Department (dispatched through Farmington Fire)	325-3501
Poison Control	1-800-432-6866
Bomb Personnel (State Police Office)	325-7547
ETHYL CORP (T.E.L. Emergencies)	504-344-7147
CHEMTREC (Chemical Emergencies)	1-800-424-9300
City of Farmington (Electric Utility)	327-7701
Kay-Ray	312-259-5600
E.I.D. Radiation Protection Bureau	505-984-0020
Mobile Inspection (Radiography Assistance	327-9473
Contact of New Mexico (Call out Assistance)	327-4666

EQUIPMENT RESOURCES

Water Tankers & Vacuum Trucks	
Chief Transport	325-2396
C & J Trucking	325-7770
Dawn Trucking Co.	327-0416
Delgarno	327-0461 or 327-6871

Triple F	334-6193
Sunco Trucking	327-0416
Earth Moving Equipment	
Adobe Construction (Ernie Motto)	334-6696
Rosenbaum	325-6367
Coffey Construction	632-3663
Atchison Construction	327-6276
Gas Co. of New Mexico	325-2889
W & C Contractors	325-1991
Welding & Cutting	
Henry Vigil	632-3045
Willie Soloman	632-3797
Justis Supply	325-3551
Wrecker or Rig Up Trucks	
Sandia Detroit	325-5071
Drake Well Service	327-7301 or 327-6847
ODECO Inc.	632-3392
Dawn Trucking	327-6316
Aerial Ladder or Basket	
City of Farmington Utility	327-7701
Farmington Fire	325-3501
Foam Supplies	
Seagull Roosevelt Refinery	801-722-5128
Thunderbird Sales	505-881-6222
Boots & Coots Fire Protection	713-999-0276

Training

On-site work personnel will have formal or prior on-the-job training for the tasks they are assigned to perform. Special training will be required for operations such as monitoring well installation. Personnel responsible for air monitoring and site safety will be qualified for these responsibilities.

On-Site Orientation

An on-site orientation session will be required for all on-site personnel and will include the following:

(1) Health effects and hazards of the chemical identified or suspected to be on-site.

(2) Personnel protection including the use, care, and fitting of personnel protective equipment, and the necessity for personnel protection, effectiveness, and limitations of equipment.

(3) Decontamination procedures.

(4) Prohibitions in areas and zones including:
    (a) site layout,
    (b) procedures for entry and exit of areas and zones, and
    (c) standard safe work practices.

(5) Emergency procedures.

(6) Medical requirements.

SECTION 3

PROJECT SCHEDULE

Due to the complex hydrogeology at the site as influenced by the Hammond Ditch, it is totally unrealistic to complete a thorough investigation of the subsurface petroleum hydrocarbons at the refinery in the four month time frame referenced in the Administrative Order. Since the subsurface groundwater movement in the area south of the ditch appears to be dependent on the seasonal use of the ditch for irrigation, any findings in this area on the direction and rate of groundwater movement would be totally dependent on whether or not the ditch was being used to transport irrigation water. Furthermore, the "worst case" conditions of the receiving waters (the Hammond Ditch and the San Juan River) would in all likelihood not occur during this time period. It seems most prudent to proceed with the investigation of the refinery in a manner which will reflect the greatest potential for off-site impacts and allow the seasonal changes in groundwater movement to be quantified. Therefore, a more realistic time schedule of twelve months has been proposed to complete the elements of the workplan, with an additional month to complete a final, comprehensive project report.

A schedule for individual project workplan tasks is presented on Figure 3.1. As shown, the proposed electrical resistivity survey would be conducted during the initial month of the project. Following the survey, the proposed groundwater monitoring well and any other necessary wells will be completed during the next month. Groundwater monitoring of all wells will commence after completion of the well(s), and will be conducted quarterly. However, water level measurements will be made on a monthly basis. A surface water sampling schedule cannot be determined in terms of project months since it will depend on low flow conditions in the San Juan River and the startup of irrigation season for sampling in the Hammond Ditch. However, all sampling and measurements will be completed in a twelve month period. As shown on Figure 3.1, the final project report will be prepared during the thirteenth month.

FIGURE 3.1

PROPOSED PROJECT SCHEDULE

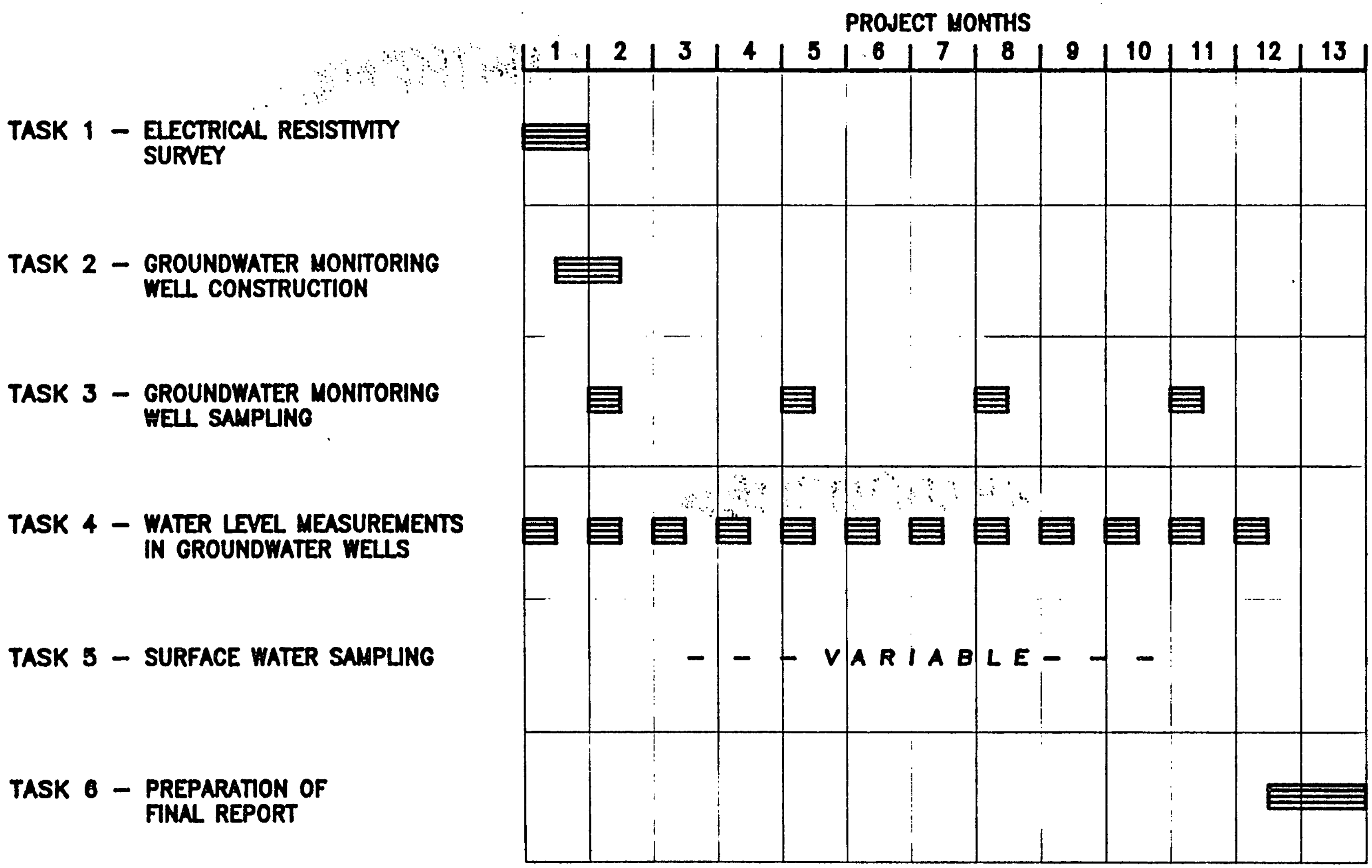


EXHIBIT I

A REVIEW OF
SUBSURFACE PETROLEUM HYDROCARBONS
AT THE BLOOMFIELD REFINERY

Prepared for

BLOOMFIELD REFINING COMPANY

by

Engineering-Science, Inc.
2901 North Interregional
Austin, Texas 78722

January 1985

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CHAPTER 1

INTRODUCTION

SITE LOCATION

The Bloomfield refinery, currently owned and operated by Bloomfield Refining Company, is located in the northwest corner of the State of New Mexico, as shown in Figure 1.1. The refinery is situated on a bluff adjacent to the San Juan River, south and slightly east of the town of Bloomfield. Although the refinery owns land on both sides of the San Juan River, all process units and storage areas are located south of the river. Approximate refinery property boundaries are shown on the plot plan presented as Figure 1.2. The plot plan also indicates the locations of the process and tank storage areas, surface waters, and elements of the wastewater treatment system.

REFINERY HISTORY

The Bloomfield Refinery was reportedly constructed in the late 1950's. The refinery operated approximately five years before being sold to Suburban Propane Corporation in the early 1960's. Plateau, Inc., a subsidiary of Suburban Propane, operated the refinery prior to its sale to the current owner in the fall of 1984. The refinery processes a combination of low sulfur crudes and petroleum which are transported to the refinery by pipeline and truck. Major refinery products include gasoline and diesel fuel, although fuel gas, heavy burner fuel, propane, butane, and other petroleum products are produced in smaller quantities.

Information pertinent to the existing subsurface situation at the refinery has been developed by several sources. Much of the information was developed by American Ground Water Consultants, Inc. (AGWC) for Plateau, Inc. and was submitted to the then New Mexico Oil Conservation Commission (NMOCC) as part of its proposed discharge and monitoring plan for refinery effluent (Ref. 1-3). The original discharge plan was submitted to the NMOCC in October 1977 and was approved in June 1978. AGWC subsequently conducted monitoring activities on the solar evaporation ponds for the purpose of determining leakage rates from the ponds, and prepared milestone reports on these activities in January 1979 and January 1981

FIGURE 1.1

LOCATION OF THE BLOOMFIELD REFINERY

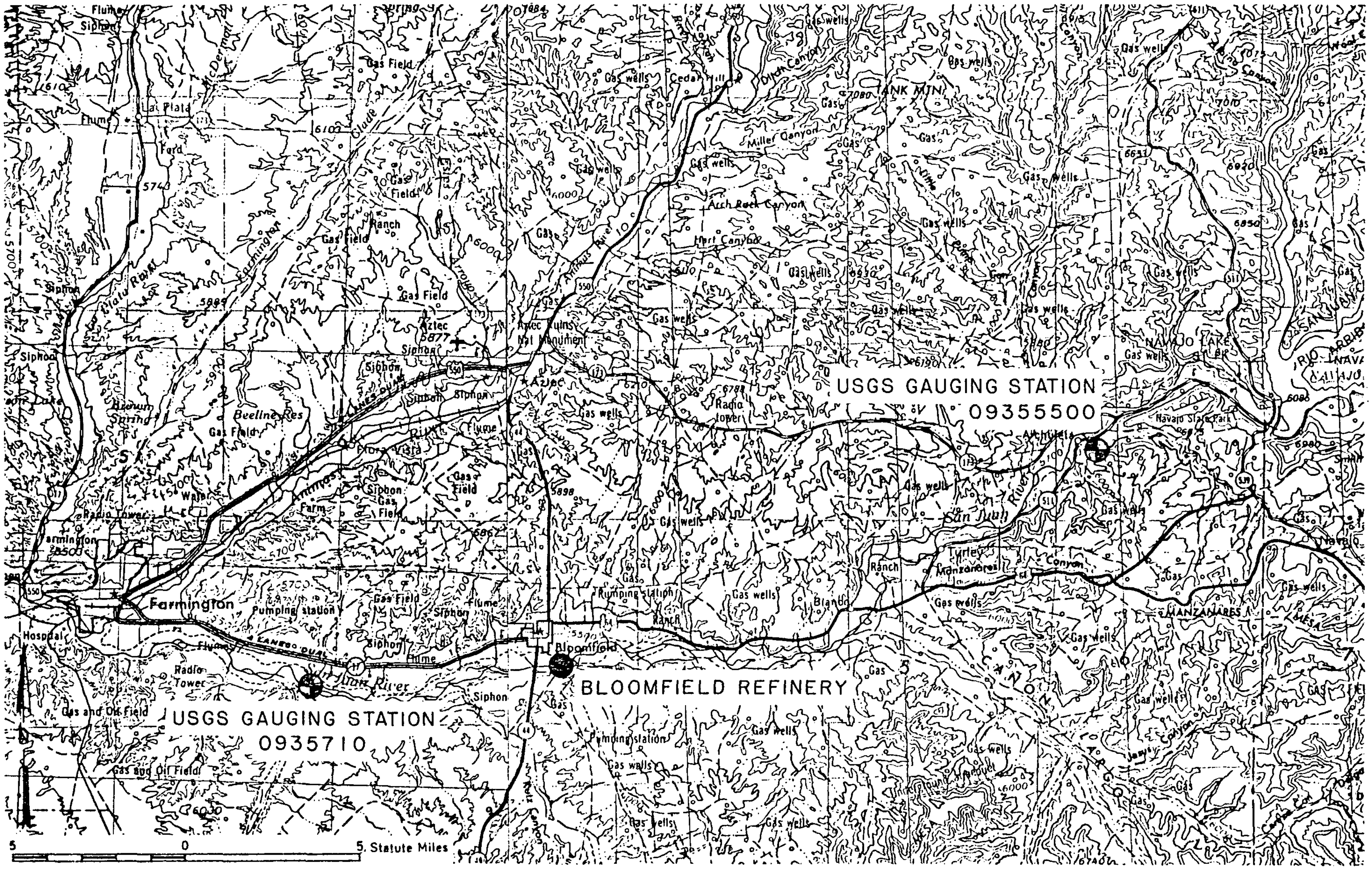
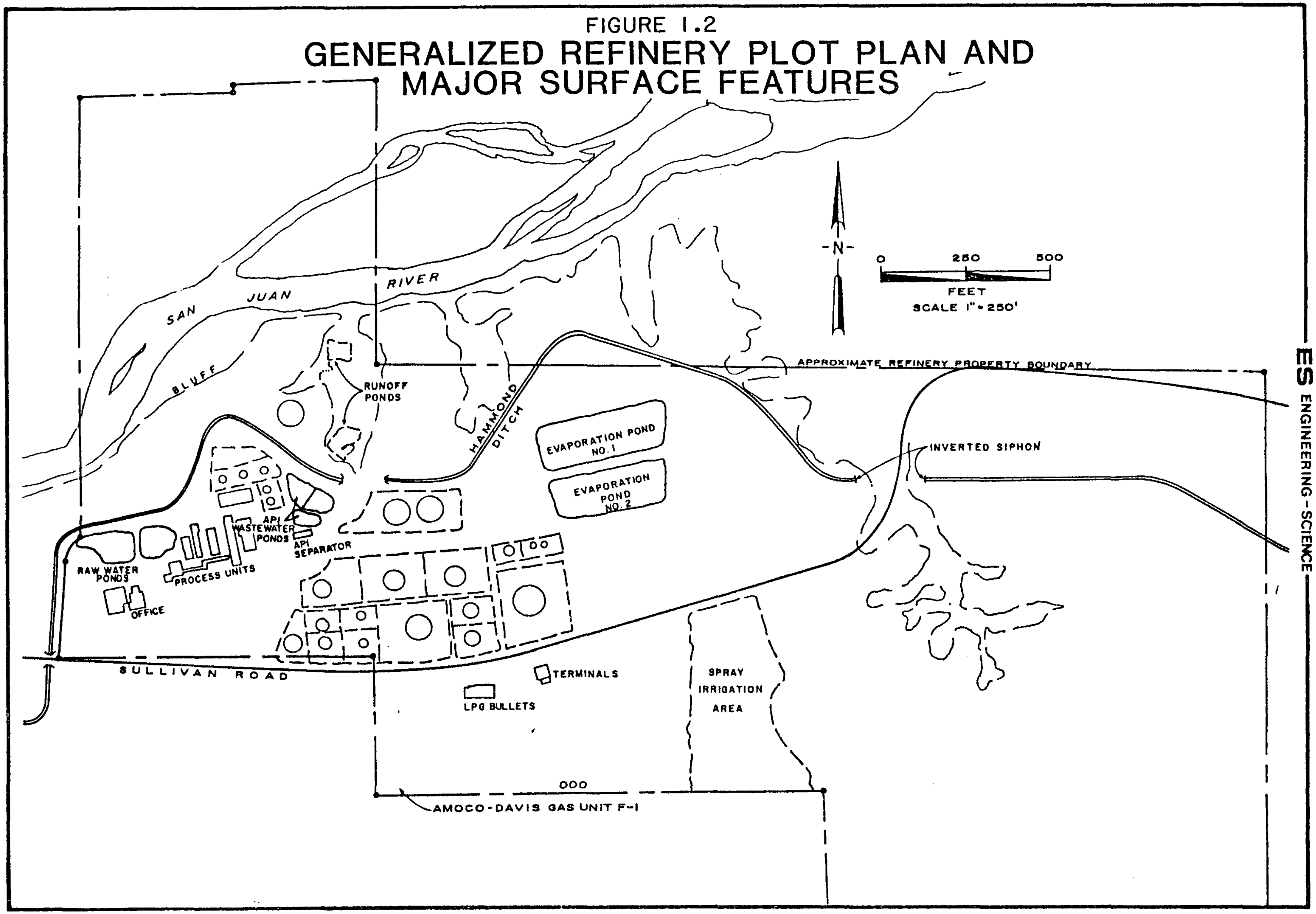


FIGURE 1.2

GENERALIZED REFINERY PLOT PLAN AND MAJOR SURFACE FEATURES



(Ref. 2, 3). These reports were submitted to the New Mexico Environmental Improvement Division (NMEID). Since the original discharge plan was scheduled to expire in the summer of 1982, an updated discharge plan was prepared and submitted to the New Mexico Oil Conservation Division (NMOCD) in March 1982 (Ref. 1). This plan ultimately was approved on June 7, 1984. During the interim, Plateau installed six groundwater monitoring wells to provide additional information on groundwater quality.

Soil and water samples from the Hammond Ditch, San Juan River, groundwater seeps, wastewater treatment system, and other refinery areas have been collected by Plateau as well as the state and EPA. Sampling efforts were conducted by the NMOCD on five separate occasions during 1981 and 1982. Plateau analyzed concurrent samples and collected additional information during the same time period. EPA's Region VI Field Investigation Team (FIT) conducted extensive site investigations during 1983 and 1984 (Ref. 4, 5).

OBJECTIVES AND SCOPE

The primary objective of this study was to compile and evaluate existing information pertaining to subsurface petroleum hydrocarbons at the Bloomfield Refinery and identify any additional data requirements to more fully characterize the nature and extent of subsurface petroleum constituents at the refinery and, if necessary, develop a remedial action plan. The scope of activities included the collection and evaluation of available data from the refinery and its consultants. Meetings were held with the NMEID and EPA in December 1984 to discuss the situation at the refinery and solicit input from these agencies. Existing data has been summarized in this report, and more detailed information can be obtained from the original sources listed in the bibliography to the report.

CHAPTER 2

ENVIRONMENTAL SETTING

SITE TOPOGRAPHY

Ground surface elevations at the site range from approximately 5,420 feet above mean sea level (msl) for the alluvial deposits along the San Juan River to over 5,570 feet msl along the southern property boundary. The most striking surface feature at the site is the bluff along the south side of the San Juan River. This bluff, shown on Figure 2.1, rises close to 100 feet above the river floodplain deposits. From the top of the bluff, the land surface slopes gradually upward to the south. Surface drainage has created several major and numerous minor intermittent stream channels or arroyos which drain in the direction of the river. The major intermittent stream channels are also indicated on Figure 2.1.

GEOLOGY AND SOILS

The Bloomfield Refinery is located on Quaternary Jackson Lake Terrace deposits approxiamtely 100 feet above the elevation of the present day San Juan River. At the time of formation, during the last glacial period, the San Juan River carried large quantities of glaciofluvial outwash which were deposited at a thickness of 10 to 15 feet over much of the refinery property. Later, wind-blown sands and silts were deposited over the coarser gravels and cobbles to form loess deposits. These deposits are found at the surface on much of the refinery property and are interbedded to some extent with the coarser deposits. The coarser gravels and cobbles underlying the quaternary silts and sands outcrop along the 70- to 100-foot bluff just south of the San Juan River.

Underlying the quaternary sand, silt, and cobble deposits is the Tertiary age Nacimiento Formation, a massively bedded gray to green to bluish clay or shale. The Nacimiento outcrops on the bluff south of the San Juan River where its exposure is at least 70 feet. The San Juan River channel is incised into the Nacimiento, which is approxiately 500 feet thick at the site as indicated by the log of the AMOCO-DAVIS gas unit F-1 near the southern property boundary. The location of this well is shown on

Figure 2.1. The first major aquifer is the Ojo Alamo, consisting of sandstone of Tertiary Age, directly underlying the Nacimiento Formation. The Ojo Alamo is, in turn, underlain by the Kirtland Shale and Fruitland Formation.

Along the bluff, and in the intermittent stream channels which carry water from the terrace to the San Juan River, the contact between the coarse cobble layer and the underlying Nacimiento Formation can be determined visually. As a result of the many investigations which have been performed at the site, the elevation of the contact has been determined at over 50 locations along the bluff and intermittent stream channels and in observation and monitoring wells throughout the site. These elevations are shown on Figure 2.1. Although the top of the Nacimiento Formation generally increases in elevation to the south at an angle of approximately one degree, the contact is not flat but undulating. The lowest subcrop elevations occur to the northwest of the refinery and generally north of the solar evaporation ponds, in the general locations indicated by the arrows on Figure 2.1. Major seeps have been observed along the northwest bluff in the area coinciding with the low subcrop elevations. Likewise, arroyos north of the solar evaporation ponds which coincide with the low subcrop elevations normally contain water. Previous studies have postulated a major east-west depression in the subcrop connecting these low areas. However, there is no information on the subcrop elevation in the area just east of the API separator and API wastewater ponds, and the subcrop depressions may or may not be connected.

GEOHYDROLOGY

Seeps along the bluff emerge in several areas, particularly those areas where the elevation of the subcrop between the Nacimiento Formation and the overlying cobble layer is lowest, northwest of the refinery and generally north of the solar evaporation ponds. Additional seeps have been observed in intermittent stream channels at higher elevations, but also at the subcrop. It appears that water entering the cobble layer from the Hammond Ditch, solar evaporation ponds, or other sources migrates through the upper permeable sands, silts, and cobbles until it encounters the relatively impermeable Namimiento Formation. The water then follows the subcrop depressions to the northwest and north of the refinery, emerging on the bluff as seeps. Some of the subsurface water is intercepted at higher subcrop elevations by the intermittent stream channels and also emerges as seeps. These seeps have been occurring for a long period of time, as evidenced by the presence of cattails, marsh grass, trees, and other vegetation in the vicinity of the active seeps.

It is probably significant that the seeps occur only at the contact between the Nacimiento Formation and the cobble layer. Although approximately 70 to 100 feet of the Nacimiento Formation are exposed on the bluff, seeps have been observed only at the contact between the two formations. Minor sandstone or silt lenses in the Nacimiento Formation and observed in the bluff during the FIT investigations did not produce seeps, suggesting that these potentially more permeable lenses are not connected to the permeable cobble, sand, and silt deposits overlying the Nacimiento.

The occurrence and movement of groundwater in the area of the refinery is complicated by the presence of the Hammond Ditch, the solar evaporation ponds, and the raw water ponds. The Hammond Ditch contributes to bank storage in the cobble layer overlying the Nacimiento Formation during the irrigation season when the ditch is full. During the winter months, water enters the ditch from the cobble layer where it was stored the previous irrigation season. Additional subsurface water emerges as seeps during all seasons in the intermittent stream channels and along the bluff at the Namimiento subcrop. Although it seems clear that water from the ditch alternately contributes to and draws from bank storage, depending on the season, the zone of influence of the ditch is not clear, and is further complicated by probable leakage from the solar evaporation ponds and the raw water ponds. Water level measurements made at the refinery indicate that maximum groundwater elevations are only slightly higher than the water surface elevations in the Hammond Ditch when flowing full. The groundwater disappears entirely when the maximum groundwater elevation encounters the Nacimiento subcrop near the southern property boundary. These observations suggest that the groundwater present in the upper sands, silts, and cobbles is attributable to the Hammond Ditch and the refinery ponds, and that there is little or no natural recharge within the quaternary sand, silt, and cobble deposits or the Nacimiento Formation in this area.

SURFACE WATERS

Two major surface water bodies may impact or may be impacted by subsurface contamination at the Bloomfield Refinery: the San Juan River and the Hammond Irrigation Ditch. Each of these water bodies will be discussed in more detail in the following paragraphs.

San Juan River

The San Juan River has its origins in the San Juan Mountains in extreme southwestern Colorado. The perennial stream is used as a domestic, agricultural, and industrial water supply in the area. Bloomfield Refining utilizes the river water as a raw water supply for refining operations. The river is used as an emergency municipal water supply by the City of Farmington, approximately 15 miles downstream from the refinery.

Flow in the San Juan River is regulated upstream of the refinery by the Navajo Dam, on which construction was completed in 1963. Between 1963 and 1982, the average regulated flow has been approximately 1,100 cfs.

As shown in Figure 2.1, the channel of the San Juan River is filled with alluvial deposits. The channel itself is incised into the top 100 feet of the Nacimiento Formation, which is visible on the exposure of the high bluff on which the refinery is located just south of the San Juan River.

Hammond Ditch

The Hammond Irrigation Ditch provides water for agriculture and livestock in the vicinity of the Bloomfield Refinery, and is not intended to be used as a source of potable water. As shown on Figure 2.1, the ditch is located on the high bluff overlooking the San Juan River, between the San Juan and the refinery process, tank storage, and wastewater treatment areas. In passing from east to west through the refinery property, the ditch passes through an inverted siphon beneath Sullivan Road on the east side of the property, through a culvert beneath an El Paso Natural Gas pipeline right-of-way near the refinery API wastewater ponds, and through another culvert beneath Sullivan Road where the ditch leaves the refinery property.

Recharge to cobbles then used as a supply? ✓

The Hammond Ditch was constructed between 1960 and 1964 in Quaternary Jackson Lake Terrace deposits. The ditch carries water during the irrigation season - approximately mid-April through mid-October. Due to the presence of the upper permeable cobble layer, the ditch acts as a line source of recharge to the cobble deposits. During the nonirrigation season, water previously held as bank storage re-enters the Hammond Ditch. Additional water in the upper cobble deposits emerges on the bluff and in intermittent stream channels as seeps at the contact between the cobble layer and the less permeable Nacimiento Formation. These intermittent stream channels and seeps support lush vegetation, including marsh grass, cattails, and trees as evidence of the increased water supply.

SITE DRAINAGE

Surface drainage at the site follows four major drainage patterns, one for each of the following areas: (1) the area north of the Hammond Ditch; (2) process, tank farm, and other confined areas; (3) the area east of the spray irrigation area; and (4) other areas south of the Hammond Ditch. North of the Hammond Ditch, surface runoff occurs directly to the San Juan River or to the intermittent stream channels that lead to the river. Some runoff may also enter the two holding ponds in the major arroyo located across the Hammond Ditch from the API wastewater ponds. These holding ponds were constructed to capture any process area spills, runoff, or overflow from the API wastewater ponds which exit the process area via the El Paso Natural Gas pipeline right-of-way. These ponds are not a part of the wastewater treatment system and were intended to prevent spills and other potential surface contamination from entering the San Juan River. At present, these ponds contain water ~~which is believed~~ to originate primarily from seepage from the Hammond Ditch. The lower pond derives water from the upper ponds ? as well as from the seeps at the contact between the cobble layer and the Nacimiento Formation.

Saw discharge on March ? 85 [illegible]

Drainage in the process area, tank farm, and wastewater treatment areas (including the spray irrigation area) is contained. Process area runoff is routed through sumps to the API separator for hydrocarbon recovery. Other accumulated water is contained within bermed areas and is subject to percolation or evaporation.

The area east of the spray irrigation area drains to a large arroyo on the eastern portion of the refinery property. This arroyo drains to the north, and ultimately contributes runoff to the San Juan River.

Other areas south of the Hammond Ditch drain to the ditches along Sullivan Road. The runoff then moves east along the road, and may enter the Hammond Ditch where it passes beneath the road.

REFINERY WASTEWATER TREATMENT

Refinery process wastewater is treated for primary oil removal in an API separator located east of the major refinery process units. The API separator is constructed of steel-reinforced concrete and follows standard API design. Process area runoff and tank farm water draw sumps are diverted to the API separator for hydrocarbon recovery. Petroleum hydrocarbon spills are handled in the same manner.

Following the API separator, wastewater flows to a series of three API wastewater ponds located north of the API separator and south of the Hammond Ditch. In 1983, these ponds were lined with a 100-mil high-density polyethylene liner by Permanent Lining Systems of Odessa, Texas. A french drain collection system consisting of four-inch PVC perforated pipe also was installed at this time to collect any leakage through the pond liner in a common observation well or sump. After the initial installation, water was detected in the observation well. Fluorescein dye added to the ponds confirmed that leakage was occurring from the ponds. The ponds were emptied and the liner seams repaired, and the ponds were put back in service. Leakage from the ponds to the collection system has occurred since that time. As leakage in a pond is detected, the pond is drained, repaired, and put back in service.

For sure?

Wastewater from the API wastewater ponds is pumped to a series of two solar evaporation ponds east of the process area and northeast of the tank farm. The two evaporation ponds cover an area of approximately five acres and are operated in series, with wastewater passing through the south pond (No. 2) to the north pond (No. 1). Originally, the ponds were constructed by forming earthen embankments from silts and sands obtained from the pond

South to North pond,

bottom. The pond bottoms have been treated with about two pounds per square foot of Wyoming bentonite to reduce leakage.

Increases in the quantity of raw wastewater during the late 1970's necessitated additional handling facilities. Consequently, in 1981, Plateau began spray irrigating approximately 10 acres east of the product and crude truck racks south of Sullivan Road and southeast of the solar evaporation ponds. The spray irrigation area is utilized primarily during the months between March and October when evapotranspiration is highest. The irrigation area is surrounded by a perimeter berm to prevent surface runoff of treated refinery effluent.

LAND-USE AND POPULATION CHARACTERISTICS

Land use in the vicinity of the refinery is primarily agricultural. Water in the Hammond Ditch is used downstream of the refinery for livestock watering and for irrigation of crops such as vegetable gardens, orchards, alfalfa, and corn, and is not intended to be a potable water supply. The refinery is remote from any major population centers. The nearest town, Bloomfield, is located approximately one mile northwest of the refinery and has a population of approximately 5,000. State Highway 44 is moderately traveled and is located approximately one-half mile west of the refinery.

CHAPTER 3

PREVIOUS SITE INVESTIGATIONS

PLATEAU INVESTIGATIONS

During the past seven to eight years, Plateau conducted several evaluations of wastewater and groundwater quality, pond leakage, and subsurface geology in conjunction with the preparation of a discharge plan for refinery effluent. Early efforts were directed to the determination of leakage rates from the solar evaporation ponds through geophysical methods. More recent efforts have focused on the quality of soils and ground and surface waters at and in the vicinity of the refinery.

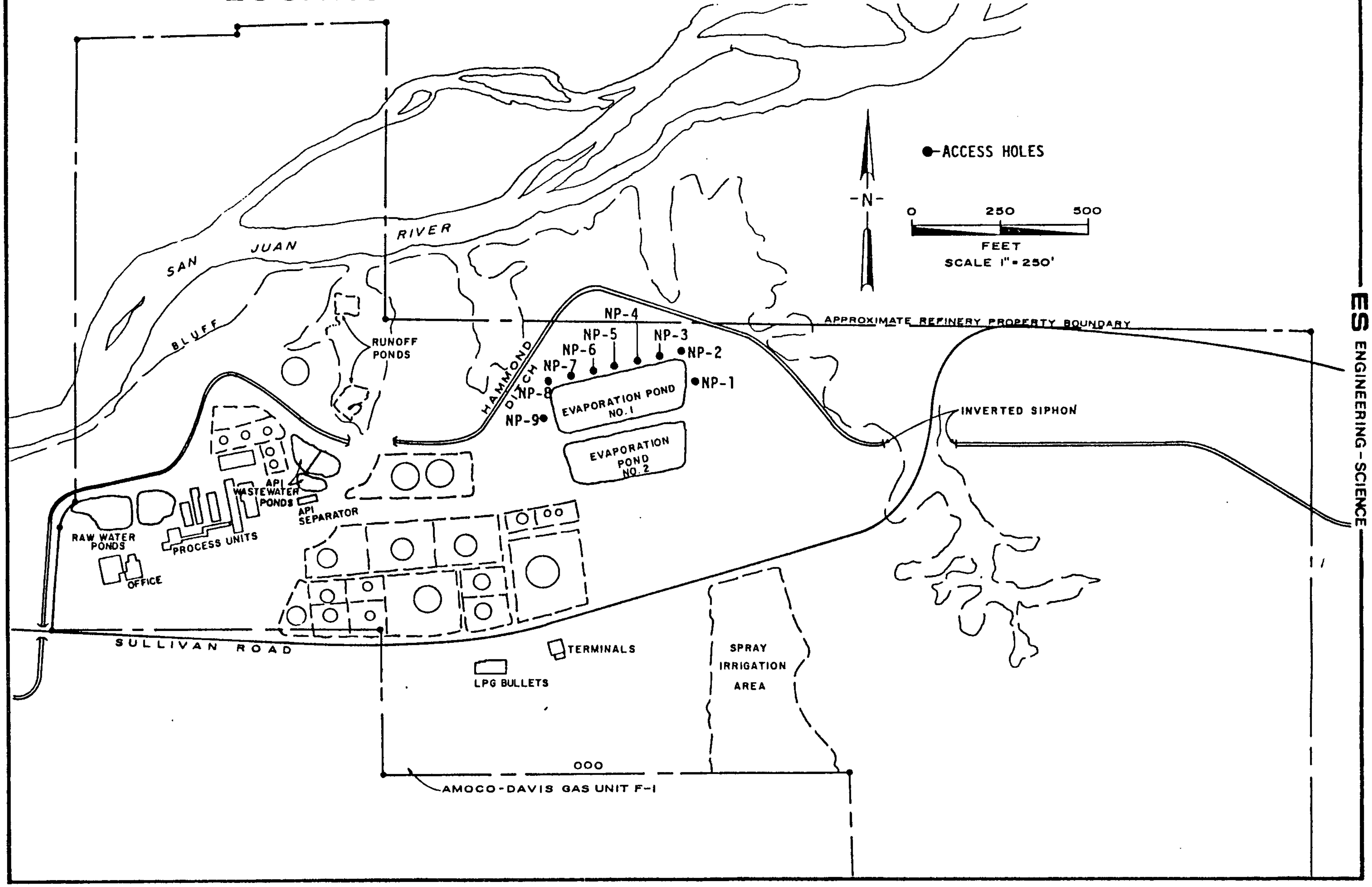
Neutron Logging

In April 1977, nine neutron-probe access holes were drilled around the north, east, and west embankments of solar evaporaton pond 1 to aid in detecting changes in soil moisture content due to leakage from the ponds when they were filled. The six-inch diameter holes were completed to a depth of 50 feet using mud-rotary methods. Locations of the access holes are shown in Figure 3.1. At the completion of drilling, the holes were water flushed and blown with air. Neutron-probe access tubes consisting of two-inch schedule 40 PVC pipe were installed in each of the holes, which were backfilled with a mixture of dry bentonite and soil to retard leakage through the annulus. The lithologic logs for the neutron-probe access holes are included as Appendix A. As shown by the logs, samples for some of the intervals were lost and were not recorded. The remaining intervals indicate that each of the holes is completed into the upper portion of the Nacimiento Formation.

Neutron logging is conducted by lowering the neutron probe into the access holes and determining the soil-moisture profile. Neutron logging is normally conducted in a dry hole so that accumulated water in the hole does not affect the probe readings. Since initially no water was anticipated in the boreholes, the holes were constructed without a bottom cap. However, water was unexpectedly detected in the access holes after they were completed. This water is attributable to leakage of water through the annular space or water contained in the Nacimiento Formation itself. Most of the

FIGURE 3.1

LOCATIONS OF NEUTRON-PROBE ACCESS HOLES



ES ENGINEERING-SCIENCE

access holes exhibited a slow response to groundwater levels and required several months to reach equilibrium. Consequently, the early efforts at neutron logging indicated variable moisture contents due to changing water levels, as well as higher readings due to the presence of water in the holes. Data collected since the equilibration of water levels in the holes indicate few changes in the soil moisture content between subsequent readings.

Access holes NP-1, 2, 3, 4, and 5 indicate a two to five volume percent increase in moisture content in the top two to three feet of the evaporation pond embankment after the pond was filled. A similar increase in soil moisture content was observed in access holes NP-6, 7, 8, and 9 at greater depths in the embankment. These small changes in moisture content are believed attributable to capillary action in the unsaturated zone in the pond embankment. Increases of approximately five to 10 volume percent were observed in most access holes at a depth of 10 to 25 feet, corresponding to the Jackson Lake Terrace silt deposits in which the ponds were constructed. Increases in moisture content were observed in the cobble layer underlying the silt deposits and, for several access holes, in the upper portion of the Nacimiento Formation. Those data indicate a slow rate of seepage from the bottom of the solar evaporation ponds, primarily to the underlying cobble layer.

Zeta-SP

Zeta-SP surveys of solar evaporation pond 1 were conducted on three occasions. This technique involved dragging electrodes over the pond bottom to determine electropotentials. Areas with significantly lower electropotentials relative to background levels generally are indicative of pond leakage. The initial survey, conducted on July 15, 1977, gave no evidence of significant areas of leakage. Subsequent surveys, conducted on July 12 and September 20, 1978, indicated some low electropotentials in the northwest corner of the pond; however, the data were highly variable and may be misleading due to the presence of aquatic plants in the pond which prevented adequate contact between the pond bottom and the electrodes. Consequently, no further surveys were conducted after this date.

Thermonics

The nine neutron-probe access holes located in the solar evaporation pond embankments also were used to develop thermal profiles of the embankment and subsurface material. These thermal profiles were used to calculate seepage rates based on the premise that variations in temperatures at depth are the result of the variability in the rate of fluid flow through the pond embankment. Areas of greatest permeability will approach the temperature of the pond more closely, whereas areas of reduced permeability will reflect changes in pond water temperature more slowly due to the reduced diffusion of heat through the embankment soils.

Temperature profiles made during the period from 1977 to 1979 were used to estimate the thermal diffusivity of the embankment soil. By assuming a typical value of soil conductivity, the groundwater velocity and, ultimately, the rate of seepage was determined to be approximately 13 gallons per minute. Various profiles indicated the major area of leakage was either in the west or east end of evaporation pond 1.

AQUATRACE

Radioactive tracer tests were conducted on solar evaporation ponds 1 and 2 between 1978 and 1981. A tracer designated TRAC 5 was injected into pond 1 near neutron probe access hole NP-8. The tracer TRAC 3 also was injected into the south solar evaporation pond (pond 2). Initial analyses for the tracer found a low concentration of TRAC 5 in pond 1 but no tracer in the San Juan River downstream of the refinery or in the Hammond Ditch either upstream or downstream of the refinery. Subsequent sampling in September and October 1978 indicated TRAC 5 in low concentrations in the Hammond Ditch and the San Juan River downstream of the refinery due to leakage from the north pond. Subsequent sampling in December 1978, July and December 1980, and January 1981, did not find the tracer in downstream San Juan River water samples. The data indicate possible leakage from Pond 1 to the Hammond Ditch as well as a small surface depression located east of the solar evaporation ponds. The amount of leakage from pond 1 to these areas was not quantified.

An attempt to estimate leakage from pond 2 was made using a separate tracer, designated as TRAC 3. Sampling based on this tracer was inconclusive, due to the fact that tracer was detected in higher concentrations upstream than downstream in both the Hammond Ditch and the San Juan River.

Water Levels

After the completion of the nine neutron-probe access holes and prior to the filling of the solar evaporation ponds, water was detected in each of the holes, and was believed to be the result of fluids introduced during drilling. The holes were blown dry, and immediately began to accumulate water again. Recovery was relatively rapid in holes NP-3, 5, 7, 8, and 9 and noticeably slower in NP-1, 2, and 4. The fact that the holes contained water prior to the filling of the pond is significant, and indicates the presence of water in the cobble layer and/or the upper Nacimiento Formation. The slow recovery of several of the observation wells is consistent with the movement of water from the cobble layer through the annular space containing a mixture of bentonite and sand or through the Nacimiento Formation, both of which are of very low permeability.

Water levels in the nine holes are tabulated in Table 3.1 and are illustrated in Figure 3.2. These data do not include periods when the holes were air blown to remove water prior to the introduction of temperature probes to provide the thermal data previously discussed. As shown, several wells such as NP-2 and NP-4 required up to one year to reach equilibrium with the water level in the vicinity of the solar evaporation ponds. Due to the slow well recovery, short-term changes in groundwater levels are impossible to assess, and the water level measurements are useful only for determining long-term trends.

During the irrigation season, water levels in the Hammond Ditch in the vicinity of the solar evaporation ponds are typically 5,498 to 5,500 feet msl. This ditch contributes to the water stored in the cobble layer, as evidenced by the presence of water in the observation wells prior to the filling of the evaporation ponds. The water levels in the wells since pond 1 was filled indicates that the pond also contributes to the water in the cobble layer. Since pond 2 was constructed in the same manner, it too

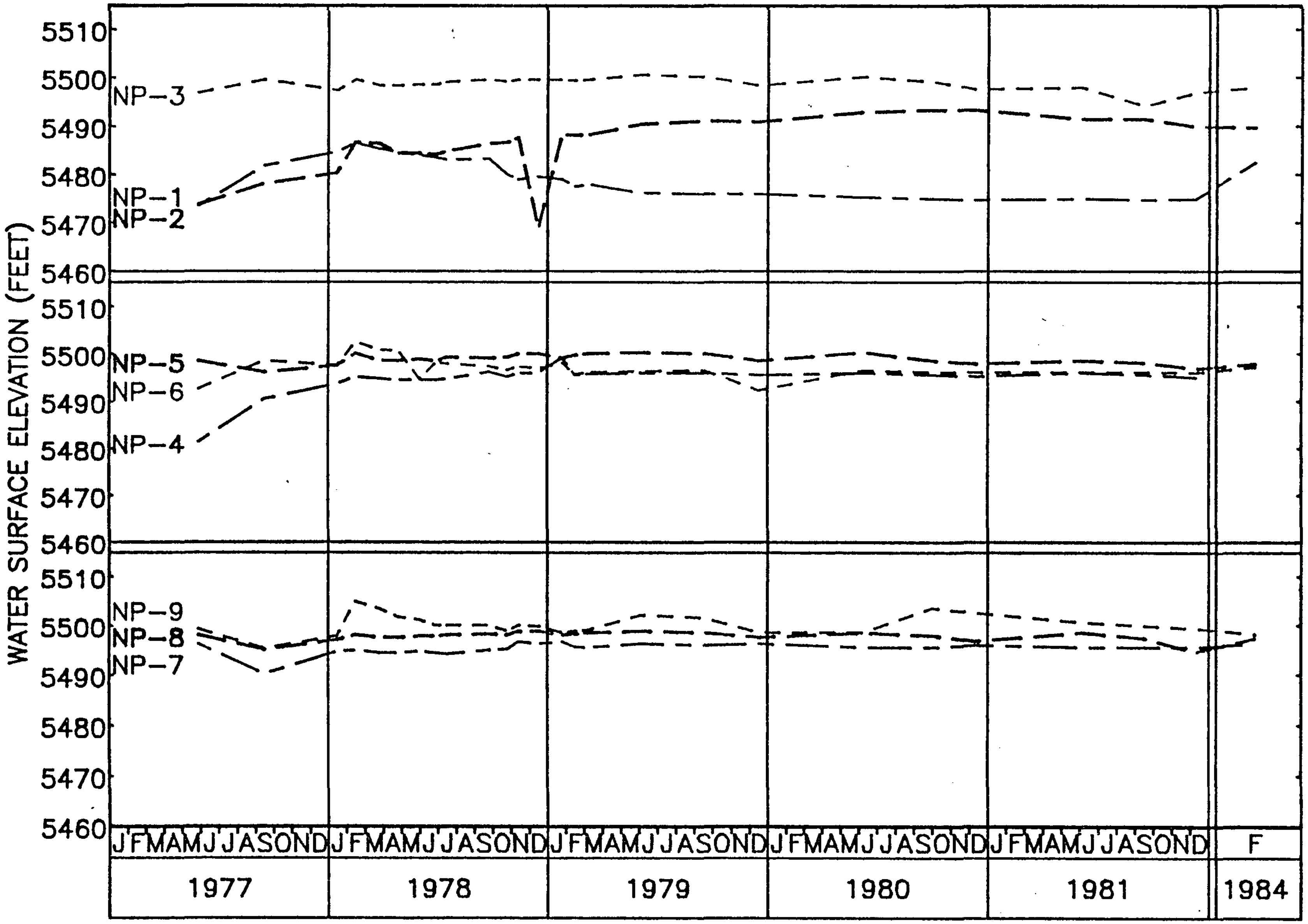
TABLE 3.1

GROUNDWATER ELEVATION MEASUREMENTS IN NEUTRON-PROBE ACCESS HOLES

Date	NP-1	NP-2	NP-3	NP-4	NP-5	NP-6	NP-7	NP-8	NP-9
21-22 May 1977	5473.66	5473.97	5497.18	5481.78	5498.68	5492.71	5496.51	5498.18	5499.49
18-19 September 1977	5481.94	5478.27	5499.83	5490.68	5496.18	5498.60	5490.44	5495.17	5495.42
10-11 January 1978	5485.09	5480.59	5497.51	5493.82	5497.77	5497.60	5494.97	5497.00	5497.93
14 February 1978	5486.78	5486.60	5499.61	5495.41	5500.04	5502.84	5495.23	5498.27	5505.04
27 March 1978	5485.54	5486.50	5498.42	5495.01	5498.83	5501.03	5494.83	5497.61	5503.30
26 April 1978	5484.82	5484.57	5498.44	5494.68	5498.78	5500.84	5494.86	5497.75	5501.90
2 June 1978	5484.32	5484.57	5498.73	5494.87	5499.08	5494.89	5494.92	5497.94	5501.10
29 June 1978	5483.69	5484.17	5498.70	5494.77	5498.87	5498.31	5494.50	5497.85	5500.17
12 July 1978	5483.39	5484.82	5499.20	5494.96	5499.54	5497.94	5494.42	5498.32	5500.28
20 September 1978	5483.47	5486.50	5499.61	5496.67	5499.20	5497.42	5495.14	5498.55	5500.29
25 October 1978	5480.28	5486.64	5499.14	5495.58	5499.57	5496.72	5495.57	5498.37	5499.09
11 November 1978	5479.18	5487.69	5499.66	5496.30	5500.01	5497.35	5496.80	5498.90	5499.92
13-14 December 1978	5479.66	5469.13	5499.71	5496.27	5500.01	5497.18	5496.55	5498.90	5499.92
23 January 1979	5479.00	5488.34	5499.85	5495.58	5499.38	5498.34	5495.07	5498.00	5498.79
13 February 1979	5477.79	5488.03	5499.49	5495.64	5499.93	5495.81	5495.70	5498.51	5499.01
8-9 March 1979	5478.17	5488.27	5499.83	5495.98	5500.21	5496.24	5495.84	5498.75	5499.37
6 June 1979	5476.42	5490.49	5500.71	5496.03	5500.43	5496.68	5496.45	5498.91	5502.21
18-19 September 1979	5476.06	5491.22	5500.17	5496.19	5500.39	5496.70	5496.14	5498.81	5501.71
12 December 1979	5476.21	5491.01	5498.51	5495.64	5498.61	5492.47	5496.65	5497.50	5498.68
9 July 1980	5475.57	5492.94	5500.37	5496.27	5500.41	5496.40	5495.66	5498.89	5498.68
2 October 1980	5475.22	5493.47	5499.10	5495.73	5498.85	5496.16	5495.87	5498.06	5503.90
11 December 1980	5475.03	5493.43	5497.71	5495.45	5497.89	5496.04	5496.06	5497.06	5502.40
5 June 1981	5475.21	5491.47	5497.86	5496.03	5498.78	5496.10	5495.50	5498.65	5500.60
17 September 1981	5475.02	5491.57	5494.28	5495.67	5498.21	5496.07	5495.77	5497.44	5499.93
8 December 1981	5475.22	5490.06	5497.14	5495.28	5497.19	5495.90	5495.83	5496.60	5499.30
15 February 1984	5482.78	5489.67	5498.04	---	5497.94	5497.23	5496.53	5497.38	5498.18
24 February 1984	5483.33	5490.34	5498.66	5496.36	5498.45	5497.65	5496.91	5497.80	5498.57
Benchmark	5521.82	5520.67	5521.13	5521.17	5521.13	5520.94	5520.97	5521.29	5520.90

FIGURE 3.2

HYDROGRAPHS OF WATER LEVELS IN NEUTRON-PROBE ACCESS HOLES



probably contributes to groundwater in the area. Maximum recharge from pond 1 appears to occur in the western end of the pond near observation well NP-9. The water level fluctuations in the wells do not appear to be related to the fluctuations of the water levels in the Hammond Ditch due to the irrigation season. Although it appears clear that both the evaporation ponds and the Hammond ditch contribute to shallow alluvial groundwater in the vicinity of the ponds, the magnitude and direction of groundwater movement is not well-defined.

Surface Water and Soil Samples

While the refinery was operated by Plateau, water and soil samples were collected on several occasions to provide additional information on wastewater quality and subsurface petroleum hydrocarbons relative to the refinery discharge plan which had been submitted previously to the NMOCD. Table 3.2 lists the analytical results of samples of the then unlined API wastewater ponds collected in September 1981. These data are typical of refinery process wastewaters (Ref. 6). A sample of the API wastewater pond effluent collected in December 1981, shown in Table 3.3, appears to be of somewhat better quality. This water is and was being pumped to the solar evaporation ponds, and was analyzed at the time the spray irrigation area had just begun operation.

Plateau collected one soil and six water samples simultaneous with an NMOCD investigation of the refinery site on July 12 and 14, 1982. These data are tabulated in Table 3.4. Concentrations of petroleum constituents, including benzene, toluene, xylene, and ethylbenzene, in the mg/l range were found in water in the alluvial river deposits at the bottom of the bluff adjacent to the San Juan River. Concentrations of aromatic and aliphatic petroleum compounds in the ppm range were detected in soil from the banks of the Hammond Ditch near the API wastewater ponds. Concentrations of several petroleum constituents in the lower ppm range were found in the API separator effluent and in the Hammond Ditch downstream of the refinery. A low concentration of the petroleum constituent toluene (0.2 mg/l) also was found in a seep on the bluff northwest of the refinery.

TABLE 3.2

ANALYTICAL RESULTS OF SEPTEMBER 1981 PLATEAU WATER SAMPLING

Parameter	North API Wastewater Pond	South API Wastewater Pond
BOD, mg/l	87.3	136
COD, mg/l	525	657
NH_3, mg/l	317	316
Sulfide, mg/l	619	802
Phenol, mg/l	145	102
pH, units	7.14	8.33

TABLE 3.3

ANAYLTICAL RESULTS OF DECEMBER 1981 PLATEAU SAMPLING OF API WASTEWATER POND EFFLUENT

Parameter	API Wastewater Pond Effluent Concentration
As, mg/l	<0.1
Ba, mg/l	<0.1
Cd, mg/l	0.01
Cr, mg/l	<0.05
SCN, mg/l	7.5
F, mg/l	0.46
Pb, mg/l	0.15
Hg, mg/l	<0.002
NO_3, mg/l	144
Se, mg/l	0.16
Ag, mg/l	<0.05
Cl, mg/l	132.5
Cu, mg/l	0.05
Fe, mg/l	0.9
Mn, mg/l	0.1
SO_4, mg/l	975
Phenols, mg/l	12
TDS, mg/l	1870
Zn, mg/l	0.35
pH, units	9.0
Al, mg/l	0.6
B, mg/l	9.2
Co, mg/l	0.11
Mo, mg/l	0.28
Ni, mg/l	0.23
Ca, mg/l	107
Mg, mg/l	13.8
Na, mg/l	508
K, mg/l	16.6
Acid Extractables:	
Dimethylphenol, mg/l	0.45
Chloromethylphenol, mg/l	1.70
Base/Neutral Extractables:	
Naphthalene, mg/l	1.05
Acenaphthalene, mg/l	0.04
Benzene, mg/l	1.7
Toluene, mg/l	1.9
Ethylbenzene, mg/l	0.068
Anthracene, mg/l	<0.1
Phenol, mg/l	6.1
2,4-dichlorophenol, mg/l	<0.1
2,4,5-trichlorophenol, mg/l	<0.1
2,4,6-trichlorophenol, mg/l	<0.1
1,1,1-trichloroethane, mg/l	<0.2
Chloroform, mg/l	9.2
PCB's, mg/l	<0.1

TABLE 3.4

ANALYTICAL RESULTS OF 7/12/82 AND 7/14/82 PLATEAU WATER AND SOIL SAMPLING

Parameter	Sample A Water from Test Trench 100 yards NW of Hammond Ditch and Sullivan Road Intersection	Sample B Water from Test Trench 150 feet SE of Hammond Ditch and Sullivan Road Intersection	Sample C Water from Hammond Ditch 150 yards S of Hammond Ditch and Sullivan Road Intersection	Sample D Water from API Separator	Sample E Groundwater from River River Terrace Deposits	Sample F Seep from Bluff NW	Sample G Soil from Hammond Ditch Near API Waste-water Pond
SO_4, mg/l	210	65	30	230	175	85	125
Cl, mg/l	370	205	40	260	320	215	109
F, mg/l	0.7	0.5	0.2	0.9	1.1	0.2	0.6
Oil and grease, mg/l	NA	NA	0.8	8.0	60	NA	NA
Phenols, mg/l	NA	NA	<0.1	1.4	0.2	NA	NA
TOC, mg/l	NA	NA	18	149	90	NA	NA
TDS, mg/l	NA	NA	5494	1710	5376	NA	NA
Cyanides, mg/l	NA	NA	4	300	80	NA	NA
Benzene, mg/l	NA	NA	0.2	5.3	70.6	ND	NA
Toluene, mg/l	NA	NA	1.3	3.7	100.0	0.2	NA
Xylenes, mg/l	NA	NA	0.8	0.3	150.3	ND	NA
Ethylbenzene, mg/l	NA	NA	0.09	0.03	19.9	ND	NA
O/M Cresol, mg/l	NA	NA	ND	0.4	ND	ND	NA
Phenol, mg/l	NA	NA	ND	0.2	ND	ND	NA
Aromatic and Alipahtics, mg/l	NA	NA	ND	28	ND	ND	15,800

NA: Not Analyzed.

ND: Not Detected.

GROUNDWATER MONITORING WELLS

In February 1984, Earl and Sons, Inc. of Cedar Crest, New Mexico, installed six monitoring wells at the Bloomfield Refinery at the locations shown on Figure 3.3. The holes were drilled using an Ingersoll Rand TH-60 rig using air rotary methods and a down-the-hole air hammer. Drilling was terminated in each hole when drilling cuttings indicated the top of the Nacimiento Formation had been penetrated. Some water also was required during drilling, and was obtained from the San Juan River. Methanol or acetone was used to rinse the bits between holes. The holes were drilled in the expected order of increasing organic concentrations to minimize cross-contamination between the wells. The lower 20 feet of each well were screened. Lithologic logs for each of the six wells are presented in Appendix B.

The water levels in the wells were determined on February 9, 1984, after the last well was completed, and again on February 14 and 15 and February 24. There were no significant differences between the sets of water level measurements. The water level measurements are presented in Table 3.5. Water levels in the five holes containing water varied by less than four feet. The water levels levels in these wells are consistent with those in the Hammond Ditch during the irrigation season, and the neutron-probe access holes. Well 6, which was dry, encountered the Nacimiento Formation above the water elevations in the other wells. The relationship between water levels and the subsurface geologic units is clearly illustrated by Cross-section A-A', taken through MW-1, 3, and 6, in a general north to south trend, as shown on Figure 3.4.

In MW-1, the top of the Nacimiento Formation is at approximately 5,493.6 feet msl. Water in the cobble layer contributed by the Hammond Ditch and evaporation ponds and overlying the Nacimiento was at 5,498.8 feet msl on February 24, 1984. At MW-3, the top of the Nacimiento is slightly higher, and the water elevation also has increased slightly in the cobble layer to about 5501.6 feet msl. South of MW-3, the elevation of the Nacimiento increases more rapidly than the water surface elevation, such that the cobble layer, which is still present at a reduced thickness in MW-6, is completely dry. The slope of the Nacimiento Formation is approximately one percent upward to the south on a regional basis.

FIGURE 3.3

LOCATIONS OF GROUNDWATER MONITORING WELLS AND GEOLOGIC CROSS-SECTION A-A'

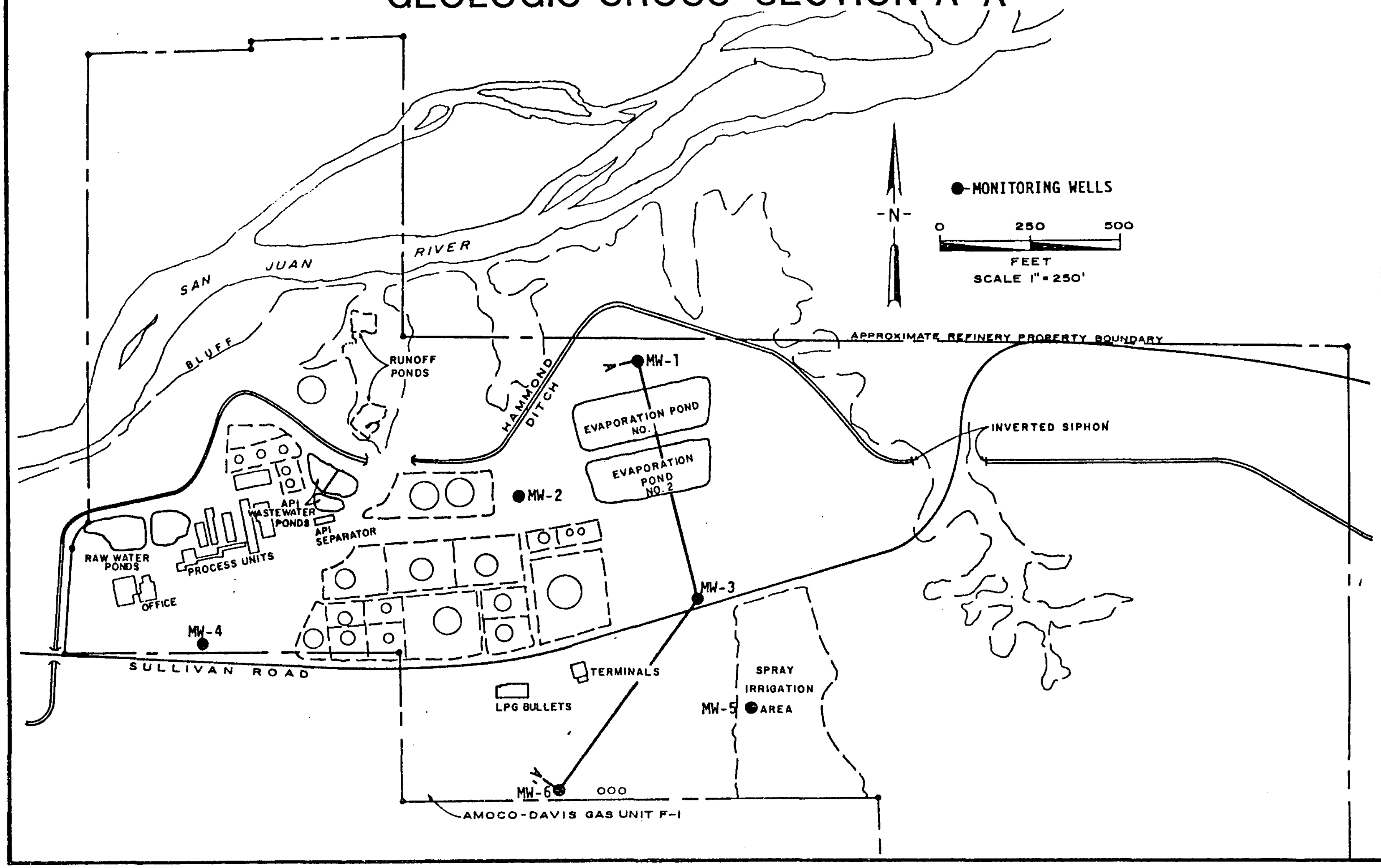


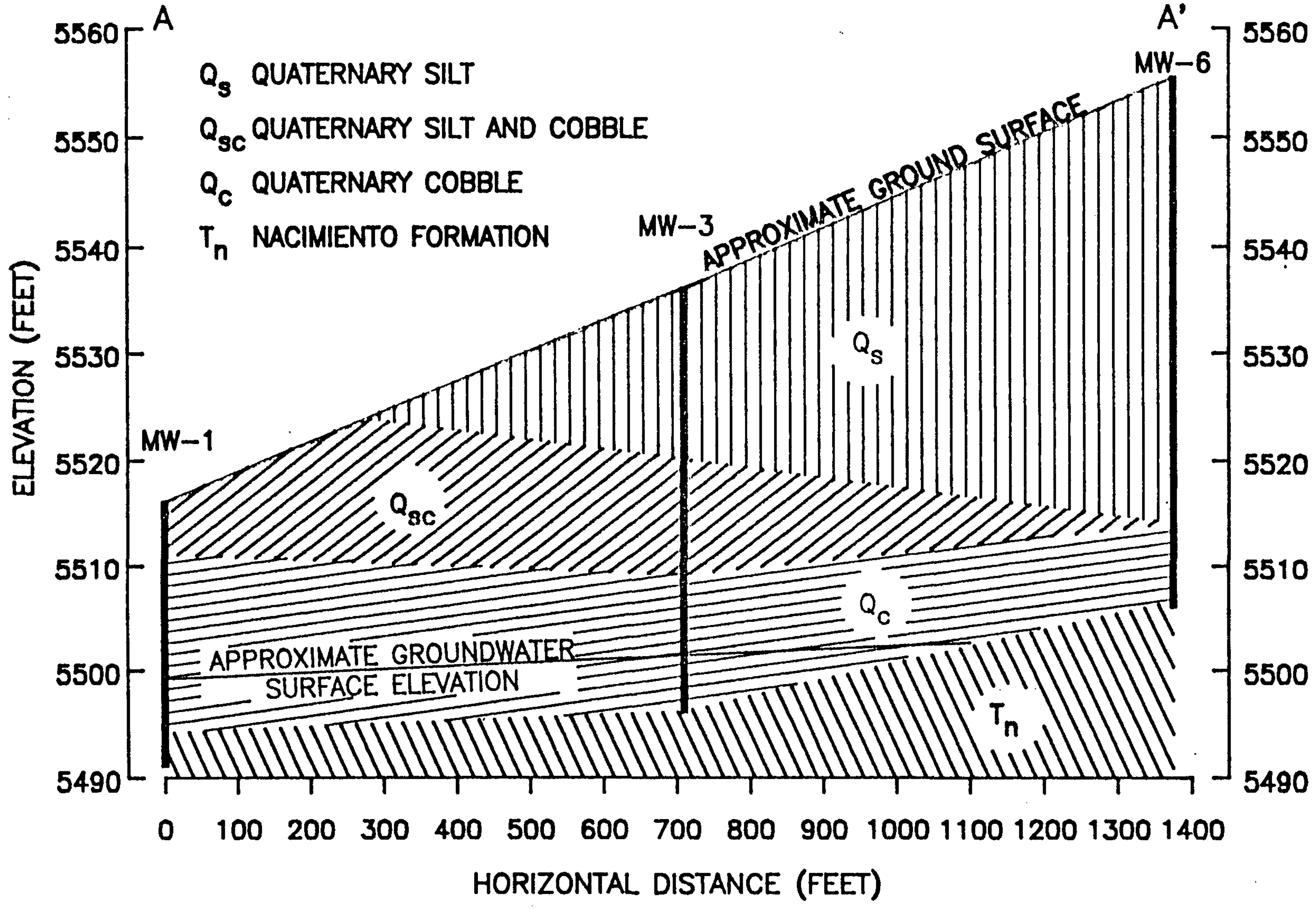
TABLE 3.5

GROUNDWATER ELEVATION MEASUREMENTS IN MONITORING WELLS, 1984

Monitoring Well	Benchmark	Water Elevation 2/9	Water Elevation 2/14-2/15	Water Elevation 2/24
MW-1	5515.64	5499.08	5498.63	5498.78
MW-2	5519.38	5500.27	5499.48	5500.37
MW-3	5535.74	5501.68	5501.48	5501.63
MW-4	5524.30	5499.36	5499.33	5499.46
MW-5	5545.01	5502.34	5501.28	5502.17
MW-6	5555.13	Dry	Dry	Dry

FIGURE 3.4

GEOLOGIC CROSS-SECTION A–A'



Background water samples were collected from wells MW-1 through MW-4 on February 15, 1984, and submitted to two laboratories for analysis. As shown in Table 3.6, significant differences between the laboratories were observed for several parameters, including aluminum, cadmium, cobalt, copper, iron, lead, nickel, selenium, nitrate, and others. Concentrations of petroleum constituents in the low mg/l range were detected in MW-4, the well located closest to the process area. MW-1, located between the Hammond Ditch and the solar evaporation pond, did not show extensive petroleum hydrocarbon or heavy metal contamination. MW-3 also appeared relatively clean, and one laboratory detected benzene, toluene, and phenol concentrations of less than 100 ug/l in MW-2.

As part of the refinery discharge plan plan approved in June 1984, the refinery has initiated a program to analyze groundwater from MW-1 and MW-4 on a quarterly basis. At the time of this report, only the first set of data, collected in September 1984, are available. These data are tabulated in Table 3.7. As shown, MW-4 has increased concentrations of petroleum-derived compounds, including phenols, benzene, and toluene. Although all petroleum compounds analyzed were less than method detection limits for MW-1, parameters such as lead and phenols had increased from previous samples. Significant differences in TDS, sulfates, chlorides, and nitrate between the two wells indicate different probable sources of groundwater constituents.

The differences between the February 15 and September analytical work are difficult to evaluate, particularly considering the differences observed between the two laboratories previously discussed. The fact that the Hammond Ditch was flowing in September but not in February probably has affected the water sampled in MW-1 since it is apparent the ditch contributes water to the cobble layer in this area. At present, it is unknown whether water in the ditch significantly impacts groundwater in the vicinity of MW-4. Given the complex hydrogeology of the site, it is likely that at least a full year of analytical data and water level measurements covering periods when the Hammond Ditch is and is not flowing, will be necessary to evaluate the water quality data adequately.

TABLE 3.6

ANALYTICAL RESULTS OF FEBRUARY 15, 1984, MONITORING WELL SAMPLING

	Well No. 1		Well No. 2		Well No. 3		Well No. 4	
	Hauser	CEP	Hauser	CEP	Hauser	CEP	Hauser	CEP
Aluminum, mg/l	43.8	<0.1	37.7	<0.1	48.8	<0.1	10.2	<0.1
Arsenic, mg/l	0.0027	<0.01	0.0102	0.01	0.0035	<0.01	0.0038	<0.01
Barium, mg/l	<1.0	0.1	<1.0	<0.1	<1.0	1.3	<1.0	0.2
Boron, mg/l	<10.0	0.2	<10.0	0.3	<10.0	0.6	<10.0	0.5
Cadmium, mg/l	0.1	0.006	0.11	0.004	0.1	0.002	0.2	0.010
Chromium, mg/l	<0.1	<0.001	<0.1	<0.001	<0.1	<0.001	<0.1	<0.001
Cobalt, mg/l	1.0	0.09	1.1	<0.01	0.93	<0.01	0.95	<0.01
Copper, mg/l	0.13	0.009	0.11	0.001	<0.1	0.007	<0.1	0.004
Iron, mg/l	12.7	0.04	15.7	0.03	43.1	0.02	8.3	<0.01
Lead, mg/l	2.8	0.006	3.1	0.005	2.7	0.004	2.8	0.006
Manganese, mg/l	1.1	1.21	11.3	18.1	1.8	4.43	3.5	2.07
Mercury, mg/l	0.001	<0.0004	0.0013	<0.0004	<0.0024	<0.0004	<0.001	<0.0004
Molybdenum, mg/l	<0.5	0.24	<0.5	0.013	<0.5	0.014	<0.05	0.005
Nickel, mg/l	0.84	0.05	0.87	0.02	0.76	<0.01	0.75	0.02
Selenium, mg/l	0.0096	0.11	0.0057	0.10	0.0053	0.07	0.0036	0.10
Silver, mg/l	<0.1	<0.01	<0.1	<0.01	<0.1	<0.01	<0.1	<0.01
Zinc, mg/l	1.1	0.45	0.5	0.32	0.8	0.67	0.9	2.8
pH (units)	7.22	7.27	7.25	7.33	7.14	7.00	6.92	6.98
TDS, mg/l	3038	3050	4825	4360	4098	5220	1600	1780
Chloride, mg/l	1040	1000	1120	1100	1012	1200	417.5	470
Cyanide, mg/l	<1.0	0.19	<1.0	0.21	<1.0	0.24	<1.0	0.17
Fluoride, mg/l	0.62	0.54	1.12	0.58	0.81	0.24	0.32	0.33
Nitrate, mg/l	1.2	0.05	1.0	0.02	46.5	<0.01	1.3	0.02
Sulfate, mg/l	240	520	1025	1700	975	2000	<10.0	<1.0
Phenols, mg/l	<0.015	0.13	0.05	0.04	<0.05	0.09	0.19	0.05
Benzene, mg/l	ND	<0.001	ND	0.032	ND	<0.001	9.24	3.96
Toluene, mg/l	ND	<0.001	ND	0.074	ND	<0.001	2.43	5.08

Hauser refers to Hauser Labs of Boulder, Colorado.

CEP refers to Controls for Environmental Pollution in Santa Fe, New Mexico.

TABLE 3.7

FIRST QUARTER MONITORING WELL ANALYTICAL RESULTS (SEPTEMBER 1984)

Parameter	Monitoring Well No. 1	Monitoring Well No. 4
As, mg/l	<0.002	<0.002
Ba, mg/l	1.0	4.0
Cd, mg/l	0.014	<0.002
Cr, mg/l	<0.005	0.10
Pb, mg/l	0.125	0.088
Hg, mg/l	<0.002	<0.002
Se, mg/l	0.35	0.40
Ag, mg/l	<0.003	<0.003
Cu, mg/l	0.10	0.03
Fe, mg/l	57.0	43.7
Mn, mg/l	1.70	7.8
Zn, mg/l	0.30	0.18
U, mg/l	<0.1	<0.1
Cl, mg/l	1059.0	410.0
SO_4, mg/l	825.0	10.0
PCB, mg/l	<0.01	<0.01
Phenols, mg/l	0.024	0.552
CN, mg/l	<0.01	<0.01
NO_3 as N, mg/l	7.2	0.02
Al, mg/l	2.0	<0.05
B, mg/l	<0.004	<0.004
Co, mg/l	0.08	<0.003
Mo, mg/l	<0.005	<0.005
Ni, mg/l	0.3	0.2
F, mg/l	0.284	0.597
TDS, mg/l	3582.0	1860.0
Benzene, mg/l	<0.01	0.419
Toluene, mg/l	<0.01	0.296
Carbon tetrachloride, mg/l	<0.01	<0.01
1,2 Dichloroethane, mg/l	<0.02	<0.02
1,1 Dichloroethylene, mg/l	<0.005	<0.005
1,1,2,2 Tetrachloroethylene, mg/l	<0.02	<0.02
1,1,2 Trichloroethylene, mg/l	<0.01	<0.01
pH, units	7.2	7.1
Ra 226 & 228, pCi/l	<5	<5

SITE SAMPLING BY NMOCD

The NMOCD conducted water and soil sampling investigations at the Bloomfield Refinery on five occasions during 1981 and 1982. The data obtained from four of these investigations are tabulated in Tables 3.8 through 3.12. A single sample collected at an unknown location on December 29, 1981, which had a COD concentration of 172 mg/l is not included.

The first sampling investigation conducted by the NMOCD occurred on September 3, 1981, when seven water samples were collected. These samples were analyzed for inorganic parameters, primarily metals, as shown in Table 3.8. Considering the high sulfate and chloride concentrations in the API wastewater pond, solar evaporation pond 1, and seeps, the fact that there is no difference in these parameters in the Hammond Ditch as it passes through the refinery suggests very little or no impact on the ditch water.

On July 6, 1982, the NMOCD collected 19 water samples at various points around the refinery, including an API wastewater pond, solar evaporation pond 1, the Hammond Ditch, the San Juan River, and numerous seeps. These samples were analyzed for TOC and seven inorganic parameters, as shown in Table 3.9. The API wastewater pond, solar evaporation pond 1, and many of the seeps were found to contain concentrations of lead, chloride, and or TDS exceeding state and federal drinking water criteria. Groundwater from the alluvial river deposits adjacent to the San Juan River and near a major seep had the highest TOC, boron, and lead concentrations. Water collected from the Hammond Ditch just downstream of the refinery contained low chloride and TDS concentrations relative to the other samples, and gave no evidence of being impacted by groundwater constituents at the refinery.

The NMOCD followed up this sampling with an investigation of water and soils at the refinery on July 12 and 14, 1982. These samples were analyzed for specific organics typically associated with petroleum products. These data are tabulated in Tables 3.10 and 3.11. Sample locations are presented in Figure 3.5.

TABLE 3.8

ANALYTICAL RESULTS OF 9/3/81 NMOCD WATER SAMPLING

Parameter	Sample 1 Sump from North API Wastewater Pond	Sample 2 Southeast Corner of Evaporation Pond No. 1	Sample 3 Upstream Hammond Ditch at West end of Siphon	Sample 4 Seep in Arroyo 150+ yards NE of Evaporation Pond No. 1	Sample 5 Seep NW of Evaporation Pond No. 1	Sample 6 Seep on Bluff 250+ yards North of North API Wastewater Pond	Sample 7 Downstream Hammond Ditch at Sullivan Road
Cl	1102.2	997.8	3.6	235.8	603.9	696.8	4.6
F	0.45	0.56	0.16	1.12	1.16	0.77	0.15
SO_4	355.2	563.3	46.3	314.3	1118.0	1896.0	46.5
Fe	0.4	<0.1	-	-	<0.1	-	<0.1
Mn	<0.1	<0.1	-	-	<0.1	-	<0.1
Ni	0.04	<0.01	-	-	<0.01	-	<0.01
Mo	<0.01	<0.01	-	-	<0.01	-	<0.01
Co	<0.005	<0.005	-	-	<0.005	-	<0.005
As	0.046	<0.005	-	-	0.005	-	<0.005
Ba	0.4	<0.1	-	-	0.4	-	<0.1
Cd	<0.001	<0.001	-	-	<0.001	-	<0.001
Cr	0.009	<0.005	-	-	<0.005	-	<0.005
Pb	<0.005	<0.005	-	-	<0.005	-	<0.005
Hg	<0.005	<0.005	-	-	<0.005	-	<0.0005
Se	<0.005	<0.005	-	-	<0.005	-	<0.005
Ag	<0.001	<0.001	-	-	<0.001	-	<0.001
Zn	<0.1	<0.1	-	-	<0.1	-	<0.1
Cu	0.061	<0.05	-	-	<0.05	-	<0.05
Al	<0.1	<0.1	-	-	0.24	-	0.1
B	1.2	-	-	-	0.28	-	0.04

All values in mg/l.

TABLE 3.9

ANALYTICAL RESULTS OF 7/6/82 NMOCD WATER SAMPLING

	Sample Location	TOC (mg/l)	Boron (mg/l)	Cobalt (mg/l)	Chromium (mg/l)	Lead (mg/l)	Chloride (mg/l)	Fluoride (mg/l)	TDS (mg/l)
S-1	Downstream Hammond Ditch 35 feet South of Sullivan Road	3.75	<0.01	<0.01	<0.01	<0.01	10	0.0027	220
S-2	Seep from Bluff NW	3.75	0.32	<0.01	<0.01	<0.01	20	0.0060	640
S-3	Seep from Bluff NW	5.63	0.29	<0.01	<0.01	0.01	130	0.0069	1679
S-4	Seep from Bluff NW	3.75	0.36	<0.01	<0.01	0.01	150	0.0092	1124
S-5	Groundwater from River Terrace near Seep	26.25	0.74	<0.01	<0.01	0.40	330	0.0124	3127
S-6	Seep Below Holding Pond	3.75	0.54	<0.01	<0.01	0.10	760	0.0092	4667
S-7	Seep at Holding Pond just North of Hammond Ditch	<1.88	0.19	<0.01	<0.01	0.02	440	0.0162	2059
S-8	API Wastewater Pond Sump	1.88	<0.01	<0.01	<0.01	0.07	960	0.0019	2927
S-9	NW Corner of Evaporation Pond No. 1	5.63	0.07	<0.01	<0.01	0.09	1130	0.0281	3831
S-10	Seep North of Hammond Ditch and NE of Evaporation Pond No. 1	5.63	<0.01	<0.01	<0.01	0.04	420	0.0116	1782
S-11	Seep E of Evaporation Pond No. 1	5.63	0.16	<0.01	<0.01	0.09	920	0.0174	4289
S-12	Seep from Culvert at Sullivan Road and E of Evaporation Pond No. 1	7.50	0.46	0.01	<0.01	0.16	280	0.0083	7875
S-14	Spray Irrigation System	3.75	<0.01	<0.01	<0.01	0.07	1180	0.0299	3822
S-15	Seep at San Juan River from Arroyo E of Refinery	3.75	<0.01	0.01	<0.01	0.14	380	0.0101	7209
S-16	San Juan River Upstream	3.75	<0.01	<0.01	<0.01	<0.01	10	0.0040	208
S-17	Groundwater near Highway 44 and Sullivan Road	11.25	<0.01	<0.01	<0.01	0.03	200	0.0240	2098
S-18	Seep from Bluff NW	11.25	<0.01	<0.01	<0.01	0.05	220	0.0057	1713
S-19	Seep from Bluff NW	1.88	<0.01	<0.01	<0.01	0.04	60	0.0140	587
S-20	Seep from Bluff NW	18.75	<0.01	<0.01	<0.01	0.09	820	0.0108	3528

TABLE 3.10

ANALYTICAL RESULTS OF 7/12/82 AND 7/14/82 NMOCD WATER SAMPLING

Parameter	Sample A Test Trench 100 yards NW of Hammond Ditch and Sullivan Road Intersection	Sample B Test Trench 150 feet SE of Hammond Ditch and Sullivan Road Intersection	Sample C Hammond Ditch 150 yards S of Hammond Ditch and Sullivan Road Intersection	Sample D API Separator	Sample E Groundwater from River Terrace Deposits	Sample F Seep from Bluff NW
Cd, mg/l	0.002	0.001	<0.001	0.001	0.04	NA
Cr, mg/l	0.013	<0.008	<0.005	0.041	0.62	NA
Pb, mg/l	0.13	0.10	<0.005	0.12	18.17	NA
Hg, mg/l	0.0014	<0.0005	<0.0005	<0.0005	<0.0005	NA
Co, mg/l	0.05	0.05	<0.05	0.069	0.57	NA
Ni, mg/l	0.13	<0.05	<0.05	0.08	0.80	NA
Oil and Grease, mg/l	NA	NA	1.2	15.7	296.2	NA
Cn, mg/l	NA	NA	ND	0.19-0.39	0.0036	NA
Phenols, mg/l	NA	NA	0.0295	21.34	1.01	NA
Cl, mg/l	365.5	385.3	5.0	1499.5	554.5	NA
F, mg/l	0.49	0.38	0.22	0.38	0.43	NA
SO_4, mg/l	146.6	12.2	51.0	239.7	1420	NA
B, mg/l	0.53	0.49	0.03	0.37	0.38	NA
TDS, mg/l	1963	1733	4180	2170	4830	NA
TOC, mg/l	NA	323	3.6	323	860	NA
Benzene, ug/l	<1	<1	<1	21.13 mg/l	15.66 mg/l	<1
Toluene, ug/l	<1	<1	<1	21.08 mg/l	44.6 mg/l	1.43 mg/l
Ethylbenzene, ug/l	<1	NA	NA	<1. mg/l	4.03 mg/l	<1
M-Xylene, ug/l	<1	<1	<1	1.27 mg/l	16.3 mg/l	<1
Aliphatic Hydrocarbon Screen	ND	ND	ND	Present	Present	ND

ND: None Detected
NA: Not Analyzed

TABLE 3.11

7/12/82 AND 7/14/82 NMOCD SOIL SAMPLING

Parameter	Sample A Test Trench 100 Yards NW of Hammond Ditch and Sullivan Road Intersection	Sample B Test Trench 150 Feet SE of Hammond Ditch and Sullivan Road Intersection	Sample E Soil Sample From River Terrace Deposits	Sample G Soil Sample in Hammond Ditch Near API Wastewater Ponds
Benzene	<1 ppb	<1 ppb	<1 ppb	0.009 ppm
Toluene	<1 ppb	<1 ppb	0.115 ppm	0.158 ppm
Ethylbenzene	NA	<1 ppb	0.044 ppm	0.056 ppm
M-Xylene	<1 ppb	<1 ppb	0.124 ppm	0.229 ppm

TABLE 3.12

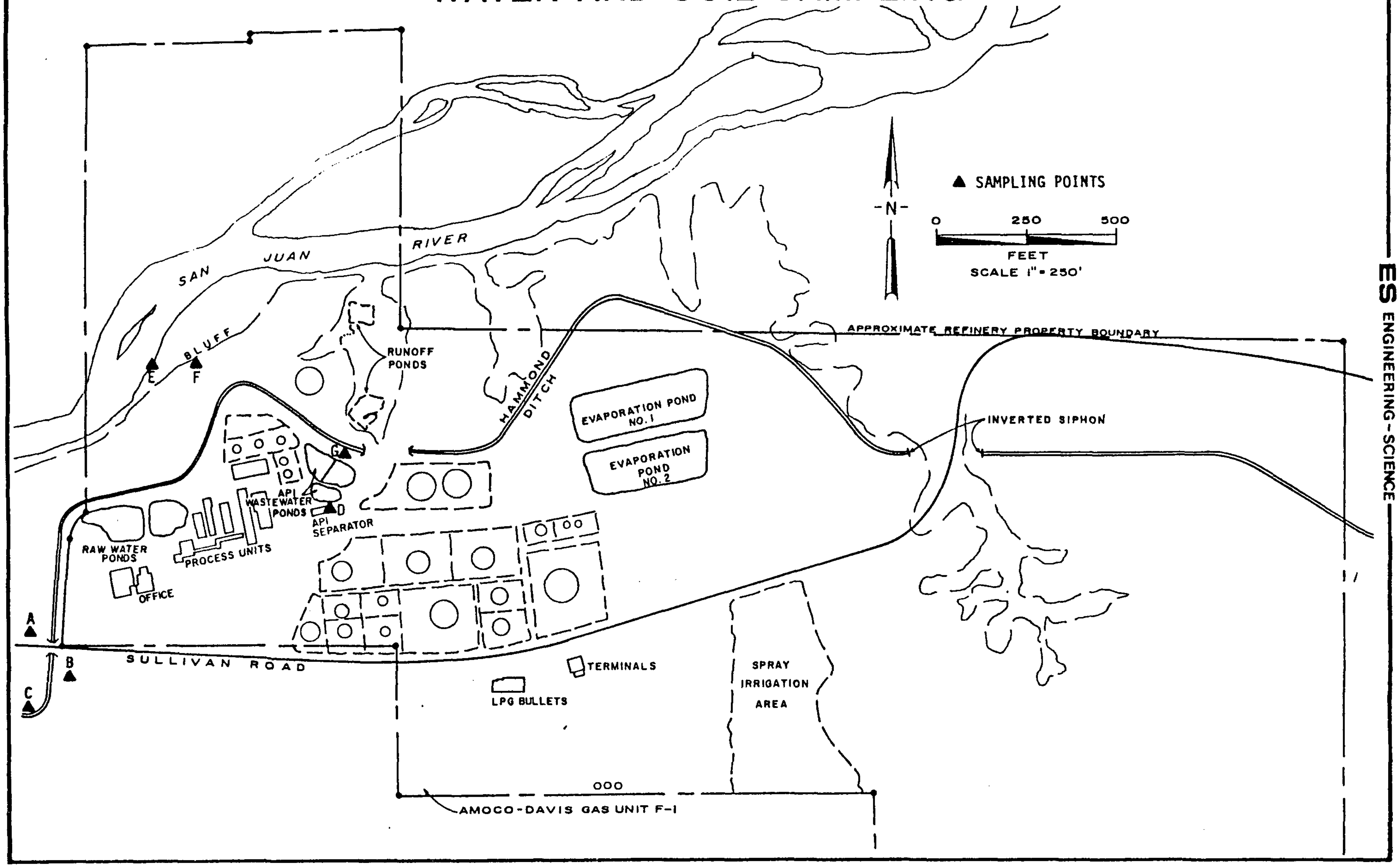
7/28/82 NMOCD WATER SAMPLING

Parameter	Sample La Alluvial Well Water	Sample Ca Hammond Ditch Downstream	Sample Da API Separator Effluent	Sample Ia Hammond Ditch Upstream at Siphon	Sample Ja Seep from Bluff NW	Sample Ka Water from Test Trench 50 yards South of two Ponds East of Refinery
SO_4, mg/l	417.2	56.7	454.2	57.3	151.8	NA
Cl, mg/l	38.2	6.5	1504	3.9	203.5	78.2
B, mg/l	0.29	0.07	0.35	0.03	0.84	0.66
TDS, mg/l	906	186	2676	184	1549	NA
TOC, mg/l	1.5	5.4	418	4.6	98	9.6
Mn, mg/l	0.36	0.05	0.11	0.05	0.92	0.13
Co, mg/l	0.05	0.05	0.05	0.05	0.05	0.069
Pb, mg/l	<0.005	<0.005	0.20	<0.005	0.26	0.38
U, mg/l	NA	NA	0.005	NA	NA	NA
Phenols, mg/l	NA	0.013	37.05	0.191	NA	NA
Cn, mg/l	ND	0.002	NA	NA	0.001	NA
Benzene, ug/l	<1	<1	17.1	<1	<1	<1
Toluene, ug/l	<1	<1	16.5	<1	<1	<1
M-Xylene, ug/l	<1	<1	3.0	<1	<1	NA
Ethylbenzene, ug/l	NA	<1	3.6	<1	<1	NA
Aliphatic Hydrocarbons,	ND	ND	Present	ND	ND	ND

NA: Not Analyzed
ND: Not Detected

FIGURE 3.5

LOCATIONS OF NMOCD AND PLATEAU 7/12 AND 7/14 1982 WATER AND SOIL SAMPLING



Water samples from the test trenches northwest and southeast of the downstream Hammond Ditch intersection with Sullivan Road had lead concentrations of two to three times state and federal drinking water criteria, and the southeast sample had a TOC concentration of 323 mg/l. However, concentrations of petroleum constituents including benzene, toluene, ethylbenzene, xylene, and aliphatic hydrocarbons typically present in refinery product were all less than detectable limits. Soil samples collected at the same locations also were free from significant concentrations of these organics. The sample of Hammond Ditch water contained low concentrations of oil and grease (1.2 mg/l) and phenols (29.5 ug/l), but otherwise differs from the concurrent sample collected by Plateau in that benzene, toluene, xylene, and aliphatic petroleum hydrocarbons were all less than detectable limits.

The water sample collected from the API separator contained concentrations of TOC and the petroleum constituents benzene and toluene in the mg/l range, as well as other compounds typical of refinery wastewaters. The concurrent sample collected by Plateau had lower petroleum hydrocarbon concentrations, although the same compounds were still present.

Groundwater from the alluvial river deposits was found to contain a variety of organic and inorganic compounds. A soil sample at this location also contained a similar variety of compounds. A high lead concentration (18.17 mg/l) was detected in this sample. Specific petroleum hydrocarbons, including benzene, toluene, ethylbenzene, and xylene, were present in concentrations in the mg/l range, although generally lower than the concentrations detected in Plateau's sample of the same date. It should be noted that the concentrations of many parameters exceed those present in the sample collected from the API separator, suggesting a probable source other than refinery effluent.

A soil sample collected from the south bank of the Hammond Ditch near the El Paso Natural Gas pipeline right-of-way was found to contain the petroleum constituents benzene, toluene, ethylbenzene, and xylene at concentrations of less than 0.25 ppm. The stained soils in this area are reportedly the result of diesel fuel spilled in the process area in past years due to improper tank-filling procedures. Downstream of this area of the ditch, two four-foot diameter berms were constructed to contain the seepage, and the collected water and petroleum hydrocarbon mixture was pumped to the API wastewater ponds for subsequent treatment. This seepage may be the source of the petroleum hydrocarbons detected further downstream in the ditch water.

The NMOCD completed their site investigations during 1982 with a visit to the refinery on July 28 for the collection of additional water samples. These analyses are tabulated in Table 3.12. As shown in the table upstream and downstream samples of the Hammond Ditch water were almost identical, and show no evidence of refinery impacts. The API separator sample was similar to samples previously collected from the same source. Samples of a seep on the northwest bluff and water from a test trench near the solar evaporation ponds had elevated lead concentrations of five to eight times state and federal drinking water standards, although little evidence of petroleum compounds was present. The NMOCD also sampled an alluvial water well at an unknown location which showed no evidence of increased metals or organic concentrations.

FIT 1983 INVESTIGATION

On May 16, 1983, the EPA conducted a FIT investigation of the Bloomfield Refinery. Water samples were collected in the Hammond Ditch upstream, downstream, and near the process area; in the San Juan River upstream and downstream; in a retention pond seep north of the API wastewater ponds; and from two seeps on the bluff, one east and one west of the refinery. Soil samples were collected in the landfarm area, the Hammond Ditch near the process area, and in the vicinity of the three seeps from which water samples were collected. These data are attached to this report as Appendix C.

Upstream and downstream samples of San Juan River water show few differences and do not indicate measurable contamination of the water downstream of the refinery. Of the metals analyzed, iron was somewhat higher downstream of the refinery than upstream, but was still well within state and federal water quality standards for drinking water supplies. Priority pollutant analyses found a single alkane in the upstream sample at 0.0075 ppm which was not detected in the river water downstream of the refinery.

Water samples from the Hammond Ditch upstream and downstream of the refinery and adjacent to the process area show no significant differences for the metals analyzed (aluminum, iron, manganese, and zinc). The same alkane identified in the upstream San Juan River sample was found in similar concentrations in the Hammond Ditch upstream and downstream of the refinery. An unknown volatile organic compound was also found in the upstream sample at a concentration of 0.12 ppm. The water sample collected from the ditch near the process area contained a low concentration (0.011 ppm) of molecular sulfur. No other priority pollutants were identified in the water samples from the Hammond Ditch water which are commonly associated with refinery operations or product. The soil sample collected of the Hammond Ditch bank near the process area contained metals concentrations typical for U.S. soils. Two alkanes were found in this soil sample at a total concentration of less than 1 ppm.

The three water samples from the seeps contained numerous volatile organic and acid and base/neutral compounds common in raw crude and refined product, including alkanes, phenolic compounds, benzene isomers, polynuclear aromatics, and a variety of unidentified compounds. The retention pond seep contained fewer petroleum-derived compounds at generally lower concentrations than the seeps sampled on the west and east bluffs. Soil samples collected in the vicinity of the seeps indicated concentrations of polynuclear aromatic compounds in the ppb to low ppm range around the west seep, whereas the soil sample collected in the vicinity of the east seep was characterized by similar concentrations of alkanes and related petroleum compounds. Only a single alkane at a concentration of 0.32 ppm was identified in soil from the retention pond seep.

FIT 1984 INVESTIGATION

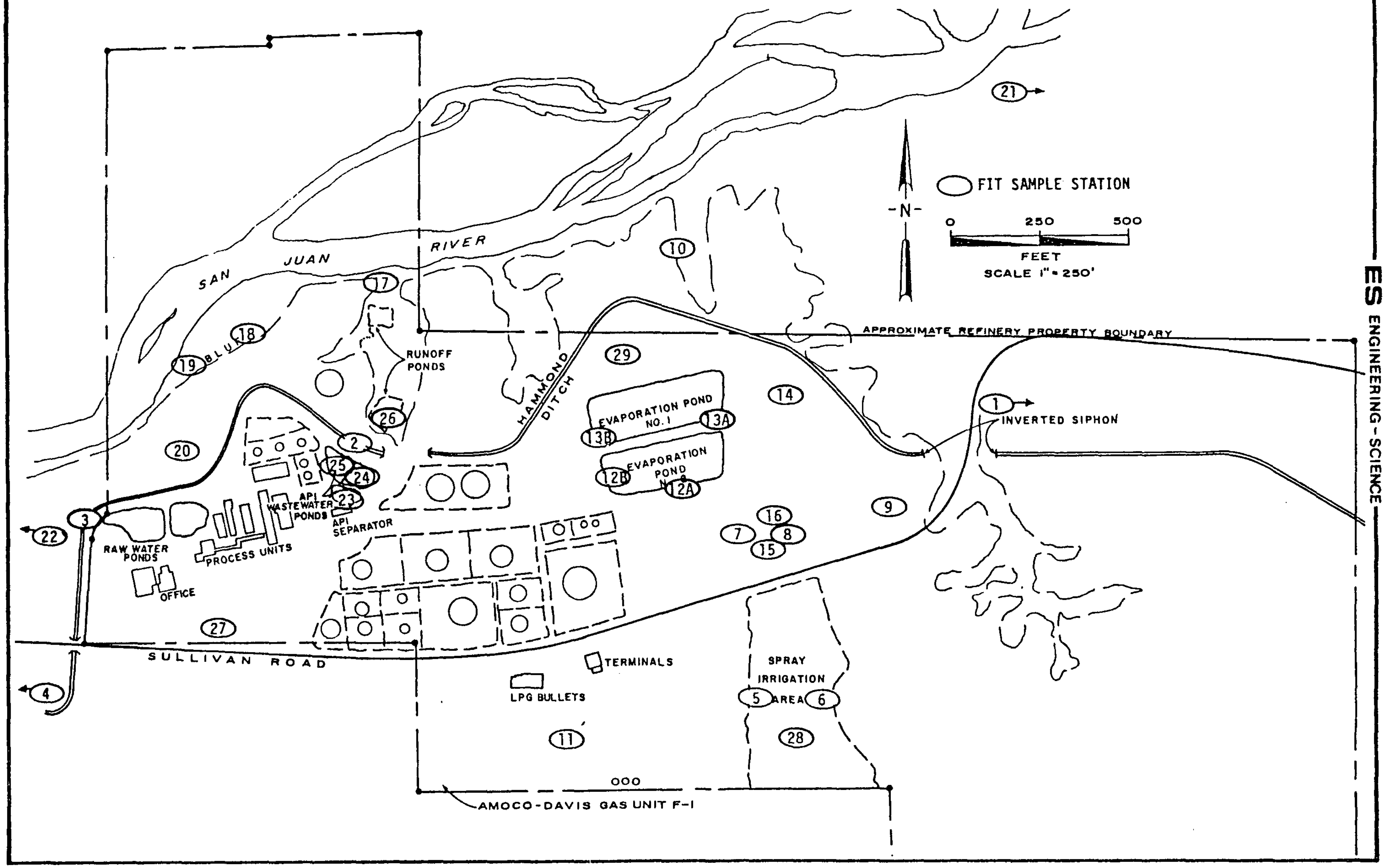
An extensive sampling program was conducted by the EPA Region VI FIT during the week of March 19-24, 1984. Samples were collected from the refinery API separator, solar evaporation ponds, spray irrigation area, groundwater monitoring wells, and other surface features in probable runoff pathways. Seepage samples and soil samples from the river alluvium also were collected, as well as upstream and downstream samples in the San Juan River and the Hammond Ditch. A map showing the locations of all samples is presented in Figure 3.6. The analytical data is attached to this report as Appendix D, along with a data summary originally presented in the FIT report.

Water and soil samples were collected at four locations in the Hammond Ditch: (1) upstream of the refinery, (2) near the API wastewater ponds, (3) below the raw water ponds, and (4) downstream of the refinery. Water samples upstream and downstream of the refinery contained no measurable concentrations of organic or inorganic parameters. A small concentration of the petroleum constituent xylene (7.3 ppb) was detected in the ditch water near the raw water ponds. Petroleum hydrocarbons including several benzene compounds and numerous unknowns were detected in the water adjacent to the API wastewater ponds. In the soil samples, unknown organic compounds were detected in all samples except that collected near the raw water ponds, at concentrations greater than 45 ppm. In the soil near the API wastewater ponds, in the area where a stain of diesel fuel had been reported previously, four polynuclear aromatic compounds (PNA's) at a total concentration of over 18 ppm were detected. Alkanes were detected in all samples, including those collected upstream of the refinery, and a large number of unknown organic compounds were found in the soil samples both upstream and downstream of the refinery. Given the large concentrations of alkanes and unknown organic compounds detected in upstream soil samples, it is impossible to determine conclusively the source of similar compounds and concentrations in downstream samples. It should be noted that off-site migration of organic compounds was not demonstrated in water samples collected in the ditch.

Soil samples collected throughout the refinery indicate a variety of organic compounds are present in widely varying concentrations. Small concentrations of toluene, heptanol, and other petroleum-derived organics of less than 2 ppm were detected in soils in the spray irrigation area. Soils in a portion of the refinery property located just north of the spray irrigation area contained higher concentrations of the petroleum constituents PNA's, alkanes, and other unknown organics in the 10-50 ppm range. Evaporation pond soils were found to contain petroleum-derived phenolic compounds, PNA's, aromatic and other solvents, alkanes, and other compounds, mostly in concentrations of less than 1 ppm, although one of the

FIGURE 3.6

LOCATIONS OF 1984 FIT SAMPLES



samples taken from the southern end of pond 2 had organic concentrations up to 10 ppm, as well as elevated chromium, copper, and zinc levels.

Soils and water samples in seepage areas and intermittent stream channels, north and northwest of the refinery, all contained evidence of organic compounds commonly associated with refinery operations and refined product. The highest concentrations of these petroleum constituents were found in soils from a major seep on the bluff northwest of the refinery and in the alluvial river deposits immediately below. PNA's, alkanes, benzene, and other petroleum constituents were detected at concentrations exceeding 100 ppm. The seeps containing the highest organic concentrations are likely the result of past spills of oil or product at the refinery, since organic concentrations are well in excess of the concentrations of the same compounds present in the API wastewater ponds or in the API separator effluent, solar evaporation ponds, or spray irrigation area.

The FIT collected water and soil samples from the San Juan River both upstream and downstream of the refinery. No evidence of downstream impacts was found, despite the high organic concentrations present in the adjacent river terrace deposits. The compounds 1,1,2-trichloroethane and 1,1,2,2-tetrachloroethane were found in both upstream and downstream soils in similar concentrations. The source of these compounds is unknown, although laboratory contamination is a strong possibility.

Three groundwater monitoring wells, MW-1, MW-4, MW-5, were sampled during the 1984 FIT visit. Petroleum hydrocarbons including ethylbenzene, xylene, and alkanes were detected in MW-5 at concentrations of less than 50 ug/l, and no organic compounds were detected in well MW-1, although a low phenol concentration had been detected in one previous analysis. Organic concentrations approaching 30 mg/l for individual petroleum constituents were found in MW-4, which is consistent with previous analyses, although concentrations of specific parameters differ from previous samples. Water from each of the wells contained elevated aluminum and iron concentrations. Manganese also was detected in MW-4 at a slightly elevated concentration (7.62 mg/l).

CHAPTER 4

SITE ASSESSMENT

CHARACTERIZATION AND POTENTIAL SOURCES OF GROUNDWATER CONSTITUENTS

Organic constituents commonly associated with refinery operations and refined product are widespread in groundwater in the upper sands, silts, and cobbles of the Jackson Lake Terrace and other Quaternary deposits above the Nacimiento Formation at the Bloomfield refinery, and have been observed in seeps in the intermittent stream channels to the north of the Hammond Ditch. The areas with petroleum hydrocarbon concentrations in the ppm range are the major seeps emerging from the bluff northwest of the refinery, the alluvial river deposits to which these seeps drain, and the vicinity of MW-4. Other seeps and arroyos north and northeast of the refinery show evidence of petroleum hydrocarbons at lower concentrations.

The areas with the highest petroleum hydrocarbon concentrations are believed to be primarily the result of hydrocarbon spills and leaks in and around the process area. The concentrations of aromatic solvents, polynuclear aromatics, alkanes, substituted benzenes, and other petroleum-derived hydrocarbons in the major northwest bluff seep and the alluvial river deposits are significantly higher than the concentrations observed in the API separator effluent, API wastewater ponds, solar evaporation ponds, and spray irrigation area and implicate a separate source. Concentrations of specific petroleum hydrocarbons in the API separator effluent and API wastewater ponds are typical of refinery operations as reported by EPA (Ref. 6). Furthermore, the presence of short-chain and low molecular weight hydrocarbons in the seepage from the northwest bluff is characteristic of refined product and also strongly suggests it may be the result of leaks and/or spillage. The 1984 FIT report also indicated that the river terrace deposits where the large petroleum hydrocarbon concentrations were found was the site of a 2,500-barrel oil spill in 1963.

The area in the vicinity of MW-4 also contains subsurface petroleum hydrocarbons. This area reportedly was near areas used at one time for truck washing and truck loading which may have contributed to the petroleum hydrocarbons present. The water sample collected at this location contained some similar compounds to the northwest bluff seep, although numerous different petroleum constituents were present in the samples.

Samples collected from the arroyo north of the solar evaporation pond generally contain fewer organic compounds at lower concentrations than those near the process area or along the northwest bluff. The petroleum compounds detected are similar to those found in the evaporation ponds and spray irrigation area, which suggests these areas as possible sources.

The extent of the petroleum hydrocarbons in the shallow subsurface is well defined in certain areas, and, although the horizontal extent is not known with certainty, the general area of petroleum hydrocarbons can be defined. It is likely that to the south, the petroleum hydrocarbons extend no further than the point where the water level intersects the Nacimiento Formation, and may not extend even this far, as the subsurface soil and water samples collected in this area by the NMOCD and Plateau did not indicate petroleum hydrocarbon presence. Soil and water samples collected west of the Hammond Ditch and north of Sullivan Road also did not indicate the presence of petroleum hydrocarbons and, furthermore, movement of impacted groundwater in this area is unlikely due to the location of the ditch, which would provide a barrier much of the year due to the hydraulic gradient when the ditch is full. In addition, groundwater movement appears to follow the Nacimiento subcrop which slopes down toward the north on a regional basis.

Taken together, the data on groundwater quality suggest multiple sources of groundwater petroleum hydrocarbons ranging from spills or leaks of crude oil or product to the seepage of partially treated wastewater. It is doubtful that all individual sources of spills could be identified, considering the hydrocarbons obviously have moved throughout the shallow subsurface and are influenced by the recharge of water form and surcharge to the Hammond Ditch. Therefore, it seems most prudent to consider the entire process area extending to MW-4 in the south as a single source of petroleum hydrocarbons.

POTENTIAL SURFACE WATER IMPACTS

Subsurface petroleum hydrocarbons at the Bloomfield Refinery potentially could impact two major surface water bodies: the San Juan River and the Hammond Ditch. Potential impacts on the Hammond Ditch can be further divided into irrigation season and non-irrigation season impacts.

San Juan River

None of the surface water or soil samples collected by Plateau, the NMOCD, or EPA upstream or downstream of the refinery indicate the river has been affected adversely by the subsurface petroleum hydrocarbons at the refinery. Although it is apparent that concentrations of petroleum hydrocarbons are present in the alluvial river deposits adjacent to the San Juan River, these compounds have not been detected downstream in measurable concentrations. Given the small flow rate of the seeps relative to the flow rate of the San Juan River, the dilution rate is sufficiently high such that even if hydrocarbons are entering the river they are diluted to such an extent that they do not have a measurable impact on water quality. Field estimates of the total rate of seepage from all seeps have been as high as 10-20 gpm. At the average river flow rate of 1,090 cfs since the Navajo dam was completed in 1963 (determined at USGS gauging station 09355500, 7.2 miles downstream from the dam and approximately 19 miles upstream from the site), the dilution rate would be 24,460 to 1 if as much as 20 gpm were entering the river. Therefore, it is hardly surprising that petroleum hydrocarbon impacts downstream from the refinery in the San Juan River have never been demonstrated.

Due to the high flow rate of the San Juan River, flow rates have not been measured in conjunction with sampling activities. If the discharge of petroleum hydrocarbons through seeps eventually leading to the river were constant, the potential for adverse impacts increases as the flow in the river decreases. This is true for several reasons. Obviously, a reduction in the San Juan River flow reduces the dilution rate for any petroleum hydrocarbons which may be entering the river. Secondly, a lowering of the river level may allow petroleum hydrocarbons present in the alluvial deposits to enter the river during low-flow conditions. Although the river flow rates during site sampling invstigations are not known, river flow rates are available at several USGS gauging stations on the San Juan River. One of these, USGS gauging station 0935710, was used briefly as a water quality station as well as a gauging station between 1978 and 1981. The station is located several miles downstream of the refinery but upstream of the City of Farmington. The locations of the gauging stations are shown on Figure 1.1. During this period, concentrations of a large number of inorganic and some organic analyses were determined on a monthly basis. Analyses of selected parameters which might be impacted by the introduction of refinery hydrocarbons to the river are summarized in Table 4.1. The data indicate there is no correlation between concentrations of these water quality parameters (including organic carbon and lead) and river flow rates which can be attributed to the subsurface petroleum hydrocarbons at the refinery. There is no indication that concentrations increase during low-flow conditions due to increased migration of petroleum hydrocarbons into the river. Furthermore, there is no indication that water quality parameters increase due to a flushing out of petroleum hydrocarbon substances from the alluvial deposits during periods of high flow.

Based on the available information, impacts on the San Juan River due to subsurface petroleum hydrocarbons at the refinery are not measurable, including during low-flow and high-flow periods.

Hammond Ditch

Potential impacts on the Hammond Ditch due to subsurface petroleum hydrocarbons at the refinery are difficult to assess, if only because of the seasonal use of the ditch to carry irrigation water. During the irrigation season, the ditch contributes water to the upper alluvial deposits as bank storage and the hydraulic gradient tends to move groundwater in directions away from the ditch, and in some instances toward the numerous seeps along the Nacimiento subcrop. Only one of many water samples collected from the ditch downstream during the irrigation season showed any evidence of petroleum hydrocarbons, and a sample collected concurrently by NMOCD was free of hydrocarbons. Petroleum hydrocarbons have been detected in the ditch below the API wastewater ponds and raw water ponds at low concentrations when the ditch is flowing - these are most likely the result of the surface soil stains in the ditch near the API wastewater ponds, since the hydrocarbons are absent in water downstream from the refinery but increase in an upstream direction to a maximum for the sample collected near the API wastewater ponds.

When the ditch is not carrying irrigation water, the hydraulic gradient is reversed and water will tend to come out of bank storage and

TABLE 4.1

ANALYSES OF SELECTED PARAMETERS AT USGS WATER QUALITY STATION 0935710 DURING THE TIME PERIOD 1977-1981

Date	Instantaneous Flow Rate (cfs)	Sulfate (mg/l)	Chloride (mg/l)	Nitrate + Nitrite- (mg/l)	Ammonia-N (mg/l)	Organic-N (mg/l)	Boron (ug/l)	Dissolved Organic Carbon (mg/l)	Total Chromium (ug/l)	Total Lead (ug/l)	Total Zinc (ug/l)
December 9, 1977	579	100	3.9	0.31	0.27	0.09	40	3.4	0	4	20
January 24, 1978	606	120	4.0	0.13	0.00	0.14	30	3.0	-	-	-
February 22, 1978	519	120	4.0	0.23	0.13	1.3	40	4.2	-	-	-
March 28, 1978	653	120	4.5	0.06	0.01	0.51	30	3.1	-	-	-
April 27, 1978	480	120	4.3	0.05	0.03	0.33	40	3.7	-	-	-
June 27, 1978	339	120	5.4	0.14	0.03	0.52	40	4.6	-	-	-
July 18, 1978	380	150	4.8	0.09	0.00	0.39	50	8.0	0	10	40
August 21, 1978	496	140	4.5	0.08	0.02	0.33	50	7.7	-	-	-
September 15, 1978	490	140	5.0	0.08	0.04	0.42	40	4.9	-	-	-
October 18, 1978	524	170	5.2	0.15	0.01	0.37	50	5.8	0	2	20
November 28, 1978	560	170	5.0	0.14	0.02	0.56	60	3.8	-	-	-
December 18, 1978	701	140	5.4	0.20	0.01	0.31	60	3.8	-	-	-
January 23, 1979	627	150	4.8	0.18	0.03	0.20	40	5.6	-	-	-
February 21, 1979	934	170	4.7	0.25	0.04	4.2	60	6.4	-	-	-
March 25, 1979	2520	130	4.4	0.23	0.04	9.2	50	3.3	-	-	-
April 24, 1979	5030	62	3.4	0.08	0.01	0.33	30	3.6	10	38	80
May 23, 1979	5530	64	3.2	0.06	0.05	0.46	40	4.9	-	-	-
June 18, 1979	4990	61	2.8	0.06	0.03	0.10	120	8.4	-	-	-
July 24, 1979	4850	50	2.2	0.15	0.02	0.41	3	1.9	0	8	30
August 22, 1979	793	94	2.5	0.08	0.27	0.93	30	5.8	-	-	-
September 17, 1979	510	130	2.5	0.06	0.01	0.39	30	7.2	-	-	-
October 24, 1979	579	150	3.6	0.06	0.08	0.45	50	9.5	0	6	20
November 20, 1979	294	250	5.1	0.18	0.04	-	50	5.9	-	-	-
December 17, 1979	1630	80	6.6	0.11	0.03	0.57	140	4.1	-	-	-
January 22, 1980	1720	79	6.4	0.46	0.02	0.40	30	4.6	-	-	-
February 18, 1980	1820	-	2.5	0.19	0.12	1.9	30	4.8	-	-	-
March 18, 1980	2640	55	2.5	0.09	0.00	0.33	30	3.3	-	-	-
April 6, 1980	724	120	3.6	0.12	0.08	0.52	30	5.9	-	-	-
May 21, 1980	977	91	2.9	0.01	0.02	0.40	60	6.7	-	-	-
June 16, 1980	1390	69	2.7	0.02	0.00	0.76	30	7.6			
July 24, 1980	855	79	2.5	0.08	0.01	0.85	40	4.3	10	16	40
August 26, 1980	1020	100	3.1	0.00	0.00	0.64	20	4.0	-	-	-
September 24, 1980	1010	81	2.7	0.00	0.00	0.35	40	4.2	-	-	-
October 30, 1980	1210	80	2.5	-	-	-	50	-	-	-	-
November 24, 1980	1560	76	2.9	0.13	0.03	0.83	40	4.7	0	10	70
December 15, 1980	1520	65	2.3	-	-	-	10	-	-	-	-
January 19, 9181	1830	62	2.3	-	-	-	10	-	-	-	-
February 23, 1981	969	86	2.7	0.01	0.06	0.75	0	4.8	-	-	-
March 23, 1981	843	88	2.6	-	-	-	20	-	-	-	-
April 20, 1981	430	150	4.1	-	-	-	30	-	-	-	-
May 26, 1981	413	130	11	0.09	0.08	0.63	20	7.2	10	3	60
June 23, 1981	373	130	3.3	-	-	-	20	-	-	-	-
July 20, 1981	588	92	2.7	-	-	-	20	-	-	-	-
August 24, 1981	759	82	2.4	0.03	0.06	0.39	20	2.7	-	-	-
September 8, 1981	1030	320	5.5	-	-	-	50	-	-	-	-

recharge the ditch. The presence of water in the ditch during all seasons supports this conclusion. The return water carries with it petroleum hydrocarbons from the shallow subsurface, which are evident in the ditch during the winter months. At present, Bloomfield Refining has constructed several earthen berms in the ditch to capture the water and low concentrations of petroleum hydrocarbons which are then pumped back to the refinery for treatment. The berms prevent the petroleum hydrocarbons from migrating off-site in the ditch during the non-irrigation season.

At the start of the irrigation season, the possibility exists that petroleum hydrocarbons in the ditch upstream of the berm will be transported downstream with the first flush of irrigation water. Some of the petroleum hydrocarbons would undoubtedly adhere to downstream ditch soils and may have contributed to the alkanes detected in off-site soil samples.

Impacts on downstream water users should be negligible during the irrigation season due to the hydraulic gradient which forces ditch water into bank storage, and the dilution factor due to the water flow in the ditch. Using current recovery procedures, petroleum hydrocarbon substances recharging the ditch during the non-irrigation season will remain on-site and receive treatment in the refinery wastewater treatment system.

POTENTIAL GROUNDWATER IMPACTS

Shallow Alluvial Groundwater

That shallow groundwater beneath the refinery contains hydrocarbons typical of refinery operations is well-documented, particularly in the vicinity of and downgradient of the process area. The available data indicate that petroleum hydrocarbons migrate downward through the permeable sand, silt, and cobble deposits until encountering the relatively impermeable Nacimiento Formation. Subsurface migration occurs along depressions in the formation, which slopes downward regionally in a northerly direction. The petroleum hydrocarbons emerge in seeps where the contact between the upper permeable layers and the Nacimiento Formation is exposed along the bluff adjacent to the San Juan River. After migrating down the bluff, the petroleum hydrocarbons accumulate in the San Juan River terrace deposits and the shallow groundwater of these deposits.

The depressions in the Nacimiento subcrop are well-documented by the presence of seeps and surveyed elevations at the contact, but are less well-defined in other areas of the refinery property. At least three separate depressions are noticeable along the bluff: two north and northeast of the solar evaporation ponds and one northwest of the refinery which contains a seep with the highest petroleum hydrocarbon concentrations analyzed. A connection between the subcrop depressions resulting in a major east-west depression through the refinery property has been inferred in previous reports and is a possibility based on the information available (Ref. 3). However, it is also possible that two of the depressions are separated by a ridge of the Nacimiento subcrop. If the ridge exists, subsurface petroleum hydrocarbons east of the ridge may be a result of past spills in the area, leakage from the solar evaporation ponds and/or the spray irrigation area. At present, the existence of this ridge and the extent of the Nacimiento subcrop depressions are not known.

Groundwater in the Nacimiento and Deeper Formations

The Ojo Alamo is the shallowest dependable potable groundwater supply in the vicinity of the refinery. This sandstone formation is approximately 500 feet below the ground surface at the refinery, underlying the thick and relatively impermeable Nacimiento Formation. Indirect evidence of the Nacimiento's low permeability exists in several facts: (1) groundwater emerges at seeps along the bluff only at the contact between the Nacimiento Formation and the more permeable cobble layer above it, never from the clay or shale itself or the thin sandstone or silt lenses which can be seen along the bluff in several locations; and (2) the neutron-probe access holes, which are completed into the top of the Nacimiento, have a very slow response to any changes in groundwater levels, indicating very slow groundwater movement at best. Based on the low formation permeability and the thickness of the formation at this location (over 400 feet), it is extremely unlikely that the upper subsurface hydrocarbons could migrate downward to such an extent that the Ojo Alamo sandstone would become contaminated.

There is presently no direct evidence to either document or disprove the presence of petroleum hydrocarbons within the Nacimiento Formation itself. Indirect evidence based on the location of groundwater seeps suggests that the potentially more permeable silts and sandstone lenses do not contain significant water or petroleum hydrocarbons. In any case, there are no domestic or irrigation wells in the area which utilize this formation as a water supply.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

Based on a review of analytical data collected by the refinery, the NMOCD, and EPA, hydrological data collected by the USGS, and hydrogeological data prepared for the refinery, the following conclusions can be drawn concerning the presence of subsurface petroleum hydrocarbons at the refinery:

(1) Petroleum hydrocarbons and other compounds commonly associated with refinery operations are widespread in groundwater in the upper sand, silt, and cobble deposits underlying the refinery. The extent of the petroleum hydrocarbons appears limited on the western refinery boundary by the Hammond Ditch and on the south by the lack of natural shallow groundwater south of a point where the groundwater levels encounter the relatively impermeable Nacimiento Formation. Subsurface petroleum hydrocarbons appear to be the result of many sources, primarily the result of many individual leaks and spills known to have occurred at the refinery.

(2) All available evidence supports the contention that petroleum hydrocarbons are confined to the upper layer of sands, silts, and cobbles overlying the Nacimiento Formation. However, there is no hard data on possible hydrocarbons in the Nacimiento Formation itself.

(3) There is little likelihood that the first major potable water aquifer, the Ojo Alamo, will be impacted measurably by the subsurface hydrocarbons at the refinery.

(4) There is no indication from the data examined that the San Juan River downstream of the refinery has been impacted measurably by the petroleum hydrocarbons, either under low-flow or high-flow conditions.

(5) Few measurable impacts have been observed in the Hammond Ditch downstream of the refinery during the irrigation

season. Water and small amounts of petroleum hydrocarbons are pumped back to the refinery for treatment during tne non-irrigation season. Even with collection, some petroleum hydrocarbons may be flushed downstream at the start of the irrigation season.

(6) The subcrop of the Nacimiento Formation shows three major depressions at the outcrop along the bluff adjacent to the San Juan River. Whether or not there is a major east-west depression through the refinery at the subcrop is presently unknown.

The following actions are recommended to obtain additional information prior to the development of a remedial action plan for the refinery:

(1) The refinery should continue to monitor groundwater quality in the six monitoring wells on a quarterly basis to develop baseline water quality in the areas where the wells are located. At least one year of data is necessary to evaluate properly the seasonal impact of the Hammond Ditch on groundwater quality. Water levels in the wells should be determined monthly for the same purpose.

(2) An additional well should be constructed in the vicinity of MW-4 to determine whether there are petroleum hydrocarbons in the Nacimiento Formation. The upper cobble layer should be cased off, and the well screened in the Nacimiento, preferably in an interval in the upper 10 to 20 feet which contains sand or silt lenses. This well should be monitored at the same frequency as the other wells.

(3) An earth resistivity survey should be conducted to determine the Nacimiento subcrop elevations throughout the refinery, particularly in the area of the possible east-west depression. The survey also may be useful in determining the extent of seepage from the solar evaporation ponds and probable mixing with the Hammond Ditch water, since the TDS concentrations are different for both sources.

(4) The San Juan River should be sampled downstream of the refinery (possibly at the Highway 44 bridge) during a low-flow period, preferably less than 300 cfs, to satisfy state and federal agency concerns about downstream water impacts. The sample should be analyzed for the full list of 129 priority pollutants.

(5) Samples of the Hammond Ditch water are recommended at the start of the irrigation season to determine whether petroleum hydrocarbons are being transported downstream and, if there is surface water transport, at which concentrations.

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APPENDIX A

NEUTRON PROBE ACCESS HOLE LITHOLOGIC LOGS

LITHOLOGY	INTERVAL (ft)
Neutron Access Hole 1	
	0-5
Samples missing	5-10
Samples missing	10-15
Samples missing	15-20
Samples missing	20-25
Cobble and large pebbles	25-30
Pebbles and cobble	30-35
Brownish silt and pebbles	35-40
Brownish green silty clay	40-45
Bluish gray silty clay	45-50
Grayish silty clay	
Neutron Access Hole 2	
	0-5
Samples missing	5-10
Samples missing	10-15
Samples missing	15-20
Samples missing	20-25
Brownish silt and pebbles	25-30
Greenish clay	30-35
Greenish gray silty clay	35-40
Grayish silty clay	40-45
Grayish silty caly	45-50
Grayish silty clay	
Neutron Access Hole 3	
	0-5
Samples missing	5-10
Samples missing	10-15
Samples missing	15-20
Brown silt, and pebbles and cobble	20-25
Pebbles and cobble	25-30
Green shale	30-35
Greenish gray clay	35-40
Greenish gray silty clay	40-45
Bluish gray silty clay	45-50
Bluish gray sandy clay	

LITHOLOGY	INTERVAL (ft)
Neutron Access Hole 5	
Samples missing	0-5
Samples missing	5-10
Samples missing	10-15
Samples missing	15-20
Gravel and pebbles	20-25
Pebbles	25-30
Greenish gray silty clay	30-35
Grayish silty clay	35-40
Grayish silty clay	40-45
Grayish silty clay	45-50
Neutron Access Hole 6	
Gray sand	0-5
Gray sand	5-10
Gray sand	10-15
Gray sand	15-20
Pebbles and cobble	20-25
Pebbles	25-30
Buff silt	30-35
Buff silty clay	35-40
Buff sand	40-45
Buff sand	45-50
Neutron Access Hole 7	
Samples missing	0-5
Brownish sand	5-10
Silt and pebbles	10-15
Pebbles	15-20
Pebbles and cobble	20-25
Pebbles and cobble	25-30
Pebbles and cobble	30-35
Grayish clayey sand	35-40
Grayish clayey sand	40-45
Grayish clayey sand	45-50

LITHOLOGY	INTERVAL (ft)
<u>Neutron Access Hole 9</u>	
Samples missing	0-5
Samples missing	5-10
Samples missing	10-15
Samples missing	15-20
Samples missing	20-25
Samples missing	25-30
Samples missing	30-35
Buff silt	35-40
Gray sand	40-45
Gray sand	45-50

APPENDIX B

GROUNDWATER MONITORING WELL LOGS

WELL NUMBER: 1
DATE: 8 February 1984
LOCATION: 29.11.27.24221

DEPTH IN FEET	DESCRIPTION
0-5	Light brown clayey sand, coarse, poorly sorted, quartzose and slightly calcareous
5-10	Yellowish gray sandy pebbles and cobbles, poorly sorted, rounded to subrounded
10-12	Yellowish gray pebbly sand, very coarse, poorly sorted, feldspathic and noncalcareous
12-22	Dark gray pebbly and sandy cobbles, some quartz pebbles, most are volcanic, subrounded cobbles and pebbles, some clay, a little water at about 18 feet
22-25	Gray-green clayey sand becoming light yellow clayey sandstone and sandy claystone

WELL NUMBER: 2
DATE: 7 February 1984
LOCATION: 29.11.27.24321

DEPTH IN FEET	DESCRIPTION
0-5	Light yellow brown silty sandy clay, very calcareous
5-10	Light yellow brown clayey sand, subrounded to subangular, moderately to poorly sorted, very calcareous
10-15	Light brown pebbly sand, clayey, very calcareous, cobbles at 15 feet
15-20	Gray sandy pebbles, poorly sorted coarse quartzose sand, pebbles are dark gray and volcanic
20-25	Dark gray cobbles, some quartz pebbles, mostly volcanic, some sand
25-26	Yellow gray clayey sandstone and sandy claystone

WELL NUMBER: 3
DATE: 8 February 1984
LOCATION: 29.11.27.24442

DEPTH IN FEET	DESCRIPTION
0-5	Yellow brown sandy silt and clay, very calcareous quartzose
5-10	yellow brown sand, calcareous, silty and clayey, quartzose
10-15	Yellow brown sand, silty and clayey, fine-grained, very calcareous, quartzose
15-27	Light brown clay, sandy, very calcareous, becoming pebbly with depth
27-35	Gray yellow brown cobbly sand, coarse, poorly sorted, silty and clayey, volcanic pebbles small amount of water at about 35 feet
35-40	Gray cobbles, pebbly and sandy, coarse sand, yellow gray clayey sandstone at about 40 feet

WELL NUMBER: 4
DATE: 9 February 1984
LOCATION: 29.11.27.23344

DEPTH IN FEET	DESCRIPTION
0-5	Yellow gray-brown sandy silt and clay, calcareous
5-10	Yellow brown silty sandy clay and clayey silt, very slightly calcareous
10-15	Reddish yellow-brown clayey sandy silt, silty clay, fine-grained quartzose sand, noncalcareous
15-19	Light brown coarse sand with clay and pebbles, calcareous
19-25	Gray pebbly sand, very coarse, poorly sorted, some clay and silt, subrounded to subangular, quartzose, pebbles rounded, slightly calcareous
25-30	Gray cobbles and pebbles, subrounded to rounded, volcanic; at about 28 feet, hydrocarbon smell and color
30-32	Gray cobbly sand, with hydrocarbon smell and color, coarse grained, sand is quartzose and feldspathic, subrounded and subangular quartz grains are clear
32	Yellow gray clayey sandstone

WELL NUMBER: 5
DATE: 6 February 1984
LOCATION: 29.11.26.31112

DEPTH IN FEET	DESCRIPTION
0-5	Pale yellow brown clay, silty, some sand, calcareous
5-10	Pale yellow brown clayey sand and quartzose silt, poorly sorted, calcareous
10-15	Yellow brown sand, subrounded quartzose sand slightly calcareous
15-20	Yellow brown sand, clayey, moderately coarse grained, very slightly calcareous
20-25	Yellow brown sand, clayey, silty, fine to medium grained, moderately sorted, noncalcareous
25-35	Yellow brown sand, silty and slightly clayey, fine-to-medium grained, well sorted, subangular, noncalcareous, becoming more clayey with depth
35-37	Yellow brown pebbly and cobbly sand, clayey, calcareous
37-47	Dark gray sandy and clayey cobbles and pebbles, water at 42 feet
47-50	Dark gray cobbles with greenish clay
50-54	Green-gray pebbly clay

WELL NUMBER: 6
DATE: 7 February 1984
LOCATION: 29.11.27.42144 or 42233

DEPTH IN FEET	DESCRIPTION
0-15	Pale yellow brown sand, clayey and silty, subangular, poorly sorted, quartzose, very calcareous, becoming more clayey with depth
15-20	Pale yellow brown silt, sandy and clayey, silt is coarse, sand is very fine, moderate sorting, quartzose and calcareous
20-25	Pale yellow sand, slightly clayey, subrounded, well sorted, quartzose, noncalcareous
25-35	Pale yellow sand, coarse to medium grained, quartzose, noncalcareous
35-41	Pale yellow sand, clayey, fine grained, silty, quartzose, slightly calcareous
41-49	Gray-black cobbles and pebbles, volcanic
49-52	Gray-green clayey sandstone and sandy claystone

APPENDIX C

1983 FIT SAMPLES

CASE NUMBER: SAS 542F

SITE NAME/CODE: Plateau Refining

CONCENTRATIONS (ppm)

PARAMETER		EPA Sample Numbers								Mean Ambient Background 1.	
		MF 9548	MF 9549	MF 9550	MF 9551	MF 9552	MF 9553	MF 9554	MF 9555	Western U. S. 2.	Eastern U. S. 2.
Task 1	Matrix Type	water	water	water	water	soil	-	soil	water	Soil	Soil
	Aluminum		0.239	0.233	0.224	7,440		4,960	0.256	5.4	3.3
	Chromium					0.15		4.1		38	36
	Barium					200		92		560	500
	Beryllium					0.61		0.28		0.6	0.6
	Cobalt					5.4		3		8	7
	Copper					11		5.2		21	14
	Iron	0.173	0.087	0.202	0.186	8,400		6,000	1.72	20,000	15,000
	Nickel					7.8		4.2		16	13
	Manganese	0.024	0.031	0.02	0.024	257		173	1.67	390	290
	Zinc		0.013	0.011	0.012	33		17	0.012	51	36
	Boron			0.171					0.421	22	32
	Vanadium					11				66	46
	Silver									-	-
Task 2	Arsenic					5.4		5.2	0.013	6.1	5.4
	Antimony								0.033	150	-
	Selenium					0.5		0.75	0.133	0.25	0.39
	Thallium									-	-
	Mercury					0.018		0.05		0.055	0.096
	Tin									10	10
	Cadmium					0.59		0.6	0.0013	1	1
	Lead					20		289	1.77	18	14
Task 3	Ammonia					10		8.5		-	-
	Cyanide									-	-
	Sulfide									-	-
Sample Station Number		02	04	03	05	05	Blank	06	06		
Sample Station Location		LC Hamond ditch W. Sul-LIVAN RD	LC San Juan River upstream	LC Hamond ditch E. Sul-LIVAN RD.	LC Hamond ditch west side	LC Hamond ditch west side	Blank low water s	MC West Bluff seep	MC West Bluff seep		

1. Ambient background concentrations apply only to soil matrix samples. Values obtained from "Geochemistry of Some Rocks, Soils, Plant and Vegetables in the Contermious United States" Geological Survey Professional Paper 574 F 1975.

2. Reference for East/West Division is the 97° W longitudinal line which bisects Region VI.

CASE NUMBER: SAS 542F

SITE NAME/CODE: Plateau Refining

CONCENTRATIONS (ppm)

PARAMETER		EPA Sample Numbers								Mean Ambient Background 1.	
		ME 9556	ME 9557	ME 9558	ME 9559	ME 9560	ME 9561	ME 9562	ME 9563	Western U. S. 2.	Eastern U. S. 2.
	Matrix Type	Soil	Water	Soil	Water	Soil	Soil	Water	Soil	Soil	Soil
Task 1	Aluminum	3810	0.251	9830	75.5	1950				5.4	3.3
	Chromium	2.2		6.6	0.042	449				38	36
	Barium	25	0.661	15	0.125	110				560	500
	Beryllium	0.26		1.5						0.6	0.6
	Cobalt			7.2		2.7				8	7
	Copper	7.0		19	0.066	123				21	14
	Iron	5230	4.56	10,800	56.5	4,420				20,000	15,000
	Nickel	2.7		10	0.062	15				16	13
	Manganese	490	7.23	285	1.16	79				390	290
	Zinc	22	0.03	45	0.161	632				51	36
	Boron		0.979		0.52					22	32
	Vanadium									66	46
	Silver									-	-
Task 2	Arsenic	3	0.039	6.8	0.044	4.3				6.1	5.4
	Antimony									150	-
	Selenium	0.2		0.75	0.034	0.32				0.25	0.39
	Thallium									-	-
	Mercury									0.055	0.096
	Tin					2.4				10	10
	Cadmium	0.49		0.96	0.0049	1.0				1	1
	Lead	24	0.067	25	0.139	43				18	14
Task 3	Ammonia			10		20				-	-
	Cyanide									-	-
	Sulfide									-	-
Sample Station Number		07	07	08	08	09	Blank	Blank	Blank		
Sample Station Location		MC East Bluff seep	MC East Bluff seep	MC Retention Pond seep	MC Retention Pond seep	MC Land farm area	Soil Blank medium	Medium water	Low soil		

1. Ambient background concentrations apply only to soil matrix samples. Values obtained from "Geochemistry of Some Rocks, Soils, Plant and Vegetables in the Contermious United States" Geological Survey Professional Paper 574 F 1975.

2. Reference for East/West Division is the 97° W longitudinal line which bisects Region VI.

TABLE 1. INORGANIC ANALYSIS SUMMARY

CASE NUMBER: SAS 542F

SITE NAME/CODE: Plateau Refining

CONCENTRATIONS (ppm)

PARAMETER		EPA Sample Numbers								Mean Ambient Background 1.	
		MF 9569								Western U. S. 2.	Eastern U. S. 2.
Task 1	Matrix Type	water								Soil	Soil
	Aluminum	0.206								5.4	3.3
	Chromium									38	36
	Barium									560	500
	Beryllium									0.6	0.6
	Cobalt									8	7
	Copper									21	14
	Iron	0.172								20,000	15,000
	Nickel									16	13
	Manganese	0.024								390	290
	Zinc	0.014								51	36
	Boron	0.234								22	32
	Vanadium									66	46
	Silver									-	-
Task 2	Arsenic									6.1	5.4
	Antimony									150	-
	Selenium									0.25	0.39
	Thallium									-	-
	Mercury									0.055	0.096
	Tin									10	10
	Cadmium									1	1
	Lead									18	14
Task 3	Ammonia									-	-
	Cyanide									-	-
	Sulfide									-	-
Sample Station Number		01									
Sample Station Location		LC									

1. Ambient background concentrations apply only to soil matrix samples. Values obtained from "Geochemistry of Some Rocks, Soils, Plant and Vegetables in the Conterminous United States" Geological Survey Professional Paper 574 F 1975.

2. Reference for East/West Division is the 97° W longitudinal line which bisects Region VI.

SE NUMBER: P1740, SAS 542F

TE NAME/CODE: Plateau Refinery

PARAMETERS					CONCENTRATIONS (ppm) EPA SAMPLE NUMBERS							
Compound	Fraction	P.P.[1]	S.H.S.[2]	T.I.[3]	F1865	F1867						
olecular sulfur	ABN			X	0.011							
nknown	ABN			X		0.014						
nknown	ABN			X		0.038						
nknown	ABN			X		0.011						
Matrix Type					Water	Water						
Sample Station Number					05	blank						
Sample Station Location					Hammond ditch west side	LC water blank						

Priority Pollutant.
Specified Hazardous Substance.
Tentatively Identified.

SE NUMBER: P 1740 SAS 5427

TE NAME/CODE: Plateau Refinery

PARAMETERS					CONCENTRATIONS (ppm)						
					EPA SAMPLE NUMBERS						
Compound	Fraction	P.P.[1]	S.H.S.[2]	T.I.[3]	F1866	F1868	F1870	F1872	F1874	F1875	F1877
aphthalene	ABN	X				2,400			32		
henanthrene	ABN	X				present	present		117		
-methyl naphthalene	ABN		X			3,800			134		
enzene	VOA	X				present			0.0124		
thyl benzene	VOA	X				5.5			0.022		
oluene	VOA	X				21			0.1		
-xylene	VOA		X			39	0.32		0.22		
hloro benzene	VOA	X					0.0196				
, 1, 2, 2, tetra chloroethane	VOA	X					0.0039				
ethylene chloride	VOA	X					0.006	present	present	0.018	0.004
luoro trichloromethane	VOA	X					present			0.011	
CB-1248	Pest	X					19.2				
hrysene	ABN	X							44		
luorene	ABN	X							49		
yrene	ABN	X							16		
CB-1242	Pest	X							460		
imethyl benzene (13)	VOA			X		25					
oluene 362	ABN	X		X		97					
imethyl benzene isomer 516	ABN			X		250					
imethyl benzene isomer 549	ABN			X		100					
trimethyl benzene isomer 644	ABN			X		280					
trimethyl benzene isomer 652	ABN			X		120			present		
nethyl ethyl benzene isomer 668	ABN			X		77					
trimethyl benzene isomer 687	ABN			X		290					
nethyl ethyl benzene isomer 723	ABN			X		120					
C-4 benzene isomer 758	ABN			X		150					
Matrix Type					Soil	Soil	Soil	Soil	Soil	Soil	Soil
Sample Station Number					05	06	07	08	09		
Sample Station Location					Hammond ditch W. side	West Bluff seep	East Bluff seep	Reten- tion POND SEEP	Land farm	MC soil blank	LC soil blank

1. Priority Pollutant.
2. Specified Hazardous Substance.
3. Tentatively Identified.

SE NUMBER: P 1740 SAS 542F

TE NAME/CODE: Plateau Refinery

PARAMETERS						CONCENTRATIONS (ppm) EPA SAMPLE NUMBERS						
Compound		Fraction	P.P.[1]	S.H.S.[2]	T.I.[3]	F1866	F1868	F1870	F1872	F1874	F1875	F1877
ıbstituted benzene isomer	764	ABN			X		200					
·4 Benzene isomer	800	ABN			X		110			present		
·4 Benzene isomer	843	ABN			X		81			present		
·5:Benzene isomer	879	ABN			X		120					
kane. [illegible] isomer	1032	ABN			X		110					
:thyl naphthalene isomer	1062	ABN			X		92					
kane	1133	ABN			X		120					
methyl naphthalene isomer	1155	ABN			X		64					
methyl naphthalene isomer	1170	ABN			X		100					
kane	1316	ABN			X		100					0.26
kane	1358	ABN			X	0.59	74	5,600				
ıkane	1447	ABN			X	0.35		1,400		1,400		
:thyl cyclopentane(12)	378	VOA			X			0.075		2		
lcohol or alkene (12)	417	VOA			X			0.051				
:thy-ethyl cyclopentane isomer		VOA			X			0.127		1		
lcohol or alkene (12)	489	VOA			X			0.068				
nknown (12)	503	VOA			X			0.15				
lkane	508	VOA			X			0.18				
lkane	520	VOA			X			0.097				
lcohol or alkene	536	VOA			X			0.066				
lkane	557	VOA			X			0.36				
lkane	580	VOA			X			0.28				
lkane	1089	ABN			X			1,800		360		
lkane	1197	ABN			X		present	6,100		870		
lkane	1299	ABN			X			8,300		1200		
ubstituted naphthalene	1440	ABN			X			1,400		present		
Matrix Type												
Sample Station Number												
Sample Station Location												

[1] Priority Pollutant.

[2] Specified Hazardous Substance.

[3] Tentatively Identified.

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SE NUMBER: P 1740 SAS 542F

TE NAME/CODE: Plateau Refinery

PARAMETERS						CONCENTRATIONS (ppm) EPA SAMPLE NUMBERS						
Compound		Fraction	P.P.[1]	S.H.S.[2]	T.I.[3]	F1866	F1868	F1870	F1872	F1874	F1875	F1877
lcohol or alkene	1445	ABN			X			110.		present		
lkane	1483	ABN			X		present	8,900	0.32	1600	0.3	
lcohol or alkene	1536	ABN			X			1700		present		
lkane	1568	ABN			X		present	9,200				
lkane	1572	ABN			X			4,300		1900		
lkane	1648	ABN			X			6,800				
lkane	1655	ABN			X			5,200		1000		
lkane	1724	ABN			X			6,600		1,100		
alkane	1797	ABN			X			4,300		1,100		
alkane	1866	ABN			X			2,400		present		
alkane	1933	ABN			X			1,500		850		
alkane	1998	ABN			X			900		800		
alkane	2059	ABN			X			610		940		
alcohol or alkene	400	VOA			X					0.78		
dimethyl cyclohexane isomer	466	VOA			X					0.65		
dimethyl cyclohexane isomer	479	VOA			X					0.66		
alkane	500	VOA			X					0.73		
alkane	513	VOA			X					0.65		
alkane	552	VOA			X					1.3		
dimethyl benzene isomer	602	VOA			X					1.2		
alkane	678	VOA			X					0.6		
alkane	1524	ABN			X			4,500				
Matrix Type												
Sample Station Number												
Sample Station Location												

1. Priority Pollutant.
2. Specified Hazardous Substance.
3. Tentatively Identified.

CASE NUMBER: P 1740 SAS 542F

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SITE NAME/CODE: Plateau Refinery

PARAMETERS					CONCENTRATIONS (ppm) EPA SAMPLE NUMBERS							
Compound	Fraction	P.P.[1]	S.H.S.[2]	T.I.[3]	F1866	F1868	F1870	F1872	F1874	F1875	F1877	
alkane 2131	ABN			X		present	present		950			
alkane 2253	ABN			X					970			
alkane 2330	ABN			X					1100			
alkane 2423	ABN			X					1000			
alkane 2535	ABN			X					1100			
alkane 2672	ABN			X					1100			
alkane 2833	ABN			X					870			
alkane 1363	ABN			X					850			
unknown 2589	ABN			X						3.5		
Matrix Type												
Sample Station Number												
Sample Station Location												

1. Priority Pollutant.
2. Specified Hazardous Substance.
3. Tentatively Identified.

ASE NUMBER: 1740 SAS 542F

ITE NAME/CODE: Plateau Refinery

CONCENTRATIONS (ppm)

PARAMETERS					EPA SAMPLE NUMBERS							
Compound	Fraction	P.P.[1]	S.H.S.[2]	T.I.[3]	F1861	F1862	F1863	F1864	F1869	F1871	F1873	F1876
alkane 1243	ABN			X		0.008	0.0075	0.009				
unknown	VOA			X				0.12				
benzene	VOA	X							0.45	7.0		
1, 2-dichloroethane	VOA	X							0.058	0.12		
Toluene	VOA	X							0.074	21		
acetone	VOA		X						present	0.48		
O-xylene	VOA		X						0.2	.26	0.0055	
cyclohexane	VOA			X					0.0088	0.11		
methyl cyclopentane	VOA			X					0.0068	0.1		
1, 2-dibromo ethane	VOA			X					0.018			
methyl-cycloHEXANE	VOA			X					0.0073	0.46		
unknown 1025	ABN			X					0.25			
unknown 1074	ABN			X					0.05			
unknown, alkane 1242	ABN			X					0.08	0.02		0.093
phenol	ABN	X								present		
2-methyl phenol	ABN	X								present		
naphthalene	ABN	X								1.6	present	
2-methyl naphthalene	ABN		X							3.0		
ethyl benzene	VOA	X								0.46		
2-butanone	VOA		X							present		
2-hexanone	VOA		X							0.28		
4-methyl-2-PENTANONE	VOA		X							present		
2-methyl butane	VOA			X						0.05		
hexane	VOA			X						0.11		
alkane	VOA			X						0.24		
unknown	VOA			X						1.6		
Matrix Type					water	water	water	water	water	water	water	water
Sample Station Number					01	02	04	03	06	07	08	Blank
Sample Station Location						Hammond Ditch W. SIDE SULLIVAN RD.	San Juan River UPSTREAM	Hammoned Ditch E. SIDE SULLIVAN RD.	West Bluff seep	East Bluff seep	Reten- pond SEEP	Med. conc

1. Priority Pollutant.
2. Specified Hazardous Substance.
3. Tentatively Identified.

CASE NUMBER: P 1740 SAS 542F

SITE NAME/CODE: Plateau Refinery

PARAMETERS						CONCENTRATIONS (ppm) EPA SAMPLE NUMBERS							
Compound		Fraction	P.P.[1]	S.H.S.[2]	T.I.[3]	F1861	F1862	F1863	F1864	F1869	F1871	F1873	F1876
alkane		VOA			X						0.18		
alkane		VOA			X						0.32		
unknown		VOA			X						1.6		
unknown	497	ABN			X						0.11		
C-3 benzene isomer	630	ABN			X						0.13		
C-3 benzene isomer	667	ABN			X						0.072		
alkane	756	ABN			X						0.15		
C-4 benzene isomer	778	ABN			X						0.084		
C-4 benzene isomer	789	ABN			X						0.14		
substituted benzene	819	ABN			X						0.27		
alkane	867	ABN			X						0.84		
alkane	881	ABN			X						0.26		
unknown	911	ABN			X						0.11		
unknown	961	ABN			X						0.08		
alkane	970	ABN			X						0.87		
alkane	987	ABN			X						0.054		
alkane	1066	ABN			X						0.39		
dimethyl naphthalene isomer	1097	ABN			X						0.04		
alkane	1123	ABN			X						0.11		
alkane	1157	ABN			X						0.23		
alkane	1283	ABN			X						0.091	0.13	
methylene chloride		VOA	X									present	
C-3 benzene isomer		VOA			X							0.064	
C-3 benzene isomer		VOA			X							0.035	
dimethyl benzene isomer	1537	ABN			X							0.55	
Matrix Type													
Sample Station Number													
Sample Station Location													

1. Priority Pollutant.
2. Specified Hazardous Substance.
3. Tentatively Identified.

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E NUMBER: P 1740 SAS 542F

E NAME/CODE: Plateau Refinery

PARAMETERS						CONCENTRATIONS (ppm) EPA SAMPLE NUMBERS							
Compound		Fraction	P.P.[1]	S.H.S.[2]	T.I.[3]	F1861	F1862	F1863	F1864	F1869	F1871	F1873	F1876
nown	707	ABN			X							0.25	
3-dihydro-1H-inden-1-one	1012	ABN			X							0.17	
nown	1140	ABN			X							0.06	
nown	1163	ABN			X							0.22	
ane	1294	ABN			X							0.16	
ane	1376	ABN			X							0.25	
ane	1526	ABN			X							0.093	
Matrix Type													
Sample Station Number													
Sample Station Location													

Priority Pollutant.

Specified Hazardous Substance

APPENDIX D

1984 FIT SAMPLES

Plateau Inc. Refinery
Bloomfield, NM
Summary of Sample Data

These samples (Stations 01-29) were taken by FIT.

NOTE: As an example to clarify this summary, unknowns (19-55,640 ppb) indicates that 19 unknowns were detected at a total concentration of 55,640 ppb.

Station 01: Hammond Ditch, upstream

Water
Organics: none
Inorganics: none

Soil
Organics: di-n-octyl phthalate (2300 ppb), alkanes (2-1020 ppb), unknowns (19-55,640 ppb)
Inorganics: none

Station 02: Hammond Ditch, below API separator pond.

Water
Organics: Substituted benzenes (3-245 ppb), unknowns (20-1487 ppb)
Inorganics: none

Soil
Organics: Polynuclear aromatic hydrocarbons (4-18,810 ppb), unknowns (21-268,300 ppb)
Inorganics: none

Station 03: Hammond Ditch, below freshwater pond.

Water
Organics: xylene (7.3 ppb)
Inorganics: none

Soil
Organics: alkanes (3-1245 ppb)
Inorganics: none

Station 04: Hammond Ditch, downstream

Water
Organics: none
Inorganics: none

Soil
Organics: alkanes (11-45,000 ppb), unknowns (11-49,900 ppb)
Inorganics: none

Station 05: Spray irrigation area

Soil
Organics: Di-n-octyl phthalate (440 ppb), toluene (1100 ppb), heptanol (690 ppb), unknowns (3-1140 ppb)
Inorganics: none

EPTox: none

Station 06: Spray irrigation area

Soil
Organics: Toluene (1700 ppb), unknowns (2-1770 ppb)
Inorganics: none

EPTox none

Station 07: Landfarm, west end

Soil
Organics: unknowns (9-6220 ppb)
Inorganics: none

EPTox none

Station 08: Landfarm, east end

Soil
Organics: Polynuclear aromatic hydrocarbons (6-4370 ppb), alkanes (20-467,043 ppb), unknowns (9-131,049 ppb), o-decyl hydroxyl amine (22,000 ppb)

Inorganics: Chromium (69.5 ppm), zinc (73 ppm).

EPTox none

Station 09: Tamerisk Area

Water
Organics: none
Inorganics: none

Soil
Organics unknowns (4-12,620 ppb)
Inorganics none

Station 10: Arroyo #1, below evaporation ponds

Water
Organics: none
Inorganics: iron (46.5 ppm), maganese (17.1 ppm)

Soil
Organics: toluene (920 ppb), alkanes (2-29,700 ppb), unknowns (7-31,500 ppb)
Inorganics: manganese (922 ppm)

Station 11: Transportation terminal sump

Water
Organics: Aromatic solvents (4-169 ppb), other aromatics (5-3150 ppb), alkanes (25-37,130 ppb), 1,2-dichloro propane (8 ppb)
Inorganics: none

Soil
Organics: Polynuclear aromatic hydrocarbons (3-146,000 ppb), aromatic solvents (2-25,300 ppb), vinyl acetate (2400 ppb), methyl cyclohexane (14,000 ppb), substituted benzenes (3-131,000 ppb), unknowns (15-8,210,000 ppb)
Inorganics: Cadmium (2.2 ppm)

High Concentration Oil:

Organics: Polynuclear aromatic hydrocarbons (5-810,000 ppb), alkanes (18-75,830,000 ppb)
Inorganics: chromium (40 ppm), cadmium (1.3 ppm)

Station 12A: South evaporation pond

Soil
Organics: Phenols (4-12,850 ppb), polynuclear aromatics (5-3410 ppb), aromatic solvents (4-13,380 ppb), other solvents (4-2,340 ppb), alkanes (8-11,415 ppb), unknowns (22-69,396 ppb), aniline (present)
Inorganics: chromium (347 ppm), copper (50 ppm), zinc (146 ppm)

EPTox: -- Reactive, sulfide (285 ppm)

Station 12B South evaporation pond

Water

Organics: Phenols (4-20,840 ppb), toluene (450 ppb), 2-methyl propane (12 ppb)

Inorganics: none

Soil

Organics: Phenols (4-4120 ppb), polynuclear aromatics (2-present), aromatic solvents (3-210 ppb), other solvents (3-741 ppb), alkanes (5-121 ppb), unknowns (11-8195 ppb), aniline (present)

Inorganics: none

EPTox none

Station 13A North evaporation pond

Water

Organics: none

Inorganics: none

Soil

Organics: 4-methyl phenol (1300 ppb), 2-methyl naphthalene (present), alkanes (7-223 ppb), unknowns (12-7510 ppb)

Inorganics: none

EPTox Reactive, sulfide (362 ppm)

Station 13B North evaporation pond

Soil

Organics: 4-methyl phenol (660 ppb), 2-methyl naphthalene (present), acetone (126 ppb), xylenes (46 ppb), hexadecanoic acid (770 ppb), alkanes (8-310 ppb), unknowns (14-5147 ppb)

Inorganics: none

EPTox none

Station 14 Pond, north of Landfarm

Water

Organics: Pentachlorophenol (56 ppb), fluoranthene (32 ppb), phenanthrene/anthracene (38 ppb), unknowns (7-180 ppb)

Inorganics: none

Soil

Organics: unknown (1-870 ppb avg)

Inorganics: Manganese (580 ppm), iron (poor duplicate agreement-29,550 & 3,690 ppm)

EPTox Reactive, sulfide (238 ppm)

Station 15 Landfarm, sludge on south side

High Concentration

Organics: Chrysene, 2-methyl naphthalene, N-nitroso diphenyl amine, xylenes and diethyl phthalate all present, acetone (32,000 ppb), alkanes (26-4,381,200 ppb), unknowns (4-389,000 ppb)

Inorganics: Aluminum (30,000 ppm), chromium (1760 ppm), barium (600 ppm), copper (200 ppm), iron (16,800 ppm), zinc (12,000 ppm), arsenic (12 ppm), cadmium (1.1 ppm), lead (42 ppm).

Station 16 Landfarm, sludge on east side

High Concentration

Organics: Xylenes (260,000 ppb), vinyl acetate (54,000 ppb), polynuclear aromatics (3-present), acetone, toluene and ethyl benzene present, alkanes (29-15,486,000 ppb), unknown (1-154,000 ppb), substituted benzene (1-510,000 ppb)

Inorganics: Aluminum (14,800 ppm), chromium (1,880 ppm), barium (400 ppm), copper (200 ppm), iron (13,200 ppm), zinc (1,480 ppm), arsenic (12 ppm), cadmium (1.3 ppm), lead (44 ppm-triplicate analysis)

Station 17 Seepage area, below runoff pond

Water

Organics: none

Inorganics: Aluminum (32.4 ppm), manganese (51 ppm)

Soil

Organics: Alkanes (2-14,700 ppb), unknowns (9-10,900 ppb)

Inorganics: Cobalt (12.5 ppm), manganese (4,580 ppm)

Station 18 Seepage area, leachate spring on face of bluff.

Water

Organics: Aromatic solvents (4-1,961,000 ppb), polynuclear aromatics (3-11,200 ppb), alkanes (14-960,800 ppb), unknowns (8-451,600 ppb), substituted benzenes (11-2,612,000), substituted naphthalene (present)

Inorganics: Manganese (7.19 ppm)

Soil

Organics: Polynuclear aromatics (4-87,000 ppb), aromatic solvents (4-579 ppb), alkanes (19-756,714 ppb), unknowns (9-339,070 ppb), substituted benzenes (7-343,469 ppb), substituted naphthalene (210,000 ppb)

Inorganics: Manganese (347 ppm)

High Concentration

Organics: Polynuclear aromatics (5-2,710,000 ppb), aromatic solvents (4-29,300,000 ppb), other solvents (3-1,310,000 ppb), N-nitrosodiphenylamine (76 ppb), alkanes (14-18,241,000 ppb), unknowns (3-2,179,000 ppb), substituted benzenes (10-19,352,000 ppb)

Inorganics: Chromium (80 ppm)

<u>Station 19</u> River terrace, stain on western edge

<u>Soil</u>

Organics: Polynuclear aromatics (3-480,000 ppb), alkanes (7-1,370,00 ppb), unknowns (5-1,060,000 ppb), substituted benzenes (7-997,000 ppb), substituted naphthalenes (3-550,000 ppb)

Inorganics: none

<u>Station 20</u> Arroyo #2, west side of river terrace

<u>High Concentration</u>

Organics: Acetone, naphthalene, toluene, 2-hexanone and di-n-butyl phthalate all present

Inorganics: Aluminum (37,200 ppm), chromium (160 ppm), barium (400 ppm), iron (15,000 ppm), lead (29 ppm)

<u>Station 21</u> San Juan River, upstream

<u>Water</u>

Organics: Unknowns (6-522 ppb)

Inorganics: none

<u>Soil</u>

Organics: 1,1,2-tricholorethane (430 ppb), 1,1,2,2-tetrachloroethane (820 ppb), unknown (7700 ppb)

Inorganics: none

<u>Station 22</u> San Juan River, downstream

<u>Water</u>

Organics: unknown (26 ppb)

Inorganics: none

<u>Soil</u>

Organics: 1,1,2-trichloroethane (610 ppb), 1,1,2,2-tetrachloroethane (950 ppb), di-n-octyl phthalate (680 ppb), unknowns (3-2460 ppb)

Inorganics: none

<u>Station 23</u> South API separator pond ~ Lime Pond

<u>Water</u>

Organics: Phenols (4-9620 ppb), polynuclear aromatics (5-860 ppb), aromatic solvents (4-12,800 ppb), aniline (220 ppb), substituted benzenes (5-8730 ppb), unknowns (4-1890 ppb), others (4-1460 ppb)

Inorganics: none

High Concentration

Organics: Polynuclear aromatics (4), aromatic solvents (4-384,000 ppb), other solvents (2-160,000 ppb), alkanes (25-4,347,000 ppb), substituted benzenes (2-358,000 ppb), unknown (92,000 ppb)

Inorganics: Chromium (240 ppm), zinc (160 ppm), lead (91 ppm)

EPTox Reactive, sulfide (410 ppm)

Station 24 Northeast API separator pond

Water

Organics: Phenols (4-13,700 ppb), aromatic solvents (4-5430 ppb), other solvents (3-4840 ppb), 1,1-dichloroethane (7.3 ppb), substituted benzenes (2-3390 ppb), alkanes (7-2207 ppb), other (82 ppb), 3-ethyl phenols (200 ppb).

Inorganics: none

High Concentration

Organics: xylenes, toluene, acetone, 2-hexanone all present,

Inorganics: aluminum (27,600 ppm), chromium (160 ppm), barium (400 ppm), zinc (80 ppm), lead (17 ppm)

EPTox Reactive, sulfide (158 ppm)

Station 25 Northwest API separator pond

Water

Organics: Phenols (4-20,120 ppb), aromatic solvents (4-15,520 ppb), aniline (440 ppb), 2-methyl napthalene present, other solvents (3-2948 ppb), alkanes (9-4333 ppb), substituted benzene (1-3299 ppb), unknown (1-5100 ppb).

Inorganics: none

Station 26 Small pond north of API separator and Hammond Ditch

Water

Organics: Alkanes and unknowns (2-85 ppb)

Inorganics: none

Soil

Organics: Polynuclear aromatics (12 below detection limits), phenanthrene (950 ppb), unknowns (23-42,140 ppb)

Inorganics: Copper (107 ppm), manganese (322 ppm), zinc (228 ppm), lead (28 ppm)

Station 27 Plateau Well #4

Water

Organics:	Aromatic solvents (3-19,000 ppb), 2-methyl naphthalene (70 ppb), naphthalene (200 ppb), substituted benzenes (7-99,850 ppb), alkanes (23-233,938 ppb), unknowns (12-26,935 ppb), organic acids (2-320 ppb)
Inorganics:	Aluminum (31.8 ppm), iron (57.7 ppm), manganese (7.62 ppm)

Station 28 Plateau Well #5

Water

Organics:	Ethyl benzene (31 ppb), xylene (6 ppb), alkanes (4-37ppb)
Inorganics:	Aluminum (76 ppm), iron (70.6 ppm)

Station 29 Plateau Well #1

Water

Organics:	none
Inorganics:	aluminum (11.6 ppm), iron (20.9 ppm)

Polynuclear aromatic hydrocarbons include naphthalene, fluorene, phenanthrene, anthracene, 2-methyl naphthalene, fluoranthene, benzo(a) anthracene, pyrene, benzo (b) fluoranthene, benzo (k) fluoranthene, acenaphthene, chrysene, benzo (ghi) perylene, dibenzofuran and ideno (1,2,3-cd) pyrene.

Aromatic solvents include benzene, toluene, ethyl benzene and xylenes.

Phenols include phenol, 4-methyl phenol, 2-methyl phenol, and 2,4-dimethyl phenol.

Other solvents include acetone, carbon disulfide, vinyl acetate, 2-hexanone and 2-butanone.

Metals are listed if sample concentration appears to be elevated in comparison to other samples in the same matrix (soil, water).

Plateau Inc. Refinery
Bloomfield, NM
Summary of Sample Data

These samples (Stations 001-008) were taken by U.S. EPA, Region VI. EPTox includes testing for ignitibilty, corrosivity and reactivity.

Stations 001 API Separator effluent

Water

Organics: Polynuclear aromatics (6-1968 ppb), aromatic solvents (4-11,700 ppb), phenols (3-1350 ppb), total phenols (10,800 ppb), aniline (380 ppb), diethyl phthalate (74 ppb), substituted benzenes (2-1330 ppb), substituted naphthalenes (2-1942 ppb), creosols (2-1280 ppb)

Inorganics: none

EPTox None

Station 002 API Separator influent

Water

Organics: Aromatic solvents (4-9180 ppb), polynuclear aromatics (7-1670 ppb), phenols (3-870 ppb), total phenols (2930 ppb), aniline (80 ppb), diethylphthalate (210 ppb), substituted benzenes (2-2070 ppb), substituted naphthalenes (2-1440 ppb), creosols (2-560 ppb)

Inorganics: None

Oil

Organics: Aromatic solvents (4-82,700,000 ppb), polynuclear aromatics (3-6,800,000 ppb), chlorobenzene (2,800,000 ppb), 1,1,1-trichloroethane (1,700,000 ppb), methylene chloride (6,700,000 ppb), total phenols (23,300 ppb), diethyl phthalate (2,000,000 ppb), alkanes (5-117,000,000 ppb), substituted benzenes (5-29,800,000 ppb), substituted naphthalenes (10-38,779,000 ppb, 12 below detection limit)

Inorganics: None

EPTox Ignitable (flash point 24°C).

Station 003: API Separator sludge, east end

Oil/Sludge

Organics: Aromatic solvents (4-4,730,000 ppb), polynuclear aromatics (3-140,000 ppb), total phenols (82,800 ppb), diethyl phthalate (150,000 ppb), alkanes (15-17,000,000 ppb), substituted benzenes (3-790,000 ppb, 2 below detection limit), substituted napthalenes (2-450,000 ppb, 17 below detection limit)

Inorganics: Chromium (883 ppm), copper (875 ppm), nickel (83 ppm), zinc (1370 ppm), arsenic (36.8 ppm), lead (372 ppm)

EPTox: Reactive, sulfide (4300 ppm).

Station 004 API Separator sludge, west end.

Oil/Sludge

Organics: Aromatic solvents (4-6,890,000 ppb), poly nuclear aromatics (5-140,000 ppb, 4 of 5 below detection limit), diethyl phthalate (150,000 ppb), 1,1,1-trichloroethane (8,400 ppb), alkanes (15-23,210,000 ppb), substituted benzenes (4-775,000 ppb, 1 below detection limit), substituted naphthalenes (6-975,000 ppb, 14 below detection limit)

Inorganics: Chromium (502 ppm), copper (967 ppm), nickel (83.4 ppm), zinc (946 ppm), arsenic (34.5 ppm), cadmium (4.1 ppm), lead (425 ppm)

EPTox Reactive, sulfide (3000 ppb)

[illegible]

Station 005 Spent Caustic – Cone roof tank – caustic is from a process unit about 100' away moves thru a closed system of pipes into the tank →

EPTOX caustic (pH 12.8)
reactive, sulfide (16,800 ppm)

Station 006 Drum in north boneyard.

Oil

Organics: Aromatic solvents (4-12,880 ppb), cholorbenzene (340 ppb), 1,1,1-trichloroethane (1,800 ppb), bis(2-ethyl hexyl) phthalate (1,600,000 ppb), diethyl phthalate (140, 000 ppb), total phenols (12,500 ppb), others (3-1,980,000 ppb)

Inorganics: None

EPTox None

Station 007 Drum in north bone yard

Oil

Organics: Aromatic solvents (4-17,370 ppb), chlorobenzene (720 ppb), 1,1,1-trichloroethane (2600 ppb), methylene chloride (4300 ppb), diethyl phthalate (270,000 ppb), phenanthrene present, total phenols (4,140 ppb)

Inorganics: None

EPTox None

Station 008 Drum in north boneyard.

Oil/Sludge

Organics: Aromatic solvents (4-31,450 ppb), chlorobenzene (3100 ppb), methylene chloride (900 ppb), naphthalene, diethyl phthalate and phenanthrene present, total phenols (5,600 ppb), alkanes (7-119,500 ppb), substituted naphthalenes (2-570,000 ppb, 17 below detection limit)

Inorganics: chromium (57.1 ppm), zinc (270 ppm), arsenic (2.5 ppm)

EPTox None

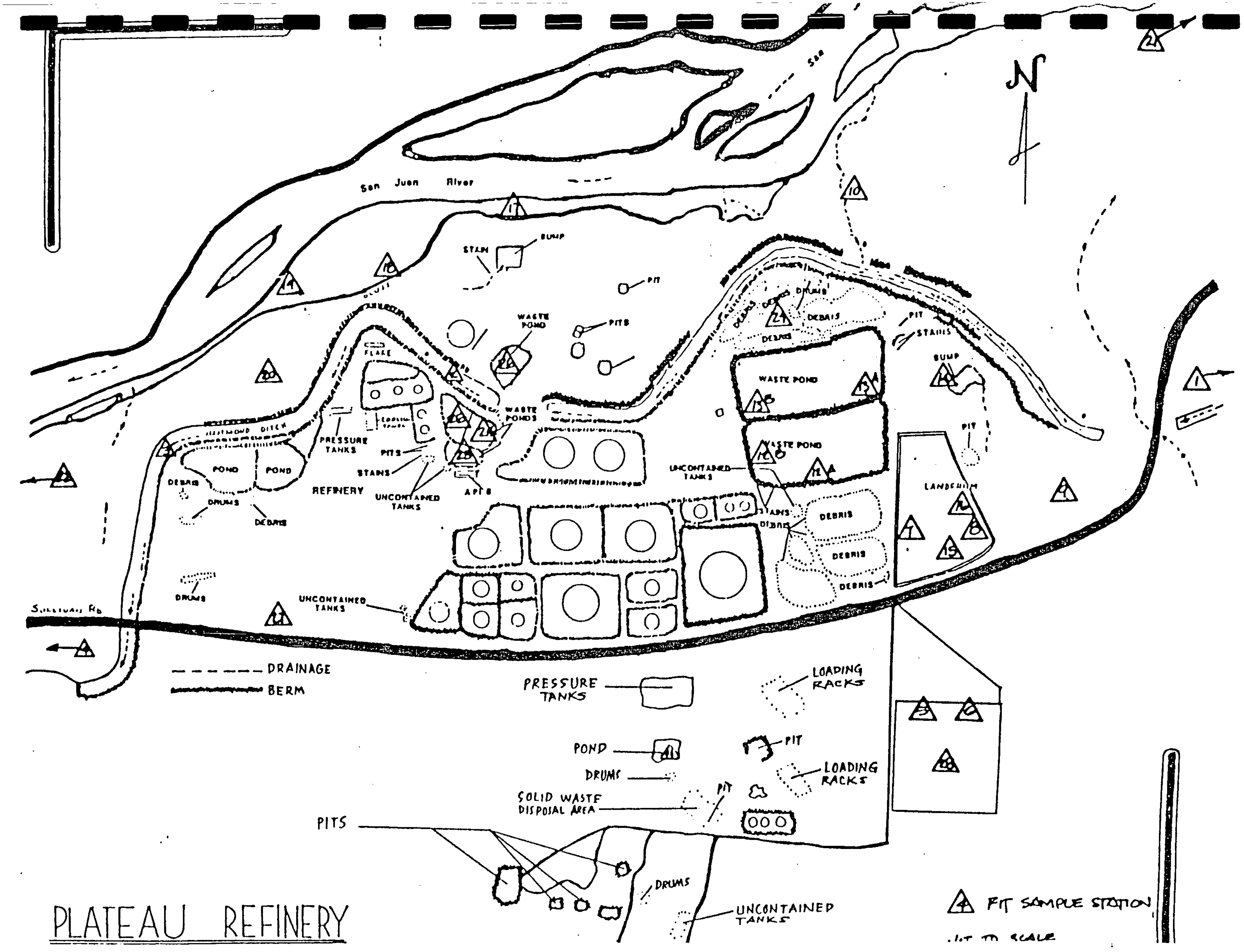
Transportation Yard drum (assumed Station 009)

Oil

Organics: Aromatic solvents (4-144,130,000 ppb), cholorbenzene (620,000 ppb), alkanes (2-48,700 ppb), substituted benzene (1-90,000,000 ppb).

Inorganics: Not analyzed

EPTox None



PLATEAU REFINERY

ASE NUMBER: 2573

Page 1 of 10

ITE NAME/CODE: Plateau Refinery
NM 1686

EP TOXICITY

CONCENTRATIONS (ppm)

	PARAMETER	EPA Sample Numbers										Ambient Background 1.	
		AR 409	AR 410	AR 411	AR 412	AR 413	AR 414	AR 415	AR 416	AR 417	AR 418	Western U.S. 2.	Eastern U.S. 2.
Task 1	Matrix Type	Soil	Soil	Soil	Soil	Soil	TWO PHASE	SLUDGE/SED	SLUDGE/SED	SLUDGE/SED	SLUDGE/SED	Soil	Soil
	Aluminum											54,000	33,000
	Chromium			0.024	0.077							38	36
	Barium	0.584	1.16	0.967	1.42	0.797		1.55	1.45	1.23	1.57	560	300
	Beryllium											0.6	0.6
	Cobalt											8	7
	Copper											21	14
	Iron											20,000	15,000
	Nickel											16	13
	Manganese											390	290
	Zinc											51	36
	Boron											22	32
	Vanadium											66	46
	Silver											<.50	-
Task 2	Arsenic											6.1	5.4
	Antimony											<150	-
	Selenium											0.25	0.39
	Thallium											-	-
	Mercury											0.055	0.096
	pH						4.2*	9.1	8.7	7.9	7.1	<10	<10
	Cadmium											<1	<1
Task 3	Lead							0.032				18	14
	FLASH POINT						93.5°C-ORG ≥71°C REM	>71°C				-	-
	Cyanide	1.13			0.94			1.02	0.20			-	-
	Sulfide					238		410	158	65.7	362	-	-
	Station No.	05	06	07	08	14		23	24	13B	13A		
	Sample Station Location	85'E. OF NW CORNER SPRAY IRRIGATION	125'N. OF NE CORNER SPRAY IRRIGATION	WEST END LANDFARM 2-4' DEPTH	EAST END LANDFARM 1-3' DEPTH	SUMP EAST EVAPORATION POND	TRANSPORTATION YARD DRUM (NOT ANALYZED)	SOUTH A.P.I POND	NE A P I POND	S.W. CORNER N. EVAPORATION POND	S.E. CORNER N. EVAPORATION POND		

1. Ambient background concentrations apply only to soil matrix samples. Values obtained from "Geochemistry of Some Rocks, Soils, Plant and Vegetables in the Conterminous United States" Geological Survey Professional Paper

Reference for East/West Division is the 97° W longitudinal line which bisects Region VI.

\- Concentration corrected for lab blank concentration

*Aqueous Phase

ASE NUMBER: ____________

ITE NAME/ CODE: ____________

CONCENTRATIONS (ppm)

PARAMETER	EPA Sample Numbers										Ambient Background 1.	
	AR 419	AR 420	AR 401	AR 402	AR 403	AR 404	AR 405	AR 406	AR 407	AR 408	Western U.S. 2.	Eastern U.S. 2.
Matrix Type	SLUDGE/SED	SLUDGE/SED	AQUEOUS	OIL	OILY SLUDGE	OILY SLUDGE	AQUEOUS	OIL	OIL	OILY SLUDGE	Soil	Soil
Aluminum											54,000	33,000
Chromium						0.125					38	36
Barium	0.991	1.18	0.415	2.18	2.02	2.97	0.482	0.06		1.39	560	300
Beryllium											0.6	0.6
Cobalt											8	7
Copper											21	14
Iron											20,000	15,000
Nickel											16	13
Manganese											390	290
Zinc											51	36
Boron											22	32
Vanadium											66	46
Silver											<.50	-
Arsenic							<12				6.1	5.4
Antimony											<150	-
Selenium				<12	0.437	0.249	<12				0.25	0.39
Thallium											-	-
Mercury				<0.97							0.055	0.096
pH	7.9	7.9	8.8	7.4*	9.5	8.9	12.8	6.4*	6.7*	7.8	<10	<10
Cadmium				<1.93							<1	<1
Lead						0.033					18	14
FLASH POINT				24°C	>71°C	>71°C		>71°C	>71°C		-	-
Cyanide		1.3									-	-
Sulfide		285	10	43	4300	3,000	16,800	47	41	65	-	-
Station No.	12B	12A	001	002	003	004	005	006	007	008		
Sample Station Location	W. END S. EVAPORATION POND	MIDDLE S. BANK S. POND	API SEPARATOR EFFLUENT	API SEPARATOR INFLUENT	API SEPARATOR SLUDGE EAST END	API SEPARATOR SLUDGE WEST END	SPENT CAUSTIC	DRUM IN NORTH BONEYARD	DRUM IN NORTH BONEYARD	DRUM IN NORTH BONEYARD		

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· Concentration corrected for lab blank concentration

*Aqueous phase

CASE NUMBER: 2573

SITE NAME/CODE: Plateau Refinery NM 1686

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SAMPLES COLLECTED BY EPA

CONCENTRATIONS (ppm)

	PARAMETER	EPA Sample Numbers										Ambient Background 1.	
		AR 401	AR 402	AR 402	AR 403	AR 404	AR 406	AR 407	AR 408			Western U.S. 2.	Eastern U.S. 2.
Task 1	Matrix Type	Water	Water	Oil	Oil/Sludge	Oil/Sludge	Oil	Oil				Soil	Soil
	Aluminum											54,000	33,000
	Chromium				883	502			57.1			38	36
	Barium			2.18				3.4				560	300
	Beryllium											0.6	0.6
	Cobalt											8	7
	Copper				875	967			26.2			21	14
	Iron											20,000	15,000
	Nickel		0.021		83	83.4			13.1			16	13
	Manganese											390	290
	Zinc	0.0305			1370	946			270			51	36
	Boron											22	32
	Vanadium											66	46
	Silver											<.50	-
Task 2	Arsenic				36.8	34.5			2.5			6.1	5.4
	Antimony											<150	-
	Selenium											0.25	0.39
	Thallium											-	-
	Mercury				*	*						0.055	0.096
	Tin											<10	<10
	Cadmium					4.1						<1	<1
Task 3	Lead				372	425			17.8			18	14
	Ammonia											-	-
	Cyanide											-	-
	Sulfide	10										-	-
	Station No.	001	002	002	003	004	006	007	008				
	Sample Station Location	API SEPARATOR EFFLUENT	API SEPARATOR INFLUENT	API SEPARATOR INFLUENT	API SEPARATOR SLUDGE EAST END	API SEPARATOR SLUDGE WEST END	DRUM IN NORTH BONEYARD	DRUM IN NORTH BONEYARD	DRUM IN NORTH BONEYARD				

1. Ambient background concentrations apply only to soil matrix samples. Values obtained from "Geochemistry of Some Rocks, Soils, Plant and Vegetables in the Conterminous United States" Geological Survey Professional Paper

Reference for East/West Division is the 97° W longitudinal line which bisects Region VI.

- Concentration corrected for lab blank concentration

* Not analyzed

ASE NUMBER: ______________________

ITE NAME/CODE: Plateau Refinery (NM 1686)

CONCENTRATIONS (ppm)

PARAMETER	EPA Sample Numbers										Ambient Background 1.	
	MF 1130	MF 1131	MF 1132	MF 1136	MF 1143	MF 1144	MF 1145	MF 1148	MF 1153	MF 1155	Western U.S. 2.	Eastern U.S. 2.
Matrix Type	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Soil	Soil
Aluminum	1	4.2		2.6	0.8	1	3.6		0.8	0.6	54,000	33,000
Chromium					0.04						38	36
Barium	0.4	0.1	0.1	0.3			0.4				560	300
Beryllium											0.6	0.6
Cobalt											8	7
Copper					0.1						21	14
Iron	1.05	3.85	0.6	3.7	0.95	0.65	46.5	0.1	0.75	0.5	20,000	15,000
Nickel											16	13
Manganese	0.165	1.62	1.38	2.04	0.015	0.27	17.1	0.165	0.06	0.03	390	290
Zinc		0.01			0.1		0.01				51	36
Boron											22	32
Vanadium											66	46
Silver											<.50	-
Arsenic							0.041				6.1	5.4
Antimony											<150	-
Selenium	0.003	0.006	0.006		0.002	0.013	0.005	0.006	0.003		0.25	0.39
Thallium											-	-
Mercury											0.055	0.096
Tin	NDB	NDB	NDB	NDB	NDB	NDB	NDB	NDB	NDB	NDB	<10	<10
Cadmium											<1	<1
Lead											18	14
Ammonia											-	-
Cyanide											-	-
Sulfide											-	-
Station No.	04	01	02	03	BLANK	09	10	14	21	22		
Sample Station Location	HAMMOND DITCH OFFSITE DOWN-STREAM	HAMMOND DITCH UPSTREAM	S. BANK HAMMOND DITCH ADJACENT TO APL	S. BANK HAMMOND DITCH ADJACENT TO W. FRESHWATER POND	FIELD BLANK	TAMERISK AREA E. OF LANDFILL	ARROYO BELOW E. SIDE EVAPORATION POND	MID SUMP E. OF EVAPORATION POND	APPROX. 1/2 MILE UPSTREAM AT S. BANK	50 FT. UPSTREAM FROM HWY 44 ON S. BANK		

1. Ambient background concentrations apply only to soil matrix samples. Values obtained from "Geochemistry of Some Rocks, Soils, Plant and Vegetables in the Conterminous United States" Geological Survey Professional Paper

Reference for East/West Division is the 97° W longitudinal line which bisects Region VI.

· Concentration corrected for lab blank concentration

ASE NUMBER: ______

ITE NAME/CODE: Plateau Refinery (NM 1686)

CONCENTRATIONS (ppm)

	PARAMETER	EPA Sample Numbers MF 1152	A,B MF1158	MF 1163	MF 1162	MF 1164	MF 1165	MF 1166	MF 1167	MF 1168	MF 1169	Ambient Background 1. Western U.S. 2.	Eastern U.S. 2.
	Matrix Type	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Soil	Soil
Task 1	Aluminum	2	32.4		1	31.8	0.8	76	0.8	0.6	0.4	54,000	33,000
	Chromium		0.01		0.02	0.04		0.04				38	36
	Barium		0.2		0.6	1.8	0.2	0.3	0.2	0.2		560	300
	Beryllium											0.6	0.6
	Cobalt		0.05									8	7
	Copper			0.05		0.05		0.1				21	14
	Iron	1.55	4.37 C	NDB	5.95 C	57.7 C	1.1 C	70.6 C	0.9 C	0.65 C	0.4 C	20,000	15,000
	Nickel				0.04			0.04				16	13
	Manganese	0.18	51		7.19	7.62	0.15	0.915	0.21	0.15	0.645	390	290
	Zinc	0.09	0.08	0.28	0.03	0.18	0.04	0.12	0.03	0.03		51	36
	Boron											22	32
	Vanadium											66	46
	Silver											<.50	-
Task 2	Arsenic		0.022	0.028	0.049	0.018				0.011		6.1	5.4
	Antimony											<150	-
	Selenium		0.004	0.002	0.002		0.005	0.002	0.002	0.003	0.003	0.25	0.39
	Thallium											-	-
	Mercury					0.0004	0.0004		0.0005	0.001		0.055	0.096
	Tin	NDB	NDB	NDB	0.03C	NDB	NDB	NDB	NDB	NDB	NDB	<10	<10
	Cadmium	0.0091				0.003						<1	<1
Task 3	Lead	0.035	0.006		0.031	0.042		0.02				18	14
	Ammonia											-	-
	Cyanide											-	-
	Sulfide											-	-
	Station No.	11	QA 17	BLANK	18	27	23	28	25	24	26		
	Sample Station Location	Truck area sump NW corner	QA Duplicate	Field Blank	Leachate Spring 25' BELOW DISCHARGE POINT	Plateau Monitor Well #4	South API Pond	Spray IRRIGATION AREA PLATEAU WELL #5	NW API Pond	NE API Pond	Pond N. of API POND		

1. Ambient background concentrations apply only to soil matrix samples. Values obtained from "Geochemistry of Some Rocks, Soils, Plant and Vegetables in the Conterminous United States" Geological Survey Professional Paper

. Reference for East/West Division is the 97° W longitudinal line which bisects Region VI.

- Concentration corrected for lab blank concentration

CASE NUMBER: ____________

SITE NAME/CODE: Plateau Refinery

CONCENTRATIONS (ppm)

PARAMETER	EPA Sample Numbers										Ambient Background 1.	
	MF 1172	MF 1174	MF 1177	MF 1178							Western U.S. 2.	Eastern U.S. 2.
Matrix Type	Water	Water	Water	Water							Soil	Soil
Aluminum	0.6	0.4	11.6								54,000	33,000
Chromium			0.01								38	36
Barium	0.2	0.2	0.2								560	300
Beryllium											0.6	0.6
Cobalt			0.1								8	7
Copper											21	14
Iron	0.75 C	1.2 C	20.9 C	NDB							20,000	15,000
Nickel			0.08								16	13
Manganese	0.255	0.135	1.38								390	290
Zinc	0.01	0.03	0.06	0.02							51	36
Boron											22	32
Vanadium											66	46
Silver											<.50	-
Arsenic	0.023	0.012									6.1	5.4
Antimony											<150	-
Selenium	0.003	0.004	0.003	0.003							0.25	0.39
Thallium											-	-
Mercury	0.0002	0.0004		0.0003							0.055	0.096
Tin	NDB	NDB	NDB	NDB							<10	<10
Cadmium			0.003								<1	<1
Lead											18	14
Ammonia											-	-
Cyanide											-	-
Sulfide											-	-
Station No.	13A	12B	29	Blank								
Sample Station Location	SE Corner of N Evap. Pond	W End of S Evap. pond	Plateau Well #1	Field Blank								

1. Ambient background concentrations apply only to soil matrix samples. Values obtained from "Geochemistry of Some Rocks, Soils, Plant and Vegetables in the Conterminous United States" Geological Survey Professional Paper

2. Reference for East/West Division is the 97° W longitudinal line which bisects Region VI.

C - Concentration corrected for lab blank concentration

CASE NUMBER: ______

SITE NAME/CODE: Plateau Refinery (NM 1686)

CONCENTRATIONS (ppm)

PARAMETER	EPA Sample Numbers										Ambient Background 1.	
	MF 1134	MF 1135	MF 1138	MF 1139	MF 1140	MF 1141	MF 1142	MF1146	MF 1147	MF 1149	Western U.S. 2.	Eastern U.S. 2.
Matrix Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
Aluminum	6820	5640	5820	9000	8400	6120	5600	4970	2620	2140	54,000	33,000
Chromium	4	14.5	5	9.5	7.5	21	69.5	4.5	2	2	38	36
Barium	160	130	130	145	235	175	140	85	50	40	560	300
Beryllium	0.5	0.25	0.25	0.5	0.5	0.25					0.6	0.6
Cobalt	2.5	2.5	2.5	5	5	2.5	5	2.5	2.5	2.5	8	7
Copper	10	10	7.5	10	10	7.5	15	7.5	2.5		21	14
Iron	7770	6770	6990	9600	11300	7820	8690	4720	3820	29550C	20,000	15,000
Nickel	6	6	6	8	8	6	6	4	4	2	16	13
Manganese	172	157	168	156	188	196	214	237	922	580	390	290
Zinc	24.5	32	24	33	33.5	32.5	73	19.5	12	9	51	36
Boron											22	32
Vanadium				10	20	10	10				66	46
Silver											<.50	-
Arsenic	1.1	1.4	1	2	2.2	2.6	2.1	1.3	1.1	0.7	6.1	5.4
Antimony											<150	-
Selenium					3	0.1	0.1	0.3	0.3	0.2	0.25	0.39
Thallium											-	-
Mercury					0.6						0.055	0.096
Tin	NDB	NDB	NDB	NDB	NDB	NDB	NDB	NDB	NDB	NDB	<10	<10
Cadmium	0.09	0.08	0.08	0.12	0.19	0.11	0.16	0.17	0.1		<1	<1
Lead	6	6.5	5	3.6	4.4	4	4.7	5.5	2.7	1.6	18	14
Ammonia											-	-
Cyanide											-	-
Sulfide											-	-
Station No.	01	02	03	05	06	07	08	09	10	14	-	-
Sample Station Location	HAMMOND DITCH UPSTREAM	S. BANK HAMMOND DITCH ADJACENT TO W. CORNER OF API	S. BANK HAMMOND DITCH ADJACENT TO W. FRESHWATER POND	85' E. OF N.W. CORNER OF SPRAY IRRIGATION AREA	125' W. OF N.E. CORNER OF SPRAY IRRIGATION AREA	WEST END OF LANDFARM 2-4 FT.	EAST SIDE OF LANDFARM 1-3 FT.	TAMERISK AREA E. OF LANDFILL	ARROYO BELOW E. SIDE OF EVAPORATION POND	MIDSUMP E. OF EVAPORATION POND		

1. Ambient background concentrations apply only to soil matrix samples. Values obtained from "Geochemistry of Some Rocks, Soils, Plant and Vegetables in the Conterminous United States" Geological Survey Professional Paper

Reference for East/West Division is the 97° W longitudinal line which bisects Region VI.

- Concentration corrected for lab blank concentration

CASE NUMBER: 2573

SITE NAME/CODE: PLATEAU REFINERY

NM 1686

CONCENTRATIONS (ppm)

	PARAMETER	EPA Sample Numbers										Ambient Background 1.	
		MF1150	MF1151	MF1154	MF1156	MF1157	MF1159	MF1160	MF1161	MF1170	MF1171	Western U.S. 2.	Eastern U.S. 2.
Task 1	Matrix Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
	Aluminum	2990	4820	2780	3690	7800	4620	4780	2060	1140	3530	54,000	33,000
	Chromium	2.5	9	3	4	8	2.5	3	1.5	1.5	19.5	38	36
	Barium	60	165	90	130	195	30	60	15	45	125	560	300
	Beryllium				0.25	0.25	0.26					0.6	0.6
	Cobalt		2.5		2.5	2.5	12.5			5		8	7
	Copper	2.5	17.5	2.5	5	7.5	5	5		107	17.5	21	14
	Iron	3690C	6140	3990	5470	9480	5860	5380	2980	5340	5530	20,000	15,000
	Nickel	2	6	2	6	6	4		2		6	16	13
	Manganese	432	154	123	159	144	4580	135	347	322	84	390	290
	Zinc	12	69	12.5	18	30.5	17	18	11	228	39.5	51	36
	Boron											22	32
	Vanadium					10						66	46
	Silver											<.50	-
Task 2	Arsenic	0.7	0.9	0.6	0.6	1.8		0.9	3.9	5	1.5	6.1	5.4
	Antimony											<150	-
	Selenium			0.2				0.1			0.54	0.25	0.39
	Thallium											-	-
	Mercury											0.055	0.096
	Tin	NDB	NDB	NDB	NDB	NDB	NDB	NDB	NDB	NDB	NDB	<10	<10
	Cadmium		2.2			0.11				0.15	0.1	<1	<1
	Lead	2.1	2.3	2.7	2.8	4.2	1.9	3.8	4.4	28	5.7	18	14
Task 3	Ammonia											-	-
	Cyanide											-	-
	Sulfide											-	-
	Station No.	14	11	21	22	06	17	19	18	26	13B		
	Sample Station Location	Mid sump E of evap pond QA Dupl.	Truck area sump NW corner	Approx. ½ mile up-stream at S. Bank	50' UP-STREAM FROM HWY 44 ON S. BANK	125' W. OF N.E. CORNER OF SPRAY IRRIG. (DUPL)	Seep below lower overflow pond	STAINED TERRACE W. OF LEACHATE SPRING	LEACHATE SPRING 25' BELOW DISCHARGE POINT	Pond N. of API pond	SW corner of N. evap. pond		

1. Ambient background concentrations apply only to soil matrix samples. Values obtained from "Ge chemistry of Some Rocks, Soils, Plant and Vegetables in the Conterminous United States" Geologica Survey Professional Pape

2. Reference for East/West Division is the 97° W longitudinal line which bisects Region VI.

C - Concentration corrected for lab blank concentration

CASE NUMBER: 2573

SITE NAME/CODE: PLATEAU REFINERY

NM 1686

CONCENTRATIONS (ppm)

	PARAMETER	EPA Sample Numbers										Ambient Background 1.	
		MF1173	MF1175	MF1176	MF1133							Western U.S. 2.	Eastern U.S. 2.
Task 1	Matrix Type	Soil	Soil	Soil	Soil							Soil	Soil
	Aluminum	2630	4790	3980	5080							54,000	33,000
	Chromium	22.5	8	347	4							38	36
	Barium	100	95	150	110							560	300
	Beryllium											0.6	0.6
	Cobalt		2.5									8	7
	Copper	15	10	50	5							21	14
	Iron	3520	5770	5730	6090							20,000	15,000
	Nickel	4	4	8	4							16	13
	Manganese	54.8	125	160	167							390	290
	Zinc	31.5	22	146	23							51	36
	Boron											22	32
	Vanadium											66	46
	Silver											<.50	-
Task 2	Arsenic	1	1	2.5	0.9							6.1	5.4
	Antimony											<150	-
	Selenium	0.23	0.1	0.17	0.1							0.25	0.39
	Thallium											-	-
	Mercury	0.1		0.2								0.055	0.096
	Tin	NDB	NDB	NDB	NDB							<10	<10
	Cadmium	0.05	0.3	0.5	0.07							<1	<1
	Lead	3.8	6.2	13	3.8							18	14
Task3	Ammonia											-	-
	Cyanide											-	-
	Sulfide											-	-
	Station No.	13A	12B	12A	04								
	Sample Station Location	SE corner of N. evap. pond	W. end of S. evap. pond	Middle of S. Bank of S. evap. pond	Hammond ditch down-stream off site								

1. Ambient background concentrations apply only to soil matrix samples. Values obtained from "Ge chemistry of Some Rocks, Soils, Plant and Vegetables in the Conterminous United States" Geologica Survey Professional Pape

2. Reference for East/West Division is the 97° W longitudinal line which bisects Region VI.

3 - Concentration corrected for lab blank concentration

CASE NUMBER: 2573 SAS 1006F

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SITE NAME/CODE: PLATEAU REFINERY

NM1686

CONCENTRATIONS (ppm)

	PARAMETER	EPA' Sample Numbers										Ambient Background 1.	
		MF5115	MF5116	MF5116	MF5116T	MF5117	MF5118	MF5119	MF5120	MF5121		Western U.S. 2.	Eastern U.S. 2.
	Matrix Type	Sludge	Sludge	Sludge	Sludge	Oil	Sludge	Oil	Sludge	Sludge		Soil	Soil
Task 1	Aluminum	30,000	14,800	14,000	15,600	400	37,200		27,600	3,600		54,000	33,000
	Chromium	1,760	1,880	1,920	2,120	40	160	80	160	240		38	36
	Barium	600	400	400	400		400		400			560	300
	Beryllium											0.6	0.6
	Cobalt											8	7
	Copper	200	200	200	400							21	14
	Iron	16,800	13,200	12,200	13,400	600	15,000		9,000	5,200		20,000	15,000
	Nickel											16	13
	Manganese	240	180	180	300		180		180	120		390	290
	Zinc	12,000	1,480	1,480	1,640				80	160		51	36
	Boron											22	32
	Vanadium											66	46
	Silver											<.50	-
Task 2	Arsenic	12	12	13	13				5			6.1	5.4
	Antimony											<150	-
	Selenium											0.25	0.39
	Thallium											-	-
	Mercury			0.3								0.055	0.096
	Tin											<10	<10
	Cadmium	1.1	1.3	1.5	1.2	1.3				0.5		<1	<1
	Lead	42	44	46	53	9	29		17	91		18	14
Task 3	Ammonia											-	-
	Cyanide											-	-
	Sulfide											-	-
	Station No.	15	16	16	16	11	20	18	24	23			
	Sample Station Location	50' SW of Boring #8 S.side of LAND-FILL	20' N OF BORING #8 E. END OF LANDFILL	Dupli-cate	Tripli-cate	Truck area su oil NE corner	ARROYO N. OF E. FRESH WATER POND	LEACHATE SPRING 25' BE-LOW DISCHARGE	NE API pond	South API pond			

1. Ambient background concentrations apply only to soil matrix samples. Values obtained from "Geochemistry of Some Rocks, Soils, Plant and Vegetables in the Conterminous United States" Geological Survey Professional Pape

2. Reference for East/West Division is the 97° W longitudinal line which bisects Region VI.

C - Concentration corrected for lab blank concentration

SE NUMBER: 2573

TE NAME/CODE: Plateau Refinery

NM 1686

CONCENTRATIONS (ppb)

PARAMETERS			EPA SAMPLE NUMBERS									
Compound	Fraction	Class	F3447	F3449	F 3450	F 3451	F 3452	F 3453	F 3454	F 3455		
Bis(2-ethylhexyl) phthalate	ABN	1	LT						LT			
Methylene Chloride	VOA	1	38	NDB		2.7	NDB	5.5 NDB	NDB	33		
UNdecane, 2,6 - Dimethyl	ABN	3	2900									
Alkane	ABN	3	5300									
Heptadecane, Tetramethy	ABN	3	5300							16000		
Alkane Derivative	ABN	3	2500									
Heptadecane tetramethyl	ABN	3	5100							32000		
Octadecane	ABN	3	3200	530						30000		
Alkane	ABN	3	4000									
Alkane	ABN	3	1700									
Hexadecane	ABN	3	2200									
Alkane	ABN	3	9300									
Unknown	ABN	3	1700	610	7100		510	770	1900	43000		
Unknown	ABN	3	15000	410	7800		300	1000	1200	26000		
Unknown	ABN	3	2200	810	4000		330		720	46000		
Octadecane	ABN	3	4000							35000		
Unknown	ABN	3	13000	2900	5500				480			
Unknown	ABN	3	3700	710	17000				380			
Unknown	ABN	3	2300	2400	10000				420			
Eicosane	ABN	3	4800							31000		
Unknown	ABN	3	4500	1700	8200				400	16000		
Unknown	ABN	3	2900	1200	15000				540			
Di-n-octyl phthalate	ABN	3		2300			440*					
1, 2, 4, - Trithiolahe	ABN	3		700								
Pentadecane, Tetramethyl	ABN	3		490		620						
Unknown	ABN	3		450	6100				280			
Matrix Type			Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil		
Sample Station Number			04	01	02	03	05	06	07	08		
Sample Station Location			Down - stream HAMMOND DITCH	Up- stream HAMMOND DITCH	S. Bank Hammond DITCH	S. Bank Hammond DITCH	85ft. E NE corner IRRIG. AREA	125 ft. W. of N.E.CORNER IRRIG.AREA	West end Land-FARM 2-4'	East side landfarm 1-3'		

1. Priority Pollutant.
2. Specified Hazardous Substance.
3. Tentatively Identified.

*Duplicate analysis did not detect this compound.

NDB - Concentration less than determined in lab blank

C - Concentration corrected for lab blank concentration

K or LT ( ) - Present in sample below quantification limit (quantification limit)

P - Present in sample (tentatively identified compound)

+ values on this sample should be multiplied by 1.37 dry weight factor.

CASE NUMBER: 2573

SITE NAME/CODE: Plateau Refinery

CONCENTRATIONS (ppb)

PARAMETERS			EPA SAMPLE NUMBERS									
Compound	Fraction	Class	F 3449	F 3450	F 3451	F 3452	F 3453	F 3455	F 3447			
Unknown	ABN	3	2100	15000					1500			
Unknown	ABN	3	3300	8200					1300			
Unknown	ABN	3	3900	17000								
Unknown	ABN	3	8900	14000								
Unknown	ABN	3	5900	17000								
Unknown	ABN	3	6400	24000								
Unknown	ABN	3	3800	14000								
Unknown	ABN	3	9000	18000								
Napthalene	ABN	1		4100								
Fluorene	ABN	1		510								
Phenanthrene/anthracene	ABN	1		1200				1000				
2 methyl napthalene	ABN	2		13000				1200				
Toluene	VOA	1		LT		1100						
Heptadien-5-yne, Dimethyl	ABN	3		9400								
Unknown	ABN	3	450	18000								
Unknown	ABN	3		20000								
Unknown	ABN	3		13000								
Fluorotrichloromethane	VOA	1			NDB	NDB	2.5					
Xylene	VOA	2			LT							
Alkane	ABN	3			620							
Heptanol	ABN	3				690						
Fluoranthene	ABN	1						LT				
Benzo (a) anthracene	ABN	1						460				
Chrysene	ABN	1						970				
Pyrene	ABN	1						740				
Cyclohexane Methyl	VOA	3			4.5			3.7				
Matrix Type			Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Sample Station Number			01	02	03	05	06	08	04			
Sample Station Location												

1. Priority Pollutant.
2. Specified Hazardous Substance.
3. Tentatively Identified.

NDB - Concentration less than determined in lab blank
C - Concentration corrected for lab blank concentration
K or LT ( ) - Present in sample below quantification limit (quantification limit)
P - Present in sample (tentatively identified compound)

CASE NUMBER: 2573

SITE NAME/CODE: Plateau Refinery

NM 1686

CONCENTRATIONS (ppb)

PARAMETERS			EPA SAMPLE NUMBERS									
Compound	Fraction	Class	F 3455									
Cyclohexane ethyl	VOA	3	18									
Unknown	VOA	3	5.6									
Cyclohexane Dimethyl	VOA	3	3.4									
Cyclohexane Trimethyl	VOA	3	18									
Unknown	VOA	3	7.5									
Unknown	VOA	3	5.8									
Unknown	VOA	3	6.0									
Unknown	VOA	3	23									
Hydroxylamine *o*-Decyl	ABN	3	22000									
Heptadecane tetramethyl	ABN	3	26000									
Eicosane	ABN	3	49000									
Eicosane	ABN	3	28000									
Eicosane	ABN	3	27000									
Eicosane	ABN	3	25000									
Eicosane	ABN	3	24000									
Eicosane	ABN	3	31000									
HexatriacoNTANE	ABN	3	34000									
Hexatriacontane	ABN	3	30000									
Hexatriacontane	ABN	3	29000									
Hexatriacontane	ABN	3	20000									
Matrix Type			Soil									
Sample Station Number			08									
Sample Station Location												

. Priority Pollutant.
. Specified Hazardous Substance.
. Tentatively Identified.

NDB – Concentration less than determined in lab blank
C – Concentration corrected for lab blank concentration
K or LT (   ) – Present in sample below quantification limit (quantification limit)
P – Present in sample (tentatively identified compound)

ASE NUMBER: 2573

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ITE NAME/CODE: Plateau Refinery
NM 1686

CONCENTRATIONS (ppb)

PARAMETERS			EPA SAMPLE NUMBERS									
Compound	Fraction	Class	F 3444	F 3445	F 3446	F 3448	F 3456	F 3457	F 3458	F 3461	F 3464	F 3466
Methylene Chloride	VOA	1			LT							
Xylene	VOA	2			LT	7.3						
Unknown	ABN	3			7.9					18	55	26
Unknown	ABN	3			74					42	70	
Unknown	ABN	3			57					34	160	
Unknown	ABN	3			48					26	68	
Benzene ethyl dimethyl	ABN	3			120							
Unknown	ABN	3			78						100	
Benzene ethyl dimethyl	ABN	3			72							
Benzene ethyl dimethyl	ABN	3			53							
Unknown	ABN	3			160					26	69	
Unknown	ABN	3			61					22		
Unknown	ABN	3			95					12		
Unknown	ABN	3			210							
Unknown	ABN	3			77							
Unknown	ABN	3			76							
Unknown	ABN	3			66							
Unknown	ABN	3			60							
Unknown	ABN	3			41							
Unknown	ABN	3			100							
Unknown	ABN	3			52							
Unknown	ABN	3			78							
Unknown	ABN	3			70							
Pentachlorophenol	ABN	1								56		
Fluoranthene	ABN	1								32		
Phenanthrene/anthracene	ABN	1								38		
Matrix Type			Water	Water	Water	Water	Water	Water	Water	Water	Water	Water
Sample Station Number			04	01	02	03	Blank	09	10	14	21	22
Sample Station Location			Down-stream HAMMOND DITCH	Up-stream HAMMOND DITCH	S. Bank Hammond DITCH	S. Bank Hammond DITCH	Field Blank	Tamerisk area	Arroyo below E. SIDE EVAP. POND	Sump E. of Evap POND	½ mile upstream ON SOUTH BANK	50 ft. upstream FROM HWY 44

. Priority Pollutant.
. Specified Hazardous Substance.
. Tentatively Identified.

NDB - Concentration less than determined in lab blank
C - Concentration corrected for lab blank concentration
K or LT ( ) - Present in sample below quantification limit (quantification limit)
P - Present in sample (tentatively identified compound)

SE NUMBER: 2573

TE NAME/CODE: Plateau Refinery

NM 1686

CONCENTRATIONS (ppb)

PARAMETERS			EPA SAMPLE NUMBERS									
Compound	Fraction	Class	F 3461	F 3463	F 3472	F 3476	F 3478					
Pyrene	ABN	1	26									
Benzene Dimethyl	ABN	3	13			32,000	98,000					
2-Methylnaphthalene	ABN	2		560 LT		4600	70*					
Benzene	VOA	1		10		21,000	9,000					
1, 2 dichloropropane	VOA	1		8								
Ethylbenzene	VOA	1		14		280,000	LT					
Methylene chloride	VOA	1		20								
toluene	VOA	1		61		560,000						
Xylene	VOA	2		84		1,100,000	10,000					
cyclohexane methyl	VOA	3		12		150,000	23,000					
Hexane 3 methyl	VOA	3		7								
3 Hexene, 2, 2-Dimethyl(E) or isomer	VOA	3		14								
Cyclohexane dimethyl	VOA	3		8		61,000	20,000					
Cyclohexane trimethyl	VOA	3		13								
Heptane, 2 methyl	VOA	3		6								
Benzene Dimethyl	VOA	3		130								
Undecane or isomer	ABN	3		1600								
Alkane	ABN	3		920								
Alkane	ABN	3		1400								
Naphthalene 2 methyl or isomer	ABN	3		1000								
Heptadecane tetramethyl	ABN	3		820								
Alkane	ABN	3		2600								
Naphthalene Dimethyl	ABN	3		820								
Alkane or Derivative	ABN	3		1500								
Naphthalene Dimethyl	ABN	3		1200								
Alkane	ABN	3		2600								
Matrix Type			Water	Water	Water	Water	Water					
Sample Station Number			10	11	17	18	27					
Sample Station Location				Truck area SUMP	Seep below LOWER OVERFLOW POND	Leachate spring 25'BELOW DISCHARGE	Plateau monitor WELL #4					

Priority Pollutant.
Specified Hazardous Substance.
Tentatively Identified.

NDB - Concentration less than determined in lab blank
C - Concentration corrected for lab blank concentration
K or LT ( ) - Present in sample below quantification limit (quantification limit)
P - Present in sample (tentatively identified compound)

*Reanalysis of sample showed only less than DL concentration

ASE NUMBER: 2573

ITE NAME/CODE: Plateau Refinery

NM 1686

CONCENTRATIONS (ppb)

PARAMETERS			EPA SAMPLE NUMBERS									
Compound	Fraction	Class	F 3463	F 3476	F 3478							
lkane	ABN	3	2800									
lkane or derivative	ABN	3	1700									
lkane or derivative	ABN	3	5000									
lkane or derivative	ABN	3	2600									
lkane or derivative	ABN	3	2000									
lkane	ABN	3	3300									
lkane	ABN	3	2400									
lkane	ABN	3	1700									
lkane	ABN	3	1500									
lkane	ABN	3	1300									
aphthalene✓	ABN	1		3200	200*							
nknown	VOA	3		95,000								
exane 2 methyl	VOA	3		43,000	10,000							
nknown	VOA	3		97,000								
entene Trimethyl	VOA	3		23,000								
nknown	VOA	3		51,000								
eptane 2 Methyl	VOA	3		140,000	22,000							
ctane ✓	VOA	3		470,000	45,000							
nknown	VOA	3		130,000	25,000							
nzene Dimethyl	VOA	3		2,500,000								
nzene Methyl	VOA	3		14,000								
exane Dimethyl	ABN	3		3,600								
nzene Ethyl	ABN	3		8,800								
nzene Ethyl	ABN	3		8,200								
nane ✓	ABN	3		4,600								
nzene propyl	ABN	3		5,000								
Matrix Type			Water	Water	Water							
Sample Station Number			11	18	27							
Sample Station Location					Plateau Monitor Well #4							
			(cont.)	(Cont.)	(Cont.)							

Priority Pollutant.
Specified Hazardous Substance.
Tentatively Identified.
*Reanalysis, of sample showed oncy 96ppb

NDB - Concentration less than determined in lab blank
C - Concentration corrected for lab blank concentration
K or LT ( ) - Present in sample below quantification limit (quantification limit)
P - Present in sample (tentatively identified compound)

ASE NUMBER: 2573

ITE NAME/CODE: Plateau Refinery

NM 1686

CONCENTRATIONS (ppb)

PARAMETERS			EPA SAMPLE NUMBERS									
Compound	Fraction	Class	F 3476	F 3477	F 3478	F 3446	F 3463					
enzene ethyl methyl	ABN	3	17,000									
enzene trimethyl	ABN	3	7,000									
enzene trimethyl	ABN	3	22,000									
enzene trimethyl	ABN	3	4,800									
enzene methyl propyl	ABN	3	4,800									
ıknown	ABN	3	8,600	19								
enzene ethyl dimethyl	ABN	3	2,400									
ıdecane	ABN	3	7,200									
ıknown	ABN	3	7,000	32								
odecane	ABN	3	32,000									
ıdecane Dimethyl	ABN	3	6,600									
idecane	ABN	3	7,000									
etradecane	ABN	3	4,000									
entachlorophenol	ABN	1		LT	LT*							
ıknown	ABN	3	37,000	47		38						
ıknown	ABN	3		94		38						
kane or alkyl derivative	ABN	3		98			550					
ıknown	ABN	3	26,000	45								
kane	ABN	3		92			780					
kane or alkyl derivative	ABN	3		64								
ıknown	ABN	3		67								
ıtane 2 methyl	VOA	3			14,000							
entane	VOA	3			12,000							
clohexane	VOA	3			18,000							
clo Pentane Methyl	VOA	3			7,100							
tanol Dimethyl	VOA	3			18,000							
Matrix Type			Water	Water	Water	Water	Water					
Sample Station Number			18	Blank	27	02	11					
Sample Station Location			SEEP	Field Blank	Plateau monitor well #4							
			(cont)		(cont.)		(cont.)					

. Priority Pollutant.
. Specified Hazardous Substance.
. Tentatively Identified.
*Reanalysis of sample did not show his compound.

NDB - Concentration less than determined in lab blank
C - Concentration corrected for lab blank concentration
K or LT ( ) - Present in sample below quantification limit (quantification limit)
P - Present in sample (tentatively identified compound)

ASE NUMBER: 2573

ITE NAME/CODE: Plateau Refinery

NM1686

CONCENTRATIONS (ppb)

PARAMETERS			EPA SAMPLE NUMBERS									
Compound	Fraction	Class	F 3478	F 3476								
Cyclopentane Ethyl Methyl	VOA	3	31,000									
Cycloheptatriene or isomer	ABN	3	110									
Octane	ABN	3	60	8800								
Octane 2 Methyl	ABN	3	92									
Benzene Dimethyl	ABN	3	610									
Unknown	ABN	3	220									
Nonane	ABN	3	220									
Cyclohexane propyl	ABN	3	100									
Octane Dimethyl	ABN	3	140									
Nonane Methyl	ABN	3	170									
Unknown	ABN	3	270									
Benzene Trimethyl	ABN	3	150									
Unknown	ABN	3	130									
Unknown	ABN	3	78									
Unknown	ABN	3	200									
Alkane	ABN	3	280									
Alkene or Benzene derivative	ABN	3	250									
Alkene or Benzene Derivative	ABN	3	570									
Cyclohexane butyl	ABN	3	86									
Unknown	ABN	3	180									
Alkene or Benzene derivative	ABN	3	120									
Unknown	ABN	3	240									
Benzene Methyl Propyl	ABN	3	150									
Unknown	ABN	3	340									
Unknown	ABN	3	69									
Unknown	ABN	3	120									
Matrix Type			Water	Water								
Sample Station Number			27	18								
Sample Station Location			Well									
			(cont.)	(cont.)								

. Priority Pollutant.
. Specified Hazardous Substance.
. Tentatively Identified.

NDB – Concentration less than determined in lab blank
C – Concentration corrected for lab blank concentration
K or LT ( ) – Present in sample below quantification limit (quantification limit)
P – Present in sample (tentatively identified compound)

CASE NUMBER: 2573

SITE NAME/CODE: Plateau Refinery

NM 1686

CONCENTRATIONS (ppb)

EPA SAMPLE NUMBERS

PARAMETERS

Compound	Fraction	Class	F 3478	F 3445	F 3463	F 3476
Undecane	ABN	3	420			
Unknown	ABN	3	88			
Dodecane	ABN	3	160			
Benzoicacid Dimethyl	ABN	3	200			
Benzoicacid Dimethyl	ABN	3	120			
Bis (2-ethylhexyl) phthalate	ABN	3		LT*	212(LT)	
Phenanthrene/anthracene	ABN	1				3400
Heptane Ethyl Methyl	ABN	3				
Cyclohexane Dimethyl	VOA	3	12,000			
Matrix Type			Water	Water	Water	Water
Sample Station Number			27	01	11	18
Sample Station Location						

1. Priority Pollutant.
2. Specified Hazardous Substance.
3. Tentatively Identified.
*Not found in reanalysis of sample

NDB - Concentration less than determined in lab blank
C - Concentration corrected for lab blank concentration
K or LT ( ) - Present in sample below quantification limit (quantification limit
P - Present in sample (tentatively identified compound)

CASE NUMBER: 2573 SAS 1006 F

SITE NAME/CODE: Plateau Refinery

NM 1686

CONCENTRATIONS (ppb)

PARAMETERS			EPA SAMPLE NUMBERS								
Compound	Fraction	Class	F 3479	F 3480	F 3481	F 3482	F 3483	F 3486	F 3488	F 3491	F 3492
2, 4-dimethylphenol ✓	ABN	1	820		520	300			840		
Phenol ✓	ABN	1	3,600		11,000	7,200			8,800		
2-methylphenol ✓	ABN	2	2,200		3,000	2,200			4,400		
4-methyphenol ✓	ABN	2	3,000		5,600	4,000			6,800		
Acenaphthene ✓	ABN	1	20K								
Naphthalene ✓	ABN	1	420								
Fluorene ✓	ABN	1	22								
Phenanthrene ✓	ABN	1	38								
Aniline	ABN	2	220		440						
2-methylnaphthalene ✓	ABN	2	380		800K						
Benzene ✓	VOA	1	2,800		1,700	2,600					
1, 1-dichloroethane	VOA	1				7.3					
ETHYL benzene ✓	VOA	1	1,000K		420	330					
Chloroform	VOA	1			5K	5K					
Acetone	VOA	2			2,600	2,300					
2-Butanone	VOA	2			290	240					
Carbondisulfide	VOA	2			53	140					
Toluene ✓	VOA	1	7,600		11,000	1,000					
Total Xylenes ✓	VOA	2	2,400	6	2,400	1,500					
Benzene, 1, 3-dimethyl	VOA	3	7,500		3,299	2,500					
Butane, 2-methyl	VOA	3		9.8	84	80					
Cyclopropane, 1,1-dimethyl	VOA	3				59					
Boric acid (HBO$_2$) cyclohexylester	VOA	3				82					
Cyclohexane	VOA	3		14	150	120					
Cyclopentane, methyl	VOA	3		6.3	150	130					
Cyclohexane, methyl	VOA	3		6.9	390	339					
Matrix Type			Water	Water	Water	Water	Water	Water	Water	Water	Water
Sample Station Number			23	28	25	24	26	13A	12B	29	
Sample Station Location			South API POND	Spray Irriga- AREA WELL#5	N. W. APT pond	N. E. API POND	Pond N. of API PONDS	S. E. Corner OF N. EVAP POND	W. end of S. EVAP. POND	Plateau well #1 N. OF EVAP. PONDS	Field Blank

1. Priority Pollutant.
2. Specified Hazardous Substance.
3. Tentatively Identified.

NDB - Concentration less than determined in lab blank
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K or LT ( ) - Present in sample below quantification limit (quantification limit)
P - Present in sample (tentatively identified compound)

CASE NUMBER: 2573 SAS 1006E

SITE NAME/CODE: Plateau Refinery
NM 1686

CONCENTRATIONS (ppb)

PARAMETERS			EPA SAMPLE NUMBERS									
Compound	Fraction	Class	F 3479	F 3480	F 3481	F 3482	F 3483	F 3486	F 3488	F 3491	F 3492	
Ethylbenzene	VOA	3		31								
Oxetane, 2, 3, 4-trimethyl	VOA	3			76	80						
1, 5-Hexadiene-3-yne	VOA	3			1,799	1,399						
Isooctane (Ethenyloxy)	VOA	3			93							
2-Propanol, 2-methyl	VOA	3							12			
Octane	VOA	3			91							
Unknown	VOA	3			5,100							
Benzene, methyl	ABN	3	300						450			
1, 3, 5-cycloheptatriene	ABN	3	640		1,500							
Ethylbenzene (see volatile FRAC)	ABN	3	300									
Benzene, 1, 3-dimethyl (see VOA FRAC)	ABN	3	1,280		840	890						
Benzene, 1-ethyl-2-methyl	ABN	3	310									
Benzene, 1, 2, 4-trimethyl	ABN	3	580									
Pyridine, 4-methyl	ABN	3	200									
Benzene, 1, 2, 3-trimethyl	ABN	3	190									
Benzene, 1-ethenyl-2-methyl	ABN	3	150									
Benzenamine, 4-methyl	ABN	3	330									
-methylnaphthalene (see ABN FRAC)	ABN	3	170									
Phosphoric acid, diethylpentyl	ABN	3	290									
(isomers 1 & 2)	ABN	3										
oluene (see volatile fraction)	ABN	3				800						
Phenol, 3-ethyl	ABN	3				200						
Cyclopropane, pentyl	ABN	3					35					
Unknown	ABN	3					50					
nknown	ABN	3	1200									
nknown	ABN	3	310									
Matrix Type			Water	Water	Water	Water	Water	Water	Water	Water	Water	
Sample Station Number			23	28	25	24	26	13A	12B	29		
Sample Station Location			South API POND	Spray Irriga-TION AREA	N.W. API POND	N.E. API POND	Pond N. of API PONDS	S.E. Corner OF N. EVAP. POND	W. end OF south EVAP. POND	Plateau well #1	Field Blank	

. Priority Pollutant.
. Specified Hazardous Substance.
. Tentatively Identified.

NDB - Concentration less than determined in lab blank
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K or LT ( ) - Present in sample below quantification limit (quantification limit)
P - Present in sample (tentatively identified compound)

CASE NUMBER: 2573 SAS 1006F

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SITE NAME/CODE: Plateau Refinery

NM 1686

CONCENTRATIONS (ppb)

PARAMETERS			EPA SAMPLE NUMBERS								
Compound	Fraction	Class	F 3479	F 3480	F 3481	F 3482	F 3483	F 3486	F 3488	F 3491	F 3492
Unknown	ABN	3	160								
Unknown	ABN	3	220								
Matrix Type			Water	Water	Water	Water	Water	Water	Water	Water	Water
Sample Station Number			23	28	25	24	26	13A	12B	29	
Sample Station Location			South API POND	Spray Irriga-TION AREA WELL#5	N.W. API POND	N.E. API POND	Pond N. of API PONDS	S.E. Corner OF N. EVAP. POND	W. end of south EVAP. POND	Plateau well #1	Field Blank -

1. Priority Pollutant.
2. Specified Hazardous Substance.
3. Tentatively Identified.

NDB - Concentration less than determined in lab blank
C - Concentration corrected for lab blank concentration
K or LT ( ) - Present in sample below quantification limit (quantification limit)
P - Present in sample (tentatively identified compound)

ASE NUMBER: EPA Lab (Houston)

ITE NAME/CODE: Plateau Refinery

SAMPLES COLLECTED BY EPA

CONCENTRATIONS (ppM)

PARAMETERS			EPA SAMPLE NUMBERS									
Compound	Fraction	Class	AR 0402 Oil	AR 0403	AR 0404	AR 0406	AR 0407	AR 0408	AR 0414	Blank		
enzene	VOA	1	1,100	290	460	0.5	0.54	0.85	530			
hlorobenzene	VOA	1	2,800			0.34	0.72	3.1	620			
, 1, 1-Trichloroethane	VOA	1	1,700		8.4	1.8	2.6					
thylbenzene	VOA	1	6,600	340	530	0.38	0.73	2.5	17,000			
ichloromethane	VOA	1	6,700				4.3	0.9				
oluene	VOA	1	18,000	1,500	1,400	2.6	3.9	6.5	4,600			
aphTHALENE	ABN	1	5,000	140	140			<140				
is(2-ethylhexyl) phthalate	ABN	1				1,600				<4		
iethyl phthalate	ABN	1	2,000	150	150	140	270	<140		<2		
enzo(a)anthracene	ABN	1			<75							
luorene	ABN	1	<980	<130	<75							
henanthrene	ABN	1	1,800	<130	<75		<160	<140				
yrene	ABN	1			<75							
otal Phenols (4AAP)	ABN	1	23.3	82.8	<3.4	12.5	4.14	5.6				
-xylene	VOA	3	34,000	1,600	2,700	4.7	6.0	11.7	66,000			
&/or p-xylene	VOA	3	23,000	1,000	1,800	4.7	6.2	9.9	56,000			
entane	VOA	3		430	560							
yclobutanone, 2-methyl	VOA	3		710				13.8				
yclohexane, methyl-	VOA	3	23,000	3,200	5,000			37.2				
yclopentane, methyl	VOA	3		780	920			8.3				
utane, 2-methyl	VOA	3			550							
ropylbenzene	VOA	3							90,000			
exane, 3-methyl-	VOA	3	15,000	2,500	1,900							
exane, 2-methyl-	VOA	3		440	1,200			7.7				
utane, 2, 3-dimethyl-	VOA	3		160								
yclohexane	VOA	3			980							
Matrix Type			Oil	Oil/Sludge	Oil/Sludge	Oil	Oil	Oil	Oil/Sludge	Water		
Sample Station Number			002	003	004	006	007	008		Blank		
Sample Station Location			API separa-TOR INFLUENT	API separa-TOR SLUDGE E.END	API separa-TOR SLUDGE W.END	Drum in north BONEYARD	Drum in north BONEYARD	Drum in north BONEYARD	Transporta-TION YARD	Blank		

1. Priority Pollutant.
2. Specified Hazardous Substance.
3. Tentatively Identified.

NDB - Concentration less than determined in lab blank
C - Concentration corrected for lab blank concentration
K or LT ( ) - Present in sample below quantification limit (quantification limit)
P - Present in sample (tentatively identified compound)

:ASE NUMBER: EPA Lab (Houston)

:ITE NAME/CODE: Plateau Refinery

Samples collected by EPA

SAMPLES COLLECTED BY EPA

CONCENTRATIONS (~~ppb~~)ppm/ug/g

PARAMETERS			EPA SAMPLE NUMBERS									
Compound	Fraction	Class	AR0402 Oil	AR 0403	AR 0404	AR 0406	AR 0407	AR 0408	AR 0414			
2-Butanone, 3-methyl	VOA	3						7.3				
Cyclohexane, 1, 3-Dimethyl-	VOA	3	10,000	1,400	1,200			26.5				
Cyclohexane, 1, 4-Dimethyl	VOA	3	10,000	750	930							
Cyclohexane, ethyl	VOA	3		1,400	1,700							
Pentane, 2, 2, 4, 4-tetraMETHYL	VOA	3			270							
Heptane	VOA	3						18.7				
Benzene, 1-methylethyl	VOA	3		510								
Heptane, 3-methyl-	VOA	3	41,000	1,800	2,800							
Heptane, 2-methyl-	VOA	3	18,000	830	1100				12.5			
Hexane	VOA	3			1,500							
Hexane, 2, 3, 4-trimethyl	VOA	3		1,000								
Hexane, 2, 2-Dimethyl	VOA	3		400								
Octane, 2-methyl	VOA	3		1200								
Octane	VOA	3			2,600							
Substituted Hydrocarbon	VOA	3							36.2			
Toluene(see volatile fraction)	ABN	3	7,900	<130	110							
Methylnaphthalene	ABN	3	6,100	180	200			210				
Ethylbenzene(see volatile FRAC)	ABN	3	3,500	<130	<75							
Xylene (isomers 1)	ABN	3	17,000	270	320							
Xylene (isomer 2)	ABN	3	5,700	<130	120							
C_2 substituted Naphthalene	ABN	3	<980	<130	<75			<140				
C_2 substituted Naphthalene	ABN	3	<980	<130	<75			<140				
C_2 substituted Naphthalene	ABN	3	4,900	<130	140			<140				
C_2 substituted Naphthalene	ABN	3	4,600	<130	120			<140				
$_2$ substituted Naphthalene	ABN	3	2,800	<130	80			<140				
$_2$ substitutec Naphthalene	ABN	3	1,500	<130	75			<140				
Matrix Type			Oil	Oil/ Sludge	Oil/ Sludge	Oil	Oil	Oil	Oil/ Sludge			
Sample Station Number			002	003	004	006	007	008				
Sample Station Location			API separator INFLUENT	API separator SLUDGE EAST END	API separator SLUDGE WEST END	Drum in north BONEYARD	Drum in north BONEYARD	Drum in north BONEYARD	Trans-portation YARD DRUM			

. Priority Pollutant.
. Specified Hazardous Substance.
. Tentatively Identified.

NDB - Concentration less than determined in lab blank
C - Concentration corrected for lab blank concentration
K or LT ( ) - Present in sample below quantification limit (quantification limit)
P - Present in sample (tentatively identified compound)

CASE NUMBER: EPA Lab (Houston)

SITE NAME/CODE: Plateau Refinery

SAMPLES COLLECTED BY EPA

CONCENTRATIONS (ppb) ppm ug/g

PARAMETERS			EPA SAMPLE NUMBERS									
Compound	Fraction	Class	AR 0402 Oil	AR 0403	AR 0404	AR 0406	AR 0407	AR 0408	AR 0414	Blank		
C_2 Substituted Naphthalene (ISOM 7)	ABN	3	<980	<130	<75			<140				
C_2 Substituted Naphthalene (ISOM 8)	ABN	3	<980	<130	<75			<140				
C_2 Substituted Naphthalene (ISOM 9)	ABN	3			<75							
C_3 Substituted Naphthalene (ISOM 1)	ABN	3	<980	<130	<75			<140				
C_3 Substituted Naphthalene (ISOM 2)	ABN	3	<980	<130	<75			<140				
C_3 Substituted Naphthalene (ISOM 3)	ABN	3	<980	<130	<75			<140				
C_3 Substituted Naphthalene (ISOM 4)	ABN	3	<980	<130	<75			<140				
C_3 Substituted Naphthalene (ISOM 5)	ABN	3	<980	<130	<75			<140				
C_3 Substituted Naphthalene (ISOM 6)	ABN	3	1,700	<130	<75			<140				
C_3 Substituted Naphthalene (ISOM 7)	ABN	3	1,700	<130	<75			<140				
C_3 Substituted Naphthalene (ISOM 8)	ABN	3	990	<130	<75			<140				
C_3 Substituted Naphthalene (ISOM 9)	ABN	3	1,500	<130	<75			<140				
C_3 Substituted Naphthalene (ISOM 10)	ABN	3	<980									
C_3 Substituted Naphthalene (ISOM 11)	ABN	3	<980									
C_3 Substituted Naphthalene (ISOM 12)	ABN	3	<980									
Ethylmethylbenzene	ABN	3	10,300	290	230							
Trimethylbenzene (isomer 1)	ABN	3	3,600	190	125							
Trimethylbenzene (isomer 2)	ABN	3	10,900	310	320							
Trimethylbenzene (isomer 3)	ABN	3	2,200	<130	<75							
Trimethylbenzene (isomer 4)	ABN	3	2,800	<130	100							
2-methylnaphthalene	ABN	3	13,000	270	360			360				
2, 5-cyclohexadiene-1,4DIONE,2,6BIS	ABN	3				210						
2, 6 bis(1,1-dimethylethyl-4 METHYLPHENOL	ABN	3				670						
4,4'-(1 methylethylidene) BIS PHENOL	ABN	3				1,100						
Di-n-butyl phthalate	ABN	1								3		
Matrix Type			Oil	Oil/Sludge	Oil/Sludge	Oil	Oil	Oil	Oil/Sludge			
Sample Station Number			002	003	004	006	007	008		Blank		
Sample Station Location			API separator INFLUENT	API separator SLUDGE EAST END	API separator SLUDGE WEST END	Drum in north BONEYARD	Drum in north BONEYARD	Drum in north BONEYARD	Transportation YARD DRUM	Blank		

. Priority Pollutant.
. Specified Hazardous Substance.
. Tentatively Identified.

NDB - Concentration less than determined in lab blank
C - Concentration corrected for lab blank concentration
K or LT ( ) - Present in sample below quantification limit (quantification limit)
P - Present in sample (tentatively identified compound)

ASE NUMBER: EPA Lab (Houston)

ITE NAME/CODE: Plateau Refinery

SAMPLES COLLECTED BY EPA

PARAMETERS			CONCENTRATIONS (ppb) EPA SAMPLE NUMBERS									
Compound	Fraction	Class	AR 0401	AR 0402	Lab Blank	AR 04MB-1	AR 04MB-2	AR04MB-3	AR 04MB-4	AR 04MB-5		
Benzene	VOA	1	2,200	2,200								
Dichloromethane	VOA	1				2.3	2.8	3.7	5.0	2.5		
Toluene	VOA	1	5,500	4,500				5.8	5.9			
Naphthalene	ABN	1	480	440								
Di-n-octylphthalate	ABN	1		<40	<4							
Diethyl phthalate	ABN	1	74	210	7							
Benzo(a)anthracene	ABN	1		<80								
Fluorene	ABN	1	70	120								
Phenanthrene	ABN	1	280	160								
Pyrene	ABN	1	18	<20								
Total Phenols (4AAP)	ABN	1	10,800	2,930								
2, 4-Dimethylphenol	ABN	1	150	160								
Phenol	ABN	1	960	520								
M-Xylene	VOA	3	2000	1100								
O ,8/or p-xylene	VOA	3	1,700	980								
Toluene	ABN	3	1,800	2,000								
Methylnaphthalene	ABN	3	420	360								
Ethylbenzene	ABN	3	300	400								
Xylene (isomers 1 &2)	ABN	3	1,780	3,200								
C$_2$ substituted Naphthalene	ABN	3	1,038	996								
C$_3$ substituted Naphthalene	ABN	3	904	444								
Dimethylphenol	ABN	3	240	190								
methylethylbenzene	ABN	3	390	660								
Trimethylbenzene	ABN	3	940	1,410								
O-cresol	ABN	3	520	300								
P-cresol	ABN	3	760	260								
Matrix Type			Water	Water	Water	Water	Water	Water	Water	Water		
Sample Station Number			001	002	Blank	Blank	Blank	Blank	Blank	Blank		
Sample Station Location			API separator EFFLUENT	API separator INFLUENT	Blank	Lab water blank	Lab water	Water blank FOR OIL	Water blank FOR OIL/SLUDGE	Water blank FOR ORGANIC PHASE		

. Priority Pollutant.
. Specified Hazardous Substance.
. Tentatively Identified.

NDB - Concentration less than determined in lab blank
C - Concentration corrected for lab blank concentration
K or LT ( ) - Present in sample below quantification limit (quantification limit)
P - Present in sample (tentatively identified compound)

Page 17 of 31

CASE NUMBER: EPA Lab (Houston)

SITE NAME/CODE: Plateau Refinery

SAMPLES COLLECTED BY EPA

PARAMETERS			CONCENTRATIONS (ppb) EPA SAMPLE NUMBERS									
Compound	Fraction	Class	AR 0401	AR 0402	Lab Blank	AR04MB-1	AR04MB-2	AR04MB-3	AR04MB-4	AR04MB-5		
Aniline	ABN	3	380	80								
2-methylnaphthalene	ABN	3	700	590								
Aldpate Straight C_6 OOH	VOA	3			23							
Acetone	VOA	3				45	18	23	14	22		
Matrix Type			Water	Water	Water	Water	Water	Water	Water	Water		
Sample Station Number			002	002	Blank	Blank	Blank	Blank	Blank	Blank		
Sample Station Location			API separator EFFLUENT	API separator INFLUENT	Blank	Lab water blank	Lab water BLANK	Water blank FOR OIL	Water blank FOR OIL/SLUDGE	Water blank FOR ORGANIC PHASE		

. Priority Pollutant.
. Specified Hazardous Substance

NDB - Concentration less than determined in lab blank

TE NAME/CODE: Plateau Refinery

NM 1686

CONCENTRATIONS (ppb)

PARAMETERS			EPA SAMPLE NUMBERS									
Compound	Fraction	Class	F 3459	F 3460	F 3465	F 3467	F 3471	F 3473	F 3474	F 3475		
Methylene Chloride	VOA	1	10	27	10	8		4.7		LT		
Fluorotrichloromethane	VOA	1	4	8	4.2							
Unknown	ABN	3	740					890				
Unknown	ABN	3	10,000					970				
Unknown	ABN	3	680					1100				
Unknown	ABN	3	1200					890				
3 Nonyne	ABN	3		1700								
Unknown	ABN	3		2100	7700	480		1500				
Unknown	ABN	3		3200				1900				
Unknown	ABN	3		6700				900				
Unknown	ABN	3		2,500				1000				
Unknown	ABN	3		1400				1800				
Docosane, 11 decyl	ABN	3		28,000								
Unknown	ABN	3		14,000		580						
Benzene Methyl	ABN	3		920								
Unknown	ABN	3		1600		1400						
di-n-octyl phthalate	ABN	1			LT	680						
Ethane, 1, 1, 2-trichloro	ABN	3			430	610						
Ethane, 1, 1, 2, 2-tetraCHLORO	ABN	3			820	950						
Hexatriacontane	ABN	3						13,000				
Toluene or isomer	ABN	3				1500	1700					
Alkane	ABN	3						1700				
Naphthalene	ABN	1							140,000	36,000		
Anthracene/phenanthrene	ABN	1							LT 13,000	3000		
2 methyl naphthalene	ABN	2							340,000	48,000		
Ethylbenzene	VOA	1							LT	61		
Matrix Type			Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil		
Sample Station Number			09	10	21	22	06	17	19	18		
Sample Station Location			Tamerisk area	Arroyo below EVAPORATION POND	½ mile upstream SITE 5. BANK	50 ft. upstream FROM HWY 44	125 ft. of N.E. CORNER OF SPRAY IRRIG	seep below LOWER OVERFLOW POND	terrace w. of LEACHATE SPRING	leachate spring 25' BELOW DISCHARGE	-	

Priority Pollutant.
Specified Hazardous Substance.
Tentatively Identified.

NDB - Concentration less than determined in lab blank
C - Concentration corrected for lab blank concentration
K or LT ( ) - Present in sample below quantification limit (quantification limit)
P - Present in sample (tentatively identified compound)

ASE NUMBER: 2573

ITE NAME/CODE: Plateau Refinery

NM 1686

CONCENTRATIONS (ppb)

PARAMETERS			EPA SAMPLE NUMBERS									
Compound	Fraction	Class	F 3474	F 3475								
Toluene	VOA	1	LT	160								
Xylene (or isomer)	VOA	2	LT	340								
Benzene Ethyl Dimethyl	ABN	3	150,000									
Benzene Ethyl Dimethyl	ABN	3	110,000									
Alkane or Derivative	ABN	3	170,000									
Benzene ethyl dimethyl or ISOMER	ABN	3	140,000									
Benzene ethyl dimethyl or ISOMER	ABN	3	150,000									
Unknown	ABN	3	150,000									
Benzene Diethyl	ABN	3	220,000									
Unknown	ABN	3	170,000									
Unknown	ABN	3	500,000	Unk.								
Benzene Ethyl Methylethyl or ISOMER	ABN	3	150,000									
Unknown	ABN	3	120,000	Unk.								
Naphthalene 2 methyl	ABN	3	250,000									
Octadecane	ABN	3	360,000									
Naphthalene Dimethyl	ABN	3	110,000									
Naphthalene Dimethyl	ABN	3	190,000									
Alkane or derivative	ABN	3	120,000									
Benzene dimethyl propyl	ABN	3	77,000									
Alkane or derivative	ABN	3	230,000									
Alkane	ABN	3	230,000									
Unknown	ABN	3	120,000									
Alkane	ABN	3	140,000									
Alkane	ABN	3	120,000									
Fluorene	ABN	3		LT 2870								
Benzene	VOA	1		15								
Matrix Type			Soil	Soil								
Sample Station Number			19	18								
Sample Station Location												

. Priority Pollutant.
. Specified Hazardous Substance.
. Tentatively Identified.

NDB - Concentration less than determined in lab blank
C - Concentration corrected for lab blank concentration
K or LT (   ) - Present in sample below quantification limit (quantification limit)
P - Present in sample (tentatively identified compound)

SE NUMBER: 2573

TE NAME/CODE: Plateau Refinery

NM 1686

CONCENTRATIONS (ppb)

PARAMETERS			EPA SAMPLE NUMBERS									
Compound	Fraction	Class	F 3474	F 3475								
Toluene	VOA	1	LT	160								
Xylene (or isomer)	VOA	2	LT	340								
Benzene Ethyl Dimethyl	ABN	3	150,000									
Benzene Ethyl Dimethyl	ABN	3	110,000									
Alkane or Derivative	ABN	3	170,000									
Benzene ethyl dimethyl or ISOMER	ABN	3	140,000									
Benzene ethyl dimethyl or ISOMER	ABN	3	150,000									
Unknown	ABN	3	150,000									
Benzene Diethyl	ABN	3	220,000									
Unknown	ABN	3	170,000									
Unknown	ABN	3	500,000	Unk.								
Benzene Ethyl Methylethyl or ISOMER	ABN	3	150,000									
Unknown	ABN	3	120,000	Unk.								
Naphthalene 2 methyl	ABN	3	250,000									
Octadecane	ABN	3	360,000									
Naphthalene Dimethyl	ABN	3	110,000									
Naphthalene Dimethyl	ABN	3	190,000									
Alkane or derivative	ABN	3	120,000									
Benzene dimethyl propyl	ABN	3	77,000									
Alkane or derivative	ABN	3	230,000									
Alkane	ABN	3	230,000									
Unknown	ABN	3	120,000									
Alkane	ABN	3	140,000									
Alkane	ABN	3	120,000									
Fluorene	ABN	3		LT 2870								
Benzene	VOA	1		15								
Matrix Type			Soil	Soil								
Sample Station Number			19	18								
Sample Station Location												

. Priority Pollutant.
. Specified Hazardous Substance.
. Tentatively Identified.

NDB - Concentration less than determined in lab blank
C - Concentration corrected for lab blank concentration
K or LT ( ) - Present in sample below quantification limit (quantification limit)
P - Present in sample (tentatively identified compound)

ASE NUMBER: 2573

ITE NAME/CODE: Plateau Refinery

NM 1686

PARAMETERS			CONCENTRATIONS (ppb) EPA SAMPLE NUMBERS									
Compound	Fraction	Class	F 3475									
Alkane	ABN	3	140,000									
Heptadecane tetramethyl	ABN	3	61,000									
Unknown	ABN	3	34,000									
Alkane or derivative	ABN	3	98,000									
Eicosane	ABN	3	140,000									
Alkane	ABN	3	71,000									
Alkane or derivative	ABN	3	43,000									
Eicosane	ABN	3	37,000									
Matrix Type			SOIL									
Sample Station Number			18									
Sample Station Location												

1. Priority Pollutant.
2. Specified Hazardous Substance.
3. Tentatively Identified.

NDB - Concentration less than determined in lab blank
C - Concentration corrected for lab blank concentration
K or LT (   ) - Present in sample below quantification limit (quantification limit)
P - Present in sample (tentatively identified compound)

ASE NUMBER: 1006F

ITE NAME/CODE: Plateau Refinery

NM 1686

CONCENTRATIONS (ppb)

PARAMETERS			EPA SAMPLE NUMBERS									
Compound	Fraction	Class	F 3468	F 3469	F 3470	F 3484	F 3485	F 3487	F 3489	F 3490	Blank	Blank 1
2, 4-dimethylphenol	BNA	1							160K	850		
Phenol	BNA	1							2400	5600		
2 - methylphenol	BNA	2							730	2400		
4 - methylphenol	BNA	2					660	1300	990	4000		
Acenaphthene	BNA	1				200K						
Fluoranthene	BNA	1				570K						
Naphthalene	BNA	1			80,000K	110K			68K	920		
N-nitro sodiphenylamine	BNA	1	Antioxidant								2700K	
is(2-ethylhexyl) phthalate	BNA	1				70C				460K		46K
i-n-butyl phthalate	BNA	1		84K					520K			
enzo(a) anthracene	BNA	1				210K				300K		
enzo(b) Fluoranthene	BNA	1				690K						
enzo(k) Fluoranthene	BNA	1				690K						
hrysene	BNA	1				230K						
enzo(ghi) perylene	BNA	1				110K						
Fluorene	BNA	1			28,000K	170K				400K		
henanthrene	BNA	1				950				990		
deno (1, 2,3, -cd) pyrene	BNA	1				150K						
yrene	BNA	1				390K				1500		
niline	BNA	2							170K	310K		
ibenzofuran	BNA	2				130K						
methylnaphthalene	BNA	2			146,000		54K	86K	70K			
enzene	VOA	1			2000 NDB					280		
thylbenzene	VOA	1			3,300 C		9.6	3K	20	2300	1500K	
ethylene chloride	VOA	1	11 C	9C	2000 NDB	13 C	7.2 C	12C	9.4 C	180 C	3400	7.5
luene	VOA	1			2000 NDB				103	3900	5500	
Matrix Type			Soil	Soil	Med/soil	Soil	Soil	Soil	Soil	Soil	Med/soil	low/soil
Sample Station Number			14	14	11	26	13B	13A	12B	12A		
Sample Station Location			Sump E. of eva-PORATION PONDS	Sump E. of eva-PORATION PONDS	Truck area SUMP	Pond N. of API PONDS	S.W. corner of N. EVAP. POND	S.E. corner of EVAP. POND	W. end of sepa-RATION POND	middle of S. BANK OF EVAP. POND	Blank	Blank 1

Priority Pollutant.
Specified Hazardous Substance.
Tentatively Identified.

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K or LT ( ) - Present in sample below quantification limit (quantification limit)
P - Present in sample (tentatively identified compound)

:ASE NUMBER: 1006F

:ITE NAME/CODE: PLATEAU REFINERY

NM1686 MSDS 095

N. Industries

PARAMETERS

CONCENTRATIONS (ppb)

EPA SAMPLE NUMBERS

Compound	Fraction	Class	F3468	F3469	F3470	F3484	F3485	F3487	F3489	F3490	Blank	Blank 1
Acetone	Volatile	2	120c	120c	2,000 NDB	96c	126c		731c	950c	20,000	16
2-butanone	"	2			2,000 NDB						2,600	
Carbon disulfide Cat + Reformer	"	2			1,000 NDB		1,3	1	3.2	190		
2-hexanone	"	2	5 NDB				5 NDB	5 NDB	5 NDB	640c	12,000	5
4-methyl-2-pentanone	"	2							5 NDB			
StyRene	"	2									1,100K	
Vinyl Acetate	"	2			2,400c				7.2	560	1,100K	
Total Xylenes	"	2			22,000c		46c	16c	87	6,900	2,900	1K
1,1,2-Trichlorotrifluoro ethane	Voa	3	Mantek	075								78
Methlcyclohexane	"	3			14,000		55	46	29	500		
Propylbenzene	"	3			29,000				19			
1,2,3-Trimethylbenzene	"	3			57,000		53	35				
1-ethyl-2-methylbenzene	"	3			45,000				38			
Cyclohexane	"	3					22		17			
Methylcyclopentane	"	3					21	14	18			
Dimethyldisulfide Reformer-Regeneration	"	3	MODS		006		15	21				
cis-1,3-dimethylcyclohexane	"	3					50			288		
Octane	"	3					56	61		412		
2-methylheptane	"	3					38			323		
2-methylpentane	"	3						7.5				
cis-1-ethyl-3-methyl-cyclopentane	"	3						38				
2-methyloctane	"	3								219		
NonaNe	"	3								373		
Unknown (scan 420)	"	3					18	38				
Unknown (scan 498)	"	3								269		
Unknown (scan 515)								22		38		
Matrix Type			soil	soil	med/soil	soil	soil	soil	soil	soil	med/soil	med/soi
Sample Station Number			14	14	11	26	13B	13A	12B	12A	Blank	Blank
Sample Station Location			SUMP E. OF EVAPORATION PONDS MIDSUMP	SUMP E. OF EVAPORATION PONDS MIDSUMP QA DUPL	Truck area sump NW corner	POND N. OF API PONDS	S.W. CORNER OF N. EVAPORATION POND	S.E. CORNER OF N. EVAPORATION POND	W. END OF SEPARATION POND	MIDDLE OF S. BANK OF S. EVAPORATION POND		

1. Priority Pollutant.
2. Specified Hazardous Substance.
3. Tentatively Identified.

NDB - Concentration less than determined in lab blank
C - Concentration corrected for lab blank concentration
K or LT ( ) - Present in sample below quantification limit (quantification limit)
P - Present in sample (tentatively identified compound)

SE NUMBER: 1006F

TE NAME/CODE: Plateau Refinery
NM 1686

PARAMETERS Compound		Fraction	Class	CONCENTRATIONS (ppb) EPA SAMPLE NUMBERS F 3468	F3469	F 3470	F 3484	F 3485	F 3487	F 3489	F 3490	Blank	Blank 1
nknown		VOA	3			123,000							
nknown		VOA	3								327		
nknown		VOA	3							75	212		
nknown		VOA	3					54					
nknown		VOA	3										550
exadecanoic acid		BNA	3					770					
ecane		BNA	3								5,300		
nde cane		BNA	3								4,005		
nknown	(Scan xx 735)	BNA	3		1,100								
nknown	(" 752-61)	BNA	3	640			560	660	750	690			
nknown	(" 814-43)	BNA	3			320,000					5,200		
nknown	(" 924)	BNA	3								1,800		
nknown	(" 932)	BNA	3			530,000							
nknown	(" 1043-1959)	RNA	3			670,000					5,900		
nknown	(" 1119-1121)	ANA	3				1,100				2,800		
nknown	(" 1147-1159)	BNA	3			530,000					6,400		
nknown	(" 1211)	BNA	3				790						
nknown	(" 1247-1255)	BNA	3			600,000	1,600				6,800		
nknown	(" 1300)	BNA	3				3,600				3,050		
nknown	(" 1340-1348)	BNA	3			820,000					4,000		
nknown	(" 1346)	BNA	3			590,000							
nknown	(" 1353)	BNA	3				4,700						
nknown	(" 1429)	BNA	3			950,000							
nknown	(" 1437)	BNA	3			420,000							
nknown	(" 1444)	BNA	3				4,500						
nknown	(" 1469)	BNA	3					610					
Matrix Type				Soil	Soil	med/	Soil	Soil	Soil	Soil	Soil	med/	low/
Sample Station Number				14	14	11	26	13B	13A	12B	12A		
Sample Station Location				Sump E. of EVAPORATION POND	Sump E. of EVAPORATION POND QA DUPL.	Truck area SUMP N.W. CORNER	Pond N. of API PONDS	SW corner N. EVAPORATION POND	SE corner EVAPORATION POND	W. end of SEPARATION POND	middle of S. BANK OF S. EVAP. POND	Blank	Blank

Priority Pollutant.
Specified Hazardous Substance.
Tentatively Identified.

NDB - Concentration less than determined in lab blank
C - Concentration corrected for lab blank concentration
KaLT ( ) - Present in sample below quantification limit (quantification limit)
P - Present in sample (tentatively identified compounds)

ASE NUMBER: 1006F

ITE NAME/CODE: PLATEAU REFINERY

NM1686

CONCENTRATIONS (ppb)

PARAMETERS			EPA SAMPLE NUMBERS									
Compound	Fraction	Class	E3468	E3469	E3470	E3484	E3485	E3487	E3489	E3490	Blank	Blank
Unknown (Scan #1513-1520)	BNA	3			710,000	1,900				4,200		
" (" 1588)	"	3					610					
" (" 1594)	"	3			660,000							
" (" 1598)	"	3					460					
" (" 1600-1602)	"	3				2,500				3,700		
" (" 1659-1677)	"	3			430,000	1,700				3,600		
" (" 1675)	"	3					460					
" (" 1677)	"	3				2,300						
" (" 1744-1751)	"	3			420,000			570		3,100		
" (" 1750)	"	3				2,000						
" (" 1776)	"	3				820						
" (" 1814)	"	3			280,000							
" (" 1819)	"	3					460					
" (" 1821-1833)	"	3				1,200				3,000		
" (" 1882)	"	3			280,000							
" (" 1889-90)	"	3				1,200				2,900		
" (" 2015-2018)	"	3				1,700	460		530	3,300		
" (" 2075-2079)	"	3				1,700		730	700	3,000		
" (" 2134-2138)	"	3				1,600	600	680	790			
" (" 2194-2199)	"	3				1,700	450	1,100	1,000	3,000		
" (" 2261-2267)	"	3				1,600	450	1,100	1,200			
" (" 2340)	"	3					450					
" (" 2339-2346)	"	3				1,500		680	1,000	2,800		
" (" 2400-2402)	"	3					620	570				
" (" 2429-2438)	"	3				1,100		680	1,000			
" (" 2538-2548)	"	3				770		590	700			
Matrix Type			soil	soil	med/soil	soil	soil	soil	soil	soil	med/soil	med/soil
Sample Station Number			14	14	11	26	13B	13A	12B	12A		
Sample Station Location											Blank	Blank

1. Priority Pollutant.
2. Specified Hazardous Substance.
3. Tentatively Identified.

NDB - Concentration less than determined in lab blank
C - Concentration corrected for lab blank concentration
K or LT ( ) - Present in sample below quantification limit (quantification limit
P - Present in sample (tentatively identified compound)

CASE NUMBER: ________________

SITE NAME/CODE: Plateau Refinery

PARAMETERS			CONCENTRATIONS (ppb) EPA SAMPLE NUMBERS									
Compound	Fraction	Class	F3468	F3469	F3470	F3484	F3485	F3487	F3489	F 3490	Blank	Blank
Unknown	BNA	3							510			
Matrix Type			Soil	Soil	Med/Soil	Soil	Soil	Soil	Soil	Soil	Med/Soil	Low/Soil
Sample Station Number			14	14	11	26	13B	13A	12B	12A		
Sample Station Location									W. END OF SEPARATION POND		Blank	Blank

1. Priority Pollutant.
2. Specified Hazardous Substance.
3. Tentatively Identified.

NDB - Concentration less than determined in lab blank
C - Concentration corrected for lab blank concentration
K or LT ( ) - Present in sample below quantification limit (quantification limit)
P - Present in sample (tentatively identified compound)

CASE NUMBER: ____________________

SITE NAME/CODE: Plateau Refinery

MSDS Mantek 075

PARAMETERS			CONCENTRATIONS (ppb) EPA SAMPLE NUMBERS									
Compound	Fraction	Class	Blank 2	Blank 3								
Methylene Chloride	Volatile	1	1K	3.6K								
Acetone	"	2	8.3									
2-Hexanone	"	2	12	7								
4-methyl-2-pentanone	"	2	1K	2K								
Styrene	"	2	1K									
Total Xylenes	"	2	1K									
Matrix Type			Low/Soil	Low/Soil								
Sample Station Number												
Sample Station Location			Blank	Blank								

1. Priority Pollutant.
2. Specified Hazardous Substance.
3. Tentatively Identified.

NDB - Concentration less than determined in lab blank
C - Concentration corrected for lab blank concentration
K or LT ( ) - Present in sample below quantification limit (quantification limit)
P - Present in sample (tentatively identified compound)

II. ORGANIC ANALYSIS SUMMARY

Page 28 of 31

CASE NUMBER: ________________

SITE NAME/CODE: ________________

PARAMETERS			CONCENTRATIONS (ppm) EPA SAMPLE NUMBERS									
Compound	Fraction	Class	F 5115	F 5116	F 5117	F 5118	F 5119	F 5120	F 5121			
N-nitrosodiphenyl amine	ABN	1	K				76					
diethyl phthalate	ABN	1	K		K							
chrysene	ABN	1	K	K*					K			
2-methyl naphthalene	ABN	2	K	K*	440		2,600		K			
acetone	VOA	2	32C	K	K	K	380C	K	75C			
xylenes	VOA	2	K	260			11,000	K	150 C			
ethyl benzene	VOA	1		K			3,200		41			
vinyl acetate	VOA	2		54			930		85			
naphthalene	ABN	1		K	K	K	K		K			
fluorene	ABN	1			170							
phenanthrene	ABN	1			200		110					
pyrene	ABN	1			K		K		K			
toluene	VOA	1		K	K	K	12,000	K	190			
dibenzofuran	ABN	2					K					
methylene chloride	VOA	1	K	K	K	K	K	K	K			
Benzene	VOA	1					3,100		37			
di-n-butyl phthalate	ABN	1			K	K						
2-hexanone	VOA	2			K	K	K	K				
cyclo hexane	VOA	3	P	280			1,900		P			
methyl cyclopentane	VOA	3	P	P			2,300		170			
2-methyl pentane	VOA	3	P	160			P		96			
methyl cyclohexane	VOA	3	P	890			2,600		380			
alcohol or alkene	VOA	3	94	490			5,000		330			
unknown	VOA	3	P	P			P		P			
cyclic alkane	VOA	3	P	420					290			
cis-1,3-dimethyl cyclo hexane	VOA	3	88	P					220			
Matrix Type			Sludge	Sludge	Oil	Sludge	Oil	Sludge	Sludge			
Sample Station Number			15	16	11	20	18	24	23			
Sample Station Location			50'S W. OF BORING #8 S. SITE LANDFILL	20' N. OF BORING #8 E. END OF LANDFILL	TRUCK AREA SUMP	ARROYO N. OF E. FRESH WATER POND	LEACHATE SPRYNG	N.E. API POND	SOUTH API POND			

. Priority Pollutant.
. Specified Hazardous Substance.
. Tentatively Identified.

K* - missing data sheet
NDB - Concentration less than determined in lab blank
C - Concentration corrected for lab blank concentration
K or LT ( ) - Present in sample below quantification limit (quantification limit)
P - Present in sample (tentatively identified compound)

E NUMBER: ______________

E NAME/CODE: ______________

CONCENTRATIONS (ppm)

PARAMETERS			EPA SAMPLE NUMBERS									
Compound	Fraction	Class	F5115	F5116	F5117	F5118	F5119	F5120	F5121			
lkane	ABN	3	246	587	1,420							
lkane	ABN	3		P					57			
nknown	ABN	3	136		P							
lkane	ABN	3	126	514								
lkane	ABN	3	128	P	P				P			
lkane	ABN	3	99.4	440	P				P			
lkane	ABN	3	84.6	P	474				P			
lkane	ABN	3	69.8	362	P				P			
lkane	ABN	3		362								
lkane	ABN	3	51.4	254								
lkane	ABN	3	P	57								
Matrix Type			sludge	sludge	oil	sludge	oil	sludge	sludge			
Sample Station Number			15	16	11	20	18	24	23			
Sample Station Location			50' S.W. OF BORING #8 S. SITE LANDFILL	20' N. OF BORING #8 E. END OF LANDFILL	Truck area sump	ARROYO N. OF E. FRESH-WATER POND	LEACHATE SPRING	NE API POND	South API pond			

. Priority Pollutant.
. Specified Hazardous Substance.
. Tentatively Identified.

NDB - Concentration less than determined in lab blank
C - Concentration corrected for lab blank concentration
K or LT ( ) - Present in sample below quantification limit (quantification limit
P - Present in sample (tentatively identified compound)

TABLE II. ORGANIC ANALYSIS SUMMARY

Page 30 of 31

CASE NUMBER: __________

SITE NAME/CODE: Plateau Refinery

CONCENTRATIONS (ppm)

PARAMETERS			EPA SAMPLE NUMBERS									
Compound	Fraction	Class	F 5115	F 5116	F 5117	F 5118	F 5119	F 5120	F 5121			
unknown	VOA	3	78	P					P			
cyclic alkane	VOA	3	82	P					P			
alkane	VOA	3	81	250					P			
unknown	VOA	3					P					
2-methyl heptane	VOA	3	120	480					270			
alkane	VOA	3	P	420			P		360			
unknown	VOA	3	110									
dimethyl benzene	VOA	3		510			8,900		300			
unknown	VOA	3	P	P			P		P			
alkane	VOA	3	71	P			P		P			
trimethyl benzene	VOA	3	P	P			3,000		P			
methyl ethyl benzene	VOA	3					1,700					
alkane	VOA	3	110	360					280			
alkane	ABN	3	173	511	1,560				131			
toluene-see VOA	ABN	3					815					
dimethyl benzene isomer	ABN	3					991		P			
dimethyl benzene isomer	ABN	3					861		P			
unknown	ABN	3					960					
trimethyl benzene isomer	ABN	3					1,090		58			
alkane	ABN	3							79			
trimethyl benzene isomer	ABN	3					724					
substitued benzene	ABN	3					671					
alkane	ABN	3	P	373			P		106			
substituted benzene	ABN	3					465					
UNKNOWN	VOA	3	65	P								
PROPYL BENZENE	VOA	3					950		P			
Matrix Type			Sludge	Sludge	Oil	Sludge	Oil	Sludge	Sludge			
Sample Station Number			15	16	11	20	18	24	23			
Sample Station Location			50' SW BORING # 8 S. SITE LANDFILL	20' N. OF BORING # 8 E. END OF LANDFILL	Truck Area Sump	ARROYO N. OF E. FRESHWATER POND	Leachate Spring	NE API Pond	South API Pond			

1. Priority Pollutant.
2. Specified Hazardous Substance.
3. Tentatively Identified.

NDB - Concentration less than determined in lab blank
C - Concentration corrected for lab blank concentration
K or LT ( ) - Present in sample below quantification limit (quantification limit)
P - Present in sample (tentatively identified compound)

CASE NUMBER: ______________

SITE NAME/CODE: ______________

CONCENTRATIONS (ppm)

PARAMETERS			EPA SAMPLE NUMBERS									
Compound	Fraction	Class	F 5115	F5116	F5117	F 5118	F 5119	F 5120	F 5121			
Unknown	ABN	3					594					
Unknown	ABN	3							92			
Unknown	ABN	3					625					
Alkane	ABN	3	P	P	556							
Alkane	ABN	3	P	P	P		358		P			
Alkane	ABN	3					457					
Alkane	ABN	3	214	606			663		133			
Alkane	ABN	3			3,350							
Alkane	ABN	3	163	P			P					
Alkane	ABN	3	P	630	3,200		663		149			
Alkane	ABN	3			7,010							
	ABN	3		154			P					
	ABN	3			3430	3,430						
Alkane	ABN	3	266	663			648		187			
Alkane	ABN	3		405	9,680		495					
Alkane	ABN	3	222		5,180				144			
Alkane	ABN	3	324	P	9,220							
Alkane	ABN	3	P	928			648		101			
Alkane	ABN	3	P	113	2,510		P		78			
Alkane	ABN	3	P	P	7,920		617		P			
Alkane	ABN	3	284	1,330	7,540		946		140			
Alkane	ABN	3	312	1,300	6,020		946		158			
Alkane	ABN	3	294	1,160	3,440		P		149			
Alkane	ABN	3	284	573	3,080		P		123			
Alkane	ABN	3	210	568	2,250		P		108			
Alkane	ABN	3	184	P	1,420		P		108			
Matrix Type			Sludge	Sludge	Oil	Sludge	Oil	Sludge	Sludge			
Sample Station Number			15	16	11	20	18	24	23			
Sample Station Location			50' SW boring #8 S SITE LANDFILL	20' N.of boring #8 E.END OF L.F.	Truck area sump	Arrayo N. of E FRESHWATER POND	Leachate Spring	NE API pond	South API pond			

1. Priority Pollutant.
2. Specified Hazardous Substance.
3. Tentatively Identified.

NDB - Concentration less than determined in lab blank
C - Concentration corrected for lab blank concentration
KaLT ( ) - Present in sample below quantification limit (quantification limit)
P - Present in sample (tentatively identified compounds)

EXHIBIT II

ANALYTICAL METHODOLOGY

FOR

GROUNDWATER MONITORING

Bloomfield Refining Company

TABLE I

PARAMETERS CHARACTERIZING THE SUITABILITY OF THE GROUNDWATER AS A DRINKING WATER SUPPLY

(40 CFR 265.92.b.1.)

Parameter	Units	EPA Standard	Detection Limits	Method	Methodology Reference*
Arsenic	mg/l	0.05	0.001	Furnace AA	1 - Method 206.2
Barium	mg/l	1.0	0.1	Flame AA	1 - Method 208.1
Cadmium	mg/l	0.01	0.005	Flame AA	1 - Method 213.1
Chromium	mg/l	0.05	0.035	Flame AA	1 - Method 218.1
Fluoride	mg/l	1.4-2.4	0.1	Electrode	1 - Method 340.2
Lead	mg/l	0.05	0.035	Flame AA	1 - Method 239.1
Mercury	mg/l	0.002	0.0002	Cold Vapor AA	1 - Method 245.1
Nitrate (as N)	mg/l	10.0	0.1	Colorimetric	1 - Method 353.3
Selenium	mg/l	0.01	0.001	Furnace AA	1 - Method 270.2
Silver	mg/l	0.05	0.01	Flame AA	1 - Method 272.1
Endrin	mg/l	0.0002	0.000009	GC	2 - Method 608
Lindane	mg/l	0.004	0.000004	GC	2 - Method 608
Methoxychlor	mg/l	0.01	0.00025	GC	2 - Method 608
Toxaphene	mg/l	0.005	0.0004	GC	2 - Method 608
2,4-D	mg/l	0.1	0.0001	GC	3
2,4,5-TP (Silvex)	mg/l	0.01	0.00005	GC	3
Radium	pCi/l	5	0.1	Proportional Counter	4 - Method 705
Gross Alpha	pCi/l	15	1	Proportional Counter	4 - Method 703
Gross Beta	pCi/l	50	1	Proportional Counter	4 - Method 703
Coliform Bacteria	No./100 ml	1	0	Membrane Filter	4 - Method 909

* See References, following TABLE IV.

TABLE II

REQUIRED PARAMETERS ESTABLISHING GROUNDWATER QUALITY

(40 CFR 265.92.b.2.)

Parameter	Units	EPA Standard	Detection Limits	Method	Methodology Reference*
Chloride	mg/l	250	5	Titration	I - 325.3
Iron	mg/l	0.3	0.02	Flame AA	I - 236.1
Manganese	mg/l	0.05	0.01	Flame AA	I - 243.1
Phenolics	mg/l	--	0.005	Distillation-Colorimetic	I - 420.1
Sodium	mg/l	--	1	Flame AA	I - 273.1
Sulfate	mg/l	250	5	Turbidimetric	I - 375.4

* See References, following TABLE IV.

TABLE III

PARAMETERS USED AS INDICATORS OF GROUNDWATER CONTAMINATION

(40 CFR 265.92.b.3.)

Parameter	Units	EPA Standard	Detection Limits	Method	Methodology Reference*
pH	pH units	6.5-8.5	0.01	Electrode	1 - 150.1
Specific Conductance	umhos/cm	--	10	Wheatstone Bridge	1 - 120.1
TOC	mg/l	--	1	Oxidation-Infrared	1 - 415.1
TOX	ug Cl/l	--	5	Dohrmann TOX	5 - 450.1

* See References, following TABLE IV.

Inorganic Analytical Methodology (Continued)

Parameter	Units	Nominal Detection Limit[a]	Methodology	Reference	Preservation Bottle No.	Maximum Holding Time[b]
INORGANIC PARAMETERS (Continued)						
Total Phosphorus as P	mg/l	0.06	Digestion; ICP Emission Spectroscopy	1-4.1.4; 3	4	28 days
		0.01	Digestion - Colorimetric	1-365.2; 1-424C,F	2	28 days
Silica as SiO_2	mg/l	0.1	ICP Emission Spectroscopy	3	4	28 days
	mg/l	1	Colorimetric	1-370.1; 2-425C	1	28 days
Biological Oxygen Demand	mg/l	2	Dilution Bottle - D.O. Probe	1-405.1; 2-507	1	48 hours
Chemical Oxygen Demand	mg/l	5	Micro Colorimetric	1-410.4; 2-508A	2	28 days
Total Organic Carbon	mg/l	0.1	Oxidation-Infrared Absorption	1-415.1; 2-505	2	28 days
Ammonia as N	mg/l	0.1	Electrode	1-350.3; 2-417E	2	28 days
		0.1	Automated Colorimetric	1-350.1	2	28 days
Total Kjeldahl Nitrogen as N	mg/l	0.1	Digestion - Electrode	1-351.4; 2-420B	2	28 days
		0.1	Digestion - Colorimetric	1-351.2	2	28 days
Total Organic Nitrogen as N	mg/l	0.1	Calculation (TKN - NH_3)	-	-	-
Oil and Grease	mg/l	1	Freon Extraction-Gravimetric	1-413.1; 2-503A	3	28 days
Free Cyanide	mg/l	0.01	Chlorination-Distillation-Colorimetric	1-335.1; 2-412F,D	6	14 days
Total Cyanide	mg/l	0.01	Distillation - Colorimetric	1-335.2; 2-412B,D	6	14 days
Phenolics	mg/l	0.01	Distillation - Colorimetric	1-420.1; 2-510A,B	2	28 days
Fecal Coliform	Colonies/100 ml	1	Membrane Filter	2-909C	8	ASAP
Total Coliform	Colonies/100 ml	1	Membrane Filter	2-909A	8	ASAP
Bromide	mg/l	0.1	Colorimetric	2-405	1	28 days
Residual Chlorine	mg/l	0.05	Amperometric	1-330.2; 2-408C	1	ASAP
Hexavalent Chromium	mg/l	0.01	Colorimetric	1-218.4; 2-312B	1	24 hours
Color	units	5	Pt-Co Colorimetric	1-110.2; 2-204A	1	48 hours
Hardness as $CaCO_3$	mg/l	5	Calculation	2-314A	4	6 months
Nitrite as N	mg/l	0.01	Colorimetric	1-354.1; 2-419	1	48 hours
Sulfide	mg/l	0.05	Titrimetric - Electrode	1-376.1; 2-427B,D	7	7 days
Sulfite	mg/l	2	Titrimetric	1-377.1; 2-428	1	ASAP
MBAS (Surfactants)	mg/l	0.1	Colorimetric	1-425.1; 2-512A	1	48 hours
Turbidity	NTU	0.1	Turbidimeter	1-180.1; 2-214A	1	48 hours

ROCKY MOUNTAIN ANALYTICAL LABORATORY

Inorganic Analytical Methodology (Continued)

Parameter	Units	Nominal Detection Limit[a]	Methodology	Reference	Preservation Bottle No.	Maximum Holding Time[b]
TRACE METALS[c]						
Aluminum	mg/l	0.05	ICP Emission Spectroscopy	3	4	6 months
Antimony	mg/l	0.002	Furnace Atomic Absorption	1-204.2	4	6 months
Arsenic	mg/l	0.002	Furnace Atomic Absorption	1-206.2	4	6 months
Barium	mg/l	0.005	ICP Emission Spectroscopy	3	4	6 months
Beryllium	mg/l	0.001	ICP Emission Spectroscopy	3	4	6 months
Boron	mg/l	0.004	ICP Emission Spectroscopy	3	4	6 months
Cadmium	mg/l	0.002	ICP Emission Spectroscopy	3	4	6 months
Chromium	mg/l	0.005	ICP Emission Spectroscopy	3	4	6 months
Cobalt	mg/l	0.003	ICP Emission Spectroscopy	3	4	6 months
Copper	mg/l	0.002	ICP Emission Spectroscopy	3	4	6 months
Iron	mg/l	0.05	ICP Emission Spectroscopy	3	4	6 months
Lead	mg/l	0.025	ICP Emission Spectroscopy	3	4	6 months
		0.001	Furnace Atomic Absorption	1-239.2	4	6 months
Manganese	mg/l	0.005	ICP Emission Spectroscopy	3	4	6 months
Mercury	mg/l	0.0002	Cold Vapor Atomic Absorption	1-245.1	4	6 months
Molybdenum	mg/l	0.005	ICP Emission Spectroscopy	3	4	6 months
Nickel	mg/l	0.01	ICP Emission Spectroscopy	3	4	6 months
Selenium	mg/l	0.002	Furnace Atomic Absorption	1-270.2	4	6 months
Silver	mg/l	0.003	ICP Emission Spectroscopy	3	4	6 months
Strontium	mg/l	0.005	ICP Emission Spectroscopy	3	4	6 months
Thallium	mg/l	0.002	Furnace Atomic Absorption	1-279.2	4	6 months
Tin	mg/l	0.03	ICP Emission Spectroscopy	3	4	6 months
Titanium	mg/l	0.002	ICP Emission Spectroscopy	3	4	6 months
Vanadium	mg/l	0.002	ICP Emission Spectroscopy	3	4	6 months
Zinc	mg/l	0.004	ICP Emission Spectroscopy	3	4	6 months
INORGANIC PARAMETERS						
pH	units	0.01	Meter	1-150.1; 2-423	1	ASAP
Specific Conductance at 25°C	umhos/cm	1	Bridge	1-120.1; 2-205	1	28 days
Total Dissolved Solids	mg/l	10	Gravimetric, 180°C	1-160.1; 2-209B	1	7 days
Total Suspended Solids	mg/l	2	Gravimetric, 105°C	1-160.2	1	7 days
Total Solids	mg/l	10	Gravimetric, 105°C	1-160.3	1	7 days
Total Volatile Solids	mg/l	10	Gravimetric, 550°C	1-160.4	1	7 days
Ortho-Phosphate as P	mg/l	0.01	Single Reagent Colorimetric	1-365.2; 2-424F	1	48 hours

ROCKY MOUNTAIN ANALYTICAL LABORATORY

Inorganic Analytical Methodology

Parameter	Units	Nominal Detection Limit[a]	Methodology	Reference	Preservation Bottle No.	Maximum Holding Time[b]
MAJOR IONS						
Sodium	mg/l	0.5	ICP Emission Spectroscopy	3	4	6 months
Potassium	mg/l	0.3	ICP Emission Spectroscopy	3	4	6 months
Calcium	mg/l	0.1	ICP Emission Spectroscopy	3	4	6 months
Magnesium	mg/l	0.1	ICP Emission Spectroscopy	3	4	6 months
Chloride	mg/l	3	Manual Titrimetric, Hg $(NO_3)_2$	1-325.3/2-407B	1	28 days
			Automated Colorimetric Ferricyanide	1-325.2	1	28 days
Fluoride	mg/l	0.1	Electrode	1-340.2/2-413B	1	28 days
Sulfate	mg/l	5	Manual Turbidimetric	1-375.4/2-426C	1	28 days
			Automated Colorimetric MTB	1-375.2	1	28 days
Total Alkalinity as $CaCO_3$ at pH 4.5	mg/l	5	Titrimetric	1-310.1/2-403	1	14 days
Carbonate Alkalinity as $CaCO_3$ at pH 8.3	mg/l	5	Titrimetric	1-310.1/2-403	1	14 days
Bicarbonate Alkalinity as $CaCO_3$ at pH 4.5	mg/l	5	Titrimetric	1-310.1/2-403	1	14 days
Hydroxide Alkalinity as $CaCO_3$	mg/l	5	Calculation	2-403	-	-
Nitrate+Nitrite as N	mg/l	0.1	Manual Cd Reduction - Colorimetric	1-353.3/2-418C	2	28 days
		0.1	Automated Cd Reduction - Colorimetric	1-353.2	2	28 days
Total Cations	meq/l	0.1	Calculation	2-104C	-	-
Total Anions	meq/l	0.1	Calculation	2-104C	-	-
Difference	%	0.1	Calculation	2-104C	-	-
RADIOCHEMISTRY						
Gross Alpha	pCi/l	0.1	Proportional Counter	2-703	5	6 months
Gross Beta	pCi/l	0.1	Proportional Counter	2-703	5	6 months
Radium 226	pCi/l	0.1	Separation - Counter	2-705	5	6 months
Radium 228	pCi/l	0.1	Separation - Counter	2-707	5	6 months
Uranium	mg/l	0.005	Fluorimetric	4-D2907-75	5	6 months

Inorganic Analytical Methodology (Continued)

References

(1) "Methods for Chemical Analysis of Water and Wastes", EPA-600/4-79-020, EMSL, Cincinnati, 1979.

(2) "Standard Methods for the Examination of Water and Wastewater", 15th Edition, APHA, 1980.

(3) Federal Register, 40 CFR 136, December 3, 1979; USEPA EMSL-Cincinnati, OH 45268.

(4) "Annual Book of ASTM Standards", Part 31, Water, 1980.

Notes

[a] Nominal values are the best achievable with the listed analytical method. Interferences in specific samples may result in a higher detection limit.

[b] Applicable to NPDES wastes as updated by Robert C. Booth, Director, EMSL-Cincinnati, September 22, 1981.

[c] Digestion procedure 1-4.1.4 used for elements determined by ICP Emission Spectroscopy when determining total metals. Digestion procedures for graphite furnace elements included with reference listed.

11/10/82

Organic Analytical Methodology

Parameter	Units	Nominal Detection Limit[a]	Methodology	Reference(1)	Preservation Bottle No.	Maximum Holding Time[b]
Purgeables	ug/l	1	Purge & Trap GC/MS	624	11	14 days
Base/Neutrals	ug/l	10	Extraction/GC/MS	625	12	7 days/40 days
Acids	ug/l	10	Extraction/GC/MS	625	12	7 days/40 days
Organochlorine Pesticides/PCB's	ug/l	0.01	Extraction/GC/ECD	608	13	7 days/40 days
		10	Extraction/GC/MS	625	12	7 days/40 days
Phenoxy Herbicides	ug/l	0.01	Extraction/GC/ECD	(2)	14	7 days/40 days
Total Organic Halogen (TOX)	ug/l	5	Adsorbtion/Coulometric	450.1(3)	15	-
Trihalomethanes (THM)	ug/l	1	Extraction/GC/ECD	(4)	11	14 days
		1	Purge & Trap GC/MS	(4)	11	14 days
Dioxin	ug/l	0.005	Extraction/GC/MS/ECD	613	16	7 days/40 days
Purgeable Halocarbons	ug/l	0.01	Purge & Trap/GC/Hall	601	11	14 days
Purgeable Aromatics	ug/l	1	Purge & Trap/GC/FID	602	17	14 days
Acrolein & Acrylonitrile	ug/l	100	Purge & Trap/GC/FID	603	18	14 days
Phenols by GC	ug/l	10	Extraction/GC/FID	604	16	7 days/40 days
Benzidines	ug/l	0.1	Extraction/HPLC	605	19	7 days/40 days
Phthalate Esters	ug/l	10	Extraction/GC/FID	606	12	7 days/40 days
Nitrosamines	ug/l	1	Extraction/GC/NPD	607	20	7 days/40 days
Nitroaromatics/isophorone	ug/l	1	Extraction/GC/FID & GC/ECD	609	12	7 days/40 days
Polynuclear Aromatics	ug/l	0.5	Extraction/HPLC	610	20	7 days/40 days
Haloethers	ug/l	1	Extraction/GC/Hall	611	17	7 days/40 days
Chlorinated Hydrocarbons	ug/l	0.02	Extraction/GC/ECD	612	12	7 days/40 days
Organophosphorus Pesticides	ug/l	0.1	Extraction/GC/NPD	622(5)	12	7 days/40 days
Triazine Pesticides	ug/l	0.1	Extraction/GC/NPD	(6)	12	7 days/40 days

References

(1) Federal Register, Vol. 44, No. 233, Monday, December 3, 1979.
(2) "Method for Chlorinated Phenoxy Acid Herbicides in Industrial Effluents," Federal Register, Vol. 38, No. 75, Part II.
(3) "Total Organic Halide," US EPA-EMSL, Cincinnati, November, 1980.
(4) Federal Register, Vol. 44, No. 231, Thursday, November 29, 1979, Appendix, Part I.
(5) "Method 622- Organophosphorus Pesticides," Proposed EPA Method, 304 (h) Committee.
(6) Federal Register, Vol. 38, No. 75, 1973.

Notes

[a] Nominal values are the best achievable with the listed analytical method for a typical component. Interferrences in specific samples may result in a higher detection limit.

[b] Applicable to NPDES Wastes as updated by Robert C. Booth, Director, EMSL-Cincinnati, September 22, 1981. Where two times are given, the first refers to the time to extraction, the second to the time of instrumental analysis.

Organic Analytical Methodology (continued)

Preservation Bottle No.	Parameter Group	Bottle	Preservation
11	Purgeables	40 ml glass with teflon lined silicone septum cap	4°C (thiosulfate if Cl_2 present)
17	Purgeables	40 ml glass with teflon lined silicone septum cap	4°C, HCl to pH less than 2 (thiosulfate if Cl_2 present)
18	Purgeables	40 ml glass with teflon lined silicone septum cap	4°C, adjust pH to 4 - 5 (thiosulfate if Cl_2 present)
16	Extractables	1 liter glass with teflon lined cap	4°C (thiosulfate if Cl_2 present)
19	Extractables	1 liter glass with teflon lined cap	4°C, adjust pH to 2 - 7 (thiosulfate if Cl_2 present)
12, 13, 14	Extractables	1 liter glass with teflon lined cap	4°C
20	Extractables	1 liter glass with teflon lined cap	4°C, store in dark (thiosulfate is Cl_2 present)
15	TOX	250 ml glass with teflon lined cap, single 1 liter glass with teflon lined cap, quad.	4°C, store in dark (thiosulfate if Cl_2 present)

GUIDELINES FOR SAMPLE BOTTLES AND PRESERVATIVES[a]

Bottle No.	Parameters	Container	Preservative	Notes
1	Cl^-, F^-, $SO_4^=$, Tot. Alk., $CO_3^=$ Alk., HCO_3^- Alk., OH^- Alk., pH, spec. cond., TDS, TSS, TS, TVS, o-PO_4 SiO_2, BOD, Br^-, res. Cl_2, Cr^{+6}, color, NO_2^-, $SO_3^=$, MBAS, Turbidity.	1 liter poly	4° C	Provide unfiltered sample for solids and turbidity.
2	Tot. P, COD, TOC, NH_3, TKN, TON, Phenolics $NO_3 + NO_2$.	500 ml poly	2 ml 50% H_2SO_4, 4°C	
3	O & G	1 liter glass	4 ml 50% H_2SO_4, 4°C	Do not filter, collect directly in bottle.
4	Na, K, Ca, Mg, Al, Sb, As, Ba, Be, B, Cd, Cr, Co, Cu, Fe, Pb, Mn, Hg, Mo, Ni, Se, Ag, Sr, Tl, Sn, Ti, V, Zn, ICP, Hardness.	500 ml poly	5 ml 50% HNO_3	Provide separate samples for total and dissolved sample (filter before adding to bottle.)
5	Alpha, Beta, Ra^{226}, Ra^{228}, U	1 liter poly (no Ra^{228}) ½ gallon poly (with Ra^{228})	10 ml 50% HNO_3 20 ml 50% HNO_3	
6	Free CN, Tot. CN	500 ml poly	2 ml 50% NaOH, 4°C	
7	Sulfide	250 ml poly	1 ml 1 N Zn acetate, 1 ml 50% NaOH, 4°C	
8	Fecal coli., total coli.	8 oz. sterile	4° C	Collect directly in sterile bottle
11	VOA, purgeable organics, THM	2 - 40 ml glass vial	4° C	Completely fill bottle, leave no air bubbles.
12	B/NA	1 liter glass	4° C	
13	Pest./PCB	1 liter glass	4° C	
14	Herbicides	1 liter glass	4° C	
15	TOX	1 liter glass	4° C	

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[a] Federal Register, 40 CFR 136, December 3, 1979, as updated by EPA, EMSL-Cincinnati, September 22, 1981.

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REFERENCES

1. "Methods for Analysis of Water and Wastes", USEPA, EMSL, Cincinnati, Ohio, 1979.
2. Federal Register, 40 CFR 136, December 3, 1979.
3. Federal Register, 38, No. 75, Part II, 1973.
4. "Standard Methods for the Examination of Water and Wastewater", APHA, 14th Edition, 1975.
5. USEPA, EMSL, Cincinnati, Ohio, November, 1980.

FIGURE 3.1

PROPOSED PROJECT SCHEDULE

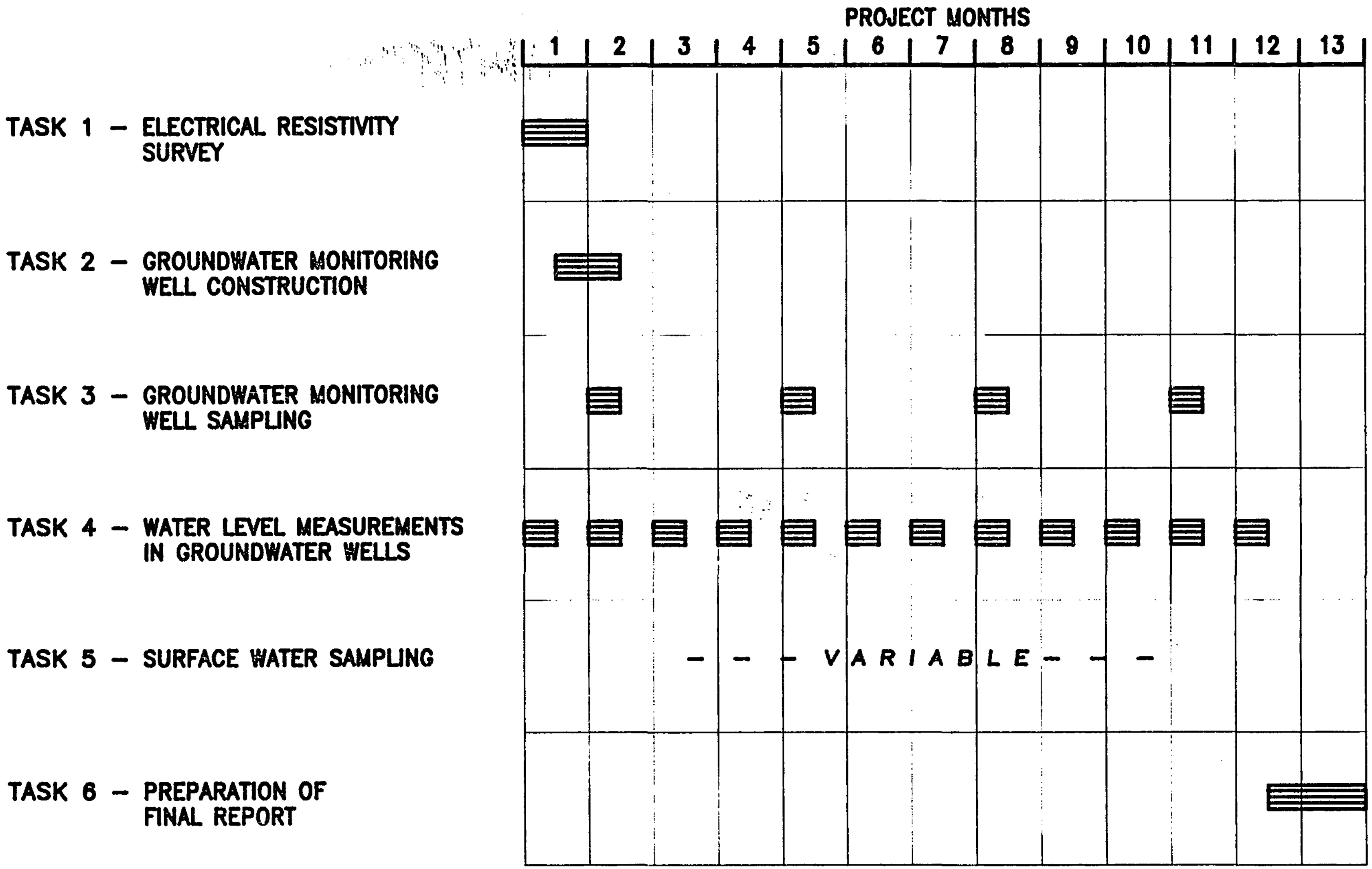

FIGURE 3.2

HYDROGRAPHS OF WATER LEVELS IN NEUTRON-PROBE ACCESS HOLES

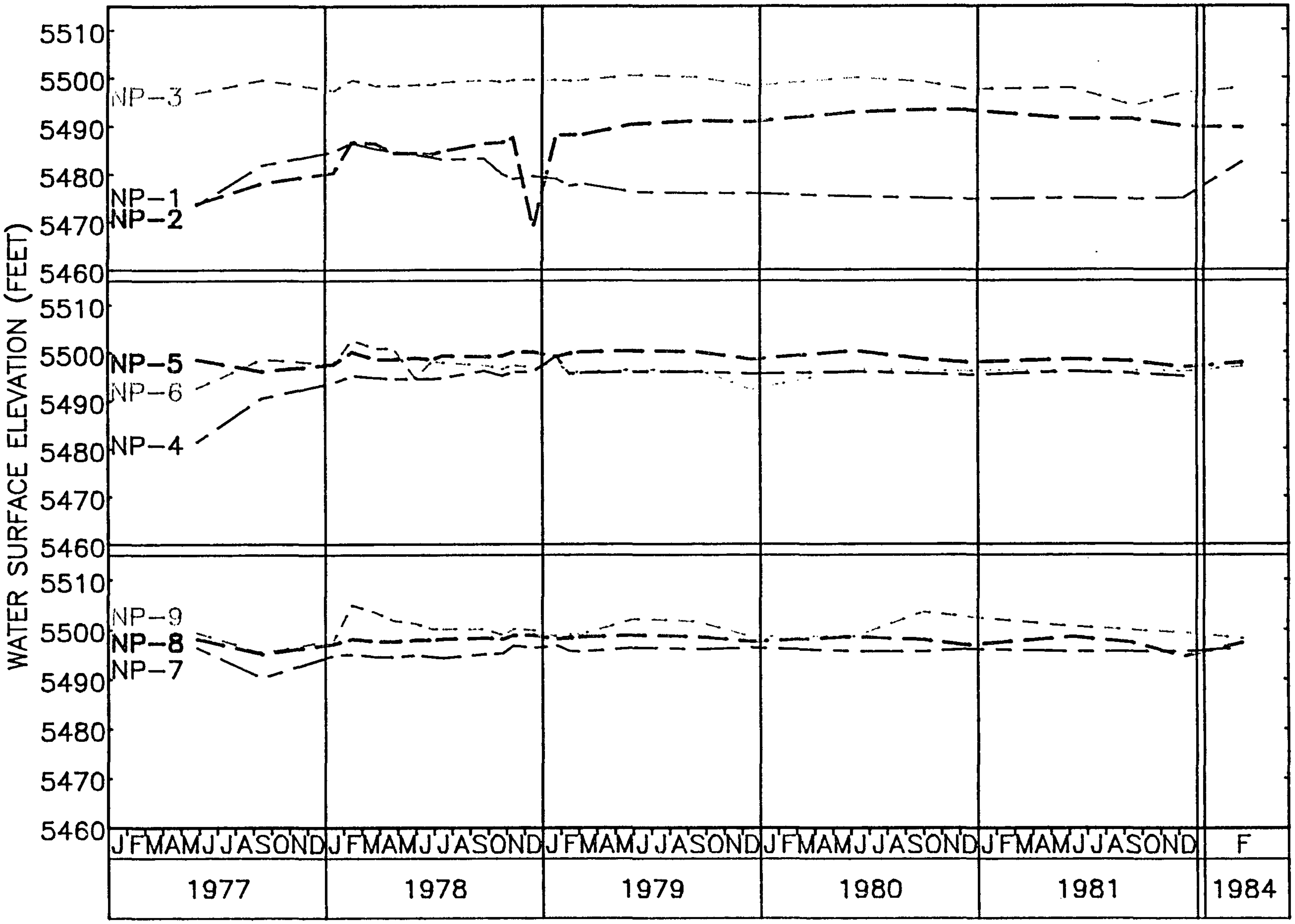

FIGURE 3.4

GEOLOGIC CROSS-SECTION A-A'