GW - 28

WORK PLANS

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NEW MEXICO
ENVIRONMENT DEPARTMENT

Hazardous Waste Bureau

2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505-6303
Phone (505) 476-6000 Fax (505) 476-6030
www.nmenv.state.nm.us

BILL RICHARDSON
Governor

DIANE DENISH
Lieutenant Governor

RON CURRY
Secretary

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Deputy Secretary

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

March 30, 2010

Darrell Moore
Navajo Refining Company
P.O. Box 159
Artesia, New Mexico 88211-0159

RE: NOTICE OF DISAPPROVAL
SWMU / AOC GROUP 3
CORRECTIVE ACTION INVESTIGATION WORK PLAN
NAVAJO REFINING COMPANY, ARTESIA REFINERY
EPA ID No. NMD048918817
HWB-NRC-09-004

Dear Mr. Moore:

The New Mexico Environment Department (NMED) has completed its review of Navajo Refining Company, Artesia Refinery's (the Permittee) *SWMU / AOC Group 3 Corrective Action Investigation Work Plan* (Work Plan), dated July 2009. NMED has reviewed the Work Plan and hereby issues this Notice of Disapproval (NOD). The Permittee must address all comments contained in this NOD.

Comment 1

In Section 2.2.1 (Clarified Slurry Oil Tanks (SWMU 17 / Group 3 AOC 1)), page 4, the Permittee states "[a]n underground storage tank is located south of the slurry slinger building and is out of service." The Permittee must revise the Work Plan to define the term out of service (e.g., the tank still contains contents but is no longer in use, if contents are present identify them, if the tank is empty and not used, identify the former use of the tank). The Permittee must also indicate if they know the condition of the underground storage tank (UST) (e.g., rusted, contains perforations), include the age of the UST, and discuss any plans to remove or leave the tank in place.

Comment 2
In Section 2.2.5 (South Alkylation Unit (SWMU 23 / Group 3 AOC5)), page 6, the Permittee states "[t]he south alkylation unit is located in the southern portion of the refinery. This unit was removed from service in the early 1980s, but most of the equipment remains in place. The unit is surrounded by other active process units and is surrounded by above ground piping." The Permittee must discuss the future use of this unit and specify if the unit will be demolished. Based on the future of the unit, the investigation of this area may be affected. See Comment 6.

Comment 3
In Section 5.1.1 (Clarified Slurry Oil Tanks), the Permittee identifies the proposed locations for the installation of three soil borings. In addition to the three soil borings, the Permittee must install two soil borings at the following locations:

a. Approximately 10 to 20 feet north of SG-04.

b. Approximately 65 feet east of Tank 58 and approximately 70 feet south of SG-02.

The locations were estimated based on the scale shown in Figure 4. The Permittee must revise the text and figure(s) in the Work Plan to incorporate the additional soil borings.

Comment 4
In Section 5.1.4 (Main API Separator), page 19, the Permittee states "[a]boveground piping surrounds the former separator. Modified rolloff boxes are located on a concrete pad east of the separator and are used as part of the catalyst fine recovery system. Tank 801 and 836 are located to the northeast of the separator area. These systems all prevent access [by] drilling rigs to areas adjacent to the separator. Photograph 4 of Appendix A shows the rolloffs on the concrete pad as well as some of the piping surrounding the separator." The Permittee must revise Figure 7 (Proposed Sample Locations Main API Separator) to depict the location of the aboveground piping that surrounds the Main API separator, the modified rolloff boxes, Tank 836, and the current API separator. Figure 7 shows the location of a previous soil gas sample AOC-2 SG-3 which is located within a bermed area with three tanks; the Permittee must revise Figure 7 to identify these tanks in the bermed area. Also, the Permittee must revise Appendix A to state the directions in which the photographs were taken (e.g., Photograph 4: Main API Separator Area - Facing north). The Permittee must revise the Work Plan accordingly.

Comment 5
In Section 5.1.4 (Main API Separator), pages 19 and 20, the Permittee states "[One] soil boring will be located approximately 20 [feet] south of the separator, assuming that a geoprobe can negotiate to the location, for collection of soil and groundwater samples. [One] soil boring will be located southwest of the separator, adjacent to the slab where the modified rolloffs are placed,

for collection of soil and groundwater samples. Figure 7 depicts previous sample locations and the proposed sample locations." The soil boring locations described in the text do not match the soil boring locations shown in Figure 7 (Proposed Sample Locations main API Separator); the text indicates soil borings will be installed 20 feet south of the separator and southwest of the separator while Figure 7 shows the soil boring locations southeast of the separator. The Permittee must revise the Work Plan to clarify this discrepancy. In addition, if no obstructions are present, the Permittee must install an additional soil boring approximately 20 feet northwest from the northwest corner of the blue perimeter surrounding the Main API separator, the Permittee must revise the Work Plan to include this boring (the locations were estimated based on the scale shown in Figure 7).

Comment 6

In Section 5.1.5 (South Alkylation Unit), the Permittee discusses the installation of one soil boring north of the unit, approximately 20 feet from MW-104. The Permittee must also install two additional soil borings that must be completed as permanent monitoring wells. These monitoring wells shall be located approximately 100 feet southwest of the southwest corner of the blue perimeter and 100 feet southeast of the southeast corner of the blue perimeter shown in Figure 8 (Proposed sample Locations – South Alkylation Unit), respectively (the locations were estimated based on the scale shown in Figure 8). These monitoring wells will help determine if contaminants are migrating off-site, as few monitoring wells are present south of the refinery. The Permittee must revise the text and figure(s) in the Work Plan to include the installation of the soil borings/permanent monitoring wells. See Comment 2.

Comment 7

In Section 5.2.1 (Soil Sample Collection Procedures), page 20, the Permittee states "[s]oil borings will be installed using direct-push (geoprobe) methods while monitor wells will be installed using hollow-stem auger drilling methods." It is not clear why the Permittee mentioned using a hollow-stem auger as permanent monitoring wells were not proposed as part of the Work Plan. To clarify, temporary wells may be installed utilizing a geoprobe; however, permanent monitoring wells (see Comment 6) must be installed using a hollow-stem auger rig. The Permittee must clarify this in the revised Work Plan.

Comment 8

The Permittee must revise Section 5.2 (Soil Investigation Methods) to include the following and revise the Work Plan accordingly:

a. The Permittee must survey or measure the soil boring/temporary well locations relative to a surveyed bench mark and describe how the locations will be determined.

b. The Permittee briefly mentions field screening methods and the use of a PID but does not discuss the instrument. The Permittee must revise the Work Plan to describe in detail the various field screening methods and instruments that will be used during the collection of soil samples (e.g., PID, olfactory, visual, include the name and model of the instrument(s) to be used).

c. The Permittee must describe how the soil samples will be logged (i.e., who will log the samples) and how the physical characteristics will be described (e.g., ASTM classification system).

d. The Permittee must describe the field equipment calibration procedures.

e. To better understand the details to be included in this section, the Permittee must refer to Appendix C (Sampling Methods and Procedures) and D (Chemical Analytical Procedures) of the Post-Closure Care Permit (Permit). The Permittee must provide the applicable information required by Permit Appendices C and D.

Comment 9

The Permittee discusses the use of Arcadis Standard Operating Procedures (SOPs) in Sections 5.2.1 (Soil Sample Collection Procedures) and Section 5.3.1 (Temporary Well Construction Methods). NMED does not approve SOPs because they can change without notice. The Permittee must revise the Work Plan to remove any references to the SOPs and instead describe in detail the procedures that will be conducted. (See Comment 8, Item e above).

Comment 10

In section 5.2.1 (Soil Sample Collection Procedures), page 21, the Permittee states "[i]f no PID reading above background or other indication of contamination is observed between 5 ft bgs and the depth at which saturated soil is encountered, a sample will be obtained within 6 to 10 ft bgs." It is not clear what the term "background" is referring to in this context. The Permittee must clarify this in the revised Work Plan.

Comment 11

In Section 5.2.2 (Soil Analytical Methods), page 22, the Permittee discusses the analytical methods that will be used for soil analysis and in bullet four, the Permittee states "[s]emi-volatile organic compounds (SVOCs) by method 8270C if the DRO concentration in corresponding sample is greater than 1,000 milligram per kilogram (mg/kg)." The Permittee must sample for SVOCs if DRO concentrations are detected at or above 800 mg/kg rather than 1,000 mg/kg. The Permittee must revise the Work Plan accordingly.

Comment 12

The Permittee must revise Section 5.3 (Groundwater Investigation Methods) to include the following:

a. The Permittee must survey or otherwise measure the soil boring/temporary well locations and describe how the locations will be determined.

b. The Permittee mentions that conductivity, pH and temperature measurements will be collected. The Permittee must identify the instruments or equipment to be used to collect these measurements.

c. The Permittee states that the equipment used for the field measurements will be calibrated at least once during each day of the sampling event. The Permittee must revise the Work Plan to describe how calibration will be completed (e.g., in accordance with the manufactures procedures, use of a span gas, use of a calibration solution).

d. The Permittee must specify instrument to be used for collecting the depth to water and depth to product measurements.

e. The Permittee must specify if any low flow purging guidance documents will be followed; if so, identify the document.

f. For a better understanding of details that need to be included in this Section, the Permittee must refer to Appendix C (Sampling Methods and Procedures) and D (Chemical Analytical Procedures) of the Post-Closure Care Permit (Permit). The Permittee must provide the applicable information required by Permit Appendices C and D.

The Permittee must revise the Work Plan accordingly.

Comment 13

In Section 5.3.4 (Groundwater Analytical Methods), page 25, the Permittee discusses the proposed groundwater analytical methods and states "[i]n addition, the soil samples from the main API separator area (AOC 4) will be analyzed for Cyanide by method 335.1." This Section is specific to groundwater but the Permittee references soil samples. The Permittee must clarify this discrepancy or explain the relevance of soil samples in the revised Work Plan.

Comment 14

In Section 5.3.5 (Groundwater Quality Assurance/Quality Control Samples), page 25, the Permittee states "QA/QC samples will be collected to monitor the validity of the soil sample collection procedures." The Permittee discusses the QA/QC for groundwater in this Section but also mentions soil sample procedures. The Permittee must clarify this discrepancy in the revised Work Plan.

Comment 15

In Section 5.3.6 ([Phase Separated Hydrocarbon] PSH Sample Collection), page 26, the Permittee states "[i]n the event that PSH is present in any of the temporary wells, samples will be collected when sufficient volume is present for adequate fingerprint analysis...In the event that insufficient PSH is present in the well to provide a 10-mL sample volume, then the PSH present will be collected and the well allowed to recharge for a period of up to 2 hours. Additional PSH will be obtained from the well using the same bailer and placed into the same sample container previously used for this well. The process will be repeated up to 3 times in an attempt to obtain adequate sample volume for fingerprinting. If insufficient volume of PSH has been obtained after 3 attempts, the PSH will be returned to the well and the container will be disposed of properly. The number of attempts made and the volume of PSH obtained from the well will be documented in the field logbook." In the event the Permittee cannot collect a sufficient sample of PSH, the Permittee must collect a sample of groundwater for analysis as specified in Section 5.3.4 (Groundwater Analytical Methods). The Permittee may not dispose of a PSH sample back into the temporary well. Instead, the Permittee must dispose the PSH into the refinery process wastewater system, upstream of the API. The Permittee must revise the Work Plan to include these changes.

Comment 16

In Section 5.4, the Permittee discusses investigation derived waste (IDW) for soils on page 27. Soil analyses in addition to that required for investigation may be required by the disposal facility. IDW management sampling and disposal information must be included in the investigation report. If the Permittee chooses to dispose of soil cuttings at the facility, NMED must be contacted for prior approval. It is possible that additional chemical analysis will be required to evaluate the IDW. No revision is necessary.

Comment 17

All analytical data must be compared to the regulatory criteria as identified in the Post-Closure Care Permit. No revision to the Work Plan is necessary. However, this information must be included in the investigation report.

The Permittee must address all comments contained in this NOD and submit a revised Work Plan. The revised Work Plan must be accompanied with a response letter that details where all revisions have been made, cross-referencing NMED's numbered comments. In addition, an electronic version of the revised Work Plan must be submitted identifying where all changes were made in red-line strikeout format. The revised Work Plan must be submitted to NMED no later than August 2, 2010.

If you have any questions regarding this letter, please contact Hope Monzeglio of my staff at (505) 476-6045.

Sincerely,

James P. Bearzi
Chief
Hazardous Waste Bureau

JPB:hm

cc: J. Kieling, NMED HWB
D. Cobrain, NMED HWB
H. Monzeglio, NMED HWB
C. Chavez, OCD
J. Lackey, NRC
P. Krueger, Arcadis

File: Reading File and NRC 2010
HWB-NRC-09-004

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NEW MEXICO

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OIL
CONSERVATION
DIVISION

Richard Mayer
Environmental Engin.
214-655-6775

DAVID G. BOYER
HYDROGEOLOGIST

RCRA ALONM PERmits
Dallas TX

LAND OFFICE BUILDING
P.O. BOX 2088
SANTA FE, NM 87504-2088
505-827-5812

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The Earth Technology Corporation®

JOE W. DAUCHY, Ph.D.
Managing Senior Environmental Scientist

520 Post Oak Boulevard, Suite 750, Houston, Texas 77027
Telephone: (713) 621-4211 / Fax: (713) 622-3311

Insert for
RFI Workplan.
5/16/90

REVISIONS TO THE NAVAJO RFI WORKPLAN

Below are the revisions which EPA has made to the Navajo RFI Workplan, dated November 1989. EPA has replaced the air monitoring requirements for the Truck Bypass Landfarm with soil coring requirements.

Page 3-4 of the RFI Workplan; Added an additional subsection on soil sampling of the Truck Bypass Landfarm (3.1.1.2.3.):

✓ 1. Navajo shall take a minimum of three (3) background soil core samples (Navajo can take more if desired). These background soil core samples shall be taken in the same soil type (Soil Conservation Service Soil Series Classification) and shall be in an area unaffected by past waste management activities or contamination.

✓ 2. Navajo shall take a minimum of nine (9) soil core samples within the boundary of the Truck Bypass Landfarm. Locations of each soil core shall be randomly selected and shall follow procedures in the Permit Guidance Manual on Unsaturated Zone Monitoring for Hazardous Waste Land Treatment Units, May 1986.

✓ 3. Five of the soil cores shall be sampled at the following intervals (measured from the present soil surface): 0-1', 3-4', 5-5 1/2', 6-7', and 8-9'. The remaining four soil cores shall be sampled in the above mentioned intervals, except for the 3-4' interval. Each sampling interval shall be analyzed for those constituents indicated in Table 3-6, including oil and grease. The background soil samples need to be analyzed only for metals and oil and grease. Samples shall not be composited prior to analysis.

✓ 4. All soil cores taken shall follow Navajo RFI Workplan Sections 3.2.2.2., Borehole Logs and 3.2.3., Sample Collection. In addition, Navajo shall identify all soil zones/horizons which are visually contaminated or are vapor analysis detected (using a OVA or PID instrument).

✓ 5. Navajo shall use the analysis of variance (ANOVA) statistical procedure for soil corings required for the Truck Bypass Landfarm. If data from the soil borings does not conform to procedures required by ANOVA, then a different statistical procedure may be used, providing the justification to EPA in the RFI Report.

✓ **Page 3-4 of the RFI Workplan; third paragraph,** first sentence of paragraph revised to read: "Ground water samples shall be obtained from monitor wells 43, 29, 39, 40, 41, and 42."

✓ **Page 3-9 of the RFI Workplan,** added an additional subsection on Groundwater Investigation of the Three Mile Ditch (3.1.3.2.5, Groundwater Investigation):

Groundwater samples shall be obtained from monitoring wells 30, 45, 46, 47 and 48. Each sample shall be analyzed for the hazardous

substance list (HSL) volatile and semi-volatile organics, inorganics (see Table 3.6.), sodium, potassium, calcium, magnesium, chloride, sulfate, bicarbonate, fluoride, and for total dissolved solids (TDS). Additionally, field measurements of pH, temperature and specific conductance shall be performed. Sampling and field measurement procedures are detailed in Section 3.2.1.
Static water level measurements shall be obtained from the existing shallow wells in the vicinity of the Three Mile Ditch. The measurements shall be obtained with an electric tape prior to sampling. The data shall be utilized to determine the direction of groundwater flow in the vicinity of the ditch. Procedures for obtaining static water levels are included in Section 3.2.1.1.

Navajo shall install one (1) background monitoring well in a zone representative of the saturated zone of monitoring wells 30, 45, and 46. This well shall be located hydraulically upgradient and shall represent groundwater unaffected by waste activities or contamination. Well installation, sampling/analysis procedures shall follow section 3.2 (and all other applicable sections) of the RFI Workplan.

The newly-installed upgradient well (background) shall be sampled and analyzed for the same constituents and parameters as wells 30, 45, 46, 47 and 48.

Page 3-8 of the RFI Workplan; the paragraphs below replace what is included in Section 3.1.3.2.2, Subsurface Sampling:

Soil sampling intervals shall be taken from the Three-Mile Ditch based on the following criteria:

1. Samples shall be collected from each of the different soil types encountered from the origination of the Ditch at the refinery to the outfall of the Ditch at the Evaporation Ponds. Based on U.S. Department of Agriculture Soil Conservation Service Report, Eddy Area, New Mexico - Sheet #6 and 7, 1968. The Ditch traverses five (5) different soil types. These five soil types are: Pima silt and clay loam, Karro loam, Reeves loam, Arno silty clay loam, and Arno - Harky complex. Within any one soil type sampling distance shall not exceed 1500 feet.

2. Samples shall be collected within these soil types, based on changes in declination of the ditch (i.e. places along the Ditch's "run" which would, because of less declination, create a greater potential for infiltration, or because of a rapid change in declination of the ditch would create a "pool", also increasing the potential for infiltration).

Samples shall be collected from the side walls of a trench created by a backhoe. Trenching will be performed in a "cross-ditch" configuration (T configuration), with material exposed perpendicular and parallel to original ditch flow. This method is preferred because:

1. Health and Safety constraints (overhead power lines) of collecting samples along the first 1.5 miles of the Ditch using a coring devise (drill rig).

2. This method shall minimize the sampling error of collection of soils which have been wind-blown or placed into the Ditch. The trench shall be visually inspected to determine the "original" Ditch surface.

Within each trench, samples shall be collected to determine the vertical migration of the constituents in the ditch. The trenching at all locations shall be completed (excavated) in such a manner to expose the soils which are visually contaminated and a minimum of 3 feet below the visual contamination (unless ground water is encountered, at which point excavation will cease). Samples shall be collected at:

1. the original ditch surface,
2. a mid-point within the visually contaminated horizon,
3. the interface of the visually contaminated soil, and visually clean soil, and,
4. three (3) feet below the visually contaminated soil.

All samples shall be collected horizontally into the trench face and shall be collected in a manner which minimizes the release/escape of any volatile constituents in the soil sample. Navajo shall also, identify all soil zones/horizons which are visually contaminated or are vapor analysis detected (using a OVA or PID instrument). Navajo shall also include in the RFI Report a cross-section and videotape (narrated) of each trench. Samples collected from trenches shall be analyzed for the hazardous substance list (HSL) volatile and semi-volatile organics, oil and grease, and inorganic metals.

Samples shall not be composited. All samples collected shall follow Navajo RFI Workplan Sections 3.2.2.2., Borehole logs (Modified to a trench log) and 3.2.3., Sample Collection.

A minimum of five (5) background soil samples (unaffected by waste management) shall be taken in the same soil type(s) that occur along the length of the Three-Mile Ditch (Soil Conservation Service Soil Series Classification). The Intervals to be collected shall be the same intervals as those of the active (ditch samples). Background soil samples need to be analyzed for metals and oil and grease.

Navajo shall use the analysis of variance (ANOVA) statistical procedure for soil trench samples. If data from the soil samples do not conform to procedures required by ANOVA, then a different statistical procedure may be used, providing the justification to EPA in the RFI Report.

Page 3-6 of the RFI Workplan, the paragraphs below have been added to Section 3.1.2.2.1., Groundwater Investigations.

Navajo shall install one (1) background monitoring well in a zone representative of the saturated zones of monitoring wells MW-1 through MW-9 and OCD1 through OCD8. This well shall be located hydraulically upgradient and shall represent groundwater unaffected by waste activities or contamination. Well installation, sampling/analysis procedures shall follow section 3.2 (and all other applicable sections) of the Workplan.

The newly-installed upgradient well (background) shall be sampled and analyzed for the same constituents and parameters as wells MW-1 through MW-9 and OCD1 through OCD8. Groundwater samples shall be obtained from the windmill south of evaporation pond No. 1. Each sample shall be analyzed for the hazardous substance list (HSL) volatile and semi-volatile organics, inorganics (see Table 3.6), sodium, potassium, calcium, magnesium, chloride, sulfate, bicarbonate, fluoride, and for total dissolved solids (TDS). Additionally, field measurements of pH, temperature and specific conductance shall be performed. Sampling and field measurement procedures are detailed in Section 3.2.1.

Page 3-23 of the RFI Workplan; Added on additional Subsection on Backhole Trench Excavation and Sampling (3.2.3.6).

Backhoe sampling in waste areas is preferentially used where drilling rig access may be difficult. Backhoe sampling is rapid, allows wide sample selection, reveals waste and soil layering.

Excavation shall proceed by removing the topsoil or cover and preceeding to dig in approximately 0.5 to 1.0 foot deep cuts using a scooping motion. The initial excavation will be about 8 feet long and 3-4 feet wide. As the excavation proceeds, the topsoil or cover is placed in one pile and the waste, when uncovered, is placed in a separate pile. All excavated materials shall be placed on 4 ml plastic sheeting to prevent the spread of contamination. Efforts shall be made to deposit materials in order of excavation. During excavation, visual observation of the pit shall be made for soil color changes, layering, and former bottom layers containing brush, grass and trash.

A detailed description of these samples shall be recorded. Sample data will include the following information, as a minimum; soil consistency, color and general appearance, free liquid accumulation, organic films or sheens, and vapor analysis (using a OVA or PID instrument).

The depth of the trench shall be measured using a drop tape or similar method.

The excavation shall be refilled in reverse order of removal. That is, the last materials excavated shall be placed first into the trench so that the original topsoil layer covers the finished trench excavation. All loose soil around the excavation will be placed in the trench. The excavation shall be refilled and compacted with a backhoe or front end loader.

The backhoe bucket shall be decontaminated before trenching is continued at a new sampling location. Decontamination shall consist of a steam or high-pressure water wash. The resultant rinsate may be discharged to the surface.

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REMEDIAL INVESTIGATION WORK PLAN FOR NAVAJO REFINING COMPANY FACILITY IN ARTESIA, NEW MEXICO

EPA ID No. NMD 048918817

Prepared for:

NAVAJO REFINING COMPANY
Artesia, New Mexico

Prepared by:

The Earth Technology Corporation
520 Post Oak Boulevard, Suite 750
Houston, Texas 77027

TETC Project 90-757

November 1989

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3.3.4 Sampling Procedures

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1.0 INTRODUCTION

1.1 PURPOSE OF THE RFI WORK PLAN

The Navajo Refinery (EPA ID No. NMD 048918817) located in Artesia, New Mexico, is regulated under the Resource Conservation Recovery Act (RCRA) and the Hazardous and Solid Waste Amendments (HSWA). One of the major provisions of HSWA (Section 3004-6) requires corrective action for releases of hazardous waste or constituents from solid waste management units (SWMUs) which are suspected to be sources of releases to the environment. The U.S. EPA conducted a Preliminary Review (PR) of all SWMUs at Navajo Refinery. Based on that review and additional information, the U.S. EPA determined that a RCRA Facility Investigation (RFI) on SWMUs at the facility was necessary. The purpose of the Work Plan is to provide the U.S. EPA with a logical and coherent approach for conducting an investigation that will allow a determination of the nature and extent of releases of hazardous waste or constituents from SWMUs identified in the permit and to provide the rationale for collecting all the necessary data to support a corrective measures study.

1.2 SCOPE OF THE RFI WORK PLAN

The required scope of the RFI Work Plan is outlined in Section C (Corrective Action for Continuing Releases) and in Section F (Scope of Work for a RCRA Facility Investigation at Navajo Refinery) of the Permit issued to the facility on March 25, 1988.

Section F.1 identifies six tasks that encompass the development and implementation of the Work Plan. Those tasks identified in Section F.1 of the permit include:

Task I: Preliminary Report: Description of Current Conditions

A. Facility Background
B. Nature and Extent of Contamination

Task II: RFI Work Plan

A. Data Collection Quality Assurance Plan
B. Data Management Plan
C. Health and Safety Plan
D. Community Relations Plan

Task III: Facility Investigation

A. Environmental Setting
B. Release Verification
C. Source Characterization
D. Contamination Characterization
E. Potential Receptor Identification

Task IV: Investigation Analysis

A. Data Analysis
B. Protection Standards

Task V: Laboratory and Bench-Scale Studies

Task VI: Reports

A. Preliminary and Work Plan
B. Progress
C. Draft and Final.

Task I outlines the format of a preliminary report which provides background information on the facility. As per correspondence (Appendix A) from the EPA, the requirements outlined in Task I have been met by Navajo. Task II identifies the informational requirements for plans that are to be included in the RFI Work Plan: Data Collection and Quality Assurance Plan, Data Management Plan, Health and Safety Plan, Community Relations Plan. Task III outlines the general scope of investigation activities that need to be conducted at the facility.

1.3 ORGANIZATION OF THE RFI WORK PLAN

This Work Plan is organized into six sections with three Appendices. The remainder of this section outlines the organization of this Work Plan. Section 2 provides a synopsis of the history of the facility. The current status of SWMUs at the facility and identifies potential receptors. Section 3 provides summary descriptions of the SWMUs at the facility at which RFI activities are to be conducted and outlines the strategy for conducting the investigations necessary to address the requirements of Task III of the permit. Section 4 provides a Data Management Plan. Section 5 provides a Health and Safety Plan. Section 6 provides a Community Relations Plan.

2.0 FACILITY BACKGROUND

2.1 FACILITY BACKGROUND

Navajo Refinery is located at 501 East Main Street in Artesia, Eddy County, New Mexico. The general location of the facility is shown in Figure 2-1. An overall facility map is shown in Figure 2-2.

The facility is a petroleum refinery which began operations in the 1920s. The ownership of the facility has changed numerous times since beginning operations. The facility consists of two separate North and South divisions (Figure 2-2). In 1969, Navajo purchased both divisions and began to integrate the operation into a single refinery capable of processing New Mexico sour crude (an asphalt-based crude) in the South Division and New Mexico intermediate crude (a paraffin-based crude) in the smaller North Division. The facility has the capacity to refine about 40,000 barrels of crude per day. The South Division produces about five-sixths of the total.

The major refining processes at the facility are: crude oil fractionation, fluidized catalytic cracking, alkylation, reforming, and desulfurization. Several auxiliary activities are associated with these processes which separate impurities from the feedstocks and products or are required for the operation and maintenance of the refinery. The units associated with these auxiliary activities include: boilers, cooling towers, storage tanks, water purification facilities, desalting units, and drying and sweetening units.

The production activities at the Navajo Refinery generate a variety of solid wastes and waste water streams. RCRA ~~solid~~ hazardous waste (oil-water separator sludges, heat exchanger bundle cleaning sludges, slop oil emulsion solids and, when produced, leaded tank bottoms) are disposed of at the facility's RCRA permitted North Colony Landfarm. The wastewater management system presently employed by Navajo consists of a wastewater treatment plant and a system of Lagoons. Table 2-1 describes the waste water streams and the wastewater treatment systems at the facility.

2.2 DESCRIPTION AND CURRENT STATUS OF SWMUs

A RCRA Preliminary Review (PR) was completed at the facility and submitted to EPA in April of 1986. The PR identified 15 Solid Waste Management Units (SWMUs) at the facility. The US EPA Region VI issued a Hazardous Waste Permit to the facility effective March 25, 1988. Table 2-2 identifies the current status of the SWMUs identified in the permit, indicates the units for which RFI work plan is required, and provides the operational status of each unit.

2.3 ENVIRONMENTAL SETTING

The environmental setting for the refinery was provided in the RFA conducted at the facility and is summarized in the subsections that follow.

2.3.1 Topography and Surface Water

The facility is located in the eastern plains of New Mexico on a broad plateau developed on flat-lying bedrock. The average elevation of the city of Artesia is 3,340 feet above MSL. The plain on which Artesia lies slopes eastward about thirty-three feet per mile. Surface drainage is dominated by small ephemeral creeks and arroyos which flow eastward to the Pecos River, located approximately three miles east of the facility.

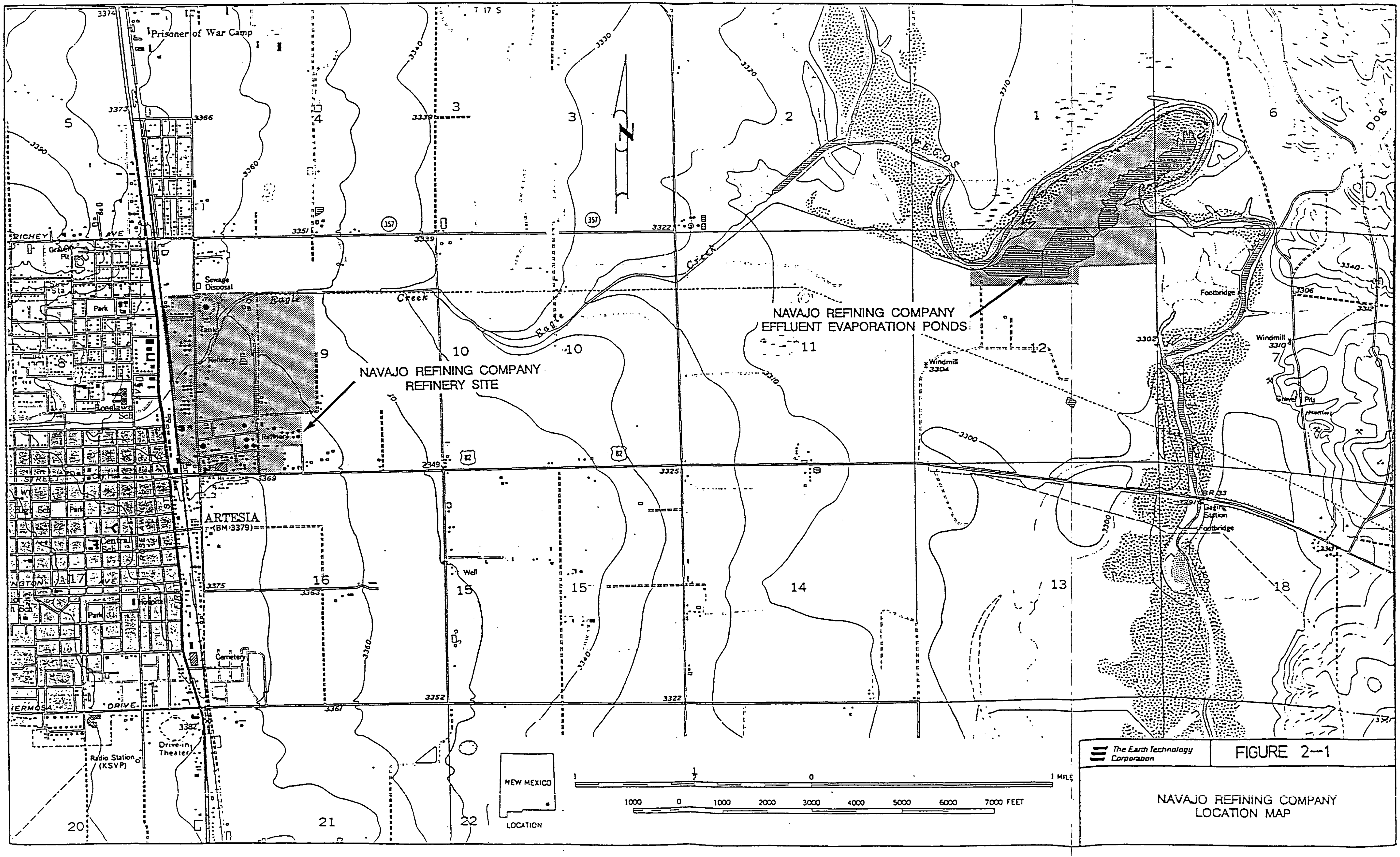

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FIGURE 2–1

NAVAJO REFINING COMPANY
LOCATION MAP

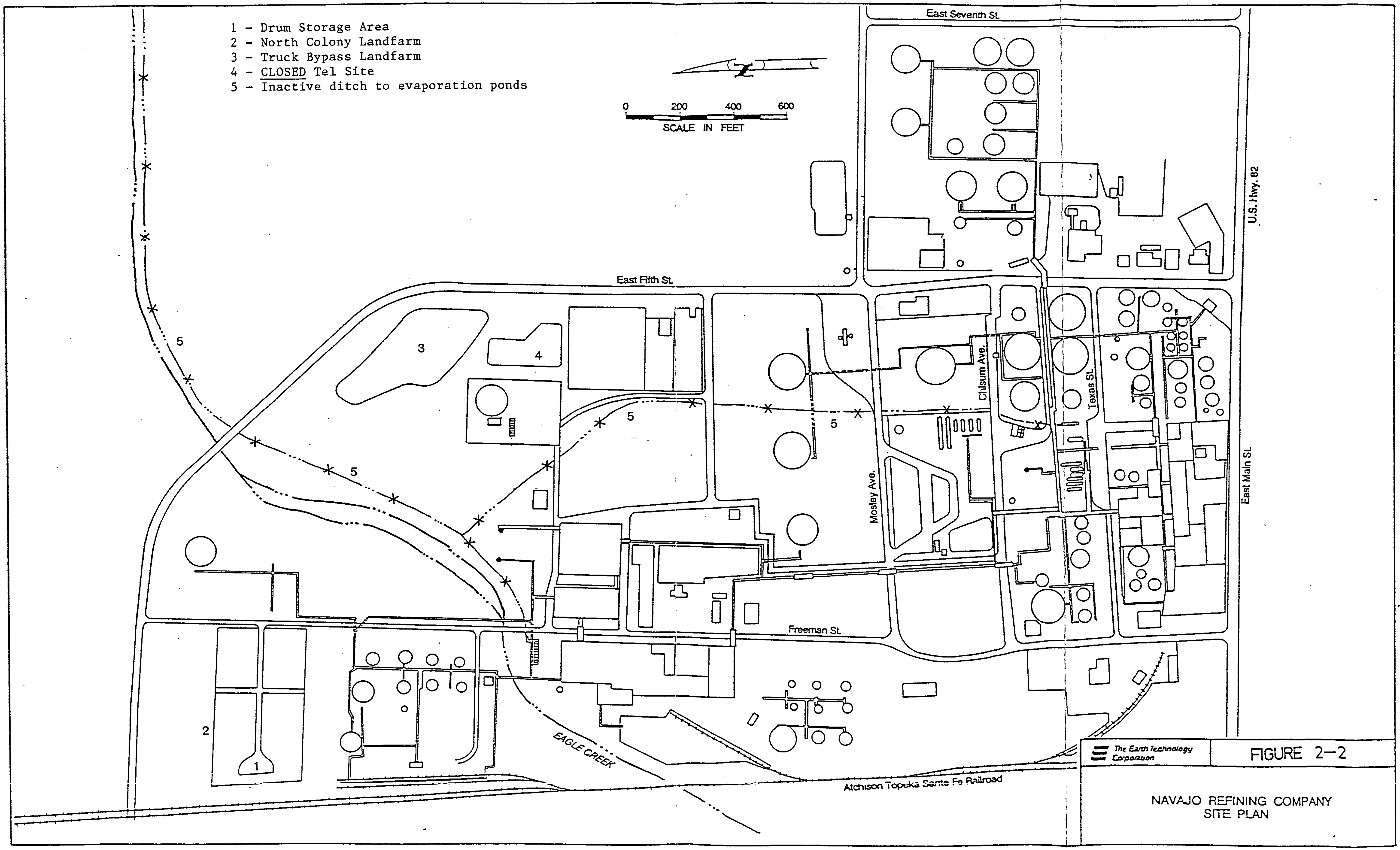


FIGURE 2–2

NAVAJO REFINING COMPANY
SITE PLAN

Table 2-1
Wastewater Streams and Wastewater Treatment
Navajo Refining Company

Process or Auxiliary Unit	Wastewater Stream Contents
Crude Oil Fractionation	Ammonia, sulfides, chlorides, oil, phenols
Catalytic Cracking	Alkaline wastewater containing high BOD and COD concentrations; oil, sulfides, phenols, cyanides, and ammonia
Alkylation	Acidic solution containing suspended solids, dissolved solids, oil, fluoride, and phenols
Reforming	No waste stream
Desulfurization	Sulfides and phenol compounds
Cooling Towers	Chromate, dissolved solids
Water Purification	Dissolved solids
Desalting Units	Dissolved solids, phenols, ammonia, sulfides
General Wash Water	Site specific

Table 2-2
SWMUs
Navajo Refining Company

	RCRA Permitted Unit	RFI Work Plan	Operational Status
North Colony Land Farm	X		Operational
TEL Weathering Area			Closed
Truck Bypass Landfarm		X	Operational
Evaporation Pond 1		X	Nonoperational
Evaporation Pond 2		X	Operational
Evaporation Pond 3		X	Operational
Evaporation Pond 4			Operational
Evaporation Pond 6			Operational
3 Mile Ditch/Eagle Creek		X	Nonoperational
North Colony Container Storage Area			Operational
HF Neutralization Sump			Operational
Slop Oil Tank			Operational
Oil-Water Separator			Operational
Fire Water Pond			Operational
Heat Exchanger Bundle Cleaning Area			Operational

Natural surface drainage at the facility is to the north and east. The major drainage in the immediate area of the site is Eagle Creek which runs southwest to northeast through the Navajo Refinery, and then runs eastward into the Pecos River. The refinery's Three Mile Ditch parallels Eagle Creek on its south side. Use of the Three Mile Ditch for waste water conveyance was discontinued in 1987. Waste water is now conveyed to Pond #2 through a high density polyethylene (HDPE) pipe. The North Colony and drum storage area, located in the northern drainage area, are surrounded by a dike.

A large portion of the Navajo Refinery is within the 100-year floodplain of either Eagle Creek or the Pecos River. However, Eagle Creek's channel has been rectified from west of Artesia to the Pecos, and the area of rectification is being extended. A dam check is also being constructed west of Artesia along Eagle Creek. According to the Preliminary Review prepared for this facility, once these measures are completed, they should effectively remove Artesia and the refinery from Eagle Creek's 100-year floodplain. Portions of the Three Mile Ditch and the Evaporation Ponds lie within the Pecos River flood plain. However, the construction of flood control dams upstream of the facility have reduced the risk of flooding at the facility. Since 1960, no discharge along the Pecos has exceeded 700 cfs.

2.3.2 Soils

Soils at the refinery are primarily of the Pima and Karro series. The Truck Bypass Landfarm is mainly Pima soils whereas the North Colony landfarm is about 60% Pima soils and 40% Karro soils. The frost-free season for Pima and Karo soils is 195 to 210 days. Extended periods of cold weather are rare and frost action potential is slight. In general, soils in the area do not freeze at depths greater than a few inches for more than a few days at a time. The top two feet of soil within the Truck Bypass Landfarm are fill material generated as a result of construction in other parts of the refinery.

The Pima and Karro soils have similar properties. Pima soils are deep, well drained, dark colored, calcarious soils, which occur on floodplains of narrow drainageways (e.g., Eagle Draw). These soils have moderate shrink-swell potential, and are subject to periodic flooding. Runoff from Pima soils is slow, permeability is moderately slow, and the water-holding capacity is high. The effective rooting depth is greater than 5 feet, and the water table is deeper than 5 feet.

The Karro soils are highly calcarious. Calcium carbonate typically accumulates at a depth of about 45 inches. These soils are found on level to gently sloping terrains and are susceptible to wind erosion. Runoff is slow and water-holding capacity is high. Permeability is moderate, and the effective rooting depth and the water table are both over 5 feet deep.

2.3.3 Geology

The geology of the Artesia area is marked by a sequence of Permian formations overlain by Quaternary alluvium. The uppermost formation is the Pecos River Valley alluvium. The westernmost extent of this alluvium is approximately 2.5 miles east of the refinery area.

The uppermost Permian formation in the Artesia area is the Seven Rivers Formation. This formation is approximately 200 feet thick in the Artesia area, and consists of a sequence of evaporates, carbonates, gypsum and shale, with isolated sand and fractured anhydrite/gypsum lenses. The bottom of this formation is marked by the Bower sand. It is not certain whether this unit is an extensive or discontinuous deposit.

Below the Seven Rivers Formation lies the Queen Formation (Permian), which consists of about 700 feet of evaporates, sands, and shales. The sands are 10 to 50 feet thick, and are predominantly near the top of the formation.

The San Andres Formation (Permian) lies beneath the Queen Formation, and is composed of limestone and dolomite containing irregular and erratic solution cavities which range up to several feet in diameter. This formation is approximately 100 feet thick.

The Permian formations dip 1 to 3 degrees towards the southeast. A normal fault trending N40E, with the northwest block downthrown, has been mapped approximately 2.5 miles east of the refinery. This fault displaces all of the above mentioned Permian formations.

2.3.4 Groundwater

The principal aquifers in the Artesia area are the San Andres and the Upper Queen Formations. The San Andres is known locally as the deep or artesian aquifer. It has been heavily developed for industrial, municipal, and agricultural use. The quality of water from this aquifer ranges from 500 to over 5,000 ppm TDS. Water is generally derived from depths ranging from 850 to 1,250 feet below ground surface. This aquifer is recharged in the Sacramento Mountains to the west of Artesia. Extensive use of this aquifer in recent decades has lowered the piezometric head of this aquifer to its current level of 50 to 80 feet below ground level. The aquifer is confined by overlying shales and evaporates of the Queen Formation.

The shallow aquifer consists of the sands of the Upper Queen Formation. The sands are confined by overlying shales and anhydrites of the Seven Rivers Formation, and are separated from the San Andres aquifer by 700 feet of carbonates, shales, and evaporates. The Upper Queen exhibits nearly 100 feet of artesial head, and yields water containing 500 to 1,500 ppm TDS. Water levels range from 40 to 60 feet below ground level. In the Artesia area, the potentoemetric surface of the shallow aquifer slopes gently east and southeast, following regional stratographic dips. South of Artesia, the potentometric surface forms a shallow trough due to extensive water use for irrigation.

Based on U.S.G.S. sources, if the San Andres and the Queen aquifers are hydraulically connected water will tend to flow upward from the deep to the shallow aquifer.

According to lithologic logs from site monitoring wells, the Seven Rivers Formation, which overlies the Queen Formation, contains water of poor quality in fractured anhydrite and sand lenses at a depth of 15 to 30 feet. This water is under artesian pressure, with static water levels 3 to 5 feet above the saturated zones. Regionally, this uppermost aquifer may have been utilized to provide low quality water for stock use, but has not been confirmed to be in any current use. The water of this aquifer is highly variable in quality, volume, areal extent, and saturated thickness.

Adjacent to the Pecos River, the Pecos Valley alluvium contains ground water at a depth of 6 to 12 feet. Historically, this water has not been utilized historically due to its poor quality. The alluvium is predominantly silty sand, possibly containing lenses of higher permeability material. Groundwater flow is sub-parallel to the Pecos River Valley, and is generally towards the river, although during periods of high flow, the hydraulic gradient may be away from the river into the alluvium. However, this reversal has not been adequately documented.

2.4 IDENTIFICATION OF POTENTIAL RECEPTORS

The community of Artesia is located directly adjacent to the facility. The PR conducted at the facility concluded that it does not appear likely that releases from SWMUs at the refinery would affect groundwater quality in the deep artesian aquifers (San Andres and Queen Formation). Artesian pressure and depth from ground surface appear to be adequate to prevent downward migration of waste constituents.

The PR indicates that the deep artesian aquifers (San Andres and Queen Formations) have been extensively developed for irrigation purposes but the shallow ground water in the Pecos River Valley alluvium is not currently utilized for any purpose due to poor water quality. The PR concluded that since the river alluvium's westernmost extent is approximately 2.5 miles east of the city of Artesia, a release of waste constituents from the SWMUs constructed in the alluvium would not pose a significant health threat to the population of Artesia.

The PR indicated that the Three Mile Ditch and the Evaporation Ponds could be susceptible to inundation in the event of major flooding. The PR report speculated that, in the event of inundation, hazardous wastes and constituents contained in the Three Mile Ditch and the Evaporation Ponds could have been released to surface water.

The PR concluded that it is unlikely that any public water supplies would be affected by releases into the Pecos River. Aquifers more than 1,000 feet deep are used for water supplies in the Artesia area.

3.0 DATA COLLECTION QUALITY ASSURANCE PLAN

The Data Collection Quality Assurance Plan (DCQAP) incorporates the site specific sampling strategy, standard operating procedures (SOPs) used for the data collection and a quality assurance project plan (QAPP). Navajo's consultant shall, in performing the DCQAP provide for each SWMU information and verification of:

Environmental Setting

- the hydrogeologic conditions at each of the facilities,
- the surface and sub-surface soils as well as the confining zones and bedrock formations,
- the chemical nature and physical description of surface waster bodies and sediments within these waters, and
- the climate in the vicinity of the facility.

Source Characterization

- Characterization of the wastes and the areas where wastes have been placed including:

  type
  quantity
  physical form
  disposition
  facility characteristics affecting release

Contamination Characterization

- Evaluation of the groundwater quality at the Evaporation Ponds 1, 2 and 3 and the Truck Bypass Landfarm
- Evaluation of the soil quality at the Evaporation Ponds 1, 2 and 3 and the 3 Mile Ditch/Eagle Creek area
- Evaluation of the surface-water quality at the 3 Mile Ditch/Eagle Creek area
- Evaluation of the air emissions at the Truck Bypass Landfarm

Potential Receptors

- An evaluation of the human populations and environmental systems that are susceptible to contaminant exposure from the facility.

Existing data from previous investigation/assessments conducted at the Navajo Refinery will be compiled in order to augment the information obtained during the RFI field investigation. Prior to utilization of the historical information an evaluation of data usability will be performed.

This section is organized into:

- Presentation of work plans (sampling strategies) for each SWMU identified for study,

- Presentation of Standard Operating Procedures (SOPs) which are applicable to those methods called for in the individual SWMU work plans, and
- Presentation of a Quality Assurance Program Plan (QAPP) addressing sampling/measurement control and handling practices applicable to all data collection.

3.1 DATA COLLECTION STRATEGY PLAN

This section provides descriptions of each of the Solid Waste Management Units (SWMU) subject to investigation; i.e., Truck Bypass Landfarm, Evaporation Ponds 1, 2, and 3, Three-Mile Ditch/Eagle Creek and North Colony Landfarm Storage Pad. Additionally, sampling strategies for three of the SWMUs are presented which, when implemented, will result in the characterization of the environmental setting and source for each unit. Further characterization of the North Colony Landfarm Storage Pad is not required as detailed in Section 3.1.4.

3.1.1 Truck Bypass Landfarm

As per Part F.1, Task III.D of the Navajo Refinery's Hazardous Waste Permit dated 3/25/88 (Permit), a contamination characterization of the groundwater and air emissions associated with the Truck Bypass Landfarm is required.

3.1.1.1 Description

The Truck Bypass Landfarm is located adjacent to East 5th St. near the central part of the refinery (Figure 3-1). The landfarm is roughly trapezoidal in shape and encompasses about 3 acres. The landfarm began operations in 1980 and is currently used for the disposal of non-hazardous waste.

The underlying soils are Pima soils, which were previously described in Section 2.1. The unit is not in the 100-year floodplain and is surrounded by a dike approximately 1.5 feet above grade. The dike is designed to contain precipitation within the landfarm area, preventing surface-water run-on and run-off.

Non-hazardous solid wastes generated at the refinery are disposed of in the landfarm, including unleaded tank bottoms, separated wastewater, spilled hydrocarbons, and hydrocarbon-contaminated materials. An average of 40 tons per year of tank bottoms, 80 tons per year of separated liquids, and 40 tons per year of hydrocarbon-contaminated materials are reportedly generated by the facility and disposed of in the Truck Bypass Landfarm.

3.1.1.2 Data Collection Strategy

Air sampling (particulate and gaseous) and groundwater sampling of existing wells will be performed to quantify the potential for the release and migration of compounds from the Truck Bypass Landfarm.

3.1.1.2.1 Air Investigation

Air samples will be obtained from two downwind and one upwind location. Samples will be obtained to measure both gaseous releases of volatile organics as well as releases of airborne particulates. Sample stations will be located immediately upwind (1) and immediately downwind (2) of the Truck Bypass Landfarm. The sample locations will be dependent upon wind direction during the sampling event. Procedures for the air sampling activity are included in Section 3.2.4.

3.1.1.2.2 Groundwater Investigation

The shallow aquifer in the vicinity of the Truck Bypass Landfarm will be evaluated to determine if organic or inorganic constituents have migrated from the landfarm treatment zone to the groundwater. This evaluation will include the following activities:

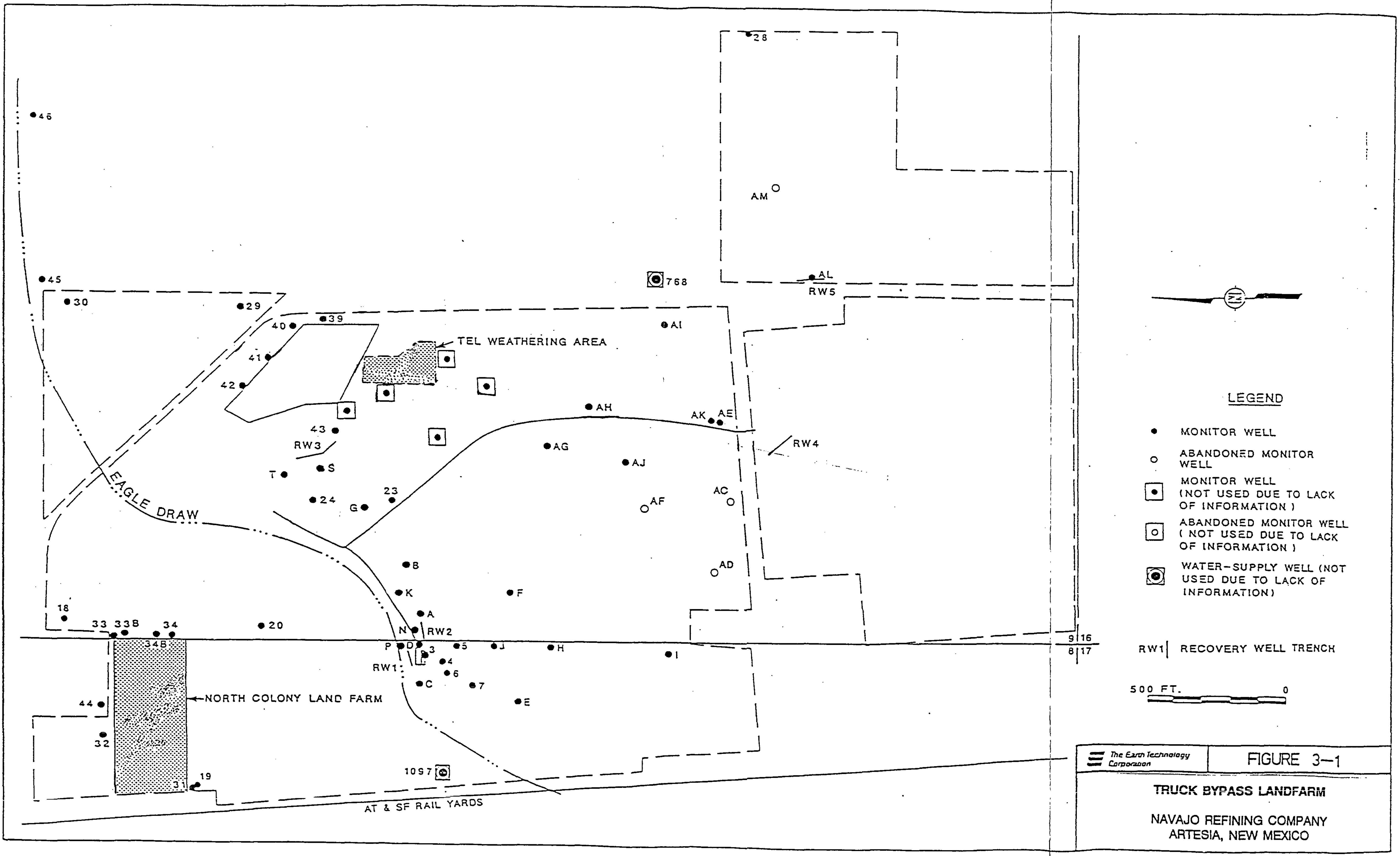


FIGURE 3-1

TRUCK BYPASS LANDFARM

NAVAJO REFINING COMPANY
ARTESIA, NEW MEXICO

- Evaluation of the existing hydrogeologic data associated with the area.
- Measuring water levels in the shallow wells in the vicinity of the landfarm.
- Sampling existing monitor wells.
- Performing aquifer tests to determine in-situ hydraulic conductivity values.

Subsurface investigations have previously been conducted in the vicinity of the Truck Bypass Landfarm. The data from these investigations will be evaluated and incorporated into this investigation.

Groundwater samples will be obtained from monitor wells 43, 29, 39, 41 and 42. Each sample will be analyzed for the hazardous substance list (HSL) volatile and semi-volatile organics and inorganics (see Section 3.3.1) and for total dissolved solids (TDS). Additionally, field measurements of pH, temperature and specific conductance will be performed. Sampling and field measurement procedures are detailed in Section 3.2.1.

Static water level measurements will be obtained from the existing shallow wells in the vicinity of the landfarm. The measurements will be obtained with an electric tape prior to sampling. The data will be utilized to determine the direction of groundwater flow in the vicinity of the landfarm. Procedures for obtaining static water levels are included in Section 3.2.1.1.

Aquifer response tests will be performed at two of the existing monitor wells. (See Section 3.2.1.2.2) Rising-level permeability tests will be accomplished by removing sufficient water from each well, to significantly lower the hydraulic head. Measurements will subsequently be made of the rise in water level vs. time with an electric tape. Utilizing the Hvorslev method, the hydraulic conductivity of the formation will be calculated. This resultant data, combined with the groundwater elevation measurement, will be used to determine the rate of groundwater flow.

3.1.2 Evaporation Ponds No. 1, 2, and 3

A characterization of the groundwater and soils associated with Evaporation Ponds 1, 2 and 3 is required per Navajo Refinery's 3/25/88 Permit.

Note: This investigation encompasses all of the ponds located adjacent to the Pecos River.

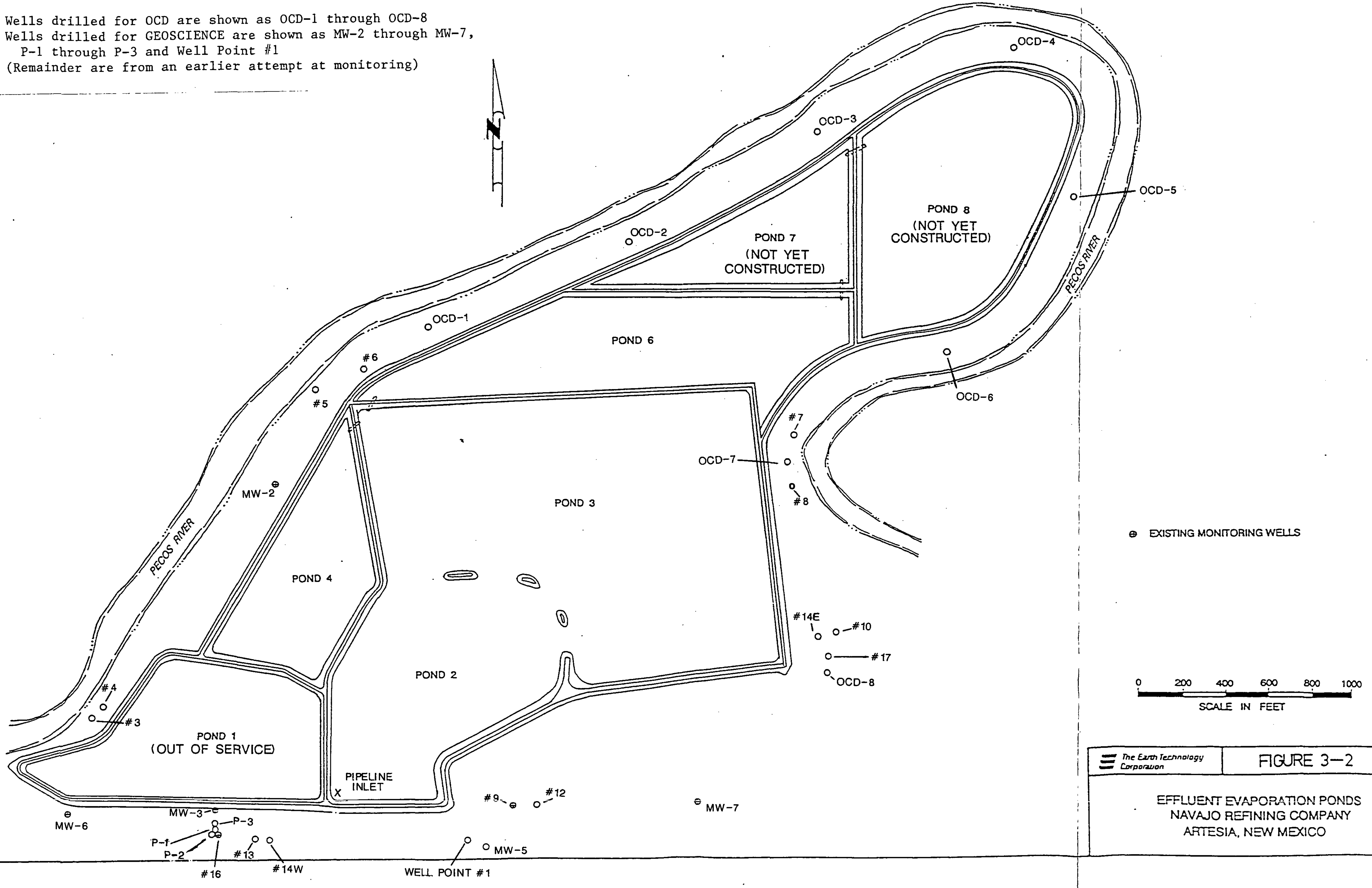
3.1.2.1 Description

The evaporation ponds, which have been used since the 1930's, are located approximately 3 miles east of the Navajo Refinery (Figure 3-2). The area of the ponds is approximately 100 acres and they range in depth from 2 to 5 feet. The ponds are contained by earthen dikes that are 6 to 12 feet high and 30 to 45 feet wide at their base. The ponds are unlined and built on silts, sands, and clays of the Pecos valley alluvium. The ponds are located on a terrace approximately 10 feet above the channel of the Pecos River which is approximately 200 feet north of Pond no. 3. The 100 year floodplain of the Pecos encompasses the pond system.

Pond #2 receives approximately 700,000 gallons of wastewater per day from the refinery wastewater treatment plant, via a 20,000 linear foot enclosed conduit. The conduit, constructed of high-density polyethylene with thermally-welded joints, replaced an open earthen ditch in 1987. Wastewaters typically contain 2,000 to 4,000 mg/l total dissolved solids.

The ponds are in series and are numbered from upstream to downstream as Ponds 2, 3, 4 and 6. Pond #1 which is out of service reportedly contains approximately 80,000 tons of sludge.

Wells drilled for OCD are shown as OCD-1 through OCD-8
Wells drilled for GEOSCIENCE are shown as MW-2 through MW-7,
P-1 through P-3 and Well Point #1
(Remainder are from an earlier attempt at monitoring)



The Earth Technology Corporation

FIGURE 3-2

EFFLUENT EVAPORATION PONDS
NAVAJO REFINING COMPANY
ARTESIA, NEW MEXICO

Samples of sludge from evaporation pond no. 1 were collected and analyzed in 1986. Compounds detected included ppb to ppm levels of benzene, toluene, ethyl benzene, and xylenes, as well as several semi-volatile organic compounds. In addition, arsenic, barium, beryllium, cadmium, chromium, lead, mercury, silver, and zinc were quantified (see Table 3-1).

Several shallow groundwater investigations of the Evaporation Pond area have been conducted resulting in the installation of numerous monitoring wells and piezometers. Previous sampling events have documented ppb levels of volatile and semi-volatile organic compounds.

3.1.2.2 Data Collection Strategy

The surface soils and shallow groundwater in the vicinity of the evaporation ponds will be evaluated to quantify the extent of contaminant migration.

3.1.2.2.1 Groundwater Investigation

The groundwater investigation will include the following activities:

- Evaluation of the existing hydrogeologic and analytical data base.
- Measuring water levels in the existing permanent monitor wells and piezometers.
- Sampling existing monitor wells.
- Performing aquifer tests to determine in-situ hydraulic conductivity values.

The existing data base for the hydrogeologic investigations and sampling events associated with the ponds will be compiled in order to augment the information obtained during the field investigation. Inconsistencies or discrepancies in the historical data will be documented and resolved during the conduct of the RFI.

Groundwater samples will be obtained from wells MW-1 through MW-9 and OCD1 through OCD8 i.e., 17 groundwater samples. Each sample will be analyzed for the HSL volatile and semi-volatile organics and inorganics and for TDS. Additionally, field measurements of pH, temperature and specific conductance will be obtained. Sampling and field measurement procedures are detailed in Section 3.2.1.

Static water level measurements will be obtained from the existing monitor wells and piezometers in the vicinity of the evaporation ponds. The measurements will be taken with an electric tape prior to groundwater sampling. The data will be utilized to determine the direction of groundwater flow in the vicinity of the evaporation pond system. Procedures for obtaining static water levels are included in Section 3.2.1.1.

Aquifer response tests will be performed at four of the existing monitor wells. Rising-level permeability tests will be accomplished as previously described in Section 3.1.1 and detailed in Section 3.2.1.2.2. The resultant data, combined with the groundwater elevation measurements, will be utilized to determine the rate of groundwater flow.

3.1.2.2.2 Surface Soil Investigation

Since there have been reports of the Evaporation Pond overflowing, the surface soils around the ponds will be sampled. Up to 20 surface samples will be obtained from areas impacted by the pond, i.e., stained areas and run-off areas. The majority of the samples will be obtained between the ponds and the primary receptor of concern, i.e., Pecos River. Sample locations will be

Table 3-1
Evaporation Pond Sludge Composition
Navajo Refining Company

Compound	Concentration (ppb)
Volatile Organic Compounds	
Benzene	11.8
Toluene	72.4
Semi-Volatile Organic Compounds	
Anthracene	5,300 - 8,500
Benzo(a)anthracene	4,600 - 13,000
Benzo(b)fluoranthene	9,200
Chrysene	8,500 - 30,000
Fluoranthene	7,800 - 24,000
Naphthalene	4,200 - 8,100
Phenanthrene	74,000 - 120,000
Pyrene	14,000 - 35,000
Fluorene	17,000 - 27,000
o-Cresol	4,900 - 7,700
p,m-Cresols	5,800 - 10,000
4-Nitrophenol	4,400 - 12,000
2,4-Dimethylphenol	4,100
Metals	
Arsenic	10,000 - 15,000
Barium	75,000 - 96,000
Chromium	250,000 - 800,000
Lead	37,000
Zinc	22,900
Mercury	60
Cadmium	460
Beryllium	460
Silver	200

determined in the field, based on visual observation of the site between the ponds and the Pecos River. The procedures for surface soil sampling are included in Section 3.2.3.4.

3.1.3 Three-Mile Ditch/Eagle Creek

A characterization of the sediment, soils and surface water associated with Three Mile Ditch and Eagle Creek is required per Navajo Refinery's 3/25/88 Permit.

3.1.3.1 Description

A 3-mile long unlined earthen ditch (approximately 20,000 linear feet) conveyed wastewater from the refinery to Evaporation Pond No. 1 from the 1930's until 1987. The ditch is 3-4 feet wide and 1-2 feet deep and is bermed along its course to prevent overflow or influx of surface water. The ditch has a slope of approximately 0.004 ft/ft and lies approximately parallel to the path of Eagle Creek. The ditch parallels the natural drainage of Eagle Creek but is not in the creek. Furthermore, the base of the conveyance ditch is approximately 5-10 feet above the creek bed.

In the past, sludge was removed from the bottom of the ditch and placed along the berms. None of the ditch wastes have been removed from the site. 3,400 Tons of sludge reportedly remain in the ditch. Compounds detected in Evaporation Pond sludge samples are expected to be similar to those contained in the Three Mile Ditch sludges (see Table 3-1).

3.1.3.2 Data Collection Strategy

Sampling of the sediments and soils associated with Three Mile Ditch will be performed to determine the characteristics of the residue associated with the ditch and the extent of migration of contaminants from the ditch to the surrounding soils. Sampling will include the sediment, subsurface soils, and surface water. Additionally, due to the proximity of Eagle Creek sediment and surface water sample will be obtained at those locations where overflows are documented or suspected. All samples will be analyzed for the HSL volatile and semi-volatile organics and inorganics.

3.1.3.2.1 Ditch Sediment Sampling

Sediment samples will be obtained form the bottom of the ditch at 1000 foot intervals. Based upon a length of 20,000 linear feet, 21 sediment samples will be obtained. The sediment samples will represent a composite of a transect the width of the ditch at a depth equal to the depth of the sediment or sludges. Depth of sludge will be determined by an on-site geologist. Sediment sampling procedures are included in Section 3.2.3.5.

3.1.3.2.2 Ditch Subsurface Sampling

At each sediment sampling location a subsurface soil sample will be obtained from the bottom (middle) of the ditch to determine the vertical extent of contaminant migration. The sample will be representative of the 0-6" depth interval below the sludge/sediment layer. 21 Subsurface samples will be obtained from the ditch for chemical analysis. Surface sampling procedures are detailed in Section 3.2.3.5.

3.1.3.2.3 Eagle Creek Sediment Sampling

Sediment samples will be obtained form the bottom of Eagle Creek at up to 5 locations including one sample upstream of the refinery. The locations will be chosen to correspond to areas of documented or suspected overflow from the ditch to the creek. Sediment sampling procedures are detailed in Section 3.2.3.5.

3.1.3.2.4 Surface Water Sampling

Surface water samples will be obtained at all sediment sampling locations including the upstream Eagle Creek sample. Consequently, a maximum of 26 surface water samples will be collected. However, since the ditch is not currently in use and the creek is frequently dry, the actual number of water samples may be less. Field measurements of pH, temperature and specific conductance will be obtained for all of the surface water samples. Surface water sampling procedures are included in Section 3.2.3.5.

3.1.4 North Colony Landfarm Storage Pad

The North Colony Landfarm, located on the northwest corner of the Navajo property, comprises approximately 3.7 acres. The unit is rectangular in shape with dimensions of approximately 600 feet by 300 feet. The landfarm has received hazardous and nonhazardous petroleum refinery wastes since 1980.

The Storage Pad associated with the landfarm has been excluded from this RFI work plan based on the following correspondence (see Appendix A):

1) US EPA Region VI Hazardous Waste Permit (Hazardous and Solid Waste Amendments, 1984) Document Dated March 25, 1988.
   Response to Comments HSWA Permit Navajo Refining Company
   Section III. Significant HSWA Comments Received
   Comment #6:/Response #6:

   "...The North Colony Container Storage Area is conditionally removed from the full RFI Workplan requirements in the HSWA based on a documented demonstration by the permittee that is to verify releases which could threaten Human health to the environment have not occurred from this unit."

2) US EPA Region VI Correspondence from Renee V. Holmes, Assistant Regional Counsel to Mr. Ronald McCallum, Chief Judicial Officer US EPA, Washington, D.C., Dated July 15, 1988. Relevant portions of the administrative record concerning Navajo Refining Company's HSWA permit appeal
   Section III. EPA Region VI Appeal Response To: The Requirement to Conduct a Release Verification Study at North Colony Container Storage Area, HSWA Permit Condition F.I., Task III B.

   "On June 23, 1988, Navajo submitted to the EPA the landfarm plot plan, inspection narrative and material safety data sheets. The documents submitted (document), the fact that the surrounding landfarm is subject to 40 CFR, Part 264 groundwater monitoring and the identification of the drums referenced in the RCRA Facility Assessment Report, are sufficient for the EPA to consider HSWA Permit Condition F.1., Task III B conditions as being satisfied."

3.1.5 Summary

The three SWMUs, i.e., Truck Bypass Landfarm, Evaporation Ponds and Eagle Creek/3 Mile Ditch, will be investigated to determine the extent of contaminant migration and potential receptors. The existing data from historical records and files will be compiled and utilized, as appropriate, to augment the RFI field investigation. Based upon correspondence from U.S. EPA, the North Colony Landfarm Storage Pad has been excluded from this RFI.

3.2.1.2 Hydrogeologic Parameters

Hydrologic parameters such as hydraulic conductivity, transmissivity, and similar characteristics will be obtained as necessary from the tests described below or from the extensive hydrogeologic literature available on the site. Soil samples will be analyzed for soil moisture, following ASTM procedures.

3.2.1.2.1 Well Discharge Measurements

Well discharge rate is obtained by measuring the time necessary for the groundwater to fill a container of known volume. This rate will be recorded in the logbook in gallons per minute (gpm).

3.2.1.2.2 Aquifer Tests

Slug tests will be conducted to quantify key hydraulic parameters such as transmissivity and hydraulic conductivity. Slug test will be conducted by Navajo's consultant at selected wells around the Evaporation Ponds and Truck Bypass Landfarm.

The procedures to be followed during the slug test are as follows:

1. The static water level will be measured and recorded.
2. A solid PVC slug (1.75" x 5 ft.) or bailer will be lowered into the well with a nylon rope.
3. The PVC slug will remain in the well until the water level in the well returned to equilibrium.
4. The static water level will be measured and recorded prior to withdrawal of the slug.
5. The slug will be removed and rising water level measurements recorded until the water level returns to the static level.

3.2.2 Drilling Procedures

Note: This RFI Work Plan (Phase I) does not include installation of additional monitoring wells. The inclusion of this section is based on assumption that data acquired during this investigation may require the installation of additional wells.

This section describes the specific procedures to be used when drilling soil borings and monitoring wells at Navajo Refinery. The objectives of the soil and groundwater investigation program at Navajo Refinery are to determine the areal and vertical extent and concentration of contaminants to facilitate future decision making. To meet these objectives, the drilling program will be performed by personnel following recognized protocols, with all steps, measurements, and anomalies permanently recorded in the field logbook.

The specific objectives of the soil boring program are to:

- Define vertical and areal extent of soil contamination
- Provide stratigraphic logs of each site
- Provide a data base for corrective measures study.

3.2 SAMPLING/ANALYSIS STANDARD OPERATING PROCEDURES

This section describes the procedures to be followed by all personnel performing release investigations, sample collection, field measurements, and field tests at Navajo Refinery. The types, locations and number of samples to be collected have been described above in Section 3.1. The procedures presented below are designed to produce:

- Data that are of a consistently high quality, and tailored to the needs and goals of the project,
- Samples that are representative of the media under investigation,
- Samples that are identified, preserved, and transported in a manner that ensures that they remain intact and produce legally valid data, and
- Data that are compatible in both type and quality to that produced by previous investigations.

All drilling, well installation, well purging, sampling methods, and related field activities will conform to State and EPA requirements. Well permits will be acquired from the appropriate agencies, and well logs and construction forms will be filed by Navajo's consultant and its subcontractors.

3.2.1 Hydrogeological Techniques

This subsection reviews procedures for characterizing groundwater releases from the Truck Bypass Landfarm and Evaporation Ponds 1, 2, and 3. These procedures include groundwater elevation measurements and hydrogeologic parameters. Drilling methods and sample collection techniques are described in Sections 3.2.2 and 3.2.3.2.

3.2.1.1 Groundwater Elevation Measurements

The depth to groundwater (static water level) is an important element in determining changes in horizontal and vertical flow gradients. In this investigation, groundwater elevation will be measured prior to each sampling event by the use of an electronic Water Level Indicator (WLI). The WLI, which has marks on it at regular intervals to indicate distance, will be lowered into the well until it contacts the water surface. Measurements will be to the nearest 0.01 foot and will be made from a clearly marked reference point on the top of each well casing; the actual depth to groundwater will be this distance minus the elevation of the well casing above the ground surface. Each well will be sounded twice for depth to water; the variation must be less than 0.1 foot between the two measurements. All equipment likely to contact the groundwater will be constructed of inert material and decontaminated prior to and following use.

A calibration check will be made in the field by taking a water level measurement with the WLI and checking the measurement with a steel tape. The difference between the two measurements should be less than 0.1 foot per 100 feet of depth to water. The results of those calibration checks will be logged in the field logbook.

If problems develop with the WLI, measurements will be made using a calibrated steel tape. The measurement will be accomplished by positioning one end of the tape on the reference point on the top of the well casing and lowering the weighted end into the well until it just makes contact with the surface of the groundwater. The tape is chalked with carpenter's chalk, and the water level is indicated by the wet portion of the chalk. The distance from the top of the well casing to the groundwater will be read directly off the tape to the nearest 0.1 foot.

In the event of surface contamination of the groundwater, a clear acrylic bailer or hydrocarbon:water interface probe will be used to measure the thickness of any hydrophobic contaminant layer.

The objectives of the monitoring well installation program are to:

- Define the vertical and areal extent of groundwater contamination
- Determine the hydrogeologic characteristics of each site
- Develop a data base for corrective measures study
- Supplement the existing monitoring well network.

3.2.2.1 Drilling Method

Drilling will be conducted using the following procedures:

- Drilling will be done with a CME 55 truck mounted rig (or equivalent) with 8" diameter hollow stem augers.
- Drilling through deeper (greater than 40 feet) sand units will be done utilizing rotary wash techniques. Rotary drilling will be dry until the first indication of the water table.
- Soil samples will be collected out front of the auger flight or rotary bit with a Shelby tube or split spoon sampler, in accordance with ASTM D-1587 and D-1586, respectively.
- Soil samples will be collected at 5 foot intervals or changes in lithology.
- Visual observations of chemicals, discoloration, strong odors, and possibly PID or FID readings, will be noted and logged.

Prior to drilling, each site will be inspected and cleared as necessary to allow access by the drilling rig and crews. Public utilities will be advised of the drilling operations and locations beforehand so that activities do not interfere with subsurface communications or utility lines. Proposed field locations of all monitoring wells and soil boreholes will be marked during the planning/mobilization phase of the field investigation. The RFI Program Manager will approve all final drilling locations before drilling is commenced.

A geologist will be present at each operating drill rig to log samples, monitor drilling operations, record depth to water table and other groundwater data, prepare borehole logs and well construction diagrams, and record well installation procedures.

3.2.2.2 Borehole Logs

Soil samples and lithologic descriptions acquired during the drilling of both monitoring wells and soil borings will be recorded on a standard borehole log. The following information will be entered in the log or attached to it:

- Project name and number.
- Borehole location and number.
- Name and initials of borehole logger.
- Description of drilling equipment used, driller's name and company, rig size and manufacturer, and method of drilling.

- Brief description of well construction, filter pack, and seal materials using the well construction log.
- Special problems encountered and their resolution.
- Distinct boundaries between soil types and/or lithologies and depths of occurrences.
- Depth of first-encountered groundwater or hydrocarbons, along with method of hydrocarbon determination.
- Estimated depth interval for each sample taken or classified, length of sampled interval and length of sample recovery, sampler type and size.
- Description of each soil sample taken, according to the methodology in ASTM D2488-84 "Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)." Soil sample descriptions will include the following:
    - Soil type
    - Grain shape
    - Grading of the predominant fraction (poor, moderate, or well)
    - Color (according to Munsell Soil Color Charts)
    - Plasticity of fines (nonplastic, low, medium, high)
    - Odor, if organic or unusual
    - Other: presence of roots or rootholes, mica, gypsum, caliche or other secondary precipitates, or surface coatings on coarse-grained particles
- Sample depths and sample numbers

3.2.2.3 Air Monitoring During Drilling

Ambient air will be monitored during all well drilling and soil boring work using a photoionization (PID) or flame ionization (FID) meter and a portable gas monitor to identify any potentially hazardous toxic or explosive vapors or gases. Readings will be taken at worker chest level and in the borehole at ground level. Air monitoring results will be included in the borehole logs.

3.2.2.4 Drilling Safety and Underground Utility Detection

All regulations, and requirements pertinent to drilling safety will be observed. Prior to drilling, refinery plant engineers and all utility companies will be contacted to determine if any of their lines underlie the site. The locations of any underground lines present will be marked in the field by utility personnel.

3.2.2.5 Equipment Decontamination

All drill rigs and associated equipment will be steam cleaned between boreholes to prevent cross-contamination. Sampling equipment will be decontaminated between samples per Section 3.2.3.1.

3.2.2.6 Well Construction and Development

3.2.2.6.1 Well Construction

All monitoring wells will be set inside a 8-inch borehole. The wells will be constructed of 2-inch I.D. Schedule 40 PVC slotted casing with a 0.01-inch slot size and 2-inch I.D. Schedule 40 PVC risers. The wells are designed to: (1) allow sufficient groundwater flow for well sampling; (2) minimize the passage of formation materials (turbidity); and (3) provide sufficient structural integrity to prevent the collapse of the intake structure. Well casing, filter pack, bentonite seal, and grout are placed from within the borehole. The wellhead is completed with a cement seal and locking surface casing (see Figure 3-3).

Casing/Screens

Well construction will consist of a standard procedure for placing slotted and blank casings into a borehole. A filter pack, bentonite seal, and cement grout are placed sequentially in the annulus between the borehole and casing/screen. The well casings will be constructed of 2-inch inside diameter Schedule 40 PVC casing with a screw cap bottom and top plug. Casing sections will be flush threaded with screw joints.

Each well screen section will be either 5 or 10 feet in length (depending on the zone being investigated) and be machine-slotted with a 0.010-inch spacing. The endings, casings, and screens will be steam cleaned prior to use in order that they are free of contaminants. The screening range will allow for seasonal fluctuation in the water table and allow for the collection of representative groundwater samples. Cleaned materials will be wrapped in plastic sheeting or placed on racks during storage. The geologist on site is responsible for the supervision of all steam cleaning procedures.

Filter Packs

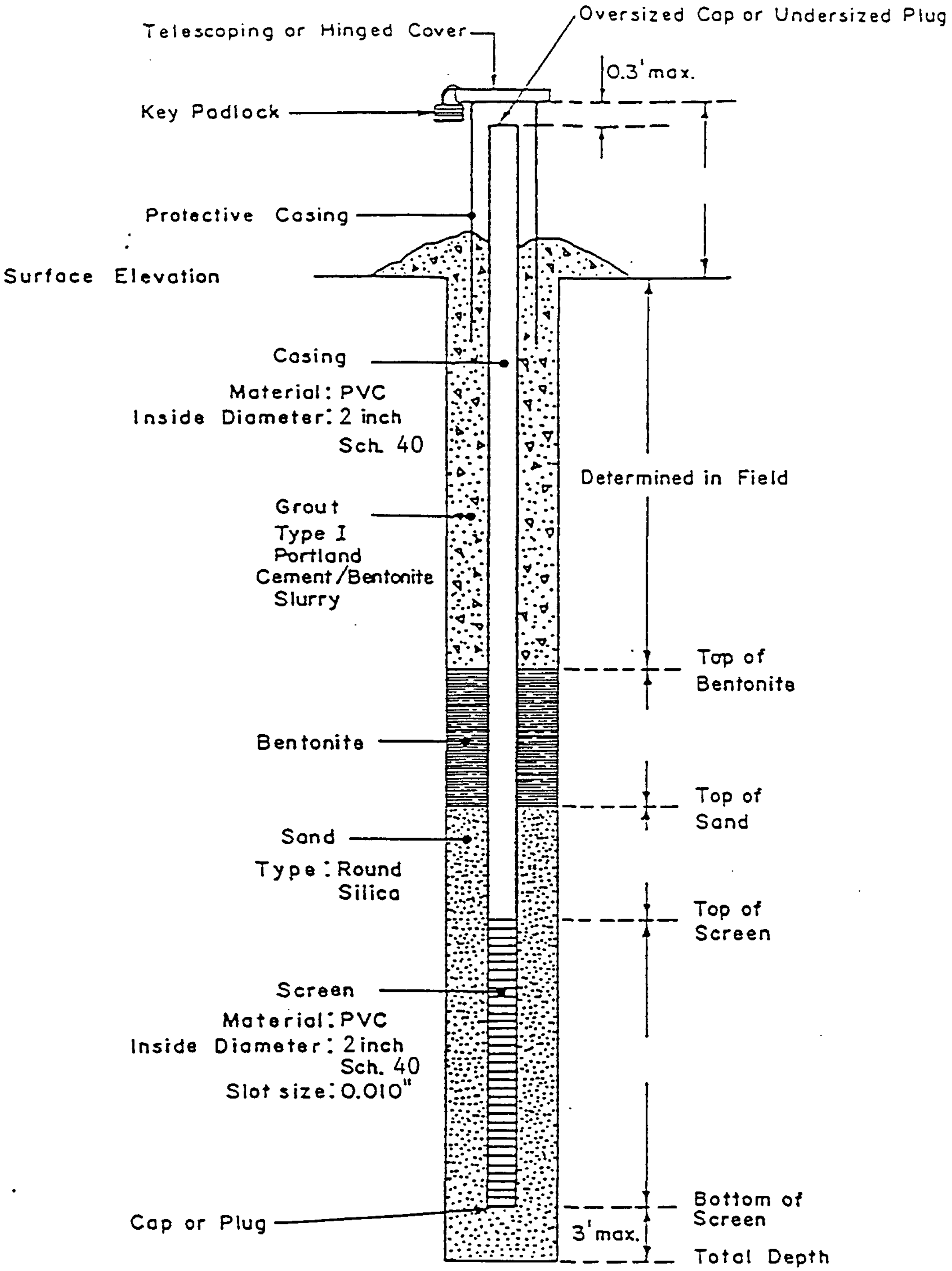
Once the casing is in place, the filter pack will be installed. The filter pack will consist of washed graded sand, and will be poured from the ground surface. The filter pack will be added at a rate to prevent bridging. The sand will be placed directly in the annular space between the casing and the borehole. The filter pack will extend from the bottom of the screen to a minimum of two feet above the screen.

The volume of filter material needed to fill the annular space will be calculated. Bridging of materials has occurred if less than the calculated volume is needed to fill the space. If this occurs, a tremie pipe may be used to break the bridging and correctly fill the space.

The field geologist will record the start and stop times of the sand packing, the depth intervals that sand was packed, the amount of sand used, and any problems that arise. The geologist will also record the type of materials used for packing, including: trade name, source, supplier, and typical grain size distribution.

Bentonite Seal

A bentonite seal will be placed in the annular space above the filter pack to separate the permeable zone from the pack and grout. The bentonite will be poured through a tremie pipe. The bentonite used will either be granular, or a slurry that is thick enough to prevent significant penetration of the underlying gravel pack. Seal thickness will be measured by sounding with a weighted probe on at least three sides of the well immediately after placement of the filter material, and again prior to



The Earth Technology Corporation

FIGURE 3—3

CROSS-SECTION OF A
TYPICAL MONITORING WELL

rehydration of the bentonite. The geologist will record the start and stop times of the bentonite seal emplacement, the interval of the seal, the amount of bentonite that was used, and any problems that arose. The geologist will also record type of bentonite and the supplier.

Cement Grout and Protective Casing

The cement grout mixture placed above the bentonite will be composed of 10:1 weight ratio of Portland cement to bentonite 5-10% high grade containing enough water for a pumpable mix. The mixture will be prepared and blended on-site to produce a thick, lump-free mixture. The grout will be placed at least one-half hour after placement of the bentonite seal, and will extend from the top of the bentonite seal to three feet below the ground surface. If possible, filter pack, bentonite seal, and grout should be slowly placed to avoid bridging of material in the annular space of the borehole.

QA/QC measurements of various well dimensions will be completed for each well unless the depth of the well makes measuring the total length of the screens and casings on the ground surface impractical. QC measurements consist of the distances from the top of the well casing to the:

- o Top of the bentonite seal
- o Top of the filter pad
- o Top of the screen
- o Bottom of the well.

If direct measurements to the screens and casings cannot be made, the number and length of screen and casing sections will be counted individually and summed to determine the total length of screens and casings.

Monitor wells completed above ground will have the cement/bentonite grout placed up to the surface and a 3-5' steel protective casing placed over the well. The protective casing will extend approximately 1-2' below land surface. The casing will have a locking cap to discourage tampering and prevent rainfall or other foreign objects from entering the wellhead. Monitor wells completed flush with the ground surface will be place in a water-tight vault with a protective locking lid. The vault will be placed on top of the cement/bentonite grout.

After the grout has completely set (about 24-72 hours), depressions due to settlement will be filled in by the same grout mixture as previously used. The start and stop times of the cementing, the vertical intervals that were cemented, the amount of cement used, the mix used (gallons of water per bag of cement), any additives to the cement, and any problems that arose during grouting will be recorded on the well construction log.

Well Protection and Marking

The protective casing will be placed over the exposed well casing and seated in a 2-foot by 2-foot by 4-inch concrete surface pad. The pad will slope away from the well. For wells located in traffic areas, a water-tight "christy" box will be set approximately one inch above grade to prevent surface water ponding. The locks on the well caps will either have identical keys, or be keyed for opening with one master key. The lock keys will be turned over to Navajo Refinery personnel after the completion of fieldwork.

Three 3-inch diameter, cement-filled steel guard posts will be installed around each well. The guard posts will be set in individual concrete footings and extend two feet below ground and three feet above ground. The number of each well will be clearly marked on the well protective casing, both in paint and by impact numbering.

Well Completion Form

Final well construction specifications will be recorded on standard boring logs. The well description will consist of construction details by depth from ground surface, and will include details on the screened interval, casing, filter pack, bentonite seal, grout, and well pad.

3.2.2.6.2 Well Development

Well development is the process by which the aquifer's hydraulic conductivity is restored by removing mobile particulates from within and adjacent to newly installed wells. Well development substantially minimizes the amount of fine materials that may accumulate in the well between sampling events, thus reducing the amount of purging needed to obtain a clear sample.

The wells will be developed using a combination of bailing, surging, and pumping. The fine-grained materials accumulated in the well casing will be bailed from the well until the bottom of the well casing can be probed. After bailing, the well will be surged using a surge block to bring in more fine-grained materials from the filter pack. The well will be bailed again to remove fine-grained material until the bottom of the casing can be probed. After the second bailing, a submersible pump will be placed in the well and pumped. During pumping, aquifer parameters consisting of pH, temperature, and electrical conductivity (EC) will be monitored. After the parameters have stabilized (i.e. less than 10% variability between readings) and the water is relatively free of sediment, the pump will be turned off and water-level recovery measurements will be recorded. After one hour, or after the water has reached its static level, recovery measurements will stop and the submersible pump will be removed from the well. Water level recovery measurements will then be recorded.

The specific procedures for surging and bailing are as follows:

- o Measure the total depth of well (TD) and depth to water (DTW).
- o Calculate casing volume (CV) using the formula

  $CV = (TD - DTW)*c$

  where c is the conversion factor for gallons per linear foot based on well diameter

  $c = 0.61$ for 3.8" well

  $c = 0.16$ for 2" well

  Casing volumes will be used to serve as guide for total volume of water to be bailed.
- o Using a surge block, surge by lifting and dropping the bailer through the column of water in the well. Surge the entire screen interval by five-foot sections using approximately 10-20 iterations per section.
- o Monitor the pH, electrical conductivity (EC), temperature, and water clarity in every casing volume removed.

- Monitor pH, EC, temperature and clarity until parameters come to equilibrium (±10% of previous casing volumes).
- The well can be considered developed when the water is clear (i.e., silt and suspended particle content is low), and the water quality parameters have reached equilibrium.

In some cases, overpumping may be used in conjunction with surge bailing to enhance well development. Overpumping is similar to surging and bailing, except that water is removed from the well through the use of a submersible pump lowered into the well. The pumping system must be able to achieve the desired yield at a given depth, and includes:

1. A check valve to prevent water from running back into the well when the pump is shut off
2. A flexible discharge hose
3. A safety cable or rope to ensure that the pump can be removed from the well
4. A flow metering system (a graduated container of a known volume and stopwatch or inline flow meter)
5. An electric generator
6. An ammeter, to measure current and monitor pump performance.

3.2.2.7 Surveying of Sampling Locations

The elevations and locations of all well installations (and sampling points) will be determined by a land surveyor at the close of the fieldwork. The elevation at the top of each new well casing (taken from a notch on the well casing) will be determined to 0.01 foot and be traceable to, and previously established from a survey marker. Both the elevation of the ground surface and the elevation of the top of the well casing will be measured. All surveyed points will be recorded on both site-specific and project maps, as will the locations of benchmarks and permanent markers.

3.2.3 Sample Collection

Described below are the procedures for collecting samples of soil, surface water, groundwater and air. In addition, decontamination of sampling equipment is also described below.

3.2.3.1 Equipment Decontamination

All sampling equipment, including internal components, will be thoroughly decontaminated prior to use and between sample points to prevent cross contamination. The drilling rigs and tools will also be cleaned and decontaminated thoroughly before and after each borehole. At a minimum, drill bits and casings will be steam cleaned and rinsed after each borehole. In some cases, more extensive decontamination procedures will be required if contaminated material remains after steam cleaning. All equipment for soil and water sampling will be washed with detergent and rinsed, first with drinking quality water and then distilled water. Sampling equipment that is not readily decontaminated will be discarded after each use. Discarded materials, including decontamination solutions, will be accumulated and stored in appropriate receptacles for proper disposal.

3.2.3.2 Groundwater Sampling

Groundwater sampling from newly-constructed monitoring wells will not commence until approximately 24-hours after well development to allow groundwater in the well to reach equilibrium conditions. Groundwater samples will be taken first from monitoring wells estimated to be least contaminated and proceed to other wells in the order of increased expected contamination, as estimated from available data and literature.

All equipment used to measure and sample the groundwater (e.g., bailers, pumps, tapes, ropes) will be decontaminated (Section 3.2.3.1) before use in each well to prevent cross contamination between wells. Equipment that is dedicated to a well does not require decontamination after use.

At the beginning of sampling, the groundwater elevation will be measured and recorded as described in Section 3.2.1.1. In addition, the distance from the top of the water surface to the water-sediment interface or well bottom will also be measured to the nearest 0.1 foot to calculate total casing water volume for well sampling.

After these measurements and prior to collection of groundwater samples, each well will be purged of: 1) water in the well, 2) water in the gravel pack, and 3) aquifer water which has been affected by the presence of the well. The well will be purged as described in Section 3.2.2.6.1. A minimum of three well casings/volumes removed to ensure that the sample will be representative of groundwater conditions. The pH, conductivity, and temperature of the groundwater will be monitored during purging at a minimum of 5-gallon intervals. A sample will be collected when these parameters have stabilized. If the well is pumped dry during the evacuation of three borehole volumes of water, the well will be allowed to recover to the original water level elevation before sampling.

The groundwater sample will be taken immediately after pumping is complete or the well has recovered. A stainless steel or teflon bailer will be used to collect water samples. The bailer will be lowered down the casing on a nylon line. Plastic sheeting will be placed around the well-head to ensure that the bailer line does not touch the ground wile raising or lowering the bailer in the well. The sample will be poured from the bailer directly into the sample container.

In a slow-recovering well, samples may have to be taken when less than three casing volumes have been removed. In this case, sampling will proceed when the water quality parameters have stabilized and the deviation from standard procedure will be documented fully in the field logbook.

At each wellhead, conductivity, pH, and temperature will be measured with portable meters before the sample is collected. In some cases, parameter measurement may be possible directly at the well discharge point. Water to be measured will be collected in nalgene or glass transfer bottles that will be rinsed with sample water prior to filling. Meter probes will be rinsed with distilled water before and after each measurement. Results will be recorded in the field logbook.

QC blanks will be collected according to the schedule outlined in Section 3.3.

3.2.3.3 Soil Sampling

Both surface and subsurface soil samples will be collected at Navajo Refinery to determine the areal and vertical extent and concentration of contaminants in soil. The procedures and requirements involved in collecting these samples are described below.

Boreholes (associated with the installation of monitoring wells) for soil samples will be drilled using the same hollow stem auger method as the monitoring wells. Samples will be obtained at five foot intervals from the land surface to 6 inches above the water table using an 18-inch long, 2-inch O.D. split-spoon sampler.

The split-spoon sampling device will be used to collect soil samples as follows:

1. A split-spoon device or sampler will be attached to the sampling rods and lowered into the borehole. The sampler will not be allowed to drop onto the soil being sampled.

2. The hammer will be positioned above and the anvil attached to the top of the sampling rods.

3. The sampler will be placed on the bottom of the boring and a seating blow will be applied by the hammer.

4. The drill rods will be marked in three successive six inch increments so that the advance of the sampler under the impact of the hammer can be easily observed.

5. The sampler will be driven with blows from the 140-pound hammer dropping 30 inches and the number of blows applied in each six-inch interval will be counted, and hammering will continue until the sampler ceases to advance or all 3 six-inch intervals are completed.

6. The number of blows required to effect each six inches of advancement will be recorded. The first six-inch interval is considered to be a seating drive. The sum of the number of blows required for the second and third six inches of penetration is termed the "standard penetration resistance," or the "N-value." If the sampler is driven less than 18 inches, the number of blows for each completed six-inch increment and for each partial increment will be recorded on the boring log. For partial increments, the depth of penetration will be reported to the nearest one inch, in addition to the number of blows. If the sampler advances below the bottom of the boring under the static weight of the drill rods and hammer, this information will be noted on the boring log.

7. The raising and dropping of the 140-pound hammer will be accomplished using either of the following two methods:

   a. By using a trip, automatic, or semi-automatic hammer drop system.

   b. By using a cathead to pull a rope attached to the hammer. The cathead shall be essentially free of rust, oil, or grease. For each hammer blow, a 30-inch lift and drop will be employed by the operator. The operation of pulling and throwing the rope will be performed rhythmically without holding the rope at the top of the stroke.

8. After driving the sampler to the desired depth, it will be brought to the surface and opened. The percent recovery or the length of sample recovered will be recorded. The composition, color, stratification, and condition of the soil samples will be described in the boring log.

The samples will be collected in three 6-inch long, removable brass liner rings contained within the sampler assembly. The first two liners contain samples for laboratory analysis and will be sealed on the ends with aluminum foil and plastic end caps. The wrapped liners will then be wrapped with aluminum foil. The third sample-filled liner will be used to determine soil lithology. Soil samples not retained for laboratory analysis and samples used for field VOC measurements will be placed with soil cuttings produced during drilling.

QC samples will be collected as described in Section 3.3.

3.2.3.4 Surface Soil Sampling

Surface soil samples along Three-Mile Ditch/Eagle Creek and samples of wastes in the Truck Bypass Landfarm will be done at locations described in Section 3.1. These sampling techniques are described below.

Pre-sampling set-up procedures are described in Step 1. Steps for sample collection and compositing of waste or soil are explained in Steps 2 and 3, respectively. Transfer of composite samples to the sample containers is described in Steps 4 & 5.

1. Pre-Sampling Set-Up: Prepare for sampling by placing plastic sheeting with sand bags (or cinder blocks) near the sample collection areas (not directly beside them) but away from the unloading zone. Place the sampling equipment on the sheet. Be careful not to soil the plastic sheet or sampling equipment with dirt or wastes near the sample collection areas.

2. Grab (Core) Sampling of Waste or Surface Soil: If the soil or waste is fairly dry, use a stainless steel coring device; if the mixture is very moist or sludge-like, use a stainless steel scoop. Place enough sample in the sample container or polyethylene pail and mix thoroughly with the scoop.

3. Composite Sampling of Waste or Soil Samples: Equal amounts of samples should be collected from the sampling points. Combine and mix thoroughly the samples in the pail with the scoop and transfer the composite sample to the sample containers as described in Steps 4 & 5.

4. Organic Volatiles/Semi-Volatiles: Using the scoop, carefully mix the materials in the pail and quickly pack them into sample container so as to avoid air spaces. Fill the container to overflowing and screw on lid. Wrap and seal lid with clear tape. Apply identification labels to container and cover with clear tape.

5. Pesticides/PCBs/Herbicides/Metals/Non-Conventionals: Using the scoop, thoroughly mix soil or waste samples in sample pail and fill sample containers. Fill each sample container to within 1/2 inch of top. This provides room for expansion should there be any gas production between sample collection and when container is open at the laboratory. Air spaces are of no concern. Wrap and seal the lid with clear tape. Apply identification labels to container and cover with clear tape.

3.2.3.5 Surface Water/Sediment Sampling Methods

The following procedures outline steps taken to collect surface water and stream sediments located along the Three-Mile Ditch/Eagle Creek.

3.2.3.5.1 Surface Water Sampling

1. Upon arrival at the location, the area will be surveyed to determine the best possible sample grab locations. Notes will be recorded of any odors, discoloration, stressed vegetation or other apparent features.

2. Samples will be obtained by immersing a sample container one-half way between the stream bottom and water surface. Samples will be collected in glass or polyethylene bottles, as required, from a position where steady flow is observed. Sample parameters will be collected in the following order:

a. Volatile Organics

b. Field measurements (pH, temperature, specific conductance)

c. Semi-volatile organics

d. Dissolved metals

e. Total metals.

3. Field measurements of temperature, pH, specific conductance, and dissolved oxygen will be performed immediately after all measurements will be recorded in field notebooks.

4. Flow measurements will be recorded with a calibrated bucket and stopwatch, or where flow is diffuse, by general observation. Flow measurements will be used to determine mass loading characteristics.

5. Sample containers will be packed in ice for transport to the staging and shipping area. Samples requiring preservation with acids or bases will be checked with pH paper. Dissolved metals samples requiring filtration will be filtered into an unpreserved sample container (i.e., no preservative solutions added) through a 45 micron membrane. The sample will then be preserved to a pH of 2, with reagent grade HNO_3 and an aliquot checked with pH paper.

6. Samples will be handled, packaged, and shipped according to procedures described in Section 3.3. Samples will be cooled to 4 C for transport to the analytical laboratory. Shipping and handling practices will be in accordance with USDOT regulations.

7. All sampling equipment (bailers and leaders) and applicable purging equipment (submersible pumps), will be decontaminated according to procedures outline in Section 3.2.3.1. Care will be taken to avoid contact of the foil wrapped sampling equipment with the ground. Plastic will be placed on the ground at sample points and staging.

8. During sampling activity, the sampling team will note the following in the field notebook:

o Date, time, location and weather

o Flow rate of surface water (3 measurements)

o Diagram of water body with sample access points

o Procedures of sampling water

o Physical characteristics of water

o Field measurements (temperature, pH, specific conductance)

3.2.3.5.2 Sediment Sampling

Sediment sampling will be attempted beneath every surface water sampling location (or in the case of dry conditions in the Three Mile Ditch/Eagle Creek area, a location designated in Section 3.1).

1. Sediment samples will be collected beneath the area used to collect a surface water sample. To avoid sediment disturbance, and introducing sediments into the surface water sample, sediments will be collected after surface water sampling.

2. If water depth permits, sediment samples will be collected by grab methods directly into the sample container. At prohibitive depths samples will be collected with a stainless steel clam shell sampler, hand auger, or shovel.

3. Samples will be packed in ice for transport to the sample staging and shipping area. Samples will be handled and shipped in accordance with USDOT regulations under 49 CFR.

4. Sampling instruments will be deconned using the method described in Section 3.2.3.1.

5. During sampling activity, the sampling team will note the following in the dedicated field book.

   o Date, time, location and weather

   o Depth of stream, seep, etc. at sample point

   o Diagram of sampling area and points

   o Visual identification of sediment using the Unified Soil Classification System

   o Sample identification number

   o Decontamination procedures for equipment

3.2.4 Air Monitoring

3.2.4.1 Monitoring for Total Suspended Particulates

The migration of total suspended particulate matter from the Navajo Refinery Facility will be determined utilizing sampling and analysis methods outlined in Appendix B to Part 50 of Title 40 of the Code of Federal Regulations (Reference Method for the Determination of Suspended Particulate Matter in the Atmosphere [High-Volume Method]).

3.2.4.1.1 Sampling Program Description

After the initial meteorological observations are made to determine prevailing conditions, two samples will be placed downwind of the site while a third (background sampler) will be placed upwind.

Each sampler will be elevated to a height of five feet (breathing zone) above the ground surface. If required, portable gasoline generators will be used to power the samplers. The generators will be located a minimum of 50 feet downwind to reduce the possibility of introduction of contamination from engine exhaust.

Samplers will be calibrated and operated for a twenty-four hour collection periods. Sample collection media (filters) will be handled and analyzed and results calculated following procedures outlined in Appendix B.

3.2.4.2 Qualitative/Quantitative Monitoring for Volatile Organics

Air samples will be collected from upwind and downwind locations and quantified for the target compounds on Table 3-2. The sampling will be performed to determine the impact of gaseous emissions from the Truck Bypass Landfarm on ambient air quality.

The quality assurance objectives for measurement data in terms of precision, accuracy, and completeness are presented in Table 3-3. The measurements will be made such that the results are representative of the sample matrix being characterized. All analytical results will be reported in ug/L corrected to standard conditions of 25°C and 760 mm mercury.

3.2.4.2.1 Sampling and Analytical Methodology

The ambient air organic vapor field sampling and analytical characterization will be performed utilizing the principles enumerated in Method TO1 "Method for the Determination of Volatile Organic Compounds in Ambient Air Using Tenax (Registered Trademark) Adsorption and Gas Chromatography/Mass Spectrometry (GC/MS)" (EPA-600/4-84-041, U. S. Environmental Protection Agency, Environmental Monitoring Systems Laboratory, Research Triangle Park, N.C., April 1984).

Organic vapors in ambient air will be cumulatively sampled on the porous polymer Tenax GC and thermally dissolved into a capillary column low resolution gas chromatograph/mass spectrometer for qualitative and quantitative characterization.

The principal components of the recommended low-volume sampling train, displayed in Figure 3-4, consist of the glass fiber prefilter, sampling cartridges, sampling manifold for accommodating duplicate sampling cartridges, a diaphragm pump, a battery-operated power supply, flow control, flow monitor, associated transfer lines, and sampling stand.

This sampling train is simple, inexpensive, compact, rugged, and sufficiently portable to be readily transported to relatively inaccessible sites or to be moved to follow shifts in wind direction during a sampling episode. Such portability is highly desirable for sampling to characterize peak emission concentration levels.

The glass fiber prefilter is optional and its use in the field will be determined in terms of professional assessment of the prevailing atomospheric conditions.

The individual sampling cartridge consists of approximately 2.0 g of 35/60 mesh Tenax GC porous polymer retained in a glass tube with silanized glass wool. The configuration and dimensions of the sampling cartridge are presented in Figure 3-5.

A 0.25 inch brass Ultra-Torr (Registered Trademark) tee part no. 3 (Cajon Co., Solon, Ohio 44139) with Vitron O-rings constitutes a convenient manifold to permit simultaneous collection of duplicate samples. The O-ring seal to the sampling cartridge body is convenient to make in the field and precludes leakage of air into the sampling train during sample collection and permits monitoring of the flow with the rotameter.

A 0.25 inch (o.d.) by 6 inch length of standard wall stainless steel inserted in the leg of the tee permits convenient attachment of the manifold to the flexible transfer line from the pump.

The duplicate sample collection provides a backup sample for analysis should a problem arise during the analytical characterization or a quality control sample to appraise the overall sampling and analysis precision.

TABLE 3-2

TARGET VOLATILE ORGANIC COMPOUNDS

Navajo Refining Company

Benzene
Toluene
Ethyl Benzene
Xylene(s)
Cumene
n-Heptane
1-Heptene

Chloroform
Carbon Tetrachloride
1,2-Dichlorethane
1,1,1-Trichloroethane
Tecrachlorethylene
1,2-Dichloropropane
1,3-Dichloropropane
Chlorobenzene
Bromoform
Ethylene Dibromide
Bromobenzene

TABLE 3-3
PRECISION, ACCURACY AND COMPLETENESS OBJECTIVES

Navajo Refining Company

Measurement Parameters	Organic Vapors presented in Table 2-2
Methods	Thermal Desorption Capillary Column Gas Chromatography Low Resolution Mass Spectrometry
Reference	Method TO1, Method for the Determination of Volatile Organic Compounds in Ambient Air Using Tenax Adsorption and Gas *Chromatograph/Mass Spectrometry* (GC/MS), EPA-600/4-84-041, U.S. Environmental Protection Agency, Environmental Monitoring Systems Laboratory, Research Triangle Park, NC, April 1984
Experimental Conditions	Spiked Laboratory Control Samples
Precision Relative Percent Difference	Thirty (30%) Percent
Accuracy Percent Recovery	Fifty (50%) Percent to One Hundred Fifty (150%) Percent
Completeness	Ninety (90%) Percent

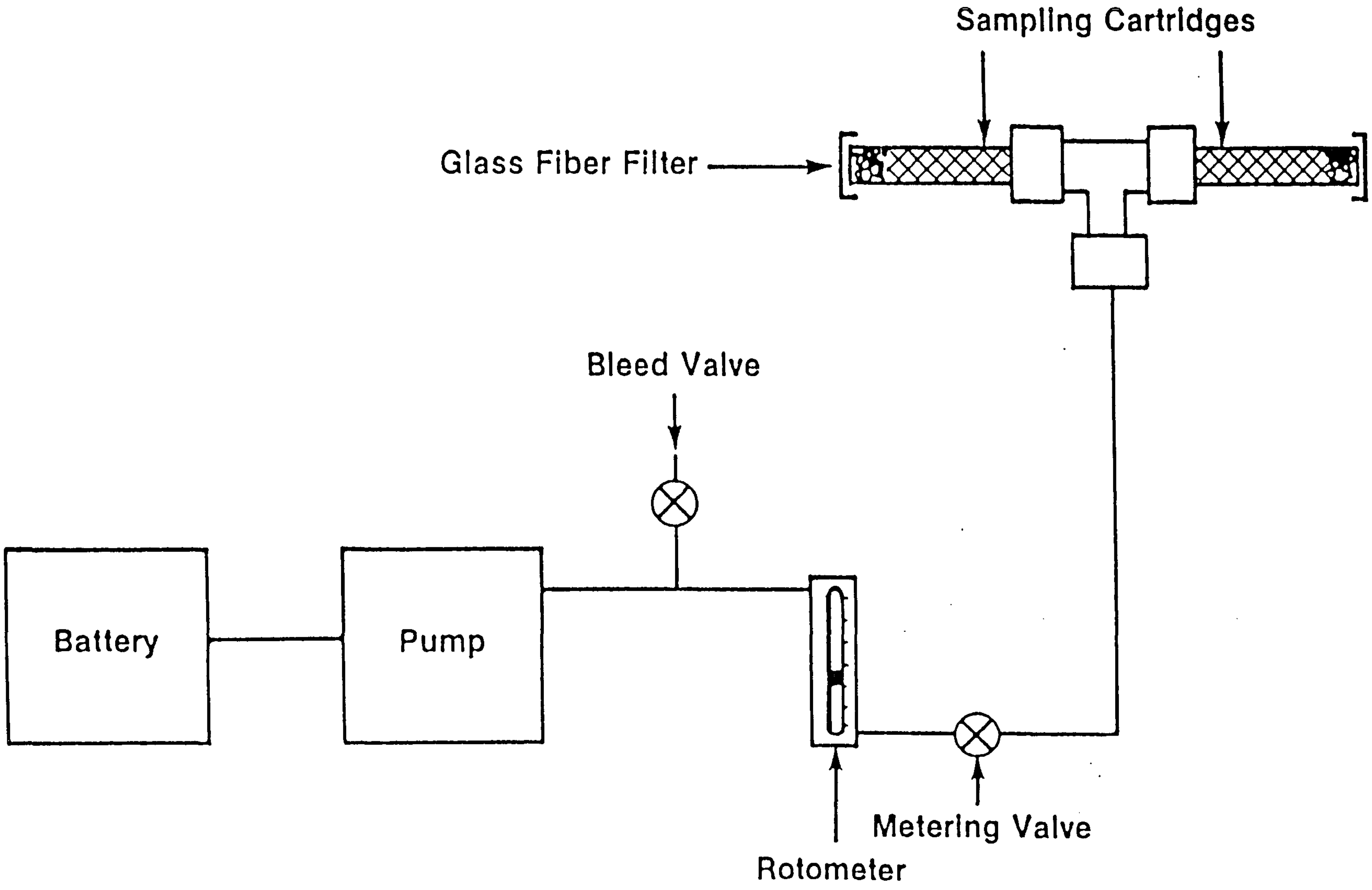


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FIGURE 3-4

SAMPLING TRAIN - SCHEMATIC

NAVAJO REFINING COMPANY
ARTESIA, NEW MEXICO

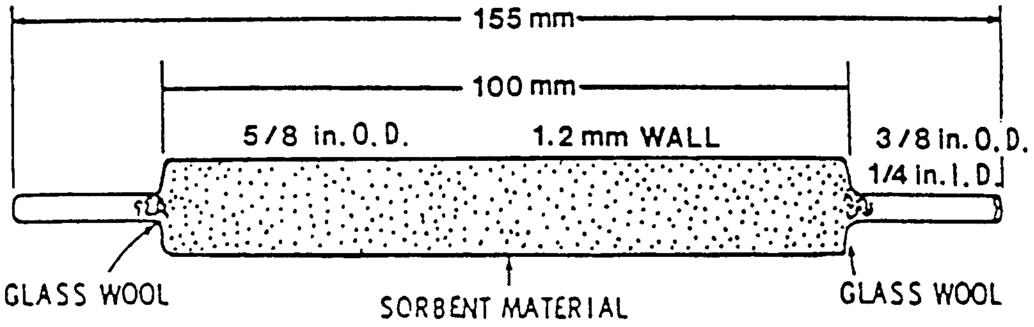

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FIGURE 3-5

SORBENT SAMPLING CARTRIDGE

NAVAJO REFINING COMPANY
ARTESIA, NEW MEXICO

The low volume sampling rates appropriate for this investigation, i.e., 300 ml/min to 1000 ml/min, can be maintained by conventional personnel monitoring pumps routinely employed for industrial hygiene studies. These diaphragm pumps are relatively maintenance free and available from a variety of manufacturers. Representative pumps includes such pumps as the Bendix Super Sampler BDX44 Pump or the MSA Portable Pump Model S.

The Bendix Super Sampler BDX44 Pump (Bendix Corporation, Lewisburg, West Virginia 24901) is a compact, double diaphragm pump with flow regulator/pulsation dampener, bypass valve, rotameter for monitoring sampling rate, stroke counter providing approximate operating time, and rechargeable nickel-cadmium battery contained in a single unit.

The MSA Portable Pump Model S (Mine Safety Appliance Co., Pittsburgh, PA 15208) is a compact diaphragm pump with flow control and bypass valves, rotameter for monitoring the sampling rate, and rechargeable nickel-cadmium battery contained in a single unit. The sampling rate through the sampling cartridges is readily adjustable using the metering and bleed values. However, no timing or total volume sampling readout is provided with this unit.

Personnel monitoring pumps are generally powered in the field by nickel-cadmium rechargeable batteries or AC power. The light weight of the nickel-cadmium rechargeable batteries is essential for worker exposure monitoring surveys where the sampling train is mounted on the individual's body to accompany him during his daily work activities. With fixed sampling stations to characterize the general workplace environment, AC power is often employed. However, due to the lack of accessibility of AC power at most field sites and the length of time required to fully recharge the nickel-cadmium batteries, sealed 6 volt wet cell batteries will be utilized as the secondary power source.

Flow control is adjusted and maintained with a critical orifice upstream from the rotameter and a bleed valve downstream from the rotameter as indicated in Figure 3-6. Adjustment of the sampling rate with the bleed valve downstream from the rotameter in conjunction with the critical orifice permits the system to be operated under conditions of lower pressure drop across the sampling cartridge. The sampling flow rate is monitored in the field with a rotameter downstream from the sampling cartridge and critical orifice but upstream from the bleed valve. The rotameter is calibrated in the laboratory prior to the field sampling and/or verified in the field at the time of sample collection using a soap bubble flowmeter to measure the flow through the individual sampling cartridges.

The transfer line is a 2 meter length of thick wall amber tubing attached to the stainless steel tube from the sampling manifold and to the sample inlet fitting on the pump unit with hose clamps.

The sampling stand consists of a 0.5 in x 2 meter length of aluminum rod and a laboratory clamp to support the sampling manifold with sampling cartridges and prefilters. The 2 meter support consists of threaded lengths of rods. The first length of the rod is driven into the ground to a sufficient depth to support the sampling manifold during any period of unattended operation. The remaining lengths are hand threaded onto the one in the ground.

The sectional feature of the support stand permits convenient transport of an entire sampling train to the field site in an individual compartmentalized field kit of reasonable dimensions.

The typical field set-up of the sampling train to collect duplicate samples is indicated in Figure 3. Air samples are collected 1.5 meters above ground level with the sampling cartridges parallel to the ground and perpendicular to the direction of the prevailing wind. Positioning the sampling manifold 1.5 meters above ground level provides minimum opportunity for the collection of particulate due to normal activity at the sample site and insures against disturbance by small animals when the field sampler must leave the site to setup or check the operation of another sampling train. Orienting both

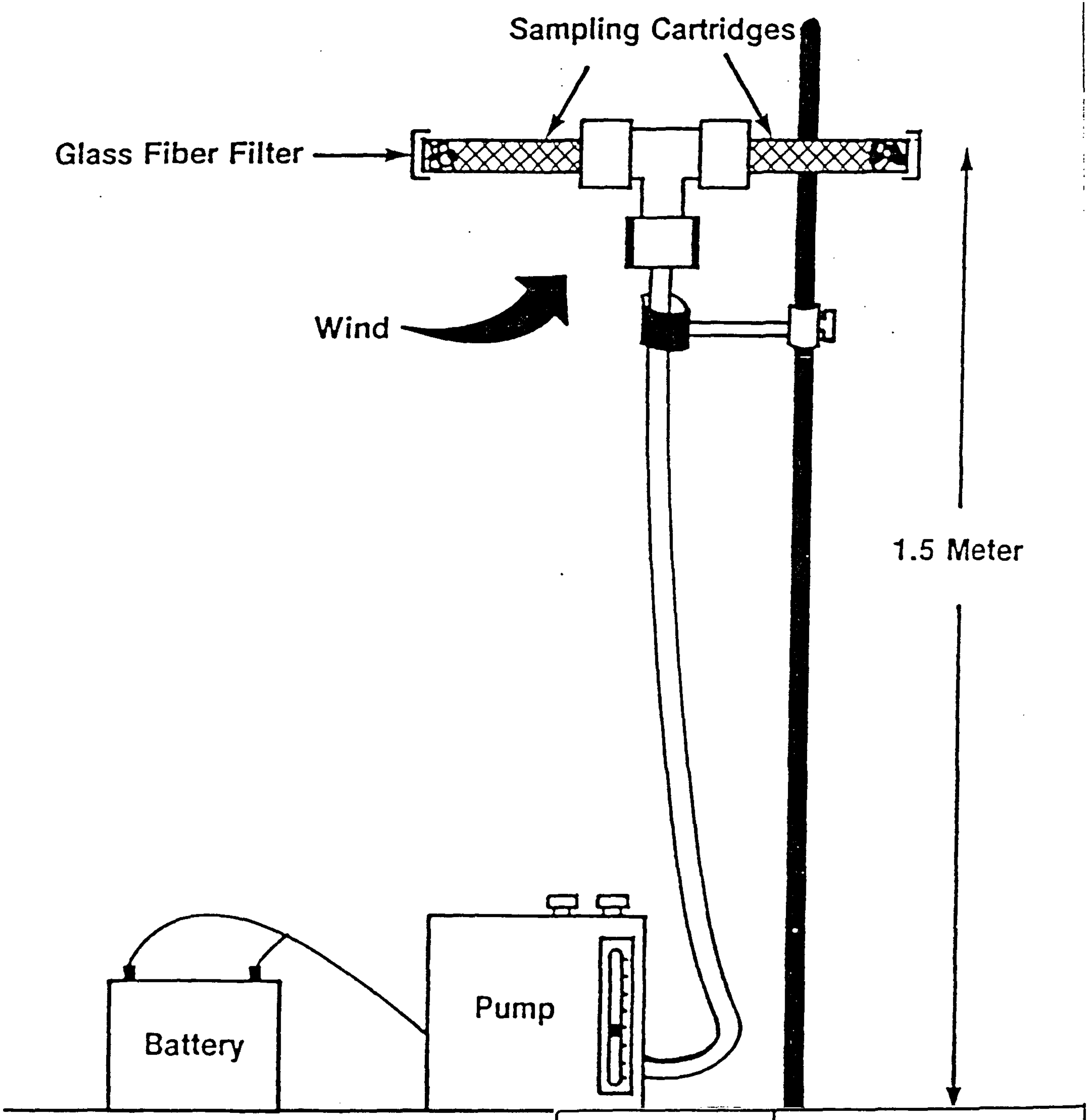

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FIGURE 3-6

SAMPLING TRAIN - FIELD SET UP

NAVAJO REFINING COMPANY
ARTESIA, NEW MEXICO

sampling cartridges parallel to the ground and perpendicular to the direction of the prevailing wind provides identical sampling characteristics for both cartridges.

3.2.4.2.2 Calibration Procedure and Frequency

The field sampling flow rates will be calibrated in the field daily with a soap bubble flow meter.

The GC/MS will be calibrated initially at three concentration levels and the calibration will be verified daily with a midpoint continuing calibration standard.

3.2.4.2.3 Data Reduction and Reporting

GC/MS reduction will be performed utilizing the technique of extracted ion current profiles and characteristic masses, i.e., mass to charge values, for each target compound.

Concentration calculations will be performed in terms of an internal standard added to the sample cartridge at the time of the analysis the sample collection volumes will be corrected to 25°C and 760 mm mercury and the concentrations will be reported in terms of ug/L.

Library matches for non-target tentatively identified compounds will be manually reviewed by an experienced mass spectroscopist prior to making the final tentative identification.

3.2.4.2.4 Internal Quality Control Checks

The field sampling quality control per each individual field sampling episode will entail simultaneous parallel collection of all field samples in duplicate, one simultaneous collection of parallel samples at different flow rates, one serial sample collection, and a trip blank.

The single shot aspect of the thermal desorption GC/MS analysis dictates that a duplicate backup cartridge be available should the first analysis attempt fail.

The simultaneous collection of parallel samples at different flow rates will serve to characterize the collection efficiency and/or capacity.

The serial sample collection will serve to characterize the capacity in terms of the breakthrough for the primary, i.e., front, sampling cartridge.

The trip blank will serve to characterize contamination introduced during transport of the sampling cartridges to and from the laboratory. The analytical quality control per batch of field samples analyzed will entail mass spectrometer tuning, evaluation of the chromatography, analysis of a method blank and/or a laboratory control blank, and internal standard quantitation.

The mass spectrometer will be tuned to pass the current U.S. Environmental Protection Agency Contract Laboratory Program performance criteria for bromofluorobenzene (BFB) or decafluorotriphenylphosphine (DFTPP).

Professional judgment will be employed to evaluate the acceptability of the chromatographic peak shape.

A method blank and/or a laboratory control blank will be analyzed each day that field samples are analyzed. The method blank and/or the laboratory control blank will serve to demonstrate that the GC/MS system is free of significant contamination.

The laboratory control blank will serve to identify contamination potentially present on the cartridges prior to transport to the field for sample collection or potentially introduced during storage of the field samples in the laboratory prior to analysis.

The absolute response of the internal standard will be monitored during the course of the day's analysis of calibration standards, blanks, and field samples.

The accuracy of the analytical method will be determined in terms of the average of duplicate determinations of the percent recovery of organic compounds spiked onto the cartridges in the laboratory.

The precision of the analytical method will be determined in terms of the relative percent difference of the duplicate determinations of the percent recovery of organic compounds spiked onto cartridges in the laboratory.

3.2.4.2.5 Specific Routine Procedures Used to Assess Data Precision Accuracy and Completeness

The precision of the method is expressed in terms of the relative percent differences (RPD) for each component are calculated as follows:

$$RPD = \frac{\backslash D_1 - D_2 \backslash \times 100}{(D_1 + D_2)/2}$$

where RPD, D_1, and D_2 are Relative Percent Difference, First Sample Value, and Second Sample Value (duplicate), respectively.

The precision will be reported as noncalculable should the parameter value for either the first sample value or the second sample value be below the detection limits.

The accuracy of the method is expressed as the percent recovery

$$100\ (SSR - SR)/SA$$

where SSR, SR, and SA are spiked sample result, sample result, and spike added, respectively.

The completeness will be calculated as the ratio of the number of samples analyzed and providing valid data to the total number of field samples submitted for analysis.

3.3 QUALITY ASSURANCE PROJECT PLAN

3.3.1 Purpose and Scope

The purpose of this Quality Assurance Project Plan (QAPP) is to document the quality assurance requirements applicable to the work conducted by Navajo Refining Company and its subcontractors during the conduct of the facility investigation. This plan describes the requirements for organizing, planning, performing, reviewing and documenting activities which affect the quality of work conducted on the Navajo Refining site by personnel, consultants and subcontractors of Navajo. This plan is intended to incorporate the requirements of EPA. The scope of this plan includes field sampling, analytical testing, equipment maintenance, data reduction and reporting.

The project QAPP as presented herein applies to all work performed by Navajo Refining and subcontractors whether performed at the site or in any office or laboratory.

All sampling and laboratory analyses will be conducted in accordance with protocols and guidelines set forth in this document. Specifically, this includes the following areas:

- Preparation of sample containers.
- Sampling procedures.
- Sample preservation.
- Sample custody.
- Sample holding time.
- Analytical procedures.
- Calibration procedures and frequency.
- Data reduction validation.
- Internal QC checks.

Table 3-4 is a summary of all anticipated sampling and analyses for the anticipated RFI activities at the Navajo Refining site. The blanks, duplicates and spike samples required are summarized in Table 3-5. Table 3-6 is a listing of the HSL volatile and semi-volatile organic and inorganic compounds.

3.3.2 Project Organization and Responsibility

3.3.2.1 Overall Responsibility

Navajo Refining's designated Program Manager is responsible for the overall management of the investigation. Although subcontractors may be used for some project tasks, Navajo assumes full responsibility for ensuring that their actions comply with all aspects of the approved Work Plan (e.g., S.O.P.s, Health and Safety Plan and Quality Assurance Project Plan).

The Program Manager will be Navajo's prime point of contact with the U.S. EPA and will have responsibility for technical, financial and scheduling matters. Furthermore, the Program Manager will coordinate the deployment of corporate resources required to successfully complete the project. In the Program Manager's absence, a designated representative, will act as the point of contact.

TABLE 3-4
ANALYTICAL SUMMARY
NAVAJO REFINING RFI

SWMU	MATRIX	EST. QUANTITY (a)	PARAMETERS
TRUCK BYPASS LANDFARM	AIR	3	- TARGET VOLATILE ORGANICS (EPA METHOD T01)
		3	- TOTAL SUSPENDED PARTICULATES
	GROUNDWATER	5	- VOLATILE ORGANICS (EPA 8240), SEMI-VOLATILE ORGANICS (EPA 8270), INORGANICS (EPA 7000 SERIES)
		5	- FIELD DETERMINATIONS: pH, TEMPERATURE, SPECIFIC CONDUCTANCE
EAGLE CREEK/ 3 MILE CREEK	SURFACE WATER	26	- VOLATILE ORGANICS (EPA 8240), SEMI-VOLATILE ORGANICS (EPA 8270, INORGANICS (EPA 7000 SERIES)
		26	- FIELD DETERMINATIONS: pH, TEMPERATURE, SPECIFIC CONDUCTANCE
	SEDIMENT/SOIL	26	- VOLATILE ORGANICS (EPA 8240), SEMI-VOLATILE ORGANICS (EPA 8270, INORGANICS (EPA 7000 SERIES)
		26	- VISUAL CLASSIFICATION
EVAPORATION PONDS	SOIL/SEDIMENT	20	- VOLATILE ORGANICS (EPA 8240), SEMI-VOLATILE ORGANICS (EPA 8270, INORGANICS (EPA 7000 SERIES)
		20	- VISUAL CLASSIFICATION
	GROUNDWATER	17	- VOLATILE ORGANICS (EPA 8240), SEMI-VOLATILE ORGANICS (EPA 8270, INORGANICS (EPA 7000 SERIES), TDS (EPA 160.1)
		17	- FIELD DETERMINATIONS: pH, TEMPERATURE, SPECIFIC CONDUCTANCE

A. PROJECTED QUANTITIES; ACTUAL NUMBER OF SAMPLES MAY CHANGE BASED UPON FIELD CONDITIONS.

TABLE 3-5
SUMMARY OF BLANKS AND DUPLICATES
NAVAJO REFINING RFI

SWMU	MATRIX (a)	DUPLICATES (b)	BLANKS (c)	SPIKES (b)
TRUCK BYPASS LANDFARM	AIR-VOLATILES (3)	1	1	1
	AIR-PARTICULATES (3)	1	1	NA
	GROUNDWATER (5)	2	2	2
EAGLE CREEK/3 MILE CREEK	SURFACE WATER (26)	2	2	2
	SEDIMENT/SOIL (26)	2	2	2
EVAPORATION PONDS	SOIL/SEDIMENT (20)	1	1	1
	GROUNDWATER (17)	1	1	1

a. ESTIMATED TOTAL VOLUME OF SAMPLES, EXCLUDING BLANKS, DUPLICATES AND SPIKES, SHOWN IN PARENTHESIS.

b. ADDITIONAL SAMPLE VOLUME WILL BE OBTAINED FOR THE REQUIRED QC ANALYSIS.

c. TRIP BLANKS. ADDITIONAL EQUIPMENT BLANKS WILL BE COLLECTED AS APPROPRIATE.

TABLE 3-6
HSL ANALYTICAL PARAMETERS
Navajo Refining Company

VOLATILES	CAS NUMBER
1. Chloromethane	74-87-3
2. Bromomethane	74-83-9
3. Vinyl Chloride	75-01-4
4. Chlorethane	75-00-3
5. Methylene Chloride	75-09-2
6. Acetone	67-64-1
7. Carbon Disulfide	75-15-0
8. 1,1-Dichloroethene	75-35-4
9. 1,1-Dichloroethane	75-35-3
10. trans-1,2-Dichlorethene	156-60-5
11. Chloroform	67-66-3
12. 1,2-Dichloroethane	107-06-2
13. 2-Butanone	78-93-3
14. 1,1,1-Trichloroethane	71-55-6
15. Carbon Tetrachloride	56-23-5
16. Vinyl Acetate	108-05-4
17. Bromodichloromethane	75-27-4
18. 1,1,2,2-Tetrachlorethane	79-34-5
19. 1,2-Dichloropropane	78-87-5
20. trans-1,3-Dichloropropene	10061-02-6
21. Trichloroethene	79-01-6
22. Dibromochloromethane	124-48-1
23. 1,1,2-Trichloroethane	79-00-5
24. Benzene	71-43-2
25. cis-1,3-Dichloropropene	10061-01-5
26. 2-Chloroethyl Vinyl Ether	110-75-8
27. Bromoform	75-25-2
28. 2-Hexanone	591-78-6
29. 4-Methyl-2-pentanone	108-10-1
30. Tetrachlorethene	127-18-4
31. Toluene	108-88-3
32. Chlorobenzene	108-90-7
33. Ethyl Benzene	100-41-4
34. Styrene	100-42-5
35. Total Xylenes	
36. Phenol	108-95-2
37. bis(2-Chloroethyl) ether	111-44-4
38. 2-Chlorophenol	95-57-8

TABLE 3-6 (cont.)
HSL ANALYTICAL PARAMETERS
Navajo Refining Company

VOLATILES	CAS NUMBER
39. 1,3-Dichlorobenzene	541-73-1
40. 1,4-Dichlorobenzene	106-46-7
41. Benzyl Alcohol	100-51-6
42. 1,2-Dichlorobenzene	95-50-1
43. 2-Methylphenol	95-48-7
44. bis(2-Cloroisopropyl) ether	39638-32-9
45. 4-Methylphenol	106-44-5
46. N-Nitroso-Dipropylamine	621-64-7
47. Hexachloroethane	67-72-1
48. Nitrobenzene	98-95-3
49. Isophorone	78-59-1
50. 2-Nitrophenol	88-75-5
51. 2,4-Dimethylphenol	105-67-9
52. Benzoic Acid	65-85-0
53. bis(2-Chloroethoxy) methane	111-91-1
54. 2,4-Dichlorophenol	120-83-2
55. 1,2,4-Trichlorobenzene	120-82-1
56. Naphthalene	91-20-3
57. 4-Chloroaniline	106-47-8
58. Hexachlorobutadiene	87-68-3
59. 4-Chloro-3-methylphenol (para-chloro-meta-cresol)	59-50-7
60. 2-Methylnaphthalene	91-57-6
61. Hexachlorocyclopentadiene	77-47-4
62. 2,4,6-Trichlorophenol	88-06-2
63. 2,4,5-Trichlorophenol	95-95-4
64. 2-Chloronaphthalene	91-58-7
65. 2-Nitroaniline	88-74-4
66. Dimethyl Phthalate	131-11-3
67. Acenaphthylene	208-96-8
68. 3-Nitroaniline	99-09-2
69. Acenaphthene	83-32-9
70. 2,4-Dinitrophenol	51-28-5
71. 4-Nitrophenol	100-02-7
72. Dibenzofuran	132-64-9
73. 2,4-Dinitrotoluene	121-14-2
74. 2,6-Dinitrotoluene	606-20-2
75. Diethylphthalate	84-66-2
76. 4-Chlorophenyl Phenyl ether	7005-72-3
77. Fluorene	86-73-7
78. 4-Nitroaniline	100-01-6

TABLE 3-6 (cont.)
HSL ANALYTICAL PARAMETERS
Navajo Refining Company

VOLATILES	CAS NUMBER
79. 4,6-Dinitro-2-methylphenol	534-52-1
80. N-nitrosodiphenylamine	86-30-6
81. 4-Bromophenyl Phenyl ether	101-55-3
82. Hexachlorobenzene	118-74-1
83. Pentachlorophenol	87-86-5
84. Phenanthrene	85-01-8
85. Anthracene	120-12-7
86. Di-n-butylphthalate	84-74-2
87. Fluoranthene	206-44-0
88. Pyrene	129-00-0
89. Butyl Benzyl Phthalate	85-68-7
90. 3,3'-Dichlorobenzidine	91-94-1
91. Benzo(a)anthracene	56-55-3
92. bis(2-ethylhexyl)phthalate	117-81-7
93. Chrysene	218-01-9
94. Di-n-octyl Phthalate	117-84-0
95. Benzo(b)fluoranthene	205-99-2
96. Benzo(k)fluoranthene	207-08-9
97. Benzo(a)pyrene	50-32-8
98. Indeno(1,2,3-cd)pyrene	193-39-5
99. Dibenz(a,h)anthracene	53-70-3
100. Benzo(g,h,i)perylene	191-24-2

TABLE 3-6 (cont.)
HSL ANALYTICAL PARAMETERS
Navajo Refining Company

PARAMETER
Aluminum
Arsenic
Barium
Beryllium
Cadmium
Chromium
Copper
Lead
Magnesium
Manganese
Mercury
Nickel
Selenium
Silver
Sodium
Zinc

3.3.2.2 Subcontractor Responsibility

The types of subcontractors which will be utilized in the monitoring and sampling field activities and their anticipated project task(s) are listed below:

SUBCONTRACTOR	FIELD TASK
Chemical Laboratory	Chemical Analysis
Drilling Company	Subsurface Exploration
Consulting Engineer	Field/Sampling Coordination

Capability Statements for each contractor will be supplied to U.S. EPA prior to the start of work.

Each subcontractor will be responsible for following the approved guidelines included in the RFI. The Program Manager will coordinate all field activities to ensure the safe and proper performance of all activities.

3.3.2.3 Quality Assurance

3.3.2.3.1 Overall QA Responsibility

The Program Manager has overall responsibility for establishing the QAPP and for its implementation in all project activities.

The Project Quality Assurance/Quality Control (QA/QC) Officer reports to the Program Manager, and coordinates with the Program Manager in the implementation of the QAPP. The project QA Officer has access to all project personnel. He has the responsibilities to monitor and verify that the project work is performed in accordance with the QAPP, and approved procedures and to assess overall QA effectiveness.

3.3.2.3.2 Field QA Responsibility

The Project QA Officer has responsibility for the on-site field QA. The QA/QC Officer and/or an assigned representative will work closely with the field staff and subcontractors to ensure that they are in compliance with all field requirements of the QAPP.

3.3.2.3.3 Laboratory QA Responsibility

The Laboratory Director and/or Chief Quality Control Officer will be responsible to the Program Manager for completion of the analytical tasks and associated QAPP activities. Quality Coordinators will be assigned by the laboratories management to implement the project QAPP and to monitor project activities on a daily basis for conformance. They will report to the Project QA/QC officer on QAPP activities.

3.3.2.3.4 QA Reports to Management

Section 3.3.14 of this QAPP describes the periodic QA reporting requirements for the RFI.

After the field work has been completed and the chemical analyses and soil testing are completed and assessed, a final quality assurance report will be prepared to be included in the final RFI report. The report will summarize the QA and audit information, indicating any corrective actions taken and the overall results of the QAPP. The Project QA/QC Officer, in coordination with the laboratory Quality Coordinators, will prepare the summary.

3.3.2.4 Performance and Systems Audits

Internal audits are performed to review and evaluate the adequacy of the QAPP, and to ascertain whether it is being completely and uniformly implemented. The project QA Officer is responsible for such audits and will cause them to be performed according to a schedule planned to coincide with appropriate activities on the project schedule.

Section 3.3.10 of this QAPP describes the periodic field and laboratory assessments and performance and systems audits to be completed during the RFI.

3.3.3 Quality Assurance Objectives

The overall objective of the Navajo Refining RFI is to provide a complete, accurate, precise and representative summary of the current state of the site. The samples and the data generated from these samples and the site generated data must provide the information necessary to complete the site summary. However, all data is subject to some error such as inability to collect samples, sampling analysis errors, faulty selection of sampling sites or inappropriate data reduction. Control or recognition of these errors is important in analyzing the data and in preparing the final summary. Establishing appropriate levels of control over sources of error and quantifying these errors when possible will assist in assessing the impact of errors on the project.

3.3.3.1 Quality Assurance Objectives

Quality assurance objectives for measurement data are usually expressed in terms of accuracy, precision, completeness, representativeness and comparability. Definitions and descriptions of how these characteristics will be obtained are as follows:

3.3.3.1.1 Accuracy

Accuracy is a measure of the system bias. Bias is defined as the difference between the mean (average) of the true sample values and mean (average) of the laboratory analyses. The exact system bias will never be known since the true sample values are not accessible, however, inferences can be drawn from an examination of field and trip blank analyses and laboratory matrix spiked sample analyses. Field blanks measure the bias introduced by contaminated equipment, sample handling and shipping and laboratory procedures. Trip blanks measure the bias introduced by field, shipping and laboratory procedures. Spiked samples measure biases in laboratory analyses.

Acceptable accuracy measures are dependent on the sample matrix and are discussed in Section 3.3.3.5. Accuracy measures are not meaningful for the screening tests conducted in the field based on the semi-qualitative/ quantitative data acquired from the PID and FID and the nature of the pH and temperature conductivity meters. Accuracy of the pH and temperature/conductivity meters will be checked by calibrating prior to daily use and a calibration check at the end of the day's use.

3.3.3.1.2 Precision

Precision is the measure of the variability of individual sample measurements. Precision will be inferred through the use of duplicate samples. If duplicate samples contain identical contaminant concentrations, any variability in the laboratory analyses must be due to variability induced by sampling, handling, or laboratory procedures. Acceptable precision values are dependent on the sample matrix and are discussed in Section 3.3.3.5. Precision values for field screening are not meaningful based on the lack of reproducibility of the samples. Field screening will be in a real time mode making duplication very difficult for the PID and FID. The pH and temperature/conductivity meters are continuous readout instruments and duplicate readings of the same sample will not yield precision values. Duplicate geotechnical tests will not be run based on the heterogeneity and expected variations of the materials.

3.3.3.1.3 Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions. Completeness is usually expressed as a percentage.

Navajo's goal for this project is 100% completeness. However, site access, sampling protocol problems, analytical problems, and the data validation process can all contribute to missing or suspect data.

3.3.3.1.4 Comparability

Comparability expresses the confidence with which one set of data can be compared with another. Comparability can be related to precision and accuracy as these quantities are measures of data reliability. At this site, no attempt will be made to quantify the relative reliability of data obtained during different studies.

Qualitatively, data subjected to strict QA/QC procedures will be deemed more reliable than other data. Field data will be obtained from a given procedure and will be reported in consistent units to allow for easy comparisons.

3.3.3.1.5 Representativeness

Representativeness is the degree to which a set of data accurately reproduce the characteristics of the population. Data is usually considered representative if the sample distribution is within statistically defined bounds of the population mean and variance.

Representativeness will be controlled by the preliminary data assessment and by performing all sampling in a meticulous manner in strict compliance with the procedures described in Sections 3.1 and 3.2.

3.3.3.2 Field Data Quality Objectives (DQO's)

The field data quality objectives can be broken into two major segments; those pertaining to field observations and field instruments and those related to sample selection, collection and shipping.

The following field activities and observations will be coordinated with the appropriate field instruments:

1. Monitoring well sampling
2. Air Monitoring

These activities will provide general and detailed information regarding the site condition that will be used in the final site evaluation.

All activities will be executed per the standard operating procedures found in Section 3.2. Calibration of the field equipment adherence to operational procedures and documentation of all observations and readings will assure the accuracy, completeness and representativeness of the data. Because of the general and qualitative measurements from most of these procedures, accuracy and precision values are not applicable.

The following media will be sampled during the RFI:

1. Soil
2. Sediment
3. Groundwater
4. Air

The results from sampling these media will be used to develop the analytical data base to provide answers to questions regarding the site and, ultimately, to generate the overall summary of the current state of this site. The analytical data must be sufficiently accurate and precise to identify the compounds present and the respective concentrations.

Field duplicates, field blanks, and trip blanks will be collected and submitted to the analytical subcontractor laboratory to provide data for assessing the quality of these data. Duplicate samples will be collected and analyzed to check for sampling and analytical reproducibility. Blank samples will be collected and analyzed to check for systematic errors in the sampling and analytical procedures and ambient site conditions.

The following paragraphs discuss the DQO's for each sample media.

Soil Samples

Soil samples will be collected from the surface and soil borings. Analysis of these samples will provide qualitative and quantitative data on the presence of the target compounds. Qualitative soil classification data will also be generated. These data will be used to assess the spread of contamination through the soils and to evaluate potential corrective actions for the site.

Soil samples will be collected according to Sections 3.1 and 3.2. Laboratory analysis will follow the procedures discussed in this section. DQO's for the laboratory are established per ASTM and EPA procedures (Section 3.3.3.3).

Accuracy and precision of measurements obtained during field observations are not applicable due to the semi-qualitative/quantitative use of the data. Representativeness will be controlled by careful documentation of the sampling location and by following approved procedures. Deviations from the sampling procedures will be described in the field log book at the time of occurence.

Sediment Samples

Sediment samples will be collected from Three Mile Ditch and Eagle Creek. Analysis of these samples will provide qualitative and quantitative data on the migration and extent of contamination. The data will be used to assess if remedial alternatives should include all or some of the above areas and what types of remediation will be necessary.

Sediment samples will be collected per Section 3.1.3 and 3.2.3.5. Representativeness will be controlled by proper documentation of the sampling locations and careful attention to the appropriate procedure. Sampling deviation will be noted in the field log book at the time of occurence.

Groundwater Samples

Groundwater samples will be collected from the existing monitoring wells associated with the Evaporation Ponds and the Truck Bypass Landfarm. Analysis of the groundwater samples will provide qualitative and quantitative data to assess the extent of groundwater contamination. The data will be used to evaluate needed remedial activities in the feasibility study.

Groundwater samples will be collected as described in Sections 3.1.2.2.1 and 3.2.1. Samples will be field screened for pH, temperature and conductivity. Accuracy of the field screening will be confirmed with pre-activity and post-activity calibration of the instrument. Representativeness will be controlled by the preliminary existing well assessment and attention to appropriate sampling procedures. Sampling deviation will be noted in the field log book.

Air Sampling

Qualitative/quantitative air sampling for volatile organics and particulates will be conducted in the vicinity of the Truck Bypass Landfarm. The results of the sampling will provide data to assess the impact to downwind receptors.

The air samples will be collected as described in Sections 3.1.1 and 3.2.4. Accuracy will be confirmed with preactivity and postactivity calibration of the sampling instruments. Representativeness will be controlled by proper documentation of the sampling locations, meteorological conditions and appropriate procedures. Sampling deviation and changes in conditions during sampling will be noted in the field log book.

3.3.3.3 Analytical Laboratory Data Quality Objectives

All groundwater, surface water, soil, and sediment samples will be analyzed using ASTM and U.S. EPA procedures. The quality assurance goals for these analyses are established in the referenced procedure.

3.3.3.4 Level of Quality Assurance

The quality control procedures used for this project and their frequency for the target compounds are described in Table 3-7. The laboratory will report and submit QA/QC data identifying the samples used for matrix spikes and matrix spike duplicates, the surrogate spikes and the percent recoveries and laboratory duplicates.

TABLE 3-7
QUALITY CONTROL PROCEDURES
NAVAJO REFINING COMPANY

PARAMETER	LAB BLANKS	SPIKES OR SURROGATES	LAB DUPLICATES	REFERENCE SAMPLES
VOLATILES	ONE PER SET OF SAMPLES, EVERY 12 HOURS OR WITH EVERY 20 SAMPLES WHICHEVER IS MORE	SURROGATE ADDED TO EACH SAMPLE AND BLANK, MS* FOR EACH SET OR EVERY 20 SAMPLES, WHICHEVER IS MORE MDS** FOR EACH SET OR EVERY 20 SAMPLES, WHICHEVER IS MORE	---	QUARTERLY
BN/A	ONE PER SET OR EVERY 20 SAMPLES	SURROGATE ADDED TO EACH SAMPLE AND BLANK, MS* FOR EACH SET OR EVERY 20 SAMPLES, WHICHEVER IS MORE MDS** FOR EACH SET OR EVERY 20 SAMPLES, WHICHEVER IS MORE	---	QUARTERLY
PEST/PCBs	ONE PER SET OR EVERY 20 SAMPLES	SURROGATE ADDED TO EACH SAMPLE AND BLANK, MS* FOR EACH SET OR EVERY 20 SAMPLES, WHICHEVER IS MORE MDS** FOR EACH SET OR EVERY 20 SAMPLES, WHICHEVER IS MORE	---	QUARTERLY
METALS	ONE PER SET OR EVERY 20 SAMPLES	ONE SPIKE PER SET OF SAMPLES OR FOR EVERY 20 SAMPLES, WHICHEVER IS MORE	DUPLICATE FOR EACH SET OR EVERY 20 SAMPLES, WHICHEVER IS MORE	QUARTERLY
CYANIDE	ONE PER SET OR EVERY 20 SAMPLES	ONE PER ANALYTICAL RUN OR AT LEAST ONE PER SET UP	ONE PER ANALYTICAL RUN OR AT LEAST ONE PER SET UP	QUARTERLY

* MS - STANDS FOR MATRIX SPIKE
**MSD - STANDS FOR MATRIX SPIKE DUPLICATE

3.3.3.5 Accuracy and Precision

The quality control limits of accuracy and precision for organic analyses are shown in Tables 3-8 and 3-9. Table 3-8 lists the organic surrogate spike recovery limits for volatiles for water and soil/sediment matrices. Table 3-9 lists the matrix spike recovery limits for water and soil/sediment for volatiles. These control limits will be completely without any outliers unless the results are deemed to be altered due to matrix effects. Any outliers will be evaluated so that matrix interferences effects may be determined. All such evaluations will be noted in the narrative for the respective set of samples. Table 3-10 lists the precision, accuracy and completion objectives for the inorganics.

3.3.3.6 Method Detection Limits

The method detection limits for the organic parameters monitored are listed in Tables 3-11 and 3-12 for the volatile and semi-volatile organics, respectively. Table 3-13 lists the detection limits for the inorganics.

3.3.4 Sampling Procedures

The QC sample collection procedures are covered by this section. Sections are included regarding the methodology for documenting sample locations, sample numbers, sample containers and sample preservation and decontamination.

3.3.4.1 Sampling Locations and Numbers

Preliminary sample locations have been predetermined for some tasks based on available data and/or the project data objectives. (See Section 3.1). However, the exact location of all samples will be determined in the field based upon field conditions. The locations will be determined by either the Program Manager or the designated field coordinator. The EPA On-Site Coordinator(s) will be consulted, if present.

The exact locations of each sampling point will be described in the project log book along with a sketch that includes a minimum of two (2), if possible three (3), distance measurements.

The measurements will be referenced to marked grid stakes and/or from permanent ground features and landmarks which are included on the site map.

There will be two (2) identification numbers used for each sample. One will be the serial identification number assigned by the laboratory. The other identification will be an in-house number designed to incorporate site specific field data into an alphanumeric code. The in-house numbering will consist of the following four (4) components:

- Project and SWMU Identification
- SWMU
- Sample Type
- Sample Location
- Sample Number

TABLE 3-8
ORGANIC SURROGATE SPIKE RECOVERY LIMITS
Navajo Refining Company

FRACTION	SURROGATE COMPOUND**	LOW/MEDIUM WATER	LOW/MEDIUM SOIL/SEDIMENT
VOA	Toluene-d_8	88-110	81-117
VOA	4-Bromofluorobenzene	86-115	74-121
VOA	1,2-Dichloroethane-d_4	76-114	70-121
BNA	Nitrobenzene-d_5	35-114	23-120
BNA	2-Flurobiphenyl	43-116	30-115
BNA	p-Terphenyl-d_{14}	33-141	18-137
BNA	Phenol-d_5	10-94	24-113
BNA	2-Fluorophenol	21-100	25-121
BNA	2,4,6-Tribromophenol	10-123	19-122
Pest.	Dibutylchlorendate	(24-154)*	(20-150)*

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* These limits are for advisory purposes only. They are not used to determine if a sample should be re-analyzed. When sufficient data becomes available, the U.S. EPA may set performance based contract required windows.

** Surrogate compounds listed are preliminary; Any proposed changes will be submitted to U.S. EPA for approval with the designated laboratories internal QA/QC Plan.

TABLE 3-9
MATRIX SPIKE RECOVERY LIMITS*
Navajo Refining Company

FRACTION	MATRIX SPIKE COMPOUND	WATER*	SOIL/SEDIMENT*
VOA	1,1-Dichloroethene	61-145	59-172
VOA	Trichlorethene	71-120	62-137
VOA	Chlorobenzene	75-130	60-133
VOA	Toluene	76-125	59-139
VOA	Benzene	76-127	66-142
BN	1,2,4-Trichlorobenzene	39-98	38-107
BN	Acenaphthene	46-118	31-137
BN	2,4-Dinitrotoluene	24-96	28-89
BN	Pyrene	26-127	35-142
BN	N-Nitroso-Di-n-Propylamine	41-116	41-126
BN	1,4-Dichlorobenzene	36-97	28-104
ACID	Pentachlorophenol	9-103	17-109
ACID	Phenol	12-89	26-90
ACID	2-Chlorophenol	27-123	25-102
ACID	4-Chloro-3-Methylphenol	23-97	26-103
ACID	4-Nitrophenol	10-80	11-114

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*These limits are for advisory purposes only. They are not to be used to determine if a sample should be re-analyzed. When sufficient multi-lab data are available, standard limits will be calculated.

TABLE 3-10
PRECISION, ACCURACY AND COMPLETENESS OBJECTIVES
Navajo Refining Company

Measurement Parameters:

Aluminum
Arsenic
Barium
Cadmium
Calcium
Chromium
Copper
Iron
Lead
Magnesium
Manganese
Mercury
Nickel
Potassium
Selenium
Silver
Sodium
Zinc

Methods:

Atomic Absorption (AA) Spectroscopy
Gravimetric Determination
Colormetric Determination

Reference: "Test Methods for Evaluating Solid Waste", SW 846, U.S. EPA.

Experimental Conditions: Spiked and unspiked field samples

Precision

Relative Percent Difference: ± 20%

Accuracy

Percent Recovery: 75%

Completeness: 90%

TABLE 3-11
Hazardous Substance List (HSL) and Required Detection Limits (RDL)** For Volatile Compounds
Navajo Refining Company

VOLATILES	CAS NUMBER	DETECTION LIMITS* LOW WATER[a] ug/L	LOW SOIL/ SEDIMENT[b] ug/Kg
1. Chloromethane	74-87-3	10	10
2. Bromomethane	74-83-9	10	10
3. Vinyl Chloride	75-01-4	10	10
4. Chlorethane	75-00-3	10	10
5. Methylene Chloride	75-09-2	5	5
6. Acetone	67-64-1	10	10
7. Carbon Disulfide	75-15-0	5	5
8. 1,1-Dichloroethene	75-35-4	5	5
9. 1,1-Dichloroethane	75-35-3	5	5
10. trans-1,2-Dichlorethene	156-60-5	5	5
11. Chloroform	67-66-3	5	5
12. 1,2-Dichloroethane	107-06-2	5	5
13. 2-Butanone	78-93-3	10	10
14. 1,1,1-Trichloroethane	71-55-6	5	5
15. Carbon Tetrachloride	56-23-5	5	5
16. Vinyl Acetate	108-05-4	10	10
17. Bromodichloromethane	75-27-4	5	5
18. 1,1,2,2-Tetrachlorethane	79-34-5	5	5
19. 1,2-Dichloropropane	78-87-5	5	5
20. trans-1,3-Dichloropropene	10061-02-6	5	5
21. Trichloroethene	79-01-6	5	5
22. Dibromochloromethane	124-48-1	5	5
23. 1,1,2-Trichloroethane	79-00-5	5	5
24. Benzene	71-43-2	5	5
25. cis-1,3-Dichloropropene	10061-01-5	5	5
26. 2-Chloroethyl Vinyl Ether	110-75-8	10	10
27. Bromoform	75-25-2	5	5
28. 2-Hexanone	591-78-6	10	10
29. 4-Methyl-2-pentanone	108-10-1	10	10
30. Tetrachlorethene	127-18-4	5	5

TABLE 3-11 (cont.)
Hazardous Substance List (HSL) and Required Detection Limits (RDL)** For Volatile Compounds
Navajo Refining Company

VOLATILES	CAS NUMBER	DETECTION LIMITS* LOW WATER[a] ug/L	 LOW SOIL/ SEDIMENT[b] ug/Kg
31. Toluene	108-88-3	5	5
32. Chlorobenzene	108-90-7	5	5
33. Ethyl Benzene	100-41-4	5	5
34. Styrene	100-42-5	5	5
35. Total Xylenes		5	5

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[a] Medium Water Required Detection Limits (RDL) for Volatile HSL Compounds are 100 times the individual Low Water RDL.

[b] Medium Soil/Sediment Required Detection Limits (RDL) for Volatile HSL Compounds are 100 times the individual Low Soil/Sediment RDL.

*Detection limits listed for soil/sediment are based on wet weight. The detection limits calculated by the laboratory for soil/sediment, calculated on dry weight basis, as required by the contract, will be higher.

**Specific detection limits are highly matrix dependent. The detection limits listed herein are provided for guidance and may not always be achievable.

TABLE 3-12
Hazardous Substance List (HSL) and Required Detection Limits (RDL)** For Semi-Volatile Compounds
Navajo Refining Company

		DETECTION LIMITS*	
VOLATILES	CAS NUMBER	LOW WATER[a] ug/L	LOW SOIL/ SEDIMENT[b] ug/Kg
36. Phenol	108-95-2	10	330
37. bis(2-Chloroethyl) ether	111-44-4	10	330
38. 2-Chlorophenol	95-57-8	10	330
39. 1,3-Dichlorobenzene	541-73-1	10	330
40. 1,4-Dichlorobenzene	106-46-7	10	330
41. Benzyl Alcohol	100-51-6	10	330
42. 1,2-Dichlorobenzene	95-50-1	10	330
43. 2-Methylphenol	95-48-7	10	330
44. bis(2-Cloroisopropyl) ether	39638-32-9	10	330
45. 4-Methylphenol	106-44-5	10	330
46. N-Nitroso-Dipropylamine	621-64-7	10	330
47. Hexachloroethane	67-72-1	10	330
48. Nitrobenzene	98-95-3	10	330
49. Isophorone	78-59-1	10	330
50. 2-Nitrophenol	88-75-5	10	330
51. 2,4-Dimethylphenol	105-67-9	10	330
52. Benzoic Acid	65-85-0	50	1600
53. bis(2-Chloroethoxy) methane	111-91-1	10	330
54. 2,4-Dichlorophenol	120-83-2	10	330
55. 1,2,4-Trichlorobenzene	120-82-1	10	330
56. Naphthalene	91-20-3	10	330
57. 4-Chloroaniline	106-47-8	10	330
58. Hexachlorobutadiene	87-68-3	10	330
59. 4-Chloro-3-methylphenol (para-chloro-meta-cresol)	59-50-7	10	330
60. 2-Methylnaphthalene	91-57-6	10	330
61. Hexachlorocyclopentadiene	77-47-4	10	330
62. 2,4,6-Trichlorophenol	88-06-2	10	330
63. 2,4,5-Trichlorophenol	95-95-4	50	1600
64. 2-Chloronaphthalene	91-58-7	10	330
65. 2-Nitroaniline	88-74-4	50	1600
66. Dimethyl Phthalate	131-11-3	10	330
67. Acenaphthylene	208-96-8	10	330
68. 3-Nitroaniline	99-09-2	50	1600

TABLE 3-12 (cont.)
Hazardous Substance List (HSL) and Required Detection Limits (RDL)** For Semi-Volatile Compounds Navajo Refining Company

VOLATILES	CAS NUMBER	DETECTION LIMITS* LOW WATER[a] ug/L	DETECTION LIMITS* LOW SOIL/ SEDIMENT[b] ug/Kg
69. Acenaphthene	83-32-9	10	330
70. 2,4-Dinitrophenol	51-28-5	50	1600
71. 4-Nitrophenol	100-02-7	50	1600
72. Dibenzofuran	132-64-9	10	330
73. 2,4-Dinitrotoluene	121-14-2	10	330
74. 2,6-Dinitrotoluene	606-20-2	10	330
75. Diethylphthalate	84-66-2	10	330
76. 4-Chlorophenyl Phenyl ether	7005-72-3	10	330
77. Fluorene	86-73-7	10	330
78. 4-Nitroaniline	100-01-6	50	1600
79. 4,6-Dinitro-2-methylphenol	534-52-1	50	1600
80. N-nitrosodiphenylamine	86-30-6	10	330
81. 4-Bromophenyl Phenyl ether	101-55-3	10	330
82. Hexachlorobenzene	118-74-1	10	330
83. Pentachlorophenol	87-86-5	50	1600
84. Phenanthrene	85-01-8	10	330
85. Anthracene	120-12-7	10	330
86. Di-n-butylphthalate	84-74-2	10	330
87. Fluoranthene	206-44-0	10	330
88. Pyrene	129-00-0	10	330
89. Butyl Benzyl Phthalate	85-68-7	10	330
90. 3,3'-Dichlorobenzidine	91-94-1	20	660
91. Benzo(a)anthracene	56-55-3	10	330
92. bis(2-ethylhexyl)phthalate	117-81-7	10	330
93. Chrysene	218-01-9	10	330
94. Di-n-octyl Phthalate	117-84-0	10	330
95. Benzo(b)fluoranthene	205-99-2	10	330
96. Benzo(k)fluoranthene	207-08-9	10	330
97. Benzo(a)pyrene	50-32-8	10	330

TABLE 3-12 (cont.)
Hazardous Substance List (HSL) and Required Detection Limits (RDL)** For Semi- Volatile Compounds
Navajo Refining Company

VOLATILES	CAS NUMBER	DETECTION LIMITS* LOW WATER[a] ug/L	DETECTION LIMITS* LOW SOIL/ SEDIMENT[b] ug/Kg
98. Indeno (1,2,3-cd)pyrene	193-39-5	10	330
99. Dibenz(a,h)anthracene	53-70-3	10	330
100. Benzo(g,h,i)perylene	191-24-2	10	330

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[c] Medium Water Required Detection Limits (RDL) for Semi-Volatile HSL Compounds are 100 times the individual Low Water RDL.

[d] Medium Soil/Sediment Required Detection Limits (RDL) for Semi-Volatile HSL Compounds are 60 times the individual Low Soil/Sediment RDL.

*Detection limits listed for soil/sediment are based on wet weight. The detection limits calculated by the laboratory for soil/sediment, calculated on dry weight basis, as required by the contract, will be higher.

**Specific detection limits are highly matrix dependent. The detection limits listed herein are provided for guidance and may not always be achievable.

TABLE 3-13
DETECTION LIMITS FOR ELEMENTS DETERMINED BY INDUCTIVELY COUPLED PLASMA EMISSION OR ATOMIC ABSORPTION SPECTROSCOPY AND CYANIDE
Navajo Refining Company

PARAMETER	DETECTION LEVEL (ug/L)
Aluminum	200
Arsenic	10
Barium	200
Beryllium	5
Cadmium	5
Chromium	10
Copper	25
Cyanide	10
Lead	5
Magnesium	5000
Manganese	15
Mercury	0.2
Nickel	40
Selenium	5
Silver	10
Sodium	5000
Zinc	20

The project and SWMU identification is a three (3) letter designation unique to the site and SWMU sampled. For this project, the identification will be designated as follows:

- NEP - Navajo Evaporation Ponds
- NLF - Navajo Truck Bypass Landfill
- NMD - Navajo 3 Mile Ditch
- NEC - Navajo Eagle Creek

Each sample type collected during the sampling program will be identified by one of the following 2-3 digit alpha codes:

- SL - Sludge Sample.
- GW - Monitoring Well Groundwater Sample.
- SS - Surface Soil Sample.
- SB - Soil Boring Sample.
- SD - Sediment Sample.
- AR - Air Sample
- XXB - XX(Matrix Type) Blank.

A three (3) digit number will be used to indicate the sampling location. Thus, the identification system will require that all sampling locations be given a separate number. The field ties to these sampling locations as well as other pertinent data will be kept in the field sampling notebook.

A two (2) digit number will be used to consecutively number replicate samples taken at a sampling site. Examples of a sample number are:

NEP-SL-001-01 = Navajo evaporation ponds, sludge sample, location 001, first sample.
NEP-SLB-001-01 = Navajo evaporation ponds, sludge sample blank, location 001, first sample.

3.3.4.2 Sample Containers and Sample Preservation

The required sample containers, filling instructions, sample preservation methods, and shipping instructions are summarized in Table 3-14 for each of the sample types.

The collected sample containers will be kept out of direct sunlight and, after decontamination and labeling, will be placed in coolers and stored at approximately 4°C (except geophysical and high hazard samples) until they are packaged for shipping to the proper laboratory. Samples designated for chemical analysis will be packaged and shipped within two days of collection.

3.3.4.3 Decontamination of Sampling Equipment

There are several categories of equipment which will require cleaning prior to use, and between sample events. These include:

- Hand Sampling Equipment
- Field Monitoring Equipment
- Drilling Equipment

The procedures which will be utilized for each are included in Section 3.2.

TABLE 3-14
SAMPLE CONTAINERS, PRESERVATIVES, AND HOLDING TIMES FOR LOW CONCENTRATION TEST PARAMETERS
Navajo Refining Company

Parameter	Container	Preservation	Holding Time	Procedure
WATER and LIQUIDS				
Purgeable Organic Compounds (Volatiles)	2-40 ml glass vials with Teflon lined caps	iced to 4°C	14 days for analysis	fill completely to exclude air bubbles
Extractable Organic (BNA Semi-Volatiles)	2-one liter glass bottles (amber) with Teflon lined caps	iced to 4°C	5 days for extraction analysis within 40 of extraction	fill bottle to neck
Metals	1-one liter high density polyethylene bottle	adjust pH to less than 2.0 with nitric acid	analysis within 6 months of collection	fill bottle to neck
SOILS AND SOLIDS:				
Purgeable Organic Compounds (Volatiles)	6-8-ounce wide-mouth glass jar	iced to 4°C	14 days for analysis	fill completely
Extractable Organic Compounds (BNA Semi-Volatiles)	6-8-ounce wide-mouth glass jar	iced to 4°C	14 days for extraction	fill completely
Inorganics	6-8-ounce wide-mouth glass jar	iced to 4°C	analysis within 6 months of collection	fill completely

3.3.5 Sample Custody

Verifiable sample custody is an integral part of field and laboratory operations. Several steps will be taken in the field and laboratory to document and ensure that samples collected in the field have been properly acquired, preserved, and identified. The following sections describe these steps in detail.

3.3.5.1 Field Sampling Documentation

3.3.5.1.1 Documentation of Sample Acquisition

A key piece of information that will be documented is the sample acquisition data. All information pertinent to field observations, surveys, and sampling will be recorded in a bound logbook with consecutively numbered pages. Entries in the logbook will include at least the following:

- location of sampling activity and addresses;
- purpose of sampling (e.g., definition of contamination, waste analysis, etc.)
- type of process (if known) producing wastes;
- type of waste (e.g., sludge, liquid, etc.);
- number and approximate volume of samples taken;
- location of sampling point;
- description of sampling point;
- date and time of collection;
- collector's sample identification number(s);
- sample distribution (e.g., chemical laboratory, geotechnical laboratory etc.);
- sample preservation;
- filtering methodology;
- references such as maps or photographs of the sampling site;
- field observations;
- any field measurements made such as pH, specific conductivity or other field parameters; and
- weather conditions.

Since sampling situations can be quite diverse, the documentation in the logbook will be sufficient to reconstruct the sampling situation without relying on the collector's memory.

3.3.5.1.2 Documentation of Sample Preservation

Proper sample preservation is important in retaining the sample characteristics prior to analysis. Sample preservation will be performed by the sampling personnel as described in Section 3.3.4.2. Sampling preservation will be documented by the sampling personnel on the chain of custody form and also in the field logbook.

3.3.5.1.3 Chain of Custody

In addition to the field logbook, each sample sent off-site will be recorded on a chain of custody record. An identifying code will be assigned to each sample and this code will be used on the chain of custody and in the logbook to ensure that the sample description is identifiable. A brief description of the sampling point will also be placed on the chain of custody form.

Chain of custody forms will become permanent records of all sample handling and shipment. Samples will be collected in accordance with the sampling procedures designated in Section 3.2. If standard sampling procedures are not used, a written justification for each deviation will be placed in the project file. Upon completion of sampling, the sample will be prepared for shipment in accordance with the applicable sample instructions including preservation, labeling and logging.

The person collecting a sample will initiate document(s) at the source of the sample and start the chain of custody procedure. Chain of custody documentation will include the following applicable data:

- field sample number, site name and project;
- date sample taken;
- date sample submitted to the laboratory;
- sample taken by (signature);
- information describing source of sample and sample itself;
- sampling method used;
- expected interferences, if any;
- remarks;
- preservation technique;
- number and type of shipping containers;
- signature of persons relinquishing and obtaining custody of samples;
- indication of sample disposition.

The sample will be kept in limited access or locked storage at the proper temperature until custody is relinquished from the site and formal documentation of the transfer is completed.

The Program Manager or On-site Coordinator will be responsible for sample storage and shipment and for completing the sample accountability records. Upon each transfer of custody, the person involved will verify sample numbers and condition and will document the sample acquisition and transfer. The field sample custodian will properly package the samples, indicate the shipping method and describe the sample accountability record, and obtain shipment documentation such as certified mail receipt or bill of laden number.

On transfer of custody of the samples to the transport agency, the field sample custodian will sign and retain a copy of the shipment documentation, witness the transport company custody signature, and send a copy of the chain of custody with the samples. On arrival at the laboratory, the sample custodian will sign for custody and return a copy of the completed chain of custody to Navajo. Laboratory custody procedures will then be conducted per Section 3.3.5.2.

Groundwater and soil samples will be shipped as environmental samples by commercial carrier following DOT regulations. Samples classified as hazardous materials will be shipped according to DOT regulations for hazardous materials.

3.3.5.1.4 Tags

Each sample will be tagged and sealed.

Sample tags are necessary to prevent misidentification of samples. Gummed paper tags will be used. The tag will include at least the following information:

- name of collector.
- date and time of collection.
- place of collection.
- collector's sample number, which uniquely identifies the sample.

Sample seals are used to preserve the integrity of the sample from the time it is collected until it is opened in the laboratory. Gummed paper seals will be used as official sample seals.

The seal will be attached in such a way that it is necessary to break it in order to open the sample container ensuring that the sample has not been tampered with.

3.3.5.1.5 Field Tracking Forms

The chain of custody form will be supplemented in the field by a field tracking form. This form is a complete listing of samples taken, the sample collector and the date and time of collection. Field tracking establishes sample custody prior to shipment and, as such, provides additional sample control.

3.3.5.2 Laboratory Operations

The minimum procedures which will be used by the laboratory for sample receipt, chain of custody, sample identification, sample extract identification, tracking of sample analyses, laboratory data assembly and documentation control are described below.

Laboratory Sample Receipt Procedures: The following laboratory receipt procedures will be used:

- The samples will be delivered directly to the laboratory receptionist on weekdays. Shortly after arrival, the samples will be transferred to the geotechnical laboratory. On weekends, holidays or outside of regular working hours, the sample custodian or his authorized personnel (only sample custodian is mentioned hereafter) will receive the samples shipped directly to the lab.

- The sample custodian will examine the shipping container and record the following information on a Log-in Sheet (called the Sheet herein), one case per form(s).

    - presence/absence of custody seal(s) on the shipping container(s)
    - condition of custody seal (i.e., intact, broken)
    - The sample custodian will open the shipping container, remove the enclosed sample documents and record on the sheet:

    - presence/absence of the chain-of-custody record(s)
    - presence/absence of airbills and/or bills of lading documenting shipment of samples
    - case and airbill numbers

  - Remove sample containers and record on the sheet:

    - condition of samples (intact, broken, leaking, etc.)
    - presence/absence of sample tags

- If sample tags are present:

    - record sample tag numbers
    - compare with chain of custody record(s)

- Compare the following documents to verify agreement among the information contained on them:

    - chain of custody records
    - sample tags
    - airbills or bills of lading

Document both agreement among the forms and any discrepancies found. If discrepancies are found, contact the project QA/QC Officer or Program Manager for clarification and notify appropriate laboratory personnel.

- If all samples recorded on the chain of custody record were received by the lab and there are no problems observed with the sample shipment, the custodian will sign the chain of custody record in the "received for laboratory by" box on the document. If problems are noted, sign for shipment and note problems in remarks box of the sheet detailing the problems. The project QA/QC Officer or Program Manager will be contacted for direction. The appropriate lab personnel will be notified. The problems and resolution will be detailed in the case narrative.

- Log-in Samples: The procedure for sample identification will be performed at this time. The information on the date and time of sample receipt, chain of custody record number, field sample numbers, lab numbers and sample tag numbers will be recorded on the Sample Log-in Sheet.

Laboratory Chain of Custody Procedures: The National Enforcement Investigations Center (NEIC) of EPA defines custody of evidence in the following ways:

- It is in your actual possession, or
- It is in your view, after being in your physical possession, or
- It was in your possession and then you locked or sealed it up to prevent tampering, or
- It is in a secure area.

In order to satisfy these custody provisions, the following standard operating procedures will be implemented:

- Samples will be stored in a secure area.
- Access to the laboratory will be through a monitored reception area.
- Visitors will sign-in the reception area and be escorted while in the laboratory.

- All transfers of samples into and out of storage will be documented on an internal chain of custody record.
- After a sample has been removed from storage by the analyst, the analyst is responsible for the custody of the sample. Each analyst must return the samples to the storage area before the end of the working day.

Laboratory Sample Identification: The following procedures will be used to determine laboratory sample identification:

- During the sample receiving process, the laboratory sample custodian or other designated personnel will assure that each sample container is identified with a unique field sample ID number and that this number is recorded in the Sample Log-in Sheet.

- The sample custodian will remove the sample tag and place it in the appropriate case file. If stick-on labels are used instead of tie-on sample tags, this fact will be noted in the comment section of the log-in sheet.

Laboratory Tracking of Sampling Analysis: A system for tracking the sample through preparation and analysis is needed because of the evidentiary nature of the sample analysis results. The laboratory records may be used in court as evidence in enforcement proceedings. Consequently, the following procedure will be used to track sample analyses.

- Both the preparation and the analysis of samples will be documented.
- All notebook pages, computer printouts, and other laboratory documents will show the case/sample number, date, signature (initials) of the analyst and other pertinent information.
- Upon completion of analysis, data will be filed in the appropriate case or sample files.
- All sample preparation information will be documented in the laboratory notebook. All sample analysis data will be documented using log-books. When sample preparation or analysis is finished by an individual, the completed documents will be placed in the appropriate sample and/or case files.

Laboratory Data Assembly: The following procedures will be adhered to for assembly of the project data:

- A procedure for organization and assembly of all documents relating to each case will be implemented by the sample custodian or designated person.
- This procedure will ensure that all documents are compiled in one location for submission to Navajo in single case files, arranged by field sample number. Case file folders will be prepared as follows:

    - Using appropriate file folders, preferably assign one folder to each case according to field number.
    - Place all documents, sample tags, forms, and laboratory generated data, pertaining to one case in the folder.
    - Documents should be arranged by document type within the case folders, i.e., all sample tags together, all traffic reports together, all deliverables, etc.
    - These document case files will be filed in one location and stored in a secure area.

The internal QA/QC Procedures for the designated laboratory will be submitted to U.S. EPA prior to the start of work.

3.3.5.3 Evidence Files

All controlled documents, log books, reports and data packages will be submitted to Navajo Refining, located in Artesia, New Mexico after the RFI completion. At this location the files will be stored in a secure area. All transfers of data into and out of the storage area will be documented on an internal chain of custody record.

The files will be kept for a minimum of six (6) years after the termination of the RFI. After the 6 year period, the EPA will be notified within thirty (30) days prior to the destruction of any documents.

3.3.6 Calibration Procedures and Frequency

3.3.6.1 Field Calibration Procedures

The field environmental monitoring equipment was previously described in Section 3.2. Each instrument will be calibrated and maintained in accordance with the manufacturer's procedures.

3.3.6.2 Chemistry Laboratory Calibration Procedures

The calibration procedures and frequency of calibration will follow the specifications of the appropriate U.S. EPA and ASTM procedures. The use and frequency of these procedures will be verified by internal audit. Additionally, a project specific quality assurance audit will be conducted by the Quality Assurance Officer.

3.3.7 Analytical Procedures

Analytical methods which will be utilized for the water, soil, waste matrix samples during the RFI are described in:

- SW 846: Test Methods for Evaluating Solid Waste (Physical/Chemical Methods) Third Edition, September 1986.
- Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020, March 1983.
- Annual Book of ASTM Standards.

The air samples will be analyzed for volatile organics (gaseous phase) per EPA Method T01, "Method for the Determination of Volatile Organic Compounds in Ambient Air Using Tenax Adsorption and Gas Chromatography/Mass Spectrometry". Monitoring for total suspended particulates will be performed per methods outlined in Appendix B to Part 50 of 40 CFR, "Reference Method for the Determination of Suspended Particulate Matter in the Atmosphere (High Volume Method)".

If alternate methods are proposed, a copy of the method, including the expected precision and accuracy and an explanation for the change, will be submitted to U.S. EPA for approval.

3.3.8 Data Reduction, Validation and Reporting

The three types of data that will be generated by this project include: chemical data, geotechnical data, and geophysical data. The following guidelines will apply to each type of data.

3.3.8.1 Data Reduction

Data reduction will be carried out using prescribed documented techniques. Any statistical summaries of the data will be presented in such a manner that the reviewer can easily judge the validity of the procedure and any conclusions drawn. Assumptions made in performing any statistical analyses will be clearly stated, as will confidence/significance levels used for any test hypotheses. Data summaries will be checked against the raw data for consistency and summary statistics recalculated in the event of doubt.

Chemical data reduction will be done in conformance with the prescribed methods referenced in the appropriate analytical procedures.

3.3.8.2 Data Validation

Chemical, geotechnical, and geophysical data will be validated by the designated Quality Assurance Coordinator. The Analysis Coordin. will perform a review of all data for each analytical task. This review will consist of the following elements; review of analytical program, examination of results, verification of results.

3.3.8.2.1 Review of Analytical Program

The responsible individual will review each set of results to ensure that the required program elements, such as method blanks, surrogate spikes, and QC samples, have been accomplished according to the program design. The supporting data will be reviewed to ensure that analyses were performed under the correct conditions and that all required procedural steps were performed.

3.3.8.2.2 Examination of Results

The Analytical Coordinator will examine the results obtained along with the pertinent chromatogram, spectra, absorption traces, and geophysical logs to ensure that the results are reasonable and that the analyst has interpreted the results correctly. Any unusual or unexpected results will be reviewed and a resolution will be made as to whether the analysis should be repeated or the results recalculated.

3.3.8.2.3 Recalculation of Results

The Analytical Coordinator will selectively recalculate results to ensure that the calculation was performed properly. Emphasis will be placed on the those results showing a significant concentration of one or more of the analytes of interest. At a minimum, one set of calculations will be checked for each batch of samples analyzed.

3.3.8.3 Data Reporting

Following data validation, the verified data will be transferred from the analytical data sheets to reporting forms. The Analytical Coordinator will be responsible for ensuring that all required information is recorded for reviewing the completed form for the accuracy of the transferred information. All data will be verified against the analytical data sheets, and the completed forms will be reviewed by the individual responsible for the analysis prior to submission of the results to the sponsor.

3.3.9 Internal QC Checks and Frequency

Internal quality control checks will be made in the laboratory and the field. These checks are discussed in this section.

3.3.9.1 Internal QC Checks and Frequency - Laboratory

QC sample frequency will follow the standard requirements cited earlier in this document. Internal quality control procedures for groundwater, surface water, soil and sediment samples will follow the appropriate U.S. EPA and ASTM guidelines. These procedures specify the number of laboratory blanks to be used, the number of calibration standards, the frequency that the calibration standards must be run, the frequency at which laboratory duplicate samples must be run, and the frequency at which spiked and referenced samples must be run. Field blanks (where applicable) will be collected to check for sample contamination due to field sampling equipment.

3.3.9.2 Internal QC Checks and Frequency - Field

The combustible gas analyzer, PID and FID are analytical instruments, that will be used in the field, which are scanning type instruments to approximate real time concentrations. Calibration and standardization are done by span gases. Electronic field instruments are zeroed electronically as an internal electronic adjustment, which compensates for the aging of batteries and changes in instrumentation characteristics. Duplicates, spikes and splits are not feasible due to the nature of the instruments.

The pH and temperature/conductivity meters will also be used on-site. Calibration and checks of the pH meter are done by standard solutions. Several duplicate readings are generally used to improve data quality when using this instrument. The temperature/conductivity meter is factory calibrated for conductivity, while the thermometer is "air" calibrated prior to each use.

3.3.10 Performance and Systems Audits

Internal audits are performed to review and evaluate the adequacy of the QAPP, and to ascertain whether it is being completely and uniformly implemented. The Quality Assurance Officer is responsible for such audits and will ensure that they are performed according to a schedule planned to coincide with appropriate activities on the project schedule. Such audits may be supplemented by additional audits for one or more of the following reasons:

a. When significant changes are made in the QAPP.
b. When it is necessary to verify that corrective action has been taken on a nonconformance reported in a previous audit.
c. When requested by the Program Manager.

The objectives of performance and systems audits are to ensure that the quality assurance program developed for this project is being implemented according to the specified requirements, to assess the effectiveness of the quality assurance program, to identify nonconformances and to verify that identified deficiencies are corrected. Upon discovery of any significant deviation from the quality assurance program, the Program Manager shall be informed of the nature, extent, and the corrective action taken/needed to remedy the deviation.

3.3.10.1 Performance Audits

A performance audit can be defined as a review of the existing sample and quality assurance data to determine the accuracy of the total measurement system(s) or a component part of the system. The analysis of project specific performance evaluation samples and the participation in scheduled inter-laboratory studies may be included as part of the performance audit.

3.3.10.1.1 Laboratory Performance Audit

The laboratory director will monitor and audit the performance of the QA procedures to ensure that the project is performed in accordance with the data quality objectives. The results of any U.S. EPA or State audits will be made available upon request to Navajo for subsequent review. Additional audits may be scheduled by Navajo at various times to evaluate the execution of sample identification, sample control and chain of custody procedures. Results from the analysis of any performance evaluation samples will be made available to Navajo for review. Any problems will be identified and corrective actions will be taken if necessary.

3.3.10.1.2 Field Performance Audit

At least one field performance audit will be conducted by the QA Officer or his designee. The field auditor will observe and review the procedures being used to ensure that they conform with the approved operating procedures. Specific attention will be given to sampling procedures and preservation to demonstrate that required methods are being used. Field instrumentation quality assurance procedures will also be verified to ensure that all proper procedures are being followed. Analytical results and quality assurance samples and analyses will be reviewed and recommendations on the adequacy and necessity for repetition of analysis will be made. The QA Officer will review the data for questionable results and will determine if repeat analyses are required. Significant analytical problems will be discussed with the QA Officer and Laboratory Manager.

The field auditor will report to the orally within 5 days on the results of each audit to transmit any significant problems with the field quality assurance program. A written report will be made by the field auditor of each field audit within 10 days after each audit.

3.3.10.2 Systems Audit

A systems audit consists of an evaluation to determine if the components of the measurement system(s) were properly selected and are being used correctly. A systems audit includes a careful evaluation of field and laboratory quality control procedures.

3.3.10.2.1 Laboratory Systems Audit

A laboratory systems audit will be conducted on a regular basis by the Laboratory Manager. The Laboratory Manager will conduct an initial systems audit to ensure that all instruments proposed for use were properly selected for the given methods and are performing properly. This will include a review of the analytical methods proposed for use and the laboratory procedures prepared from these methods. Necessary changes will be confirmed in writing to the Navajo QA Officer, to ensure that the laboratory meets all of the measurement systems requirements of the quality assurance plan. After this initial systems audit is complete, the Laboratory Manager will:

- implement the analytical plan and ensure that all quality control measures are executed as written;
- ensure that all analysts and technicians are properly trained;
- verify on a routine basis that all instruments are performing properly and that conditions, etc., are as required; and
- conduct periodic evaluations of personnel and instruments during the course of the analyses to ensure that initial conditions persist.

The Laboratory Manager will report orally to the Navajo QA Officer if the systems audit shows a significant discrepancy from the QAPP. Each major systems change will require a written summary to Navajo QA Officer to document the change made. All system changes will be documented in the project Quality Assurance notebook.

The Laboratory Manager, or his designee, will conduct the following as part of the routine analytical system to ensure compliance with the work plan and quality assurance requirements:

- verify that incoming samples correspond to the chain of custody form or packing list that accompanies them;
- inspect the samples and document the condition of each sample, especially any circumstances which might have adverse effect on the analytical results;
- note the analyses required on each sample and transmit this information to the Analysis Coordinators;
- review all data generated to ensure that all analyses were run as specified, including quality controls; and
- prepare the data for submission to the sponsor or for entry into a computerized data bank, as appropriate.

The Laboratory Manager will periodically review the data records to ensure that the requirements are being met.

The Laboratory Manager, or his designee, will perform the following functions to ensure the sample collection systems meet the requirements. He will:

- ensure that proper container cleanup procedures are followed prior to use and that containers are protected from contamination once prepared for use;
- provide a sample of containers to the analytical coordinator, who will determine if the containers are free of contamination;
- prepare field spikes, duplicates, and blanks, as called for in the work plan, and provide these for analysis along with field samples, ensuring that the analyst is unable to distinguish between actual and quality control samples; and
- maintain all records necessary including chain of custody information on the samples.

The Navajo QA Officer will conduct at least one detailed laboratory systems audit during the project. This audit will be described in Section 3.3.10.3.

3.3.10.2.2 Field Systems Audit

At least one field system audit will be conducted by the Navajo QA Officer, or his designee. The field auditor will review the field equipment selection and use to ensure that the equipment is capable of safely and accurately performing the desired functions. Equipment selection review will be based on the capabilities and limitations of the instrument/sampling device. Use will be reviewed based on observations and comparison of actual versus expected results. The first field systems audit is expected to be conducted soon after field start up.

The field auditor will meet with key field staff members to evaluate the field program and determine if changes are necessary to improve the results. A written record of these meetings will be placed into the project file within 10 days after the meeting and program revisions will be incorporated as necessary.

The field auditor will submit a written report within 10 days after each audit and will discuss significant changes with the project management prior to any major changes.

3.3.10.3 Detailed Laboratory Performance and Systems Audit

As part of the quality assurance program, the Navajo QA Officer will conduct a detailed laboratory performance and system audit during the project.

The objectives of the detailed audit are:

- To determine that a quality assurance program has been put into use and documented in accordance with specified requirements;
- To verify by examination and evaluation of objective evidence that the documented program has been implemented;
- To assess the effectiveness of the quality assurance program;
- To identify nonconformances; and
- To verify correction of identified deficiencies.

The Laboratory Manager will be notified of the audit at a reasonable time before the audit is performed. This notification may be in writing and include such information as the general scope and schedule of the audit and the name of the audit team leader.

A brief pre-audit conference will be conducted at the audit site with laboratory management. The purpose of the conference will be to confirm the audit scope, present the audit plan, discuss audit sequence and plan for the post-audit conference.

Audits are performed on the basis of written checklists or list of questions prepared prior to the audit to ensure the depth and continuity of the audits. During the conduct of the audit, each item on the list is marked with one of the following entries;

S	Item is satisfactory
U	Item is unsatisfactory
X	Item is not applicable
N	Item was not audited

The audit checklist is intended for use as a guide and will not restrict the audit investigation when findings raise further questions that are not specifically included in the checklist. The checklist will include, as a minimum, review of QA data, laboratory procedures, chain of custody records, calibration records, and problem resolutions.

Selected elements of the quality assurance program shall be audited to determine whether they are being implemented effectively.

Conditions requiring immediate corrective action shall be reported immediately to the Program Manager and resolutions will be recommended to replace the faulty procedures.

At the conclusion of the audit, a post-audit conference will be held with laboratory management to present audit findings and clarify misunderstandings. Audit findings shall be concisely stated by the Navajo QA Officer on the List of Findings for Post-Audit Conference (Figure 3-7). The findings of the audit will be acknowledged by the Laboratory Manager signing the post-audit conference record.

An audit report will be prepared within 15 working days by the Navajo QA Officer and signed by the Laboratory Manager. The report will include the following:

- Description of audit scope
- Identification of the auditors
- Persons contacted during pre-audit, audit and post-audit activities
- A summary of audit results, including an evaluation statement regarding the effectiveness of the QA Program elements which were audited.
- Details of findings and program deficiencies will be reported on a Standard Audit Report Format similar to Figure 3-8. Each finding and program deficiency shall be identified and described in sufficient detail to assure that corrective action can be effectively carried out by the project organization.
- Recommendations for correcting the findings or improving the QA Program.
- The audit report will be addressed to the Navajo Program Manager.

The Laboratory Manager or his designated representative will respond to the audit deficiencies by completing a Corrective Action plan in written form within 20 working days. The response will clearly state the corrective action for each finding, including action to prevent recurrence and the date the corrective action will be completed. If corrective action has been completed, supporting documentation will be attached to the reply.

Follow-up action will be performed by the Laboratory Manager or his designated representatives to:

- Evaluate the adequacy of the response.
- Assure the corrective action is identified and scheduled for each nonconformance.
- Confirm that corrective action is accomplished as scheduled. Re- audits will be conducted and reported in the same manner as the original audit.
- Follow-up action may be accomplished through written communication, re-audit, or other appropriate means.

FIGURE 3-7
QUALITY ASSURANCE AUDIT FINDING REPORT
Navajo Refining Company

Project ______________________________

Audit No. ________ Audit Date ______________________

Audit Finding No. ______________________________

QUALITY ASSURANCE AUDIT FINDING REPORT

Audited Organization ______________________________

Audited Area ______________________________

10 CFR 50 Appendix B Requirement ______________________________

NQA-A ______________________________

QAM ______________________________

OBSERVATION/FINDING

RECOMMENDATION

Corrective Action Required Yes Prepared By ______________________

No ______________________________

____

CORRECTIVE ACTION REPLY Response Date Due ______________________

Prepared By ____________________ Title ______________ Date ______________

____

____

CORRECTIVE ACTION VERIFIED

By ______________________________

Title ______________ Date ______________

FIGURE 3-8

STANDARD AUDIT REPORT FORMAT

Navajo Refining Company

Project No.________________________________

To: ____, Project Director

Subject: Report of Audit of (project unit) , on (date)

PURPOSE:

Give the name and title of the person conducting the audit, and list any individuals who may have assisted in conducting the audit.

PERSONNEL CONTACTED:

Present the checklist from which the audit was conducted, with the appropriate S, U, X or N marking for each item op the list.

DISCUSSION:

Indicate nonconformance noted. A nonconformance is defined as a deficiency in characteristic, procedure or documentation which renders the quality of an item unacceptable or indeterminate. Examples of nonconformance include incorrect or inadequate documentation or deviations from prescribed office, field, or laboratory procedures.

CORRECTIVE ACTION:

Indicate action to correct and to prevent recurrence of nonconformances, and dates by which reply to audit must be received and corrective action completed.

RECOMMENDATIONS:

Present suggestions regarding items or procedures which are not considered nonconformances, but which may result in nonconformances if allowed to continue, or for which relatively minor changes may result in improved quality.

Records will be generated and retained for all audits. Records will include audit reports, written replies, the record of completion of corrective actions, and documents associated with the conduct of audits which support audit findings and corrective actions as appropriate.

3.3.10.4 Nonconforming Items and Disposition

The supervisory and staff personnel will, during the execution of their normal activities, make certain that the work is performed in accordance with the requirements of the QAPP, establish procedures or accepted professional practices. Rework or revision of work due to nonconformance is described in the applicable work procedure. Any irregularities and/or deviations will be reported in writing to the QA Officer and the Navajo Program Manager. Any person may originate a report on irregularities and/or deviations.

The originator of a Nonconformance and Disposition Action Report (NCR) will describe his findings on the form provided for this purpose (Figure 3-9). A nonconformance is defined as a deficiency which renders the quality of an item unacceptable or indeterminate. Depending on the nature of the nonconformance, the quality of the item in question may be accepted following an investigation of the nonconformance.

The work which has the irregularities and/or deviations may be temporarily stopped while the nonconformance is being investigated. Section 3.3.14 presents a summary of the written quality assurance reports that will be submitted to management.

Disposition

The Navajo Program Manager will be responsible for initiating disposition action on all nonconforming items. The procedure will be as follows:

- The Navajo Program Manager will review the nonconformance and disposition action reports and take the necessary action; he will complete the disposition section of the report.
- The Navajo Quality Assurance Officer or his designee will review, verify and countersign the Program Manger's disposition.
- The completed report will be filed in the appropriate file.

3.3.10.5 Schedule of Audits

A summary of the performance and systems audits to be performed is shown in Table 3-15.

3.3.11 Preventative Maintenance

3.3.11.1 Laboratory Maintenance

All instruments will be maintained in accordance with manufacturer's recommendations and/or normal laboratory practice. All maintenance will be documented and maintained in permanent records by the individual responsible for each instrument. This will include both routine, scheduled maintenance and unscheduled maintenance required by operational failures.

All nonroutine or scheduled maintenance will be reported to the Analysis Coordinator responsible for that instrument and will enter the communication scheme reported in Section 3.3.10. The Analysis

FIGURE 3-9

NONCONFORMANCE AND DISPOSITION ACTION REPORT (NCR)

Navajo Refining Company

Date: ____________________

SUBMITTAL

NCR NO: ____________________

TO: ______________________

Description of Nonconformance and Cause:____________________________________

____

____

Proposed Disposition____

____

____

Submitted by__________________Location__________________

Approved by__________________Date__________________

DISPOSITION (by Project Manager or designee)

Implementation of Disposition Assigned to: ____________________

Actual Disposition: ____

____

____

______________________________Disposition completed on ____________________
(Date)

____
(Signature)

VERIFICATION

Disposition reviewed and work inspected by______________on______________Disposition verified by__________________on____________________________________

(Use additional sheet or memo if needed.)

TABLE 3-15
SCHEDULE OF AUDITS TO BE PERFORMED
NAVAJO REFINING COMPANY

AUDIT TYPE	CONDUCTED BY	AREA	SCHEDULE	(WORKING DAYS AFTER AUDIT) REPORT SCHEDULE	REPORT TYPE
SYSTEM STARTUP	LABORATORY MANAGER	LABORATORY	PRIOR TO PROJECT START OR IMMEDIATELY FOLLOWING	5 10	ORAL WRITTEN
SYSTEM STARTUP	NAVAJO PROGRAM MANAGER OR DESIGNEE	FIELD	FOLLOWING STARTUP	5 10	ORAL WRITTEN
PERFORMANCE	LABORATORY MANAGER	LABORATORY	WEEKLY	5 MONTHLY	ORAL WRITTEN
PERFORMANCE	NAVAJO QA OFFICER OR DESIGNEE	FIELD	SEMIMONTHLY	5 MONTHLY	ORAL WRITTEN
IN-DEPTH SYSTEMS AND PERFORMANCE	NAVAJO QA OFFICER OR DESIGNEE	FIELD AND LABORATORY	MID PROJECT	15	WRITTEN
AUDIT FOLLOWUP	NAVAJO QA OFFICER OR DESIGNEE	FIELD AND LABORATORY	AS NEEDED	20	WRITTEN
SYSTEMS	LABORATORY MANAGER	LABORATORY	SEMIMONTHLY	MONTHLY	WRITTEN
SYSTEMS	NAVAJO PROGRAM MANAGER OR DESIGNEE	FIELD	SEMIMONTHLY	MONTHLY	WRITTEN

Coordinators will review the maintenance records on a regular basis to ensure required maintenance is occurring.

3.3.11.2 Field Maintenance

All field instruments, sampling equipment and machinery will be maintained in accordance with manufacturers recommendations and normal field practice. All maintenance will be documented in permanent records by the individual responsible for each item. This will include routine scheduled maintenance and unscheduled maintenance. Unscheduled maintenance will be reported to the Project QA/QC Officer and the Program Manager. The Project QA/QC Officer will review the maintenance records on a regular basis to ensure required maintenance is occurring.

3.3.12 Data Assessment

All data generated will contain a statement on the accuracy and precision of the methodology used to obtain them. The procedures and equations for determining the accuracy and precision are discussed in Section 3.3.7, Analytical Procedures, and Section 3.3.9, Internal QC Checks and Frequency. These procedures will be reviewed during the performance audits described in Section 3.3.10, Performance and Systems Audits, to ensure that the procedures are being implemented and accurately followed. Field data will be assessed by the procedures referenced in this document and those respective operating procedures found in Section 3.2. These procedures will also be reviewed during the performance audits.

3.3.13 Corrective Action

The ultimate responsibility for maintaining quality in the analyses lies with the Navajo Program Manager. The routine operation of the quality assurance program, however, falls upon the QA/QC Officer, and the Laboratory Manager.

The Laboratory Manager will have the responsibility for ensuring that his personnel are adequately trained to perform analyses, that equipment and instrumentation under his control are calibrated and functioning properly, and that systems audits are performed on a regular basis.

The Laboratory Manager will have the responsibility for preparation and implementation of quality assurance plans. The Laboratory Manager or his designee will review the data generated to ensure that quality control samples are run as specified in the protocol.

The Navajo Quality Assurance Officer will have the responsibility for the preparation of S.O.P.s and quality assurance guidelines for the project, and for conducting/evaluating the results from systems audits. The Quality Assurance Officer will review program plans for consistency with organizational and contractual requirements and advise the Laboratory Manager.

The Navajo QA Officer or his designee also have responsibility for conducting and evaluating the QA procedures for the field testing and ensuring that all necessary corrective action items will be completed.

3.3.14 Quality Assurance Reports to Management

Section 3.3.10 describes the periodic assessments and performance and systems audits to be completed during the Navajo RFI Site Project. Table 3-16 is a summary of the written quality assurance reports that will be submitted to management.

TABLE 3-16
QA REPORTS TO MANAGEMENT
Navajo Refining Company

Report	Responsibility	Schedule
Laboratory Start Up Systems Audit Results	Laboratory Manager	10 days after audit
Field Start Up Systems Audit Results	QA Officer	10 days after audit
Laboratory Performance Audit Results	Laboratory Manager	Monthly
Field Performance Audit Results	QA Officer	10 days after audit
Laboratory Systems Audit Results	Laboratory Manager	Monthly
Field Systems Audit Results	QA Officer	10 days after audit
In-depth Performance and Systems Audit Results	QA Officer	Mid Project
Audit Deficiency Resolution	Field or Laboratory Personnel	As needed, 20 days after notice
Quality Assurance Summary	QA Officer	At Project Conclusion

As reported in Section 3.3.10, weekly assessment of the sample and quality assurance for accuracy, precision and completeness will be conducted and reported orally to the QA Officer. All audits and quality assessments will be reported in oral and written form to the QA Officer to provide rapid response to quality assurance problems and documentation of the audit and response in the project files.

After the field work has been completed and the final analyses are completed and checked, a final quality assurance report will be prepared to be included in the final RFI report. The report will summarize the quality assurance and audit information, indicating any corrective actions taken and the overall results of the QAPP.

4.0 DATA MANAGEMENT PLAN

4.1 DATA MANAGEMENT

The RFI will result in significant amounts of data, including results of chemical, physical, geotechnical and/or biological analyses. This may involve analyses of many constituents, in different media, at various sampling locations, and at different times. Data management procedures have been established to effectively process these data such that relevant data descriptions (e.g., sample numbers, locations, procedures, methods, and analysts) are readily accessible and accurately maintained.

In order to ensure effective data management, a data management plan will be implemented to document and track investigation data and results. This plan addresses data and report processing procedures, project file requirements and all project-related progress reporting procedures and documents. This plan provides the format(s) to be used to present the data, including data reduction.

4.2 DATA PRESENTATION

RFI data will be arranged and presented in a clear and logical format. Tabular, graphical, and other visual displays (e.g., contaminant isopleth maps) will be incorporated for organizing and evaluating such data. Particular methods most applicable to the RFI will vary with the type of unit, the type of data, the medium under consideration, and other factors.

Table 4-1 summarizes the methods and information to be incorporated into the data presentation of this RFI.

Sample identification numbers as well as laboratory data management (i.e., designation of blanks, duplicates, spikes, replicates, and data flagging) and data reduction techniques are presented in Section 3.3.

4.3 STATISTICAL PROCEDURES

Due to the presence of background or anthropogenic levels of organics and inorganics in various media or matrices, statistical tools can be utilized to evaluate data sets or populations. For instance, the data resulting from the RFI may be evaluated utilizing a T-test which indicates mathematical dissimilarity between populations. The rationale behind the selection of a specific statistical method, along with the appropriate documentation, will be included with the evaluation of the RFI data.

4.4 SCHEDULE

The estimated schedule for the RFI is included as Figure 4-1.

TABLE 4-1
USES OF TABLES AND GRAPHICS
Navajo Refining Company

Tabular Displays

1. DISPLAY SITE INFORMATION AND MEASUREMENTS TO BE PROVIDED:

   A. Water Table Elevations

      1. Field parameters.
      2. Date/time.
      3. Well coordinates used in determination.

   B. Sampling Location Coordinates

      1. Field parameters/lab parameters (gross).
      2. Date/time.
      3. Person collecting samples.

2. DISPLAY ANALYTICAL DATA

   A. List of constituents of concern and other monitoring parameters with associated analytical measurements.

   B. Display sorted results (e.g., by medium, sampling date, soil type).

   C. Compare study and background area data (Statistical Procedures).

      1. Statistical calculations
      2. Statistical reference charts

   D. Report input data, boundary conditions, and output values from mathematical modeling.

Graphic Displays

1. DISPLAY SITE FEATURES TO BE PROVIDED:

   A. Site layout and topographic map.

   B. Sampling locations map(s).

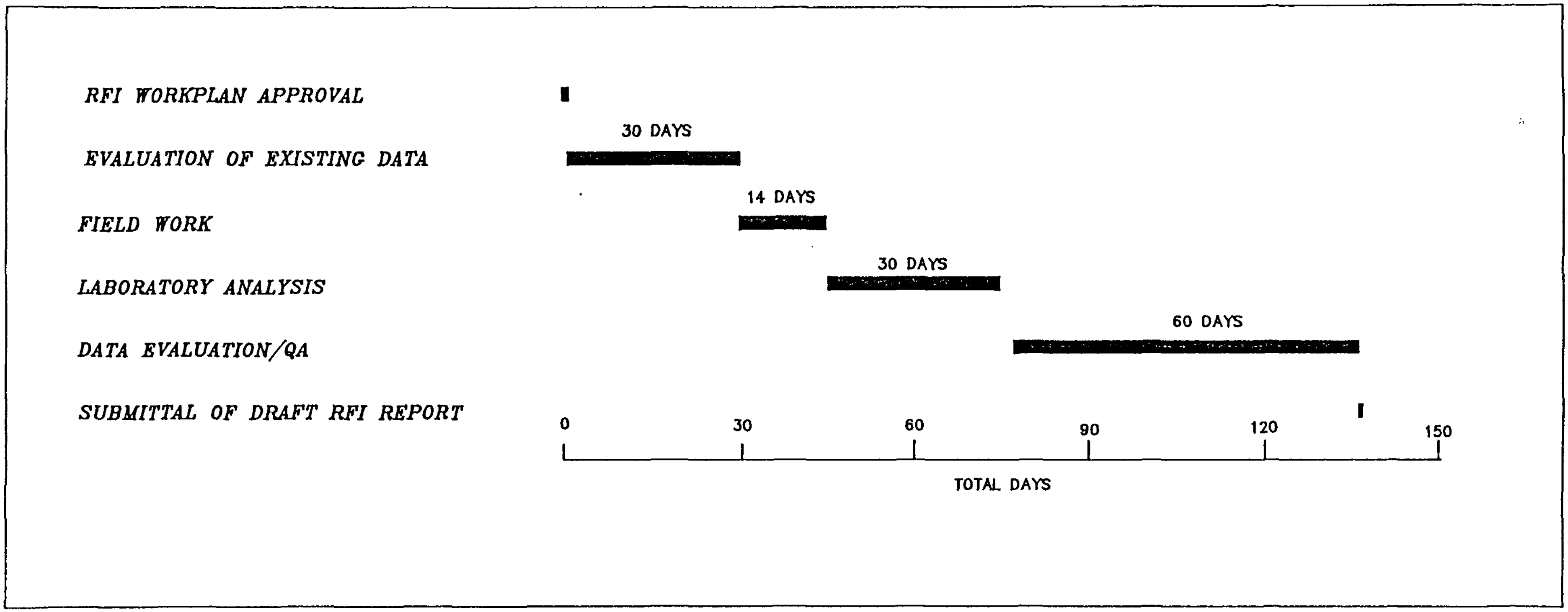
   C. Stratigraphy and water table elevations (profile, transect, and/or fence diagram).

   D. Potentiometric contour map of groundwater.

2. ILLUSTRATE THE EXTENT OF CONTAMINATION

   A. Areal extent of contamination for each SWMU and media.

SCHEDULE OF RFI WORKPLAN ACTIVITIES



The Earth Technology Corporation

PROJECT NO. 90-757
NAJAVO REFINING RFI WORKPLAN

FIGURE 4-1 SCHEDULE OF RFI ACTIVITIES

520 Post Oak Boulevard * Suite 750 * Houston * Texas * 77027

5.0 HEALTH AND SAFETY PLAN

The Health and Safety Plan (attached as Appendix C) has been designed to establish safe procedures and practices for personnel engaged in field work associated with the Resource Conservation and Recovery Act (RCRA) Facility Investigation at the Navajo Refinery in Artesia, New Mexico. All field personnel will be required to read the Health and Safety Plan and abide by all its provisions. The development of the plan is in accordance with the EPA's Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities and Part 1910.120 of Title 29 of the Code of Federal Regulations (Hazardous Waste Operations and Emergency Response).

The Health and Safety Plan may be modified by the Health and Safety Office with approval of the Project Manager in response to additional information about conditions at the site.

6.0 COMMUNITY RELATIONS PLAN

6.1 GENERAL

This community relations plan outlines procedures to be initiated to address community issues and foster communication among interested parties.

6.2 COMMUNITY RELATIONS OBJECTIVES

The objectives of the community relations program are to:

- Initiate and maintain open communication between the Navajo Refinery, the US EPA, local, state and federal officials, the media and interested citizens and groups.
- Provide a central information contact and/or Community Relations Coordinator from whom interested parties can receive information on project activities and status.
- Develop a mailing list including involved agencies and organizations, elected officials and residents who indicate interest in the project.
- Provide information on project status in a timely, consistent and understandable manner.
- Provide a means for interested parties to express concern and make inquiries.
- Monitor changes in community concerns as the project progresses so that, if necessary, the community relations plan may be modified to address the changes.

6.3 COMMUNITY RELATIONS TECHNIQUES

The following techniques are to be used to inform citizens, public officials, and the media of RFI activities:

- Prior to initiation of RFI operations, Navajo Refining Company will provide public notice of the RFI via the local newspaper and ask that any questions or comments be directed to the Community Relations Coordinator.
- Based on public response to this notice, Navajo may release press releases and fact sheets to interested local newspapers to inform them of upcoming RFI activities and present RFI findings.
- The Navajo Refinery Community Relations Coordinator will maintain ongoing contact with the refinery technical staff to keep informed of project progress, ensure that the staff is aware of community concerns and ensure that these concerns are addressed.
- Revise mailing lists as required to keep interested parties informed of project status.
- Establish a document repository so that all reports, data and information related to the RFI is easily accessible for public review.

- If community interest is high, conduct a public meeting (announced in a press release) at a convenient location in the community to give the general public a chance to give and receive feedback regarding site activities.

APPENDIX A

EPA CORRESPONDENCE

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION VI
1445 ROSS AVENUE, SUITE 1200
DALLAS, TEXAS 75202

July 15, 1988

U.S. Environmental Protection Agency
401 M Street, S.W.
Washington, D.C. 20460
Attn: Mr. Ronald McCallum,
Chief Judicial Officer

Re: Navajo Refining Company
Artesia, New Mexico
RCRA Appeal No. 88-3

Dear Mr. McCallum:

In furtherance of your March 29 correpsondence enclosed is our response to Navajo Refining Company's HSWA permit appeal. We have also enclosed the relevant portions of the administrative record and one coy of Navajo's June 20 letter wherein Navajo agrees to withdraw from its appeal the two issues which have been resolved. By copy of this letter, Navajo's counsel has been furnished with a copy of our response and the documents.

Yours very truly,

Renee V. Holmes

Renee V. Holmes
Assistant Regional Counsel

Enclosures

cc: Mr. Robert E. Morse, III

U.S. ENVIRONMENTAL PROTECTION AGENCY

BEFORE THE ADMINISTRATOR

IN THE MATTER OF	§	HSWA PERMIT NO.:
	§	
NAVAJO REFINING COMPANY	§	NMD048918817

MEMORANDUM OF LAW AND AUTHORITIES

I. BACKGROUND

Navajo Refining Company (Navajo) in Artesia, New Mexico is a petroleum refinery which processes crude oil and asphalt, carbon black oil, fuel oil, diesel fuel, gasoline and liquified petroleum gas.

On February 24, 1988, the Environmental Protection Agency (hereinafter referred to as "EPA") Region VI, issued to Navajo Refining Company (hereinafter referred to as "Navajo") a Hazardous Waste Permit, pursuant to the Resource Conservation Recovery Act (RCRA), as amended by the Hazardous and Solid Waste Amendments (HSWA) of 1984. Navajo filed its HSWA permit appeal on March 24, 1988, raising the following issues:

1. The requirement to submit a Preliminary Report, HSWA Permit Condition F.1, Task I; and

2. the requirement to conduct a release verification study at North Colony Container Storage Area. HSWA permit condition F.1, Task III B.

3. the requirement to conduct a RCRA Facility Investigation (RFI) and a Corrective Measures Study (CMS) on certain sites identified as 3-Mile Ditch/Eagle Creek and Evaporation Ponds 1, 2, and 3. HSWA Permit Conditions B.5(b) (iii)-(vi), C.1(b) (ii-v), F.1, Task III, D.1-3.;

Navajo and EPA Region VI representatives met on May 23 ,1988, at Region VI's office to discuss and attempt resolution of the matters raised in the appeal. A compromise was reached as Navajo agreed to furnish EPA information and data pertaining to the North Colony and Preliminary Report issues no later than June 6, 1988. EPA agreed to review that information to determine whether the documents would satisfy the relevant permit conditions. If EPA determined that the affected permit conditions were satisfied, Navajo would withdraw the appropriate issue or issues from its permit appeal.

EPA received the information on June 23, 1988 and July 8, 1988, and reviewed it for sufficiency. EPA considers the submitted information as satisfying the North Colony Container Storage Area release verification permit condition and the Preliminary Report submittal permit condition. By acknowledgment dated July 13, 1988, Navajo has agreed to withdraw these two issues from its HSWA permit appeal within thirty (30) days of execution of the acknowledgment. The requirement to conduct an RFI and CMS on 3-Mile Ditch/Eagle Creek and Evaporation Ponds 1, 2 and 3 is the remaining appeal issue.

A. Historical use of 3-Mile Ditch/Eagle Creek and the Evaporation Ponds

Oil and water products from refinery operations pass through one of the two API oil-water separators, resulting in recyclable oil, waste sludge and waste water. The sludge is landfarmed and the waste water is carried by the ditch to the three evaporations ponds. The ditch is unlined and earthen and it has been used in the refinery operations for more than fifty years. The evaporation ponds are three miles east of the rest of the facility, cover 80 acres and have also been used for more than fifty years. They receive plant drainage from the ditch, waste water from the API oil-water separators and overflow from the fire water pond. The ponds are very close to the Pecos River, one pond is within 200 feet of the river. Overflows of the ditch and ponds have been documented by the April, 1979 and May 1980 site investigations (ditch) heavy June 1979 rains (ditch), February 1979 Bureau of Land Management documented discharge (ponds) and a 1974 lagoons evaluation (ponds).

B. Comments During the Public Comment Period

During the public comment period, Navajo raised the same issue that is the basis of its HSWA permit appeal. In comment five (5), Navajo stated that the evaporation ponds and 3-Mile Ditch/Eagle Creek are off-site units and thus , not part of the permitted facility for HSWA corrective action purposes. In addition, Navajo has stated that (1) inasmuch as the ponds and ditch have been regulated by New Mexico Oil and Conservation Division (NMOCD) since 1974, groundwater and surface water impact analysis are required for the ponds and ditches by the (NMOCD) and (2) inasmuch as Navajo has certified the ponds and ditches to the New Mexico Environmental Improvement Division as not having received hazardous waste, EPA corrective action by EPA is redundant and may conflict with State corrective action.

The EPA response noted that RCRA Facility Investigations (RFI's) are needed to carry out the requirements of Section §3004(u) of the RCRA Hazardous and Solid Waste Amendments, 42 U.S.C. §6924(u). Section 3004 requires corrective action for releases of hazardous waste constituents from any solid waste management unit at a treatment, storage, or disposal facility. EPA also stated that the ditch and the ponds are within the definition of facility, found in 50 Fed. Reg. 28712 (July 1, 1985).

At an April 1981 site inspection, thick oily deposits were noted on the water in the ditch and the surrounding vegetation on the ditch's banks. A June 1985 site investigation of the ditch and the most upstream evaporation pond detected chromium levels that exceeded the EPA Toxicity limit for characteristic hazardous waste at the pond. (See the 11-19-85 Sampling Trip Summary and 04-14-86 Preliminary Assessment Report).

II. EPA Region VI Appeal Response To: The Requirement To Submit a Preliminary Report, HSWA Permit Condition F.1, Task I

On June 23, 1988, Navajo submitted to the EPA, Volumes I and II of the Final Report, Groundwater Investigations of Pond #1 and 3-Mile Ditch/Eagle Creek and monitoirng well data for the truck by-pass landfarm. EPA considers the submitted information and documents previously furnished, as satisfying HSWA permit condition F.1, Task I.

III. EPA Region VI Response to the Appeal of Requirement to Conduct a Release Verification Study at North Colony Container Storage Area, HSWA Permit Condition F.1., Task III B.

On June 23, 1988, Navajo submitted to the EPA the landfarm plot plan, inspection narrative and material safety data sheets. The documents submitted, the fact that the surrounding landfarm is subject to 40 CFR, Part 264 groundwater monitoring and the identification of the drums referenced in the RCRA Facility Assessment Report, are sufficient for the EPA to consider HSWA Permit Condition F.1., Task III B conditions as being satisfied.

IV. EPA Region VI Appeal Response to the Issue Concerning RFI and CMS Permit Requirements for 3-Mile Ditch/Eagle Creek and Evaporation Ponds 1, 2 and 3, HSWA Conditions B.5.(b) (III)-(VI), C-1(b)(II-v); F.1., Task III, D.1.-3.

Navajo contends that 3-Mile Ditch/Eagle Creek and the evaporation ponds are off-site facilities and therefore not subject to HSWA regulation. This is the same argument which Navajo raised in its public comment. In support of its position, Navajo references the three mile distance from the refinery, Navajo's lack of legal title to all of the ditch, and its lack of exclusive control of the ditch because adjoining landowners and the public have the right to use the ditch.

The definition of facility, found in the preamble to the July 26, 1982, regulations (47 Fed. Reg. 32288-89) is applicable to the 1984 HSWA Amendments (50 Fed. Reg. 28712). The term "facility" means the entire site under the control of the owner or operator engaged in hazardous waste management (50 Fed. Reg. 28712). It is interpreted as referring to "the broadest extent of EPA's area jurisdiction under Section 3004 of RCRA" [50 Fed. Reg. 28172] and includes all of the contiguous property which the owner or operator controls. The ditch has been used since the 1930's to transport waste materials to the evaporation ponds and Navajo has maintained the ditch. EPA has confirmed, by telephone conversations with Navajo's legal representative and the owners of the property adjoining the ditch, that Navajo has received verbal authority from the owners to use the ditch. This is consistent with the definition of an easement.

EPA interprets "facility" to include all contiguous property under the control of the owner or operator. Control is the operative term and it is a factual determination. The control need not be exclusive and legal title is not required. Navajo's use of the ditch for over fifty years the verbal approval of the various adjoining owners and Navajo's maintenance of the ditch establish Navajo's exercise of control. The ditch connects various portions of the facility, therefore constituting contiguous property, which is subject to the HSWA permit.

The applicable statutory authority is RCRA Section 3004(u), 42 U.S.C. 6924(u), which applies to releases at a permitted facility. Section 3004(v) is inapplicable because the present situation is not off-site contamination from an on-site contamination release. The state is not authorized to implement the HSWA amendments therefore EPA enforces the HSWA provisions and the implementing regulations, notwithstanding the New Mexico Oil and Conservation Division's regulatory actions. The required HSWA corrective action is not regulatorily redundant, as suggested by Navajo. Its purpose is to ensure that the investigation and subsequent actions satisfy the corrective action requirements of HSWA.

Although Navajo certified to the NMEID that hazardous wastes have not been received by the ponds or the ditch, the June 1985 site investigation found otherwise, as indicated by chromium levels exceeding the EP Toxicity limit for a characteristic hazardous waste. These elevated levels show that the API separators did not remove all of the hazardous waste from the waste stream, therefore hazardous constituents have been received by the ditch and the ponds.

V. CONCLUSION

The 3-Mile Ditch/Eagle Creek and Evaporation ponds, as part of a HSWA permitted facility are subject to the conditions contained in the permit. Therefore the corrective action is mandated by Section 3004(u) of RCRA and the RFI, and CMS are appropriate and consistent with EPA policy and regulations.

CERTIFICATE OF SERVICE

I do hereby certify that a copy of the foregoing Memorandum of Law of Authorities was hand-delivered to the Regional Hearing Clerk, U.S. Environmental Protection Agency, Region VI, 1445 Ross Avenue, Dallas, Texas and true and correct copies of the same were mailed First Class United States Mail, postage prepaid, on this 15th day of July 1988, addressed to the following:

Honorable Ronald McCallum
Chief Judical Officer
U.S. Environmental Protection Agency
401 M Street, S.W.
Washington, D.C. 20460

Robert E. Morse, III
Crain, Caton and James
3300 Two Houston Center
Houston, Texas 77010-1079

Renee V. Holmes
Renee' V. Holmes
Assistant Regional Counsel

APPENDIX B

AMBIENT PARTICULATE MONITORING PROCEDURES

APPENDIX B—REFERENCE METHOD FOR THE DETERMINATION OF SUSPENDED PARTICULATE MATTER IN THE ATMOSPHERE (HIGH-VOLUME METHOD)

1.0 *Applicability.*

1.1 This method provides a measurement of the mass concentration of total suspended particulate matter (TSP) in ambient air for determining compliance with the primary and secondary national ambient air quality standards for particulate matter as specified in § 50.6 and § 50.7 of this chapter. The measurement process is nondestructive, and the size of the sample collected is usually adequate for subsequent chemical analysis. Quality assurance procedures and guidance are provided in Part 58, Appendixes A and B, of this chapter and in References 1 and 2.

2.0 *Principle.*

2.1 An air sampler, properly located at the measurement site, draws a measured quantity of ambient air into a covered housing and through a filter during a 24-hr (nominal) sampling period. The sampler flow rate and the geometry of the shelter favor the collection of particles up to 25-50 μm (aerodynamic diameter), depending on wind speed and direction.(*3*) The filters used are specified to have a minimum collection efficiency of 99 percent for 0.3 μm (DOP) particles (see Section 7.1.4).

2.2 The filter is weighed (after moisture equilibration) before and after use to determine the net weight (mass) gain. The total volume of air sampled, corrected to EPA standard conditions (25° C, 760 mm Hg [101 kPa]), is determined from the measured flow rate and the sampling time. The concentration of total suspended particulate matter in the ambient air is computed as the mass of collected particles divided by the volume of air sampled, corrected to standard conditions, and is expressed in micrograms per standard cubic meter (μg/std m^3). For samples collected at temperatures and pressures significantly different than standard conditions, these corrected concentrations may differ substantially from actual concentrations (micrograms per actual cubic meter), particularly at high elevations. The actual particulate matter concentration can be calculated from the corrected concentration using the actual temperature and pressure during the sampling period.

3.0 *Range.*

3.1 The approximate concentration range of the method is 2 to 750 μg/std m^3. The upper limit is determined by the point at which the sampler can no longer maintain the specified flow rate due to the increased pressure drop of the loaded filter. This point is affected by particle size distribution, moisture content of the collected particles, and variability from filter to filter, among other things. The lower limit is determined by the sensitivity of the balance (see Section 7.10) and by inherent sources of error (see Section 6).

3.2 At wind speeds between 1.3 and 4.5 m/sec (3 and 10 mph), the high-volume air sampler has been found to collect particles up to 25 to 50 μm, depending on wind speed and direction.(*3*) For the filter specified in Section 7.1, there is effectively no lower limit on the particle size collected.

4.0 *Precision.*

4.1 Based upon collaborative testing, the relative standard deviation (coefficient of variation) for single analyst precision (repeatability) of the method is 3.0 percent. The corresponding value for interlaboratory precision (reproducibility) is 3.7 percent.(*4*)

5.0 *Accuracy.*

5.1 The absolute accuracy of the method is undefined because of the complex nature of atmospheric particulate matter and the difficulty in determining the "true" particulate matter concentration. This method provides a measure of particulate matter concentration suitable for the purpose specified under Section 1.0, Applicability.

6.0 *Inherent Sources of Error.*

6.1 *Airflow variation.* The weight of material collected on the filter represents the (integrated) sum of the product of the instantaneous flow rate times the instantaneous particle concentration. Therefore, dividing this weight by the average flow rate over the sampling period yields the true particulate matter concentration only when the flow rate is constant over the period. The error resulting from a nonconstant flow rate depends on the magnitude of the instantaneous changes in the flow rate and in the particulate matter concentration. Normally, such errors are not large, but they can be greatly reduced by equipping the sampler with an automatic flow controlling mechanism that maintains constant flow during the sampling period. Use of a contant flow controller is recommended.[*]

6.2 *Air volume measurement.* If the flow rate changes substantially or nonuniformly during the sampling period, appreciable error in the estimated air volume may result from using the average of the presampling and postsampling flow rates. Greater air volume measurement accuracy may be achieved by (1) equipping the sampler with a flow controlling mechanism that main-

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[*] At elevated altitudes, the effectiveness of automatic flow controllers may be reduced because of a reduction in the maximum sampler flow.

tains constant air flow during the sampling period,* (2) using a calibrated, continuous flow rate recording device to record the actual flow rate during the samping period and integrating the flow rate over the period, or (3) any other means that will accurately measure the total air volume sampled during the sampling period. Use of a continuous flow recorder is recommended, particularly if the sampler is not equipped with a constant flow controller.

6.3 *Loss of volatiles.* Volatile particles collected on the filter may be lost during subsequent sampling or during shipment and/or storage of the filter prior to the postsampling weighing.(*5*) Although such losses are largely unavoidable, the filter should be reweighed as soon after sampling as practical.

6.4 *Artifact particulate matter.* Artifact particulate matter can be formed on the surface of alkaline glass fiber filters by oxidation of acid gases in the sample air, resulting in a higher than true TSP determination.(*6 7*) This effect usually occurs early in the sample period and is a function of the filter pH and the presence of acid gases. It is generally believed to account for only a small percentage of the filter weight gain, but the effect may become more significant where relatively small particulate weights are collected.

6.5 *Humidity.* Glass fiber filters are comparatively insensitive to changes in relative humidity, but collected particulate matter can be hygroscopic.(*8*) The moisture conditioning procedure minimizes but may not completely eliminate error due to moisture.

6.6 *Filter handling.* Careful handling of the filter between the presampling and postsampling weighings is necessary to avoid errors due to loss of fibers or particles from the filter. A filter paper cartridge or cassette used to protect the filter can minimize handling errors. (See Reference 2, Section 2).

6.7 *Nonsampled particulate matter.* Particulate matter may be deposited on the filter by wind during periods when the sampler is inoperative. (*9*) It is recommended that errors from this source be minimized by an automatic mechanical device that keeps the filter covered during nonsampling periods, or by timely installation and retrieval of filters to minimize the nonsampling periods prior to and following operation.

6.8 *Timing errors.* Samplers are normally controlled by clock timers set to start and stop the sampler at midnight. Errors in the nominal 1,440-min sampling period may result from a power interruption during the sampling period or from a discrepancy between the start or stop time recorded on the filter information record and the actual start or stop time of the sampler. Such discrepancies may be caused by (1) poor resolution of the timer set-points, (2) timer error due to power interruption, (3) missetting of the timer, or (4) timer malfunction. In general, digital electronic timers have much better set-point resolution than mechanical timers, but require a battery backup system to maintain continuity of operation after a power interruption. A continuous flow recorder or elapsed time meter provides an indication of the sampler run-time, as well as indication of any power interruption during the sampling period and is therefore recommended.

6.9 *Recirculation of sampler exhaust.* Under stagnant wind conditions, sampler exhaust air can be resampled. This effect does not appear to affect the TSP measurement substantially, but may result in increased carbon and copper in the collected sample. (*10*) This problem can be reduced by ducting the exhaust air well away, preferably downwind, from the sampler.

7.0 *Apparatus.*

(See References 1 and 2 for quality assurance information.)

NOTE: Samplers purchased prior to the effective date of this amendment are not subject to specifications preceded by (†).

7.1 *Filter.* (Filters supplied by the Environmental Protection Agency can be assumed to meet the following criteria. Additional specifications are required if the sample is to be analyzed chemically.)

7.1.1 *Size:* 20.3 ± 0.2 × 25.4 ± 0.2 cm (nominal 8 × 10 in).

7.1.2 *Nominal exposed area:* 406.5 cm^2 (63 in^2).

7.1.3. *Material:* Glass fiber or other relatively inert, nonhygroscopic material. (*8*)

7.1.4 *Collection efficiency:* 99 percent minimum as measured by the DOP test (ASTM-2986) for particles of 0.3 μm diameter.

7.1.5 *Recommended pressure drop range:* 42–54 mm Hg (5.6–7.2 kPa) at a flow rate of 1.5 std m^3/min through the nominal exposed area.

7.1.6 *pH:* 6 to 10. (*11*)

7.1.7 *Integrity:* 2.4 mg maximum weight loss. (*11*)

7.1.8 *Pinholes:* None.

7.1.9 *Tear strength:* 500 g minimum for 20 mm wide strip cut from filter in weakest dimension. (See ASTM Test D828-60).

7.1.10 *Brittleness:* No cracks or material separations after single lengthwise crease.

7.2 *Sampler.* The air sampler shall provide means for drawing the air sample, via reduced pressure, through the filter at a uniform face velocity.

7.2.1 The sampler shall have suitable means to:

a. Hold and seal the filter to the sampler housing.

b. Allow the filter to be changed conveniently.

c. Preclude leaks that would cause error in the measurement of the air volume passing through the filter.

d. (†) Manually adjust the flow rate to accommodate variations in filter pressure drop and site line voltage and altitude. The adjustment may be accomplished by an automatic flow controller or by a manual flow adjustment device. Any manual adjustment device must be designed with positive detents or other means to avoid unintentional changes in the setting.

7.2.2 *Minimum sample flow rate, heavily loaded filter:* 1.1 m^3/min (39 ft^3/min).††

7.2.3 *Maximum sample flow rate, clean filter:* 1.7 m^3/min (60 ft^3/min).††

7.2.4 *Blower Motor:* The motor must be capable of continuous operation for 24-hr periods.

7.3 *Sampler shelter.*

7.3.1 The sampler shelter shall:

a. Maintain the filter in a horizontal position at least 1 m above the sampler supporting surface so that sample air is drawn downward through the filter.

b. Be rectangular in shape with a gabled roof, similar to the design shown in Figure 1.

c. Cover and protect the filter and sampler from precipitation and other weather.

d. Discharge exhaust air at least 40 cm from the sample air inlet.

e. Be designed to minimize the collection of dust from the supporting surface by incorporating a baffle between the exhaust outlet and the supporting surface.

7.3.2 The sampler cover or roof shall overhang the sampler housing somewhat, as shown in Figure 1, and shall be mounted so as to form an air inlet gap between the cover and the sampler housing walls. †This sample air inlet should be approximately uniform on all sides of the sampler. †The area of the sample air inlet must be sized to provide an effective particle capture air velocity of between 20 and 35 cm/sec at the recommended operational flow rate. The capture velocity is the sample air flow rate divided by the inlet area measured in a horizontal plane at the lower edge of the cover. †Ideally, the inlet area and operational flow rate should be selected to obtain a capture air velocity of 25 ±2 cm/sec.

7.4 *Flow rate measurement devices.*

7.4.1 The sampler shall incorporate a flow rate measurement device capable of indicating the total sampler flow rate. Two common types of flow indicators covered in the calibration procedure are (1) an electronic mass flowmeter and (2) an orifice or orifices located in the sample air stream together with a suitable pressure indicator such as a manometer, or aneroid pressure gauge. A pressure recorder may be used with an orifice to provide a continuous record of the flow. Other types of flow indicators (including rotameters) having comparable precision and accuracy are also acceptable.

7.4.2 † The flow rate measurement device must be capable of being calibrated and read in units corresponding to a flow rate which is readable to the nearest 0.02 std m^3/min over the range 1.0 to 1.8 std m^3/min.

7.5 *Thermometer,* to indicate the approximate air temperature at the flow rate measurement orifice, when temperature corrections are used.

7.5.1 *Range:* −40° to +50° C (223-323 K).

7.5.2 *Resolution:* 2° C (2 K).

7.6 *Barometer,* to indicate barometric pressure at the flow rate measurement orifice, when pressure corrections are used.

7.6.1 *Range:* 500 to 800 mm Hg (66-106 kPa).

7.6.2 *Resolution:* ±5 mm Hg (0.67 kPa).

7.7 *Timing/control device.*

7.7.1 The timing device must be capable of starting and stopping the sampler to obtain an elapsed run-time of 24 hr ±1 hr (1,440 ±60 min).

7.7.2 *Accuracy of time setting:* ±30 min, or better. (See Section 6.8).

7.8 *Flow rate transfer standard,* traceable to a primary standard. (See Section 9.2.)

7.8.1 *Approximate range:* 1.0 to 1.8 m^3/min.

7.8.2 *Resolution:* 0.02 m^3/min.

7.8.3 *Reproducibility:* ±2 percent (2 times coefficient of variation) over normal ranges of ambient temperature and pressure for the stated flow rate range. (See Reference 2, Section 2.)

7.8.4 *Maximum pressure drop at 1.7 std m^3/min;* 50 cm H_2O (5 kPa).

7.8.5 The flow rate transfer standard must connect without leaks to the inlet of the sampler and measure the flow rate of the total air sample.

7.8.6 The flow rate transfer standard must include a means to vary the sampler flow rate over the range of 1.0 to 1.8 m^3/min (35–64 ft^3/min) by introducing various levels of flow resistance between the sampler and the transfer standard inlet.

7.8.7 The conventional type of flow transfer standard consists of: An orifice unit with adapter that connects to the inlet of the sampler, a manometer or other device to measure orifice pressure drop, a means to

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(†) See note at beginning of Section 7 of this appendix.

†† These specifications are in actual air volume units; to convert to EPA standard air volume units, multiply the specifications by $(P_b/P_{std})(298/T)$ where P_b and T are the barometric pressure in mm Hg (or kPa) and the temperature in K at the sampler, and P_{std} is 760 mm Hg (or 101 kPa).

vary the flow through the sampler unit, a thermometer to measure the ambient temperature, and a barometer to measure ambient pressure. Two such devices are shown in Figures 2a and 2b. Figure 2a shows multiple fixed resistance plates, which necessitate disassembly of the unit each time the flow resistance is changed. A preferable design, illustrated in Figure 2b, has a variable flow restriction that can be adjusted externally without disassembly of the unit. Use of a conventional, orifice-type transfer standard is assumed in the calibration procedure (Section 9). However, the use of other types of transfer standards meeting the above specifications, such as the one shown in Figure 2c, may be approved; see the note following Section 9.1.

7.9 *Filter conditioning environment*

7.9.1 *Controlled temperature:* between 15° and 30° C with less than ±3° C variation during equilibration period.

7.9.2 *Controlled humidity:* Less than 50 percent relative humidity, constant within ±5 percent.

7.10 *Analytical balance.*

7.10.1 *Sensitivity:* 0.1 mg.

7.10.2 Weighing chamber designed to accept an unfolded 20.3 x 25.4 cm (8 x 10 in) filter.

7.11 *Area light source,* similar to X-ray film viewer, to backlight filters for visual inspection.

7.12 *Numbering device,* capable of printing identification numbers on the filters before they are placed in the filter conditioning environment, if not numbered by the supplier.

8.0 *Procedure.*

(See References 1 and 2 for quality assurance information.)

8.1 Number each filter, if not already numbered, near its edge with a unique identification number.

8.2 Backlight each filter and inspect for pinholes, particles, and other imperfections; filters with visible imperfections must not be used.

8.3 Equilibrate each filter in the conditioning environment for at least 24-hr.

8.4 Following equilibration, weigh each filter to the nearest milligram and record this tare weight (W_i) with the filter identification number.

8.5 Do not bend or fold the filter before collection of the sample.

8.6 Open the shelter and install a numbered, preweighed filter in the sampler, following the sampler manufacturer's instructions. During inclement weather, precautions must be taken while changing filters to prevent damage to the clean filter and loss of sample from or damage to the exposed filter. Filter cassettes that can be loaded and unloaded in the laboratory may be used to minimize this problem (See Section 6.6).

8.7 Close the shelter and run the sampler for at least 5 min to establish run-temperature conditions.

8.8 Record the flow indicator reading and, if needed, the barometric pressure (P_3) and the ambient temperature (T_3) see NOTE following step 8.12). Stop the sampler. Determine the sampler flow rate (see Section 10.1); if it is outside the acceptable range (1.1 to 1.7 m³/min [39–60 ft³/min]), use a different filter, or adjust the sampler flow rate. Warning: Substantial flow adjustments may affect the calibration of the orifice-type flow indicators and may necessitate recalibration.

8.9 Record the sampler identification information (filter number, site location or identification number, sample date, and starting time).

8.10 Set the timer to start and stop the sampler such that the sampler runs 24-hrs, from midnight to midnight (local time).

8.11 As soon as practical following the sampling period, run the sampler for at least 5 min to again establish run-temperature conditions.

8.12 Record the flow indicator reading and, if needed, the barometric pressure (P_3) and the ambient temperature (T_3).

NOTE: No onsite pressure or temperature measurements are necessary if the sampler flow indicator does not require pressure or temperature corrections (e.g., a mass flowmeter) or if average barometric pressure and seasonal average temperature for the site are incorporated into the sampler calibration (see step 9.3.9). For individual pressure and temperature corrections, the ambient pressure and temperature can be obtained by onsite measurements or from a nearby weather station. Barometric pressure readings obtained from airports must be station pressure, not corrected to sea level, and may need to be corrected for differences in elevation between the sampler site and the airport. For samplers having flow recorders but not constant flow controllers, the average temperature and pressure at the site *during the sampling period* should be estimated from weather bureau or other available data.

8.13 Stop the sampler and carefully remove the filter, following the sampler manufacturer's instructions. Touch only the outer edges of the filter. See the precautions in step 8.6.

8.14 Fold the filter in half lengthwise so that only surfaces with collected particulate matter are in contact and place it in the filter holder (glassine envelope or manila folder).

8.15 Record the ending time or elapsed time on the filter information record, either from the stop set-point time, from an elapsed time indicator, or from a continuous flow record. The sample period must be 1,440 ± 60 min. for a valid sample.

8.16 Record on the filter information record any other factors, such as meteorological conditions, construction activity, fires or dust storms, etc., that might be pertinent to the measurement. If the sample is known to be defective, void it at this time.

8.17 Equilibrate the exposed filter in the conditioning environment for at least 24-hrs.

8.18 Immediately after equilibration, reweigh the filter to the nearest milligram and record the gross weight with the filter identification number. See Section 10 for TSP concentration calculations.

9.0 *Calibration.*

9.1 Calibration of the high volume sampler's flow indicating or control device is necessary to establish traceability of the field measurement to a primary standard via a flow rate transfer standard. Figure 3a illustrates the certification of the flow rate transfer standard and Figure 3b illustrates its use in calibrating a sampler flow indicator. Determination of the corrected flow rate from the sampler flow indicator, illustrated in Figure 3c, is addressed in Section 10.1

NOTE: The following calibration procedure applies to a conventional orifice-type flow transfer standard and an orifice-type flow indicator in the sampler (the most common types). For samplers using a pressure recorder having a square-root scale, 3 other acceptable calibration procedures are provided in Reference 12. Other types of transfer standards may be used if the manufacturer or user provides an appropriately modified calibration procedure that has been approved by EPA under Section 2.8 of Appendix C to Part 58 of this chapter.

9.2 *Certification of the flow rate transfer standard.*

9.2.1 *Equipment required:* Positive displacement standard volume meter traceable to the National Bureau of Standards (such as a Roots meter or equivalent), stop-watch, manometer, thermometer, and barometer.

9.2.2 Connect the flow rate transfer standard to the inlet of the standard volume meter. Connect the manometer to measure the pressure at the inlet of the standard volume meter. Connect the orifice manometer to the pressure tap on the transfer standard. Connect a high-volume air pump (such as a high-volume sampler blower) to the outlet side of the standard volume meter. See Figure 3a.

9.2.3 Check for leaks by temporarily clamping both manometer lines (to avoid fluid loss) and blocking the orifice with a large-diameter rubber stopper, wide cellophane tape, or other suitable means. Start the high-volume air pump and note any change in the standard volume meter reading. The reading should remain constant. If the reading changes, locate any leaks by listening for a whistling sound and/or retightening all connections, making sure that all gaskets are properly installed.

9.2.4 After satisfactorily completing the leak check as described above, unclamp both manometer lines and zero both manometers.

9.2.5 Achieve the appropriate flow rate through the system, either by means of the variable flow resistance in the transfer standard or by varying the voltage to the air pump. (Use of resistance plates as shown in Figure 1a is discouraged because the above leak check must be repeated each time a new resistance plate is installed.) At least five different but constant flow rates, evenly distributed, with at least three in the specified flow rate interval (1.1 to 1.7 m^3/min [39–60 ft^3/min]), are required.

9.2.6 Measure and record the certification data on a form similar to the one illustrated in Figure 4 according to the following steps.

9.2.7 Observe the barometric pressure and record as P_1 (item 8 in Figure 4).

9.2.8 Read the ambient temperature in the vicinity of the standard volume meter and record it as T_1 (item 9 in Figure 4).

9.2.9 Start the blower motor, adjust the flow, and allow the system to run for at least 1 min for a constant motor speed to be attained.

9.2.10 Observe the standard volume meter reading and simultaneously start a stopwatch. Record the initial meter reading (V_i) in column 1 of Figure 4.

9.2.11 Maintain this constant flow rate until at least 3 m^3 of air have passed through the standard volume meter. Record the standard volume meter inlet pressure manometer reading as ΔP (column 5 in Figure 4), and the orifice manometer reading as ΔH (column 7 in Figure 4). Be sure to indicate the correct units of measurement.

9.2.12 After at least 3 m^3 of air have passed through the system, observe the standard volume meter reading while simultaneously stopping the stopwatch. Record the final meter reading (V_f) in column 2 and the elapsed time (t) in column 3 of Figure 4.

9.2.13 Calculate the volume measured by the standard volume meter at meter conditions of temperature and pressures as $V_m = V_f - V_i$. Record in column 4 of Figure 4.

9.2.14 Correct this volume to standard volume (std m^3) as follows:

$$V_{std} = V_m \frac{P_1 - \Delta P}{P_{std}} \frac{T_{std}}{T_1}$$

where:

V_{std} = standard volume, std m^3;

V_m = actual volume measured by the standard volume meter;
P_1 = barometric pressure during calibration, mm Hg or kPa;
ΔP = differential pressure at inlet to volume meter, mm Hg or kPa;
P_{std} = 760 mm Hg or 101 kPa;
T_{std} = 298 K;
T_1 = ambient temperature during calibration, K.

Calculate the standard flow rate (std m³/min) as follows:

$$Q_{std} = \frac{V_{std}}{t}$$

where:
Q_{std} = standard volumetric flow rate, std m³/min
t = elapsed time, minutes.

Record Q_{std} to the nearest 0.01 std m³/min in column 6 of Figure 4.

9.2.15 Repeat steps 9.2.9 through 9.2.14 for at least four additional constant flow rates, evenly spaced over the approximate range of 1.0 to 1.8 std m³/min (35-64 ft³/min).

9.2.16 For each flow, compute

$\sqrt{\Delta\Delta H\,(P_1/P_{std})(298/T_1)}$

(column 7a of Figure 4) and plot these value against Q_{std} as shown in Figure 3a. Be sure to use consistent units (mm Hg or kPa) for barometric pressure. Draw the orifice transfer standard certification curve or calculate the linear least squares slope (m) and intercept (b) of the certification curve:

$\sqrt{\Delta\Delta H\,(P_1/P_{std})(298/T_1)}$

$= mQ_{std} + b$. See Figures 3 and 4. A certification graph should be readable to 0.02 std m³/min.

9.2.17 Recalibrate the transfer standard annually or as required by applicable quality control procedures. (See Reference 2.)

9.3 *Calibration of sampler flow indicator.*

NOTE: For samplers equipped with a flow controlling device, the flow controller must be disabled to allow flow changes during calibration of the sampler's flow indicator, or the alternate calibration of the flow controller given in 9.4 may be used. For samplers using an orifice-type flow indicator downstream of the motor, do not vary the flow rate by adjusting the voltage or power supplied to the sampler.

9.3.1 A form similar to the one illustrated in Figure 5 should be used to record the calibration data.

9.3.2 Connect the transfer standard to the inlet of the sampler. Connect the orifice manometer to the orifice pressure tap, as illustrated in Figure 3b. Make sure there are no leaks between the orifice unit and the sampler.

9.3.3 Operate the sampler for at least 5 minutes to establish thermal equilibrium prior to the calibration.

9.3.4 Measure and record the ambient temperature, T_2, and the barometric pressure, P_2, during calibration.

9.3.5 Adjust the variable resistance or, if applicable, insert the appropriate resistance plate (or no plate) to achieve the desired flow rate.

9.3.6 Let the sampler run for at least 2 min to re-establish the run-temperature conditions. Read and record the pressure drop across the orifice (ΔH) and the sampler flow rate indication (I) in the appropriate columns of Figure 5.

9.3.7 Calculate $\sqrt{\Delta H(P_2/P_{std})(298/T_2)}$ and determine the flow rate at standard conditions (Q_{std}) either graphically from the certification curve or by calculating Q_{std} from the least square slope and intercept of the transfer standard's transposed certification curve: $Q_{std} = 1/m \quad \sqrt{\Delta H(P_2/P_{std})(298/T_2)} - b$. Record the value of Q_{std} on Figure 5.

9.3.8 Repeat steps 9.3.5, 9.3.6, and 9.3.7 for several additional flow rates distributed over a range that includes 1.1 to 1.7 std m³/min.

9.3.9 Determine the calibration curve by plotting values of the appropriate expression involving I, selected from Table 1, against Q_{std}. The choice of expression from Table 1 depends on the flow rate measurement device used (see Section 7.4.1) and also on whether the calibration curve is to incorporate geographic average barometric pressure (P_a) and seasonal average temperature (T_a) for the site to approximate actual pressure and temperature. Where P_a and T_a can be determined for a site for a seasonal period such that the actual barometric pressure and temperature at the site do not vary by more than ±60 mm Hg (8 kPa) from P_a or ±15° C from T_a, respectively, then using P_a and T_a avoids the need for subsequent pressure and temperature calculation when the sampler is used. The geographic average barometric pressure (P_a) may be estimated from an altitude-pressure table or by making an (approximate) elevation correction of −26 mm Hg (−3.46 kPa) for each 305 m (1,000 ft) above sea level (760 mm Hg or 101 kPa). The seasonal average temperature (T_a) may be estimated from weather station or other records. Be sure to use consistent units (mm Hg or kPa) for barometric pressure.

9.3.10 Draw the sampler calibration curve or calculate the linear least squares slope (m), intercept (b), and correlation coefficient of the calibration curve: [Expression from Table 1] = $mQ_{std} + b$. See Figures 3 and 5. Calibration curves should be readable to 0.02 std m³/min.

flow controller, the flow controlling mechanism should be re-enabled and set to a flow near the lower flow limit to allow maximum control range. The sample flow rate should be verified at this time with a clean filter installed. Then add two or more filters to the sampler to see if the flow controller maintains a constant flow; this is particularly important at high altitudes where the range of the flow controller may be reduced.

9.4 Alternate calibration of flow-controlled samplers. A flow-controlled sampler may be calibrated solely at its controlled flow rate, provided that previous operating history of the sampler demonstrates that the flow rate is stable and reliable. In this case, the flow indicator may remain uncali-

relative change between initial and final flows, and the sampler should be recalibrated more often to minimize potential loss of samples because of controller malfunction.

9.4.1 Set the flow controller for a flow near the lower limit of the flow range to allow maximum control range.

9.4.2 Install a clean filter in the sampler and carry out steps 9.3.2, 9.3.3, 9.3.4, 9.3.6, and 9.3.7.

9.4.3 Following calibration, add one or two additional clean filters to the sampler, reconnect the transfer standard, and operate the sampler to verify that the controller maintains the same calibrated flow rate; this is particularly important at high altitudes where the flow control range may be reduced.

TABLE 1. EXPRESSIONS FOR PLOTTING SAMPLER CALIBRATION CURVES

	Expression	
Type of sampler flow rate measuring device	**For actual pressure and temperature corrections**	**For incorporation of geographic average pressure and seasonal average temperature**
Mass flowmeter	I	I
Orifice and pressure indicator	$\sqrt{I\left(\frac{P_2}{P_{std}}\right)\left(\frac{298}{T_2}\right)}$	$\sqrt{I\left(\frac{P_2}{P_a}\right)\left(\frac{T_a}{T_2}\right)}$
Rotameter, or orifice and pressure recorder having square root scale*	$I\sqrt{\left(\frac{P_2}{P_{std}}\right)\left(\frac{298}{T_2}\right)}$	$I\sqrt{\left(\frac{P_2}{P_a}\right)\left(\frac{T_a}{T_2}\right)}$

*This scale is recognizable by its nonuniform divisions and is the most commonly available for high-volume samplers.

TABLE 2. EXPRESSIONS FOR DETERMINING FLOW RATE DURING SAMPLER OPERATION

Type of sampler flow rate measuring device	Expression	
	For actual pressure and temperature corrections	For use when geographic average pressure and seasonal average temperature have been incorporated into the sampler calibration
Mass flowmeter	I	I
Orifice and pressure indicator	$\sqrt{I\left(\frac{P_3}{P_{std}}\right)\left(\frac{298}{T_3}\right)}$	$\sqrt{I}$
Rotameter, or orifice and pressure recorder having square root scale*	$I\sqrt{\left(\frac{P_3}{P_{std}}\right)\left(\frac{298}{T_3}\right)}$	I

*This scale is recognizable by its nonuniform divisions and is the most commonly available for high-volume samplers.

10.0 *Calculations of TSP Concentration.*

10.1 Determine the average sampler flow rate during the sampling period according to either 10.1.1 or 10.1.2 below.

10.1.1 For a sampler without a continuous flow recorder, determine the appropriate expression to be used from Table 2 corresponding to the one from Table 1 used in step 9.3.9. Using this appropriate expression, determine Q_{std} for the initial flow rate from the sampler calibration curve, either graphically or from the transposed regression equation:

$Q_{std}=$

1/m ([Appropriate expression from Table 2]−b)

Similarly, determine Q_{std} from the final flow reading, and calculate the average flow Q_{std} as one-half the sum of the initial and final flow rates.

10.1.2 For a sampler with a continuous flow recorder, determine the average flow rate device reading, I, for the period. Determine the appropriate expression from Table 2 corresponding to the one from Table 1 used in step 9.3.9. Then using this expression and the average flow rate reading, determine Q_{std} from the sampler calibration curve, either graphically or from the transposed regression equation:

$Q_{std}=$

1/m ([Appropriate expression from Table 2]−b)

If the trace shows substantial flow change during the sampling period, greater accuracy may be achieved by dividing the sampling period into intervals and calculating an average reading before determining Q_{std}.

10.2 Calculate the total air volume sampled as:

$V-Q_{std}\times t$

where:

V=total air volume sampled, in standard volume units, std m^3/;

Q_{std}=average standard flow rate, std m^3/min;

t=sampling time, min.

10.3 Calculate and report the particulate matter concentration as:

$$TSP=\frac{(W_f-W_i)\times 10^6}{V}$$

where:

TSP=mass concentration of total suspended particulate matter, µg/std m^3;

W_i=initial weight of clean filter, g;

W_f=final weight of exposed filter, g;

V=air volume sampled, converted to standard conditions, std m^3,

10^6=conversion of g to µg.

10.4 If desired, the actual particulate matter concentration (see Section 2.2) can be calculated as follows:

$(TSP)_a=TSP\ (P_3/P_{std})(298/T_3)$

where:

$(TSP)_a$=actual concentration at field conditions, $\mu g/m^3$;

TSP=concentration at standard conditions, $\mu g/std\ m^3$;

P_a=average barometric pressure during sampling period, mm Hg;

P_{std}=760 mn Hg (or 101 kPa);

T_a=average ambient temperature during sampling period, K.

11.0 *References.*

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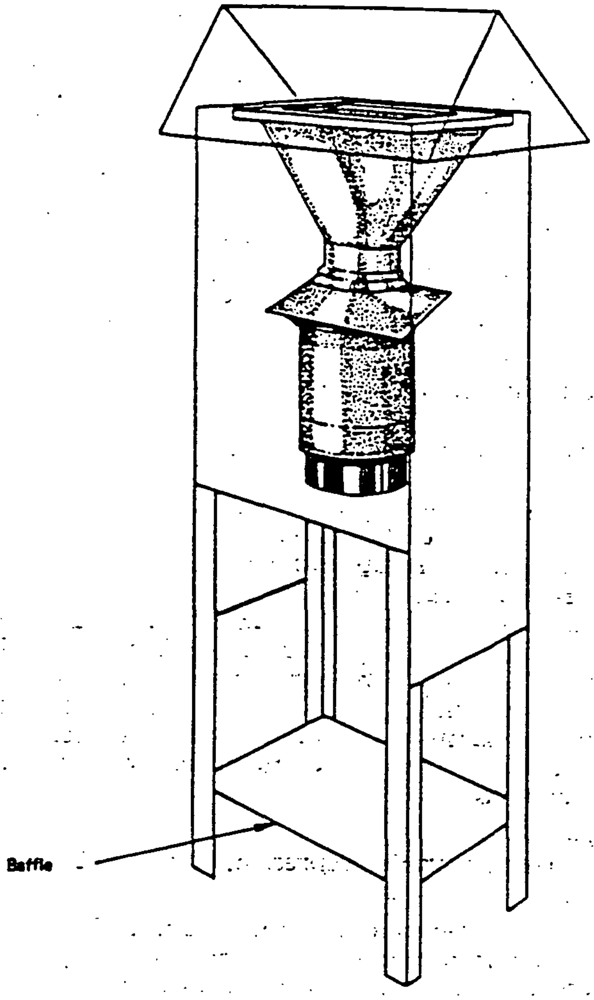
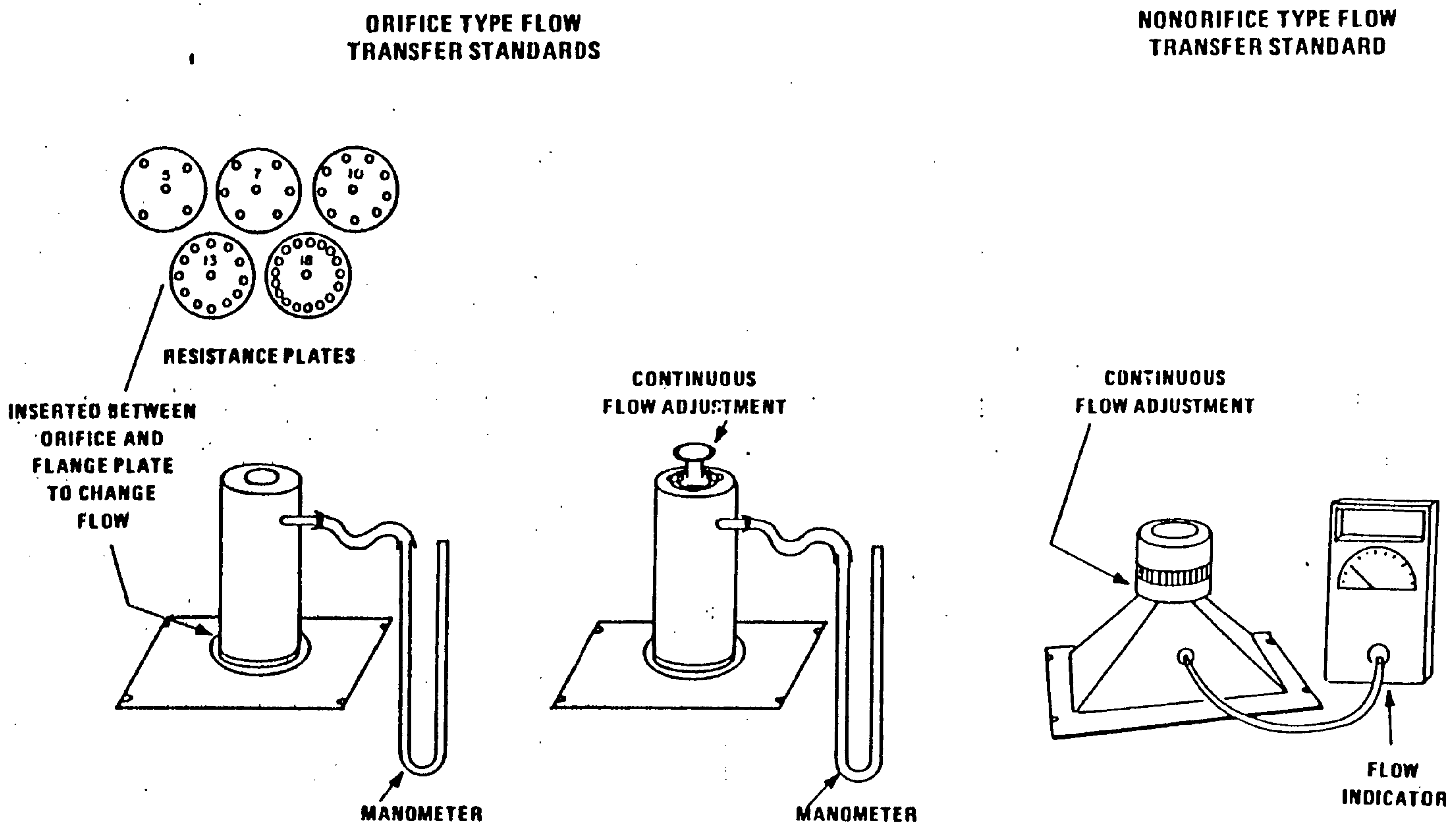


Figure 1. High-volume sampler in shelter.



2a. ORIFICE UNIT USING FIXED RESISTANCE PLATES.

2b. PREFERABLE ORIFICE UNIT WITH EXTERNALLY ADJUSTABLE RESISTANCE.

2c. ELECTRONIC FLOWMETER WITH EXTERNALLY ADJUSTABLE RESISTANCE.

Figure 2. Various types of flow transfer standards. Note that all devices are designed to mount to the filter inlet area of the sampler.

ORIFICE TRANSFER STANDARD CALIBRATION

1. Required determinations:
   V_m, t, T_1, P_1 and ΔH
2. Calculate flow of standard volume

$$V_{std} = V_m\left(\frac{P_1 - \Delta P}{P_{std}}\right)\left(\frac{T_{std}}{T_1}\right) = V_m\left(\frac{P_1 - \Delta P}{P_{std}}\right)\left(\frac{298}{T_1}\right)$$

$$Q_{std} = \frac{V_{std}}{t}$$

P_{std} = 760 mm Hg or 101 k Pa

SAMPLER CALIBRATION

1. Required determinations (see Table 1 in step 9.3.9 for the appropriate expression involving I):
   ΔH, T_2, P_2, and I

FLOW MEASUREMENT DURING SAMPLING

1. Required determinations:
   T_3, P_3, and I (for specific P and T corrections);

   I (if average barometric pressure and seasonal average temperature have been incorporated at previous calibration.)

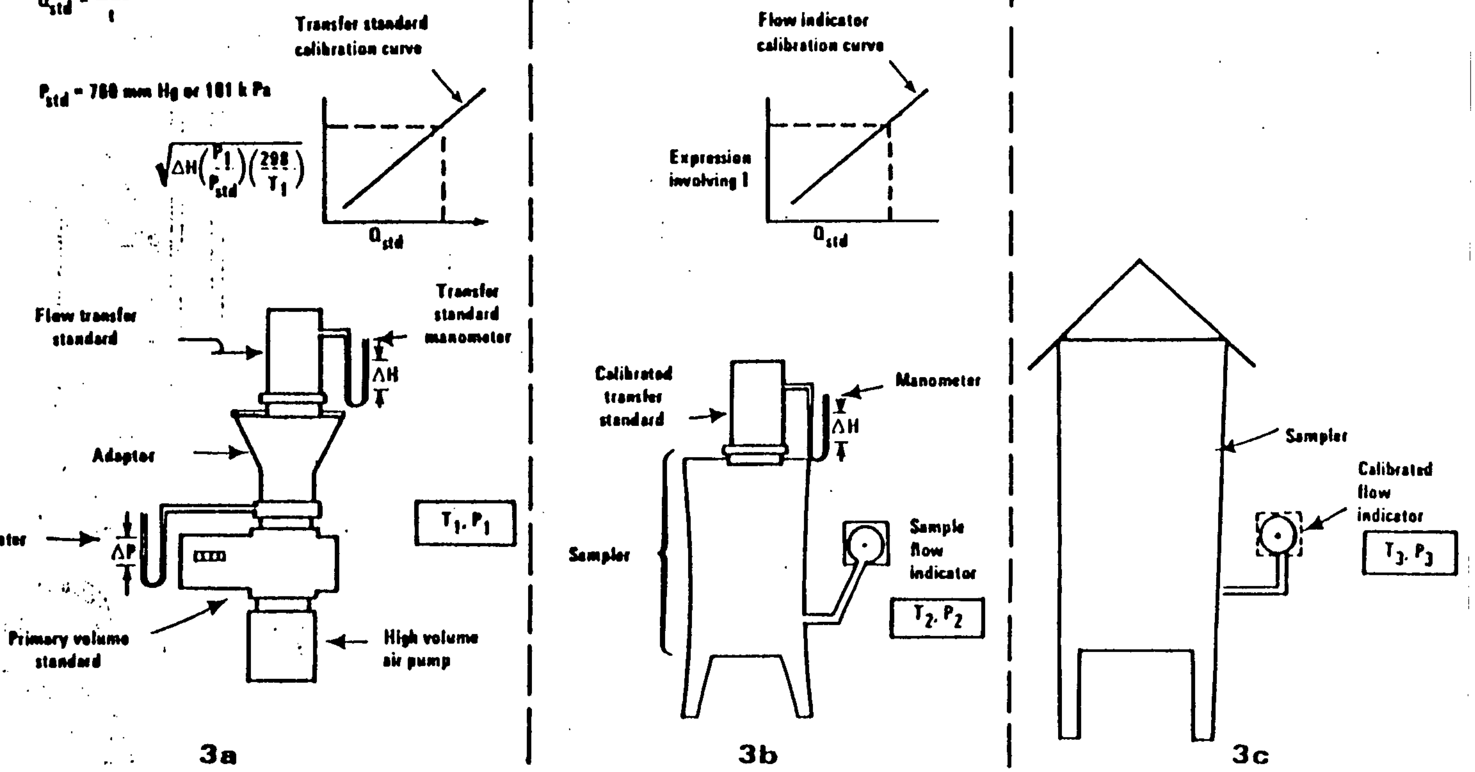


Figure 3. Illustration of the 3 steps in the flow measurement process.

ORIFICE TRANSFER STANDARD CERTIFICATION WORKSHEET

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(7a)
Run No.	Meter reading start V_i (m^3)	Meter reading stop V_f (m^3)	Sampling time t (min)	Volume measured V_m (m^3)	Differential pressure (at inlet to volume meter) ΔP (mm Hg or kPa)	(X) Flow rate Q_{std} (std m^3/min)	Pressure drop across orifice ΔH ☐ (in) or ☐ (cm) of water	($\hat{Y}$) $\sqrt{\Delta H\left(\frac{P_1}{P_{std}}\right)\left(\frac{298}{T_1}\right)}$
1								
2								
3								
4								
5								
6								

RECORDED CALIBRATION DATA

Standard volume meter no. ______________________

Transfer standard type: ☐ orifice ☐ other

Model No. ______________ Serial No. ______________

(8) P_1: ______________ mm Hg (or kPa) (10) P_{std}: 760 mm Hg (or 101 kPa)

(9) T_1: ______________ K (11) T_{std}: 298 K

Calibration performed by: ______________________

Date: ______________

CALCULATION EQUATIONS

(1) $V_m = V_f - V_i$

(2) $V_{std} = V_m\left(\frac{P_1 - \Delta P}{P_{std}}\right)\left(\frac{T_{std}}{T_1}\right)$

(3) $Q_{std} = \frac{V_{std}}{t}$

LEAST SQUARES CALCULATIONS

Linear ($Y = mX + b$) regression equation of $Y = \sqrt{\Delta H(P_1/P_{std})(298/T_1)}$ on $X = Q_{std}$ for Orifice Calibration Unit (i.e., $\sqrt{\Delta H(P_1/P_{std})(298/T_1)} = mQ_{std} + b$)

Slope (m) = ______________ Intercept (b) = ______________ Correlation coefficient (r) = ______________

To use for subsequent calibration: $X = \frac{1}{m}(Y-b)$; $\boxed{Q_{std} = \frac{1}{m}\left(\sqrt{\Delta H\left(\frac{P_2}{P_{std}}\right)\left(\frac{298}{T_2}\right)} - b\right)}$

Figure 4. Example of orifice transfer standard certification worksheet.

HIGH-VOLUME AIR SAMPLER CALIBRATION WORKSHEET

Site Location: ____________________

Date: ____________ Barometric Pressure, P_2 mm Hg (or kPa) ____________

Calibrated By: ____________ Temperature, T_2 (K) ____________

Sampler No. ____________ Serial No. ____________

Transfer std. type: ____________ Serial No. ____________

P_{std} = 760 mm Hg (or 101 kPa)

Optional:

Average barometric pressure: P_a = ____________

Seasonal average temperature: T_a = ____________

No.	ΔH Pressure drop across orifice ☐(in) or ☐(cm) of water	$\sqrt{\Delta H\left(\frac{P_2}{P_{std}}\right)\left(\frac{298}{T_2}\right)}$	(X) Q_{std} (from orifice certification) std m³/min	I Sampler flow rate indication (arbitrary)	(Y) For specific pressure and temperature corrections (see Table 1) ☐ I or ☐ $\sqrt{I\left(\frac{P_2}{P_{std}}\right)\left(\frac{298}{T_2}\right)}$ or ☐ $I\sqrt{\left(\frac{P_2}{P_{std}}\right)\left(\frac{298}{T_2}\right)}$	For incorporation of average pressure and seasonal average temperature (see Table 1) ☐ I or ☐ $\sqrt{I\left(\frac{P_2}{P_a}\right)\left(\frac{T_a}{T_2}\right)}$ or ☐ $I\sqrt{\left(\frac{P_2}{P_a}\right)\left(\frac{T_a}{T_2}\right)}$
1						
2.						
3						
4						
5						
6						

LEAST SQUARES CALCULATIONS

Linear regression of Y on X: $Y = mX + b$; Y = appropriate expression from Table 1; $X = Q_{std}$.

Slope (m) = ______ Intercept (b) = ______ Correlation Coeff. (r) = ________

To determine subsequent flow rate during use: $X = \frac{1}{m}(Y-b)$; $\boxed{Q_{std} = \frac{1}{m}(\text{[appropriate expression from Table 2]} - b)}$

Figure 5. Example of high-volume air sampler calibration worksheet.

[47 FR 54912, Dec. 6, 1982; 48 FR 17355, Apr. 22, 1983]

APPENDIX C

HEALTH & SAFETY PLAN

HEALTH AND SAFETY PLAN
FOR THE
NAVAJO REFINERY
RCRA FACILITY INVESTIGATION

PREPARED FOR:

NAVAJO REFINING COMPANY

BY:

The Earth Technology Corporation (Western)
520 Post Oak Boulevard
Suite 750
Houston, Texas 77027

November 1989

HEALTH AND SAFETY PLAN
NAVAJO REFINERY
RCRA FACILITY INVESTIGATION

SUBSECTION TITLE PAGE

ATTACHMENTS

THE EARTH TECHNOLOGY CORPORATION
HEALTH AND SAFETY PLAN
FOR THE
NAVAJO REFINERY
RCRA FACILITY INVESTIGATION (RFI)

1.0 PROJECT IDENTIFICATION

Client:	Navajo Refining Company
Project:	Navajo
Project Number:	90-757
Date of Plan:	______________
Anticipated Dates of Work:	______________

2.0 INTRODUCTION

This Health and Safety Plan (HSP) establishes guidelines and requirements for the safety of field and laboratory personnel during the conduct of the activities associated with the referenced project. All employees of Navajo Refinery's selected consultant and its subcontractors involved in this project are required to abide by the provisions of this plan. They are required to read this plan and sign the attached Compliance Agreement (Attachment A).

The Health and Safety guidelines and requirements presented are based on a review of available information and an evaluation of potential hazards. This plan may be modified by the Program Manager or the Health & Safety Officer in response to additional information regarding the potential hazards to investigative personnel.

3.0 SITE DESCRIPTION AND HISTORY

3.1 SITE LOCATION

Navajo Refinery is located at 501 East Main Street in Artesia, Eddy County, New Mexico Township 17 South Regional 26 East. The general location of the facility is shown in Figure 3-1. An overall facility map is shown in Figure 3-2.

3.2 TOPOGRAPHY

Artesia lies in the southeastern plains of New Mexico on a broad, mature plateau developed on flat-lying bedrock. The city is at an average elevation of 3390 feet (MSL) on an essentially featureless plain which slopes eastward at about 3 feet per mile (0.35 degree). Surface drainage is dominated by small ephemeral creeks and arroyos which flow eastward to the Pecos River located approximately 3 miles east of the refinery site (see Figure 3-1). These small drainages are parallel and spaced at about 0.75 to 1.5 miles apart.

3.3 EXPECTED WEATHER CONDITIONS

The site is characterized by semiarid conditions. Annual rainfall is approximately 12 inches per year with the majority falling between May and October. The average annual pan evaporation is over 112 inches, 65 percent of which occurs from May to October.

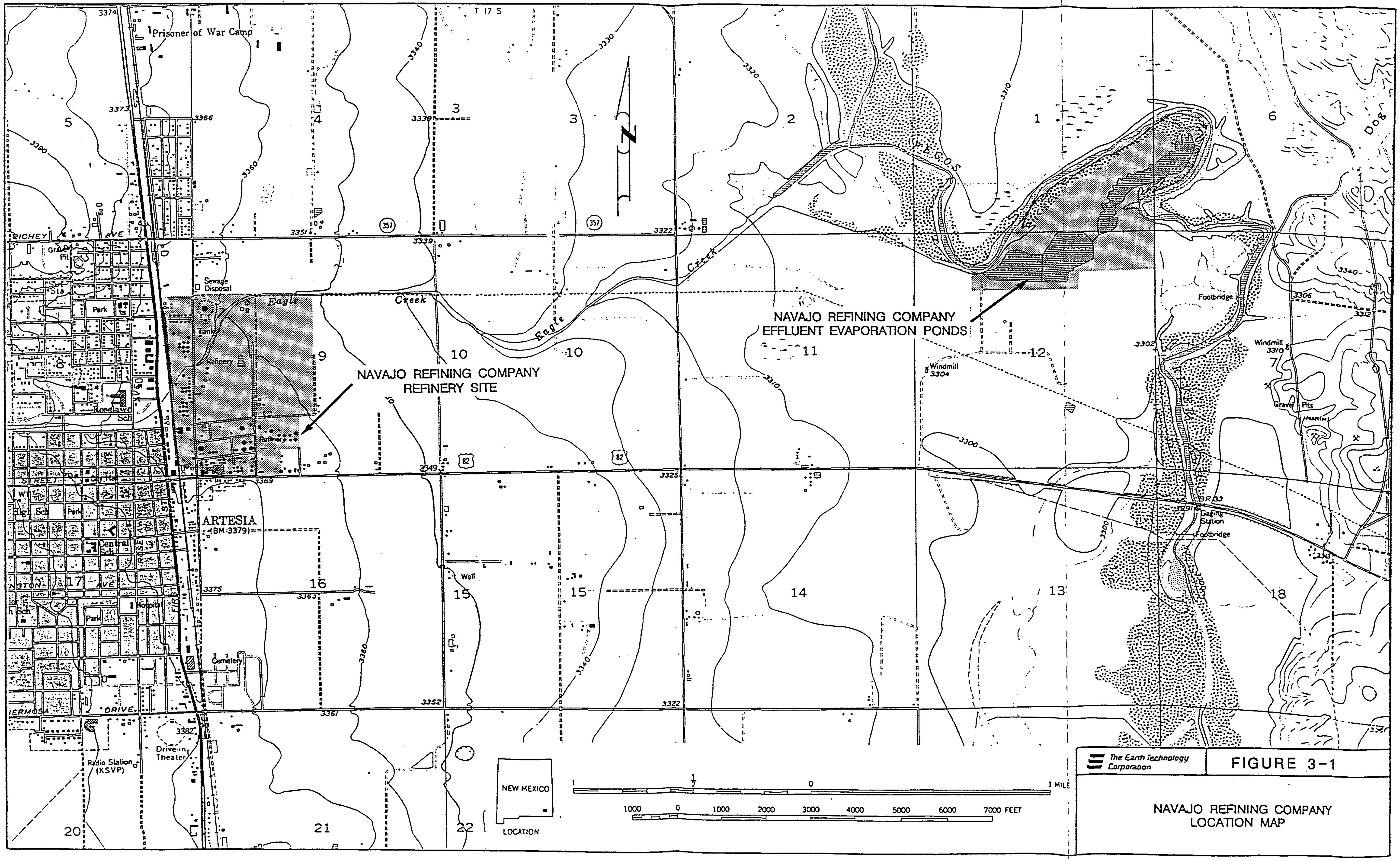
The annual mean temperature in Artesia is approximately 61 degrees. The individual daytime temperatures often exceed 100° with a record high recorded in Artesia of 116°. The average monthly daytime maximum temperature occurring in July, the warmest month, is approximately 92° while in January, the coldest month, average daytime temperatures are in the mid to high 50's. Below freezing temperatures are common during the winter months.

3.4 SITE HISTORY/BACKGROUND

The facility is a petroleum refinery which began operations in the 1920s. The technology, size and ownership of the facility has changed numerous times since beginning operations. The facility consists of two separate divisions designated the North Division and the South Division. In 1969, Navajo purchased both divisions from Conoco and began to integrate the operation in to a single refinery capable of processing New Mexico sour crude (an asphalt-based crude) in the South Division and New Mexico intermediate crude (a paraffin-based crude) in the smaller North Division. The facility has the capacity to refine about 36,000 barrels of crude per day. The South Division produces about five-sixth of the total.

The major refining processes at the facility are: crude oil fractionation, fluidized catalytic cracking, alkylation, reforming, and desulfurization. Several auxiliary activities are associated with these processes which separate impurities from the feedstocks and products or are required for the operation and maintenance of the refinery. The units associated with these auxiliary activities include: boilers, cooling towers, storage tanks, water purification facilities, desalting units, and drying and sweetening units.

The production activities at the Navajo Refinery generate a variety of solid wastes and wastewater streams. RCRA solid waste (eg., oil-water separator sludges, heat exchanger bundle cleaning sludges, slop oil emulsion solids and, when produced, leaded tank bottoms) are disposed of at the facility's RCRA permitted North Colony Landfarm. The wastewater management system presently employed by Navajo consists of a system of Lagoons.



The Earth Technology Corporation

FIGURE 3-1

NAVAJO REFINING COMPANY
LOCATION MAP

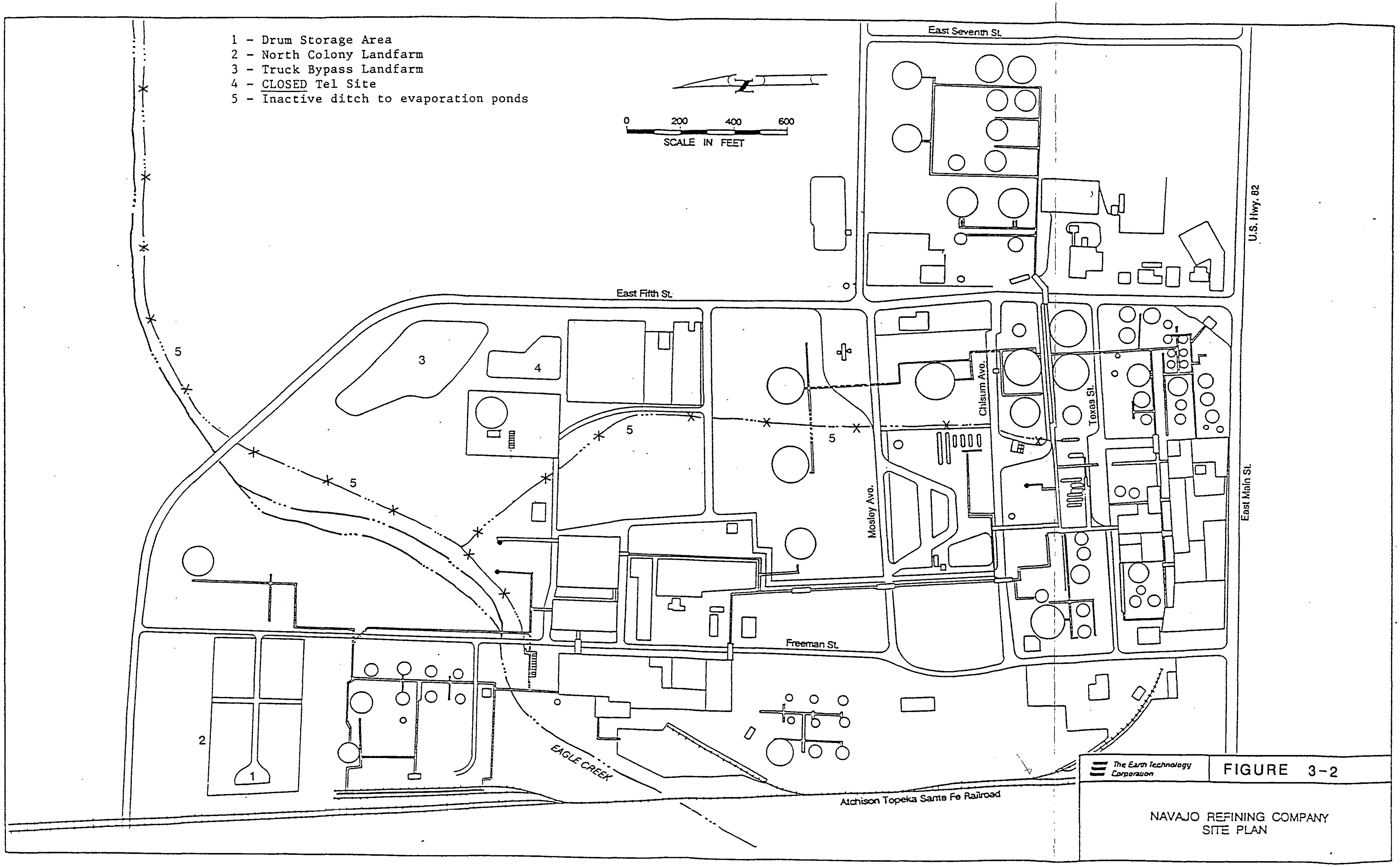


FIGURE 3-2

NAVAJO REFINING COMPANY
SITE PLAN

In addition to the above-described facilities for waste treatment and disposal, Navajo has disposed of some of its wastes at the Artesia City Landfill prior to (and possibly after) 1979.

In March 1986, Navajo Refinery submitted a revised application for a Hazardous and Solid Waste permit to the U.S. EPA. The U.S. EPA conducted a preliminary review of all solid waste management units (SWMU) at the site in April 1986. Based on this review, it was determined that a RCRA Facility Investigation (RFI) was required. Completion of this investigation was made a condition of permit approval.

4.0 STAFF ORGANIZATION, RESPONSIBILITIES AND AUTHORITIES

Program Manager, (Consultant selected by Navajo Refinery), Telephone Number:

The Program Manager has the primary responsibility for all on-site activities associated with the Navajo Refinery site. Although health and safety is the responsibility of all personnel working at the Site, the Program Manager will receive special assistance in these areas from the Director of Corporate Health and Safety (DCHS) and the Health and Safety Officer (HSO). The authorities and responsibilities of the key health and safety personnel are discussed below.

4.1 DIRECTOR OF CORPORATE HEALTH AND SAFETY (DCHS) - Consultant selected by Navajo Refinery), Telephone Number:

4.1.1 Authority (DCHS):

- Change or modify protection levels as required.
- Suspend work due to Health and Safety Program violations, health related incidents and other increased work risk situations.
- Remove personnel from work site if their actions endanger the health and safety of other field personnel.

4.1.2 Responsibilities (DCHS):

- Review and approve the Site Specific Health and Safety Plan.
- Provide corporate oversight of all aspects of the Health and Safety program.
- Conduct Site inspections to monitor compliance with the applicable procedures.
- Approve selection of Health and Safety Officer.

4.2 HEALTH AND SAFETY OFFICER (HSO) - (Consultant selected by Navajo Refinery), Telephone Number: ____________________

4.2.1 Authority (HSO):

- Change or modify protection levels as required.
- Suspend work due to Health and Safety Program violations, health related incidents and other increased risk situations.
- Remove personnel from work site if their actions endanger the health and safety of other field personnel.
- Authorize personnel to enter the Site based on medical and training requirements.

4.2.2 Responsibilities (HSO):

- Implement the Site Specific Health and Safety Plan.

- Conduct Site inspections to monitor compliance with the approved Health and Safety Plan.
- Provide or coordinate training sessions.
- Coordinate the Medical Monitoring Program.
- Conduct respirator fit tests as required.
- Coordinate the acquisition, calibration, and maintenance of air monitoring equipment, respirators, and other safety equipment.

5.0 WASTE CHARACTERIZATION

Waste encountered during investigation activities may have resulted from any of the numerous refinery processes and auxiliary activities conducted at the site and described in the work plan.

5.1 TYPES

Types of contaminated material may include liquids (groundwater, water in evaporation ponds, separators, conveyance ditches, decontamination solutions, etc.); semi-solids (oil-water separator sludges, evaporation pond sludges, heat exchanger sludges, landfarm sludges, etc.); solids (soils, sediments and debris from sumps, ponds, ditches and landfarms and suspended particulates matter from contaminated areas), and gases (volatized organic and inorganic vapors from ponds, ditches, tanks, sumps, etc.).

5.2 COMPOUNDS DETECTED AT THE SITE

Table 5-1 lists the applicable OSHA Standards, ACGIH recommended TLVs, STELs and IDLH levels for compounds which may be suspected to be present at the site.

TABLE 5-1

APPLICABLE EXPOSURE LIMITS OF COMPOUNDS PRESENT OR EXPECTED TO BE PRESENT

COMPOUND	OSHA TWA (1)	OSHA STEL (2)	ACGIH TLV (3)	ACGIH STEL (4)	IDLH (5)
AMMONIA	—	35ppm	25ppm	35ppm	500 ppm
ARSENIC AND COMPOUNDS (as As)	0.01 mg/m^3	—	0.2 mg/m^3	—	VARIABLE
BARIUM COMPOUNDS	0.5 mg/g^3	—	0.5 mg/m^3	—	250 mg/m3
BENZENE	1 ppm	5 ppm	10 ppm	—	2000 ppm
BERYLLIUM AND COMPOUNDS (as Be)	0.002 ppm	0.005 ppm	0.002 ppm	—	VARIABLE
CADMIUM, DUSTS (as Cd)	0.2 mg/m^3	0.6 mg/m^3	0.05 mg/m^3	—	40 mg/m^3
CHROMIUM, METAL AND INSOLUBLE SALTS (as Cr)	1 mg/m^3	—	0.5 mg/m^3	—	500 mg/m^3
COAL TAR PITCH VOLATILES	0.2 mg/m^3	—	0.2 mg/m^3	—	400 mg/m^3
CRESOLS	5 ppm	— (skin)	5 ppm	—	250 ppm
CYANIDES (as Cn)	5 ppm	—	5 mg/m^3	— (skin)	50 mg/m^3
ETHYLBENZENE	100 ppm	125 ppm	100 ppm	125 ppm	2000 ppm
GASOLINES	300 ppm	500 ppm	300 ppm	500 ppm	—
HYDROGEN CYANIDE	—	4.7 ppm	10 ppm (skin)	— (skin)	60 mg/m^3
HYDROGEN FLOURIDE	3 ppm	6 ppm	3 ppm	—	20 ppm
HYDROGEN SULFIDE	10 ppm	15 ppm	10 ppm	15 ppm	300 ppm
LEAD, INORGANIC DUST AND FUMES	0.05 mg/m^3	—	0.15 mg/m^3	—	VARIABLE
MERCURY, ALKYL COMPOUNDS DUSTS	0.01 mg/m^3	0.03 mg/m^3 (skin)	0.01 mg/m^3 (skin)	0.03 mg/m^3 (skin)	10 mg/m^3 (skin)
MERCURY, ALL FORMS EXCEPT ALKYL VAPOR	—	—	0.05 mg/m^3	—	—

TABLE 5-1 (cont.)

APPLICABLE EXPOSURE LIMITS OF COMPOUNDS PRESENT OR EXPECTED TO BE PRESENT

COMPOUND	TWA (1)	OSHA STEL (2)	OSHA TLV (3)	ACGIH STEL (4)	ACGIH IDLH (5)
MERCURY, ARYL AND INORGANIC	—	—	0.1 mg/m^3	—	—
NAPHTHALENE	10 ppm	15 ppm	10 ppm	15 ppm	500 ppm
PARTICULATES, NOT OTHERWISE REGULATED (TOTAL)	15 mg/m^3	—	10 mg/m^3	—	—
PHENOL	5 ppm	— (skin)	5 ppm	— (skin)	100 ppm
SILVER, METAL, DUST, FUMES AND COMPOUNDS (as Ag)	0.01 mg/m^3	—	0.01 mg/m^3	—	VARABLE
TETRAETHYL LEAD	—	0.075	0.15 (skin)	— (skin)	40 mg/m^3
TOLUENE	100 ppm	150 ppm	100 ppm	150 ppm	2000 ppm
XYLENE	100 ppm	150 ppm	100 ppm	150 ppm	10,000 ppm
ZINC	—	—	—	—	—

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1. Occupational Safety and Health Administration (OSHA) Time Weighted Average (TWA) Values from Table 2-1-A Final Rule Limits, CFR 1910.1000 and specific chemical regulations.
2. OSHA Short Term Exposure Limits (STEL). Values from Table 2-1-A Final Rule Limits, CFR 1910.1000 and specific chemical regulations.
3. American Conference of Governmental Industries Hygenists (ACGIH) Time Weighted Average (TWA) Values from ACGIH Threshold Limit Values and Biological Exposure Indicies for 1989-1990.
4. ACGIH Short Term Exposure Limit (STEL) Values from ACGIH Threshold Limit Values and Biological Exposure Indicies for 1989-1990.
5. Immediately Dangerous to Life and Health. Values from NIOSH Pocket Guide to Chemical Hazards, September 1985.

6.0 HAZARD ASSESSMENT

A number of hazards exist or will exist during investigation operations at the Navajo Site. These hazards are primarily due to the toxic nature of chemicals contaminating the site. This section assesses field operations by classifying the work into three activity groups (No Waste Contact Activities, Limited Waste Contact Activities, and Direct Waste Contact Activities) based on the likelihood of chemical exposure. The groups are then further defined by assessing possible exposure to additional site hazards - physical hazards associated with equipment operation and materials handling; electrical hazards; biologic hazards; noise hazards; heat and cold stress hazards and fire hazards.

Methods of controlling and reducing exposure to the chemical hazards are outlined in Section 7.0 and methods to reduce the danger of the additional site hazards are provided in Sections 8.0 - 10.0.

6.1 TOXIC AND HAZARDOUS SUBSTANCES ROUTES OF EXPOSURE

Hazards associated with toxic chemicals are of primary importance at the site. A number of chemicals may exist at the site in vapor, liquid, or solid form. Toxicological properties of those compounds are provided in Attachment B. These materials can enter the unprotected body via inhalation, absorption through the skin, ingestion, or possibly through a puncture wound (injection). These contaminants can potentially cause injury at the point of contact or may act systematically causing toxic effects in other areas of the body.

Chemical exposures are generally divided into two categories: acute and chronic. Symptoms resulting from acute exposures usually occur during or shortly after exposure to a sufficiently high concentration of a contaminant. The concentration required to produce such effects varies widely from chemical to chemical. The term "chronic exposure" generally refers to exposures to "low" concentrations of a contaminant over a long period of time. The "low" concentrations required to produce symptoms of chronic exposure depend upon the chemical, the duration of each exposure, and the number of exposures. For a given contaminant, the symptoms of an acute exposure may be completely different from those resulting from chronic exposure.

For either chronic or acute exposure, the toxic effect may be temporary and reversible, or may be permanent (disability or death). Some chemicals may cause obvious symptoms such as burning, coughing, nausea, tearing eyes, or rashes. Other chemicals may cause health damage without any such warning signs (this ia a particular concern for chronic exposure to low concentrations). Health effects such as cancer or respiratory disease may not become manifest for several years or decades after exposure. In addition, some toxic chemicals may be colorless and/or odorless, may dull the sense of smell, or may not produce any immediate or obvious physiological sensations. Thus, a worker's senses or feelings cannot be relied upon in all cases to warn of potential toxic exposure.

The effects of exposure not only depend on the chemical, its concentration, route of entry, and duration of exposure, but may also be influenced by personal factors such as the individual's smoking habits, alcohol consumption, medication use, nutrition, age, and sex.

An important exposure route of concern at the site is inhalation. The lungs are extremely vulnerable to chemical exposure. Even substances that do not directly affect the lungs may pass through lung tissue into the bloodstream, where they are transported to other vulnerable areas of the body. Some toxic chemicals present in the atmosphere may not be detected by human senses, i.e., they may be colorless, odorless, and their toxic effects may not produce any immediate symptoms. Respiratory protection is therefore extremely important at the site. Chemicals can also enter the respiratory tract through punctured eardrums. Where this is a hazard, individuals with punctured eardrums should be medically evaluated specifically to determine if such a condition would place them at unacceptable risk and preclude their working at the task in question.

Direct contact of the skin and eyes by hazardous substances is another important route of exposure expected at this site. Some chemicals directly injure the skin. Some pass through the skin into the bloodstream where they are transported to vulnerable organs. Skin absorption is enhanced by abrasions, cuts, heat, and moisture. The eye is particularly vulnerable because airborne chemicals can dissolve in its moist surface and be carried to the rest of the body through the bloodstream (capillaries are very close to the surface of the eye). Wearing protective equipment, not using contact lenses in contaminated atmospheres (since they may trap chemicals against the eye surface), keeping hands away from the face, and minimizing contact with liquid and solid chemicals can help protect against skin and eye contact.

Although ingestion should not be a significant route of exposure at the site, it is important to be aware of how this type of exposure can occur. Deliberate ingestion of chemicals is unlikely; however, personal habits such as chewing gum or tobacco, drinking, eating, smoking, and applying cosmetics on site may provide a route of entry for chemicals. It is for this reason that use of these items is not allowed on-site.

The last primary route of chemical exposure is injection, whereby chemicals are introduced into the body through puncture wounds (for example, by stepping or tripping and falling onto contaminated sharp objects). Wearing safety shoes, avoiding physical hazards, and taking common sense precautions are important protective measures against injection.

6.2 CLASSIFICATION OF FIELD ACTIVITIES

The objective of this investigation is to determine the baseline environmental conditions at the site. The scope of the investigation will be focused on collecting the type and amount of data required to be submitted with the permit application for continued operation of the facility's hazardous waste unit.

For purposes of the Health and Safety Plan, the activities included in this project has been based on the degree of contact field personnel are likely to have with the contaminated wastes. These groupings may be revised by the Health and Safety Officer if on-site observations indicate they are not providing adequate protection. It is the responsibility of all personnel to assess deficiencies noted in the protection of field personnel, and to report any deficiencies to the Health and Safety Officer so that procedures can be formally changed.

The following field activities are grouped by degrees of exposure.

6.2.1 No Waste Contact Activities - Activities that involve no contact with contaminated materials include:

o Mobilization and demobilization.

6.2.2 Limited Waste Contact Activities - Activities that involve indirect or potential for contact with waste include:

o Site surveying.
o Off-site sampling activities.

6.2.3 Direct Waste Contact Activities - Activities that involve direct contact with contaminated wastes include:

- Installation of on-site soil borings.
- Laboratory analysis of soil, sediment and groundwater samples.
- Installation/redevelopment of on-site monitoring wells.
- Collection of on-site soil, sediment, sludges, groundwater and surface water samples.
- Preparation for shipment of soil, sediment, sludge, groundwater and surface water samples.
- Decon Operations

6.3 HAZARD ASSESSMENT

An assessment of hazards has been made for each of the activity groups.

6.3.1 For activities which involve no waste contact, the primary hazards are physical hazards such as heat or cold stress, contact with biologic hazards, and fire hazards associated with support operations (e.g., refueling).

6.3.2 For activities which involve only limited or a potential for waste contact, the following hazards have been identified and shall be protected against:

- Physical hazards such as material handling and the use of equipment while wearing personal protective equipment (PPE)

- Heat/cold stress.

- Inhalation of low concentrations of organic and inorganic vapors and particulates contaminated with organic and inorganic chemicals.

- Limited skin or eye contact with organic and inorganic wastes.

- Ingestion of organic and inorganic compounds.

- Contact with biologic hazards.

6.3.3 For activities which involve direct waste contact, the following hazards have been identified and shall be protected against:

- Physical hazards associated with material handling and the use of equipment while wearing PPE.

- Heat/cold stress.

- Inhalation of high concentrations of organic and inorganic vapors and particulates contaminated with organic and inorganic compounds.

- Extensive skin or eye contact with organic wastes.

- Ingestion of organic and inorganic compounds.

- Contact with biologic hazards

7.0 CHEMICAL HAZARD CONTROL

Actions will be taken to reduce and maintain employee exposure to below the permissible exposure levels of those hazardous chemicals found on the site. These actions include implementing engineering controls, utilizing personnel protective equipment, designating and limiting access to certain work areas and implementing appropriate personnel and equipment decontamination procedures (Section 14.0). Air monitoring (Section 13.0) will be performed to ensure compliance and alert to any need to upgrade protection.

7.1 ENGINEERING CONTROLS

Dust control operations (covering dusty areas) will be utilized as necessary to prevent spread of airborne contamination.

7.2 PERSONAL PROTECTIVE EQUIPMENT

It is important that personal protective equipment and safety requirements are appropriate to protect against the potential or known hazards at the Site. Protective equipment has been selected based on the types, concentrations, possibilities and the routes of personnel exposure from substances at the Site. The following levels of protection are required for the following activity groups.

Activity	Level of Protection *
No Waste Contact Activities (6.2.1)	D
Limited Waste Contact Activities (6.2.2)	Modified D
Direct Waste Contact Activities (6.2.3)	Modified D, C or B *(Based on monitoring results and H&S Officer assessment of work activity)

7.2.1 Level B Protection

Personal Protective Equipment

- Full facepiece supplied-air respirator (NIOSH approved).

  Respirators may be:

  -Full facepiece pressure-demand, self-contained breathing apparatus

  or

  -Full facepiece pressure-demand, airline respirator (with escape bottle for IDLH or potential for IDLH atmosphere)

- Chemical-resistant clothing (Hooded, one or two-piece chemical-splash suit or disposable, chemical-resistant, one-piece suits)
- Long underwear*

- Coveralls*
- Gloves (outer), chemical-resistant
- Gloves (inner), chemical-resistant
- Boots (outer), chemical-resistant, steel toe and shank
- Boot covers (outer), chemical-resistant (disposable)*
- Hard hat (face shield*) (as required)
- Hearing protection (as required)
- Radio*

*Optional Equipment

7.2.2 Level C Protection

Personal Protective Equipment

- Full or half-facepiece air-purifying respirator, equipped with combination high efficiency dust/mist and organic vapor cartridges (NIOSH approved)

  or

  Full facepiece powered air purifying respirator equipped with combination high efficiency, dust/mist and organic vapor cartridges (NIOSH approved)
- Chemical-resistant clothing (one-piece or two-piece chemical splash suit or disposable, chemical-resistant coveralls)
- Coveralls*
- Long underwear*
- Gloves (outer), chemical-resistant
- Gloves (inner), chemical-resistant*
- Boots (outer), chemical-resistant, steel toe and shank
- Hard hat (face shield*) (as required)
- Chemical protective goggles (with half-face respirators)
- Hearing protection (as required)
- Radio*

*Optional Equipment

7.2.3 Modified Level D Protection

Personal Protective Equipment

- Chemical resistant clothing (one-piece or two-piece chemical splash suit or disposable, chemical resistant coveralls)
- Coveralls*
- Long underwear*
- Gloves (outer), chemical resistant
- Gloves (inner), chemical resistant
- Boots (outer), chemical resistant, steel toe and shank
- Hard hat (face shield*) (as required)
- Safety glasses or chemical splash goggles
- Hearing protection (as required)
- Radio*

*Optional equipment

7.2.4 Level D Protection

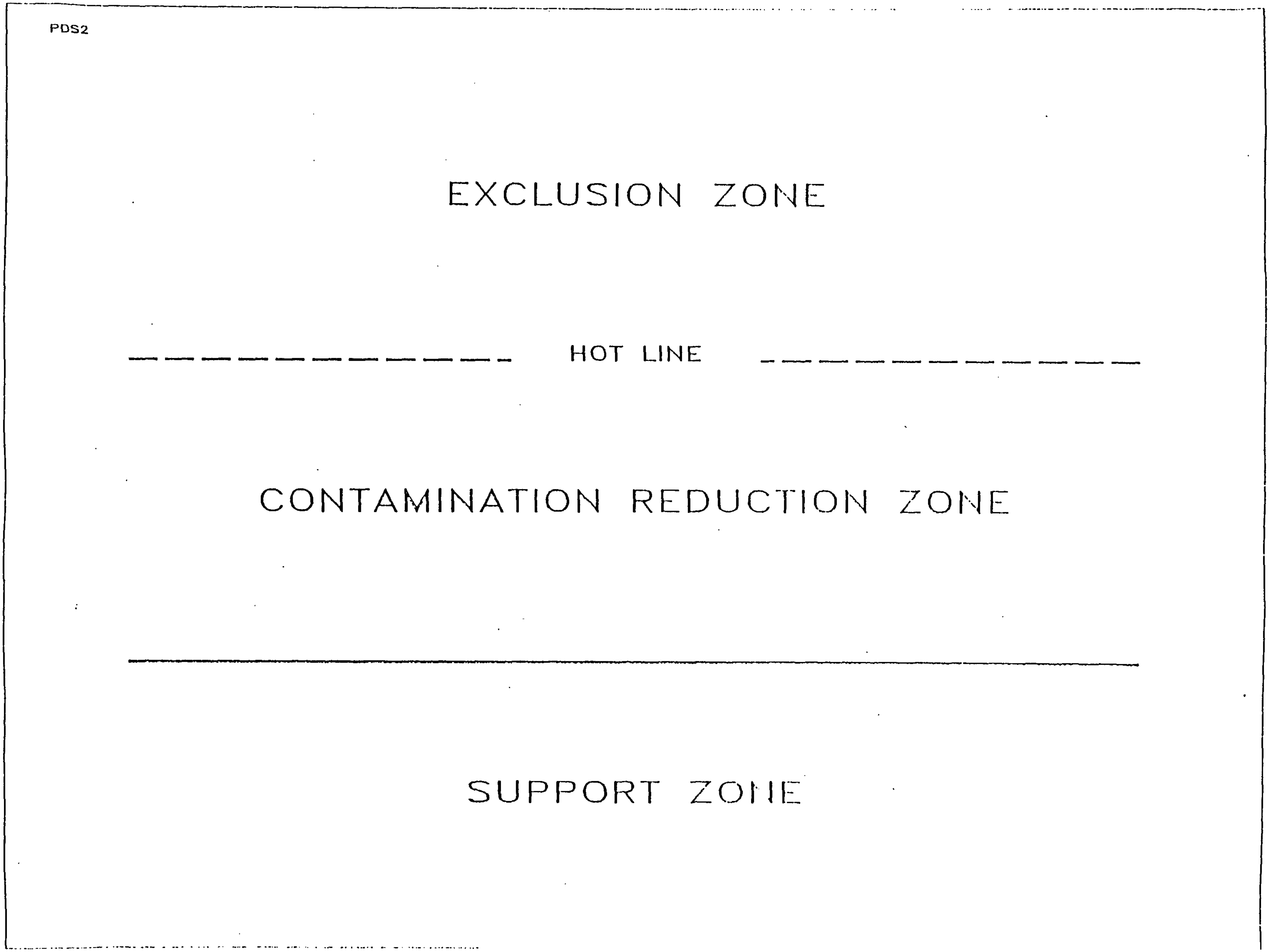
Personal Protective Equipment

- Coveralls
- Gloves*
- Boots/shoes, leather or chemical resistant, steel toe and shank
- Safety glasses or chemical splash goggles
- Hard hat (face shield*) (as required)
- Hearing protection (as required)
- Radio*

*Optional equipment

7.3 WORK ZONE DELINEATION

To restrict the movement of contaminants from the Site to uncontaminated areas, work zone areas shall be set up and appropriately marked (See Figure 7-1). The work zones shall be as follows:


PDS2
EXCLUSION ZONE
HOT LINE
CONTAMINATION REDUCTION ZONE
SUPPORT ZONE

7.3.1 Zone 1: Exclusion Zone

The Exclusion Zone is the zone where contamination does or could occur. All persons entering this zone shall wear the level of protection set forth in the this Section and prescribed by the Health and Safety Officer.

7.3.2 Zone 2: Contamination Reduction Zone

The Contamination Reduction Zone provides a transition zone between contaminated and clean areas of the Site. This zone shall be located directly outside the Exclusion Zone. All personnel and equipment leaving the Exclusion Zone shall be decontaminated. Procedures for decontamination are specified in Section 14.

7.3.3 Zone 3: Support Zone

The Support Zone shall be an uncontaminated area from which operations shall be directed. It is essential that contamination be kept out of this area.

(NOTE: These zones may change and will be updated as required)

8.0 ADDITIONAL SITE HAZARD CONTROLS

8.1 PHYSICAL HAZARDS

In addition to the chemical hazards involved with the Navajo investigation, a number of physical hazards will be present. These will vary according to specific activities implemented. The following subsections briefly describe some of these anticipated hazards and control methods.

8.1.1 General Site Safety Procedures

Hazards due to normal site activities include falling, tripping, improper lifting, pinching, bumping, etc. These hazards can be reduced by using "common sense," and following the guidelines below:

- Running and horseplay will not be allowed.
- All equipment will be used only by personnel familiar with its use, and authorized to use the equipment.
- Safety devices on equipment must be left intact and used as designed.
- Equipment and tools should be kept clean and in good repair, and used only for their intended purpose.
- Good housekeeping practices will be followed.
- Hazardous areas will be marked and barricaded.
- Trenching/excavation operations (if required) will be conducted in accordance with 29CFR 1926.650.
- Use of chemicals will be limited to authorized personnel familiar with their use and associated hazards.
- No smoking, flame or spark producing devices will be allowed within the confines of the Navajo Refinery except in especially designated areas.

8.1.2 Heavy Equipment Operation (if required)

- Operation of heavy equipment will be limited to personnel specifically trained for operation of that piece of equipment.
- The operator shall use the safety devices provided with the equipment, including seat belts.
- While in operation all personnel not directly required shall keep a safe distance from the equipment, preferably greater than 50 feet.
- Prior to utilization of any heavy equipment at the Navajo Facility, the appropriate facility operating permits shall be obtained from the designated supervisor personnel.

- Personnel directly involved in an activity shall avoid moving into the path of a piece of equipment, or any portion thereof. Areas blinded from the operator's vision will be avoided.

- Additional riders will not be allowed on equipment unless specifically designed for that purpose.

- Cranes and lifting devices shall be load tested and inspected in accordance with 29CFR 1926.550. Rigging will be in accordance with 29 CFR 1926.251.

8.1.3 Mechanical Equipment Operation

Operation of mechanical equipment (eg. drill rig) presents another potential source for physical hazards. Some guidelines which shall be followed include:

- Operation will be conducted by authorized personnel familiar with the machine, its operation, and safety provisions.

- Keep hands, feet, etc., away from all moving parts.

- Maintenance and/or adjustments to machinery will not be conducted while in operation. Power will be disconnected prior to maintaining equipment.

- Adequate operating area shall be provided, allowing sufficient clearance and access for operation.

- Good housekeeping practices shall be followed.

- Prior to utilization of any mechanical equipment at the Navajo Facility, the appropriate facility operating permits shall be obtained from the designated supervisory personnel.

- No boring, augering or subsurface exploration will be initiated until the area is determined to be free of underground pipelines or appurtances that may interfere or present a safety hazard.

8.2 ELECTRICAL HAZARDS

Electrical wiring and apparatus safety procedures shall be conducted in accordance with local and state codes and OSHA's standard 29 CFR Part 1910.137 (2). These requirements include but are not limited to:

- No electrical work, tie-in to plant electric system, use of portable generators, etc. will be initiated until approved by Navajo Refinery's authorized representative and the appropriate permits are issued.

- All electrical wiring and equipment shall be of a type listed by UL or Factory Mutual Engineering Corp. for the specific application.

- All installations shall comply with the National Electrical Safety Code (NESC), or the National Electrical Code (NEC) regulations.

- All work shall be by personnel familiar with code requirements and qualified for the class of work to be performed.

- Live parts of wiring or equipment shall be guarded to protect all persons or objects from harm.

- Electric wire or flexible cord passing through work areas shall be covered or elevated to protect it from damage by foot traffic, vehicles, sharp corners, projections, or pinching.

- Temporary power lines, switch boxes, receptacle boxes, metal cabinets, and enclosures around equipment shall be marked to indicate the maximum operating voltage.

- Patched, oil-soaked, worn or frayed electric cords or cables shall not be used.

- Portable handlamps shall be of the molded composition or other type approved for the purpose. Metal-shell, paperlined lampholders shall not be used. Handlamps shall be equipped with a handle and a substantial guard over the bulb that is attached to the lampholder or the handle.

- Extension cords or cables shall not be fastened with staples, hung from nails, or suspended by barb wire.

- All electrical circuits shall be grounded in accordance with the NEC and the NESC unless otherwise noted in the reference manuals.

- Portable and semi-portable electrical tools and equipment shall be grounded by a multiconductor cord having an identified grounding conductor and a multicontact polarized plug-in receptacle.

- Semi-portable equipment, floodlights, and work lights shall be grounded. The protective ground of such equipment should be maintained during moving unless supply circuits are de-energized.

- Tools protected by an approved system of double insulation, or its equivalent, need not be grounded. Double insulated tools shall be distinctly marked and listed by UL or FM.

- Ground fault circuit interrupters (GFCIs) are required in all circuits used for portable electric tools. The GFCI shall be calibrated to trip within the threshold values of 5ma± 1ma as specified in UL Standard 943. All GFCIs shall be UL listed and installed in accordance with the most recent edition of the National Electric Code. The permanent wiring shall be electrical circuits grounded in accordance with the NEC. GFCIs may be sensitive to some equipment such as concrete vibrators. In these instances, an assured equipment grounding conductor program is acceptable.

- Flexible cord sets shall be of a type listed by the UL. Flexible cord sets used on construction sites shall contain the number of conductors required for the service plus an equipment ground wire. The cords shall be hard usage or extra hard usage as specified in the NEC. Approved cords may be identified by the word "outdoor" or letters "WA" on the jacket.

- Bulbs attached to festoon lighting strings and extension cords shall be protected by wire guards or equivalent unless deeply recessed in a reflector.

- Temporary wiring shall be guarded, buried, or isolated by elevation to prevent accidental contact by workers or equipment.

8.3 NOISE

Control of noise hazards shall be in accordance with 29 CFR Part 1910.95. The hazards associated with excessive noise include:

- Workers being startled, annoyed, or distracted.
- Physical damage to the ear, pain, and temporary and/or permanent hearing loss.
- Communication interference that may increase potential hazards due to the inability to warn of danger and the proper safety precautions to be taken.

8.4 BIOLOGIC HAZARDS

Poisonous snakes and insects, arachnids (spiders), and poisonous and thorny plants are indigenous to the site and present a hazard to workers. All personnel will be warned to avoid contact with these biologic hazards.

8.5 HEAT AND COLD STRESS

Temperature extremes coupled with the requirement to wear protective clothing make heat or cold injury possible. A discussion of measures to be implemented to monitor for and prevent these type of injuries is included in Attachment D.

9.0 ACCIDENT PREVENTION

9.1 RESPONSIBLE PERSONNEL

All personnel shall conduct themselves in a manner that will minimize the potential for accidents. The Health and Safety Officer, foremen, and supervisory personnel shall see that their personnel are operating in a safe manner in compliance with this document. Any variations from these documents must be approved by the Health and Safety Officer prior to initiation.

9.2 GENERAL SITE SAFETY RULES

- o There will be an informal safety meeting each morning prior to commencing operations.
- o The project site is divided into an EXCLUSION ZONE (i.e., WORK AREA) and a SUPPORT ZONE (i.e., Administrative area) separated by a CONTAMINATION REDUCTION ZONE (i.e., Personnel and Equipment Decontamination Facilities). Entrance to and exit from the EXCLUSION ZONE will be via the CONTAMINATION REDUCTION ZONE. Only authorized, properly protected personnel will be allowed to enter the work area.
- o All personnel and equipment must be decontaminated when passing from the EXCLUSION ZONE to the SUPPORT ZONE. Prior to departing from the Site, or at the end of the work day, all personnel will process through the Decontamination Station where disposable clothing and equipment will be removed.
- o All personnel in the EXCLUSION ZONE will be required to wear, at a minimum, the gear specified in the TETC Health and Safety Plan and/or by the Health and Safety Officer.
- o No eating, drinking, smoking or chewing will be permitted in the EXCLUSION ZONE.
- o Prior to eating, drinking or smoking, all personnel must wash their hands and faces.
- o All questions concerning Health and Safety matters should be referred to the Health and Safety Officer.
- o All personnel will be required to clean their respirators at the end of the work day.
- o Violation of these rules will result in immediate dismissal from the site.

10.0 FIRE PREVENTION AND PROTECTION

To minimize the potential for fires and to reduce the impact of any fire, proper fire prevention and protection procedures will be followed. Requirements include, but are not limited to, the following:

10.1 FIRE PREVENTION

- No smoking is allowed in any Exclusion or Contamination Reduction Zone.
- All sources of ignition will be prohibited within a 50 foot radius of operations or substances which constitute a fire hazard, including fueling operations. These areas are to be posted with signs reading, NO SMOKING or OPEN FLAME.
- All tanks, containers, and pumping equipment, portable or stationary, used for the storage of flammable and combustible liquids must be FM or UL approved and the appropriate signs posted.
- All storage, handling, or use of flammable and combustible liquids shall be under the supervision of qualified persons.
- Electrical lighting shall be the only means used for artificial illumination on site, or in areas where flammable liquids, vapors, fumes, dust, or gases are present. All electrical equipment and installations shall be in accordance with the National Electrical Code for hazardous locations. Globes or lamps shall not be removed or replaced nor shall repairs be made on the electrical circuits until it has been de-energized.
- No flammable liquid with a (closed cup test) flash point below 100°F (37.7°C), shall be used for cleaning purposes.
- Equipment using flammable liquid fuel shall be shut down during refueling, servicing, or maintenance. This requirement may be waived for diesel fueled equipment serviced by a closed system with attachments designed to prevent spillage.

10.2 FIRE PROTECTION

- Portable fire extinguishers shall be provided where needed and inspected and maintained in accordance with NFPA 10, Portable Fire Extinguishers.
- Fire extinguishers shall be suitable placed, distinctly marked, readily accessible, and maintained in a fully charged and operable condition.
- An ABC fire extinguisher, rated not less than 10-B:C shall be provided within 50 feet (15.8m) of wherever more than 5 gallons of flammable or combustible liquids or 5 pounds of flammable gas are being used on the worksite. This requirement does not apply to the integral fuel tanks of motor vehicle.
- At least one portable fire extinguisher having a rating of not less than 20-B:C (units shall be located not less than 25 feet (7.62 m), nor more than 75 feet (22.86m) from any flammable liquid storage area located outside).

- Each drill rig, bulldozer, scraper, dragline, crane, motor grader, front-end loader, mechanical shovel, backhoe, and other similar equipment shall be equipped with at least one dry chemical or carbon dioxide fire extinguisher, having a minimum UL rating of 5-B:C.

- Each *service or fueling area shall be provided with at least one fire extinguisher having a rating* of not less than 20-B:C located so that an extinguisher will be within 75 feet (22.86m) of each pump, dispenser, underground fill pipe opening, and lubrication or service area.

- Fire extinguisher equipment shall be provided in storage areas according to the hazard present.

- Emergency telephone numbers and reporting instructions shall be conspicuously posted.

11.0 MEDICAL MONITORING PROGRAM

11.1 PRE-WORK ASSIGNMENT PHYSICAL EXAMINATION

All of Field Service workers and assigned subcontractor personnel shall be required to pass a comprehensive pre-employment medical examination prior to working at hazardous waste sites. The examination includes:

o Complete medical and occupational history

o Full physical examination

o Vital systems check

o Screening audiometry

o Visual acuity

o Pulmonary function test

o Electrocardiogram

o Chest x-ray

o Blood test including CBC and SMA24 and PCB Blood Levels

o Urinalysis including microscopic

o Drug screen

o Back motion tests

o Other special tests as deemed necessary by the Company Physician.

Following the results of the hands-on physical and the laboratory tests, the physician determines whether the employee is:

o Qualified to work in areas where exposure to chemicals or physical stress is possible

o Physically able to use protective equipment, including respirator

11.2 ANNUAL AND EXIT EXAMINATION

An identical program will be conducted on an annual basis and at employee termination. Additional testing may be conducted when special or unusual conditions exist.

11.3 MEDICAL SUPPORT SERVICES

The Company Physicians provide medical consultation services (to advise on medical and health questions as they arise) and evaluation and care of individuals with work related exposures, injuries or illness.

11.4 EMERGENCY MEDICAL CARE AND TREATMENT

Prior to starting work at the Site, local emergency organizations (i.e., hospital, ambulance, fire department, police, etc.) will be contacted to coordinate adequate response to potential emergencies.

Emergency telephone numbers (Appendix C) and a map with directions to the nearest medical treatment facility will be conspicuously posted at the Site.

Emergency decontamination equipment and first aid equipment will be readily available on-site.

In the event of an injury or chemical exposure, the affected employee(s) will be transported to the Medical Center. If possible, employee(s) suffering from chemical exposure will be accompanied by a material safety data sheet giving specific information about the chemicals.

11.5 BIOLOGIC MONITORING

Since the possibility of exposure to tetraethyl lead exists, pre-work baseline blood and urine lead levels will be determined for operations personnel.

Biological lead checks will be accomplished every two weeks for urine and once per month for blood.

Post-job, employee termination blood and urine lead levels will be determined for all operations personnel.

Personnel with elevated blood or urine lead levels will be restricted from working on the project. Company physicians will evaluate the biological lead levels and impose restrictions as required.

12.0 HEALTH AND SAFETY TRAINING PROGRAM

12.1 INITIAL TRAINING

Prior to entering the site, TETC field personnel and assigned project subcontractor personnel will receive a minimum of 40 hours training to meet requirements for hazardous waste operations training as outlined in 29 CFR 1912.120.

12.2 SITE SPECIFIC TRAINING

Employees assigned to the site will be given site specific training to include the following subject matter:

12.2.1 Navajo Refinery safety rules and regulations.

12.2.2 Acute and chronic effects of toxic chemicals found at the Site.

12.2.3 Routes of potential exposure and field activities which could result in such exposure.

12.2.4 Need for personal protection, types of protection, its effectiveness and limitations.

12.2.5 Proper use and fitting of respiratory protective equipment.

12.2.6 Medical surveillance program review.

12.2.7 Work zones established at the Site.

12.2.8 Prohibited activities in the Exclusion and Contamination Reduction Zone. The prohibited activities include:

- Wearing glasses or having facial hair, such as beards and long sideburns, which interfere with respirator fit,
- Wearing contact lenses,
- Eating, drinking, smoking, chewing gum and use of smokeless tobacco products,
- Wearing of personal articles such as watches, rings, etc.,
- Working when ill.

12.2.9 Engineering controls and safe work practices associated with each employee's work assignment including dust control measures and use of "buddy system."

12.2.10 Personal and equipment decontamination procedures.

12.2.11 Emergency response procedures.

12.2.12 Basic operational safety, emphasizing hazards expected on-site.

12.3 VISITOR AND SUB-CONTRACTOR TRAINING

Sub-Contractors and visitors to the Site will be made aware of the hazards associated with the Site, emergency procedures and will be trained in the use, limitations and fit of any personal protective equipment required during the visit.

12.4 SAFETY MEETING

An informal "tailgate" type safety meeting will be held each morning. This meeting will be conducted by the Health and Safety Officer or his designated representative and include field operations personnel. Safety/accident prevention information pertinent to job performance will be discussed at these meetings.

12.5 LABORATORY CONSIDERATIONS

12.5.1 Analytical Laboratory

Analysis of waste, soil sediment and water samples for detailed chemical analysis will be conducted by the subcontract analytical laboratory. The laboratory director must be informed of any possible contaminants in the samples that would require special handling procedures to prevent risks to the health and safety of laboratory personnel.

13.0 AIR MONITORING PROGRAM

The Health and Safety Officer shall be responsible for enforcing Air Monitoring Action Levels.

Prior to initiation of field work, a general air quality survey will be made to determine ambient air quality at the site. Results of this survey will be used to designate locations of decontamination and support zones and determine initial personnel protective equipment requirements and monitoring frequencies.

During field activities at the Site, an air quality survey shall be performed utilizing equipment described below. If additional chemical hazards are encountered during the course of the project, other types of instruments may be required.

NOTE: Based on his evaluation of air monitoring data, type of work in progress, likelihood of exposure etc., the Health and Safety Officer may modify the levels of personal protection and frequency of sampling.

13.1 PHOTO IONIZATION DETECTOR (PID)

13.1.1 The HNU Photo Ionization Detector (HNU) or Photovac TIP shall be used to detect trace concentrations of certain organic gases and a few inorganic gases in the air. The PID is most sensitive to aromatic hydrocarbons, aliphatic amines, and unsaturated chlorinated hydrocarbons.

Carbonyl and unsaturated hydrocarbons, sulfides, ammonia, and the heavier paraffins C_5 - C_7 can also be detected but with a lesser degree of sensitivity. Methane, ethane and other light paraffins are not detected by the PID.

13.1.2 Monitoring will be conducted in each work area prior to start of each days operations and at least twice each day in every active work area.

The PID reading taken in the breathing zone shall be used in conjunction with information about known or suspected contaminants at the Site to determine what level of protection is required. The following guidelines shall be used:

PID READING (ppm)	MINIMUM LEVEL OF PROTECTION OR ACTION
>500	Evacuate
>5 - 500	Level B
>1 - 5	Level C
Background - 1	No respiratory protection needed.

NOTE: The mention of specific monitoring instruments or techniques in the plan shall not preclude the use of other instrumentation or methods which will give equally superior results.

13.2 FLAME IONIZATION DETECTOR (FID)

13.2.1 The Century Model 128 Organic Vapor Analyzer (OVA) or equivalent shall be used to provide real time measurements of organic vapor concentrations in the work area. The FID is most sensitive saturated, unsaturated and aromatic hydrocarbons.

13.2.2 Monitoring will be conducted in each work area prior to the start of each days operations and periodically (as determined by the Health and Safety Officer) in each active work area. The OVA measurement taken in the breathing zone shall be used in conjunction with known or suspected contaminants at the site to determine what level of protection is required. The following guidelines shall be used:

OVA READING (ppm)	MINIMUM LEVEL OF PROTECTION OR ACTION
>500	Evacuate
>5 - 500	Level B
>1 - 5	Level C
Background - 1	No respiratory protection required

13.3 COMBUSTIBLE GAS INDICATOR (CGI)

13.3.1 An Exotox Portable Gas Monitor is a multifunction instrument that can be used to monitor for combustible gases, oxygen deficiency, hydrogen sulfide, and carbon monoxide. When used as a combustible gas indicator flammable gas concentrations are measured as percentages of the Lower Explosion Limit (LEL).

13.3.2 During field activities, the following action levels shall be observed:

CGI READING (% of LEL)	ACTIONS TO BE TAKEN
1% - 10%	Investigate and control source of combustible gas
>10% - 25%	All ignition sources shall be shut off
>25%	All ignition sources shall be shut off and site will be evacuated

13.3.3 This instrument shall be used continuously during all direct and limited waste contact activities.

13.4 HYDROGEN SULFIDE MONITOR

13.4.1 An Exotox instrument or equivalent (see above) will be used to continuously monitor for hydrogen sulfide if exposure is deemed possible.

13.4.2 The following action levels for determining the appropriate level of protection shall be used:

H_2S LEVEL (ppm)	MINIMUM LEVEL OF PROTECTION OR ACTION
>100	Evacuate
>10 - 100	Level B
Background - 10	No respiratory protection required

13.5 RESPIRABLE DUST MONITORING

13.5.1 A MINIRAM PDM-3 or similar instrument will be used to conduct continuous real time respirable dust monitoring in the exclusion zone anytime operations are underway.

13.5.2 Action guidelines are prescribed below:

MINIRAM READING (mg/m^3)	MINIMUM LEVEL OF PROTECTION OR ACTION
>50	Evacuate
>20 - 50	Level B
>1 - 20	Level C
Background - 1	No respiratory protection required

13.6 SELF MONITORING

While at the Site TETC employees will be required to self-monitor their health and that of their co-workers.

Visual observations include:

- Behavioral Changes
- Sensation Losses
- Coordination Losses
- Skin Rashes
- Increased Salivation
- Gum and Lip Discoloration
- Slurred Speech
- Pupil Dilation
- Change in Appetite
- Weight Loss

Any abnormalities or changes are to be reported and investigated. Such aspects could be symptoms of toxic exposure and must not be allowed to linger without medical attention. In addition, all accidents and injuries, no matter how small or insignificant, are to be reported and investigated.

14.0 PERSONNEL AND EQUIPMENT DECONTAMINATION

14.1 GENERAL

Each time an employee enters the contamination reduction zone he/she must make a thorough self-examination. Equipment must be removed without exposure to the wearer. Before eating or use of tobacco products the hands and face must be scrubbed to avoid accidental ingestion of wastes. Footwear must be changed prior to egress from Contamination Reduction Zone to avoid "tracking" of contaminants outside the secure area.

14.2 PERSONNEL DECONTAMINATION FACILITIES

The following facilities will be provided and maintained for personnel decontamination:

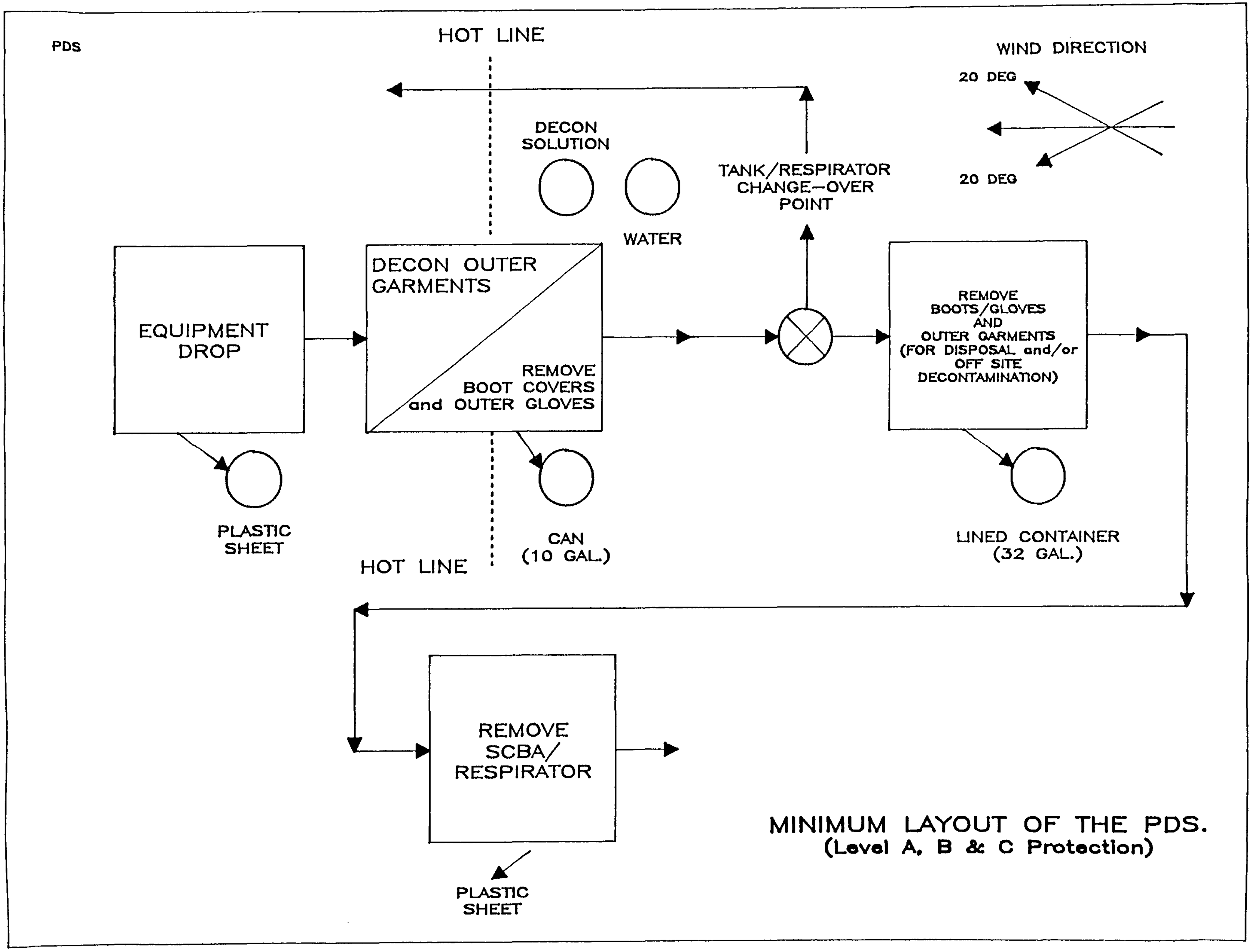
14.2.1 Contamination Reduction Zone which contains the following stations (See Figure 14-1):

- Station 1: Segregated Equipment Drop equipped with plastic drop cloths for deposit of hand carried equipment.
- Station 2: Boot, Suit, Outer Glove and Respirator Wash and Rinse Station equipped with one wash tub for washing boots, suits,gloves and respirators; one wash tub for rinsing boots, suits, gloves and respirators; detergent; scrub brushes and potable water.
- Station 3: Tape, Outer Glove and Outer Boot Removal Station equipped with container for removed tape, outer gloves and outer boot disposal.
- Station 4: Respirator Tank or Canister Change Station equipped with air tanks and canisters and extra overboots and gloves.
- Station 5: Boot, Outer Garment and Inner Glove Removal Station equipped with container and bench or stool.
- Station 6: Respirator Removal and Decontamination Station equipped with buckets for washing and rinsing respirators, brushes, sponges, detergent and paper towels.
- Station 7: Inner Work Clothing Removal Station equipped with bin for collection of soiled clothes, and enclosure for disrobing.
- Station 8: Field Wash Station equipped with hand/face washing facilities to be used before eating or going to the restroom, water, soap, and towels.
- Station 9: Redress Station

14.3 PERSONAL PROTECTIVE EQUIPMENT DECONTAMINATION

14.3.1 Clothing: The consultant shall provide all required safety clothing. Safety clothes shall be left at the PDS. No safety clothing (including boots) shall be worn or carried out of the project area unless properly decontaminated. Soiled safety clothes shall be disposed as appropriate.

14.3.2 Respirators: All required respirators will be provided and maintained by the consultant and will be cleaned daily. Cleaning and maintenance will be accomplished by the



MINIMUM LAYOUT OF THE PDS.
(Level A, B & C Protection)

assigned user in accordance with the appropriate OSHA standards (29 CFR 1910.134) and those procedures outlined in consultant's Standard Operating Procedures.

14.4 EQUIPMENT DECONTAMINATION PROCEDURES

14.4.1 General

Decontamination of equipment is essential to avoid spread of contamination to clean areas.

Key elements in decontamination are inspection and washing. The latter may require scrubbing, scraping and/or high pressure detergent solution application or steam cleaning depending on the level of soil attachment (Frequency of lubrication, etc. may therefore also be affected).

To prevent cross-contamination from off-site sources, any equipment used in sampling activities will be decontaminated prior to use inside the exclusion zone. Any vehicles, equipment and materials brought into the Exclusion Zone will be considered contaminated and will remain in the Exclusion Zone until no longer necessary to the project. All contaminated vehicles, equipment and materials will be decontaminated at a designated equipment decontamination area before being taken off-site.

14.4.2 Equipment Decontamination Facilities

The following facilities for equipment decontamination shall be provided and maintained:

- Portable steam cleaner or high pressure washer.
- Degreasers.
- Trisodium phosphate detergent.
- Wire brushes, scrapers and pads.

14.5 HANDLING OF WASTES GENERATED AT THE SITE

Personnel will make every effort to minimize the volume of contaminated materials. All disposable clothing and other contaminated solid material will be placed in containers for storage. Legible and understandable labels will be affixed prominently to containers of contaminated waste. The waste will be properly disposed at an approved disposal facility.

Soil boring cuttings shall be drummed and stored on-site pending analysis results and dispositation instructions. Rinsate from decontamination procedures will be collected then discharged to the waste treatment system.

15.0 EMERGENCY RESPONSE PROCEDURES

The following standard emergency procedures will be used by on-site personnel. The Health and Safety Officer shall be notified of any on-site emergencies and be responsible for ensuring that the appropriate procedures are followed.

15.1 PERSONNEL INJURY IN THE EXCLUSION ZONE

Upon the notification of an injury in the Exclusion Zone, the designated emergency signal (series of short horn blasts) shall be sounded. All Site personnel shall assemble at the decontamination line. A rescue team will enter the Exclusion Zone (if required) to remove the injured person to the hotline. The Health and Safety Officer should evaluate the nature of the injury, and the affected person should be decontaminated to the extent possible prior to movement to the Support Zone. The appropriate first aid shall be the administered and contact should be made for an ambulance with the designated medical facility (if required). No persons shall re-enter the Exclusion Zone until the cause of the injury or symptoms is determined.

15.2 PERSONNEL INJURY IN THE SUPPORT ZONE OR CONTAMINATION REDUCTION ZONE

Upon notification of an injury in the Support Zone, the Health and Safety Officer will assess the nature of the injury. If the cause of the injury of loss of the injured person does not affect the performance of site personnel, operations may continue, with the appropriate first aid and necessary follow-up as stated above. If the injury increases the risk to others, the designated emergency signal (series of short horn blasts) shall be sounded and all site personnel shall move to the decontamination line for further instructions. Activities on-site will stop until the added risk is removed or minimized.

15.3 FIRE/EXPLOSION/CHEMICAL RELEASE

Upon notification of a fire, explosion or chemical release on-site, the designated emergency signal (series of short horn blasts) shall be sounded and all Site personnel assembled at the decontamination line. The fire department shall be alerted and all personnel moved to a safe distance from the involved area.

15.4 PERSONAL PROTECTIVE EQUIPMENT FAILURE

If any Site worker experiences a failure or alteration of protective equipment that affects the protection factor, that person and his/her buddy shall immediately leave the Exclusion Zone. Re-entry shall not be permitted until the equipment has been repaired or replaced.

15.5 EMERGENCY ESCAPE ROUTES

The emergency escape route is designated for use in those situations where egress from the Exclusion Zone cannot occur through the decontamination line is to:

- o To be designated by the Health and Safety Officer based upon location of work area.

15.6 RE-ENTRY TO EXCLUSION ZONE

In all situations, when an on-site emergency results in evacuation of the Exclusion Zone, personnel shall not re-enter until:

- o The conditions resulting in the emergency have been corrected.

- The hazards have been reassessed.
- The Site Safety Plan has been reviewed.
- Site personnel have been briefed on any changes in the Health and Safety Plan.

15.7 EMERGENCY EQUIPMENT

The following emergency equipment will be maintained on site at all times:

- First Aid Kit
- Fire Blanket
- Eye/Face Wash
- Fire Extinguisher
- Snakebite/Bee Sting
- Lantern/Flashlight
- Icepacks
- Warning Horn

16.0 ILLUMINATION

Work areas will be lighted to not less than the minimum illumination intensities required to enable employees to work safely.

17.0 SANITATION

17.1 POTABLE WATER

An adequate supply of potable water will be provided on the Site. Portable containers used to dispense drinking water shall be capable of being tightly closed, and equipped with a tap. Single service cups, to be used once, will be supplied, along with a sanitary container for unused cups and a receptacle for disposing of the used cups.

17.2 NON-POTABLE WATER

Outlets for non-potable water, such as water for firefighting purposes or decontamination, shall be identified to indicate clearly that the water is unsafe and is not to be used for drinking or washing purposes. There shall be no cross- connection, actual or potential, between a system furnishing potable water and a system furnishing non-potable water.

17.3 TOILET FACILITIES

Toilets will be provided in accordance with Table H-102.2 of OSHA standard 29 CFR 1910.120. Toilet facilities of the following types will be used on Site:

(1) Chemical toilets, or

(2) Recirculating toilets.

If both males and females are present on-site, separate facilities will be provided.

17.4 WASHING FACILITIES

Employees will be provided adequate washing facilities and such facilities will be in near proximity to the work area, within controlled access work zones and so equipped as to enable employees to remove hazardous substances.

18.0 COMMUNICATION PROCEDURES

18.1 PERSONNEL IN THE EXCLUSION ZONE

Personnel in the Exclusion Zone should remain within sight of the supervisor. The Buddy System will be utilized.

18.2 EMERGENCY SIGNAL

A series of short horn blasts will be the emergency signal to indicate that all personnel should leave the Exclusion Zone.

18.3 HAND SIGNALS

The following hand signals may be used:

Hand Gripping Throat - Out of air, Can't breathe, Respirator problem.

Grip Partner's Wrist or Both Hands Around Waist - Leave area immediately.

Hands on Top of Head - Need assistance.

Thumbs Up - OK - I am all right, I understand.

Thumbs Down - No, negative.

18.4 SITE TELEPHONE

Prior to initiation of investigation operations, a Site telephone will be installed (or access obtained). This telephone will be maintained in operational condition at all times. Emergency numbers and evacuation routes will be posted (Attachment C).

19.0 REFERENCES

Occupational Health and Safety Guidance Manual for Hazardous Waste Site Activities, NIOSH/OSHA/USCG/EPA October 1985

Protecting Personnel at Hazardous Waste Sites, S. P. Levine and W. F. Martin, Eds, Butterworth Publishers, 1985

NIOSH Pocket Guide to Chemical Hazards, U.S. Department of Health and Human Services, September, 1985

Threshold Limit Values and Biological Exposure Indices for 1989-1990, American Conference of Governmental Industrial Hygienists, 1989

NIOSH Respirator Decision Logic, U.S. Department of Health and Human Services, May 1987

Occupational Exposure to Hot Environments, U.S. Department of Health and Human Services, April 1986

NIOSH/OSHA Occupational Health Guidelines for Chemical Hazards, U. S. Department of Health and Human Services, January 1981

Dangerous Properties of Industrial Materials, Fifth Edition, N. Irving Sax, Van Norstand Reinhold Company, 1979

Hazardous Waste Operations and Emergency Response, Department of Labor, OSHA, 29 CFR 1910

CHRIS Hazardous Chemical Data, U.S. Department of Transportation, USCG, November 1984

OSHA Safety and Health Standards for the Construction Industry, U. S. Department of Labor, OSHA, 29 CFR 1926/1910

Handbook of Toxic and Hazardous Chemicals and Carcinogens, Second Edition, Marshall S. Hig, Noyes Publications, 1985

Multimedia Standard First Aid (Student Workbook), American Red Cross, 1981

Hypothermia, Richard Mann, Corporate Health Services, American Red Cross, Houston, Texas, March 1987

Characterization of Hazardous Waste Sites-A Methods Manual, Vols. 1 and 2, EPA/600/4-84-075 and 076

NIOSH Manual of Analytical Methods, U. S. Department of Health and Human Services, February 1984

Patty's Industrial Hygiene and Toxicology, 30 Edition, John Wiley & Sons, Inc., 1978

ATTACHMENT A

COMPLIANCE AGREEMENT

ATTACHMENT A

COMPLIANCE AGREEMENT

HEALTH AND SAFETY PLAN COMPLIANCE AGREEMENT
Navajo Refining Company
Artesia, New Mexico

I,_________________________(print name), have received a copy of the Health and Safety Plan for the Navajo Refining Company site investigation. I have read the plan, understand it and agree to comply with all of its provisions. I understand that I could be prohibited from working on the project for violating any of the safety requirements specified in the plan.

Signed:

____
(Signature)   (Date)

Firm:____

ATTACHMENT B

TOXILOGICAL PROPERTIES
OF
CHEMICALS FOUND ON THE NAVAJO REFINING SITE

ATTACHMENT B

TOXILOGICAL PROPERTIES
OF
CHEMICALS FOUND ON THE NAVAJO REFINERY SITE

The chemical compounds described in the following pages were found or known to have been used at the Navajo Refinery Site.

Information on the compounds was copied from - Handbook of Toxic and Hazardous Chemicals and Carcinogens, 2nd Edition, Marshall Sittig, Noyes Publications, 1985 - and is presented to provide personnel with a basic knowledge of the chemicals and their toxic effects.

ATTACHMENT C

EMERGENCY CONTACTS
AND
EMERGENCY EVACUATION ROUTE

ATTACHMENT C

EMERGENCY CONTACTS AND EMERGENCY EVACUATION ROUTE

Emergency Medical Care/Fire/Police -

A. Hospital:

B. Ambulance:

C. Air Evacuation:

D. Fire:

TO BE COMPLETED PRIOR TO INITIATION OF SITE INVESTIGATION ACTIVITIES.

E. Police:

F. Sheriff:

G: Poison Hotline:

H. Corporate Director Health and Safety:

I: Health and Safety Officer:

EMERGENCY EVACUATION
ROUTE MAP WILL BE GENERATED
PRIOR TO THE INITIATION
OF THE SITE INVESTIGATION

ATTACHMENT D

ENVIRONMENTAL STRESS

ATTACHMENT D

ENVIRONMENTAL STRESS

Climatic conditions are important considerations in planning and conducting work at the Site. The effects of ambient temperature can cause physical discomfort, loss of efficiency, personal injury and increased accident probability. In particular, heat stress, due to protective clothing decreasing body ventilation is an important factor.

The following plans serve to outline procedures to mitigate environmental stress factors.

ATTACHMENT D

ENVIRONMENTAL STRESS
HEAT STRESS CASUALTY PREVENTION PLAN

Due to the decrease in body ventilation caused by wearing personal protective equipment there exists an increase in the potential for heat casualties. Site personnel will be instructed in the identification of a heat stress victim, the first-aid treatment procedures for the victim and the prevention of heat stress casualties.

A. IDENTIFICATION AND TREATMENT

1. Heat Cramps

   a. Symptoms: Heat cramps are caused by heavy sweating with inadequate electrolyte replacement and may be manifested by muscle spasms and pain in the limbs and abdomen.

   b. First Aid: Have the victim move to the Personal Decontamination Station and rest. Firm pressure and warm, wet towels placed over the cramped area give relief. Give electrolyte solution to drink.

2. Heat Exhaustion

   a. Symptoms: Usually begins with muscular weakness, dizziness, nausea, and a staggering gait. Vomiting is frequent. The bowels may move involuntarily. The victim is very pale, his skin is clammy, and he may perspire profusely. The pulse is weak and fast, his breathing is shallow. He may faint unless he lies down.

   b. First Aid: Immediately remove the victim to a shady or cool area with good air circulation in the Personnel Decontamination Station. Remove all protective outer wear. Call a physician. Treat the victim for shock. (Make him lie down, raise his feet 6-12 inches and keep him warm but loosen all clothing.) If the victim is conscious, it may be helpful to give him sips of a salt water solution (1 teaspoon of salt to 1 glass of water) or commercial electrolyte drink. Transport victim, to a medical facility as soon as possible.

3. Heat Stroke

   a. Symptoms: This is the most serious of heat casualties due to the fact that the body excessively overheats. Body temperatures often are between 107 degrees - 110 degrees F. First there is often pain in the head, dizziness, nausea, oppression, and the skin is dry, red and hot. Unconsciousness follows quickly and death is imminent is exposure continues. The attack will usually occur suddenly.

   b. First Aid: Immediately evacuate the victim to a cool and shady area in the Personnel Decontamination Station. Remove all protective outer wear and all personal clothing. Lay him on his back with the head and shoulders slightly elevated. It is imperative that the body temperature be lowered immediately. This can be accomplished by applying cold wet towels, ice bags, etc., to the head. Sponge off the bare skin with cool water or rubbing alcohol, if available, etc. The main objective is to cool him without chilling him. Give no stimulants. Transport the victim to a medical facility as soon as possible.

4. Prevention of Heat Stress

   a. One of the major causes of heat casualties is the depletion of body fluids. On the site there will be plenty of fluids available. Personnel should replace water and salts lost from sweating.

Salts can be replaced by either a 0.1% salt solution, more heavily salted foods, or commercial mixes such as Gatorade. The commercial mixes are advised for personnel on low sodium diets.

b. A work schedule should be established so that the majority of the work day will be during the morning hours of the day before ambient air temperature levels reach their highs.

c. Work/rest guidelines will be implemented for personnel required to wear Level B or C protection. This guideline is as follows:

Ambient Temperatures	Maximum Wearing Time
Above 90 degrees F	1/2 hour
80 - 90 degrees F	1 hour
70 - 80 degrees F	2 hours
60 - 70 degrees F	3 hours
50 - 60 degrees F	4 hours

A sufficient period will be allowed for personnel to "cool down". This may require shifts of workers during operations.

d. 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.

5. Heat Stress Monitoring

For monitoring the body's excess heat recuperative ability, one or more of the following techniques should be used as a screening mechanism. Monitoring of personnel wearing protective clothing should commence when the ambient temperature is 70 degrees Fahrenheit or above. Frequency of monitoring should increase as the ambient temperature increases or if slow recovery rates are indicated. When temperatures exceed 80 degrees Fahrenheit, workers must be monitored for heat stress after every work period.

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%), 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 work period, the following work cycle should be shortened by 33%.

Body temperature should be measured orally with a clinical thermometer as early as possible in the resting period. Oral temperature (OT) at the beginning of the rest period should not exceed 99.7 degrees Fahrenheit. If it does, the next work period should be shortened by 10 minutes (or 33%), while the length of the rest period stays the same. However, if the OT exceeds 99.7 degrees Fahrenheit at the beginning of the next period, the following work cycle should be further shortened by 33%. OT should be measured again at the end of the rest period to make sure that it has dropped below 99.7 degrees Fahrenheit.

Body water loss (BWL) due to sweating should be measured by weighing the worker in the morning and in the evening. The clothing worn should be similar at both weighings; preferably the workers should be nude. The scale should be accurate to plus or minus 1/4 lb. BWL should not exceed 1.5% of the total body weight. If it does, workers should be instructed to increase their daily intake of fluids by the weight lost. Ideally, body fluids should be maintained at a constant level during the work day. This requires replacement of salt lost in sweat as well.

ATTACHMENT D

ENVIRONMENTAL STRESS
COLD STRESS CASUALTY PREVENTION PLAN

A decrease in ambient air temperature and the effects of wind velocity, increase the potential for injury due to cold stress. Site personnel will be instructed in the identification, prevention and first-aid for cold stress.

A. IDENTIFICATION and TREATMENT of COLD STRESS

1. Frostbite

a. Symptoms

Frostbite usually begins with numbness and/or pain in the extremities or exposed skin surfaces and a decrease in manual dexterity (known as frostnip). If exposure continues, the skin may take on a white waxy appearance. As further cooling occurs the tissue will freeze completely, and progressive symptoms will be indicated by skin color turning to a mottled or blotchy white then grayish yellow and finally grayish blue. Severe tissue damage has occurred.

b. First Aid

If initial symptoms (frostnip) are present, remove the victim from the cold and have him gently warm the affected area. If advanced symptoms are present or if the condition does not respond to this simple care, transport to a medical facility at once.

2. Cold Stress (Hypothermia)

a. Symptoms

In hypothermia, the body core temperature is reduced. Hypothermia will very likely result in reduced mental alertness, reduction in rational decision making, fatigue, drowsiness, and loss of consciousness with a threat of fatal consequences. During exposure to cold, severe uncontrollable shivering develops as a first symptom of cold stress.

b. First Aid

The onset of heavy shivering, excessive fatigue, reduced manual dexterity or other symptoms of hypothermia are indications for immediate return to the heated shelter. The outer layer of clothing should be removed and the remainder of the clothing loosened to permit sweat evaporation. Warm sweet drinks and soups should be consumed to provide caloric intake and fluid volume. Oral temperature will be determined and the workman will be transported to a medical facility if the core body temperature is below 96 degrees F.

B. PREVENTION of COLD STRESS

Exposed skin surfaces may be protected by the use of appropriate cold weather protective clothing. These protective items can include facemasks, handware, and footware. Windbreaks can shield the work area from the cooling effects of wind. The workers shall wear cold protective clothing appropriate for the level of cold and physical activity with an objective to protect all parts of the body with emphasis on hands and feet. Provisions for keeping the workers hands warm in addition to use of insulated gloves include use of warm air jets and radiant heaters. Adequate insulating clothing to maintain body core temperatures above 36 degrees C (97°F) will be used. The use of extra insulating clothing and/or a reduction in the duration of exposure period are special precautions. During periods of extreme cold (10 degrees F or less) workers should use the buddy system for constant protective observation. Eye protection against glare and ultraviolet light will be worn in snow and/or ice terrain.