NM1 - 1

MONITORING REPORTS

YEAR(S):

1995

Tipperary Corporation

Lane Salt Lake Water Disposal Pits

Site Assessment Project

RECEIVED
JUN 06 1995
Environmental Bureau
Oil Conservation Division

Whole Earth
Environmental, Inc.
16337 Park Row
Houston, Texas 77084

Introduction

WHOLE EARTH

Whole Earth Environmental, Inc.

16337 Park Row, Houston, Texas 77084-5191
713/492-7077 Fax: 713/578-1190

May 1, 1995

Tipperary Corporation
633 Seventeenth St.
Suite 1550
Denver, Colorado 80202

Attn: Robert Fehlmann

Dear Mr. Fehlmann:

Enclosed, please find a copy of our Site Assessment and suggested Closure Protocols for the Lane Salt Lake Disposal Facility near Tatum, New Mexico.

Thank you for the opportunity of allowing us to work on this very interesting project.

Warmest regards,

Mike Griffin
President
Whole Earth Environmental, Inc.

Profile

SITE PROFILE

Geographic

The site is located in northern Lea County, New Mexico approximately 1 mile south of the county line and approximately 20 miles north and east of Tatum, New Mexico. The area is sparsely populated; the nearest residence is that of the land owner, Mr. Carl Lane Johnson, which is located at a distance of approximately 1.3 miles to the southeast of the facilities. The sole access to the site is by an unpaved lease road terminating at the facility.

The terrain immediately surrounding Lane Salt Lake consists of low, rolling hills and slight draws. The location of the facility was designed to incorporate the natural contours of the land to provide a gravity flow to the Lane Salt Lake. At the time of our survey, the disposal pits were located approximately 1/4 mile southeast of the lake edge, however, because of the relatively flat contour of the lake basin, minor changes in lake levels result in significant expansion or contraction of the lake's perimeter. With the recent cessation of discharge from the facilities, the lake has already significantly diminished in size. The area between the facility and the lake is described as a salt flat with the top of the perched water table approximately at ground level. The surface features of the salt flat consist of fine clays and silts with a surface salt encrustment approximately 1/4 - 1/2" in thickness. (USGS topographical map enclosed).[1]

The pits are located atop a triassic redbed layer situated at a depth of approximately 15' bgl, (below ground level). According to the testimony of Mr. E.L. Reed, Consulting Geologist, taken on May 17, 1967 at the time of the initial permit hearing, both the surface and ground waters flow into Lane Salt Lake.[2] Prior to any discharge into the lake from O&G operations, the lake waters were found to contain up to sixty-five times the acceptable concentrations of iron and three hundred twenty-four times the acceptable concentrations of total dissolved solids.[3,4]

The area is considered semi-arid, (ave. 10.7" annual average rainfall),[5] with the primary land use being the grazing of cattle.

Facilities Design and Use

The disposal facility was constructed in 1967 at the edge of a natural salt playa lake. According to the land owner, the lake was mined for salt by local ranchers from at least the early part of the century through the late 20's.

The facilities consist of one 1,500 bbl salt water skimmer tank and two 500 bbl. crude storage tanks, three bermed and netted surface impoundments, and ancillary gathering and transportation lines. The total surface area within impoundment is approximately 43,000 square feet.

The tank system was designed to receive fluids consisting primarily of produced brine water containing minor amounts of hydrocarbons from various oil and gas operators in the area and to further separate the hydrocarbons from the produced waters through the skimmer tanks system. The oils were collected and subsequently transported off location for further processing and sales, and the brine waters discharged into the evaporation pits.

The three unlined pits were constructed in a cascading "stair-step" configuration following the natural slope of the site. The total elevation gradient between the pits is approximately ten feet, sloping downward to the north.

The facility operated from third quarter 1967 through December, 1993 during which time it received and processed 88,384,211 barrels of produced brine water.[6] A new disposal injection well was brought on line in December of 1993 at which time all general discharges into the Lane Salt Lake Facility were terminated.

REFERENCES

1. United States Geological Survey 7.5' map.

2. Transcript of Case No. 3570, Regular Hearing Before the New Mexico Oil Conservation Commission, May 17, 1967.

3. New Mexico Water Quality Control Commission Ground Water Standards QCC 82-1 Amendment No. 4.

4. Southwestern Laboratories File No. C-1902-W Laboratory Analysis of Water dated August 15, 1978.

5. United States Department of Agriculture Soil Stabilization and Conservation Service Rainfall Tables for Lea County, New Mexico.

6. State of New Mexico Oil Conservation Division Form C-120-A Monthly Water Disposal Report filed by Burro Pipeline Corporation dated December, 1993.

Submit 1 Copy to Santa Fe
and 1 Copy to Appropriate
District Office by 15th of
Second Succeeding Month.

DISTRICT I
P.O. Box 1980, Hobbs, NM 88240

DISTRICT II
P.O. Drawer DD, Artesia, NM 88210

DISTRICT III
1000 Rio Brazos Rd., Aztec, NM 87410

State of New Mexico
Energy, Minerals and Natural Resources Department

Form C-120-A
Revised 1-1-89

OIL CONSERVATION DIVISION

P.O. Box 2088
Santa Fe, New Mexico 87504-2088

MONTHLY WATER DISPOSAL REPORT

Disposal System Operator: BURRO PIPELINE CORPORATION
Disposal System: LANE SALT LAKE

Address: 800 N. Marienfeld, Suite 100
Midland, Texas 79701

County: Lea
Month: Dec 19 93

LEASE	WELL NO.	LOCATION				PREVIOUS - CUM DISPOSED WATER BARRELS	CURRENT MONTH DISPOSED WATER BARRELS	NEW-CUMULATIVE DISPOSED WATER BARRELS	AVERAGE INJECTION PRESSURE
		UL	S	T	R				
	1	Z	21	11S	33E	88298059	86152	88384211	G

I hereby certify that the above is true and complete to the best of my knowledge and belief.

Signature:

Printed Name: MICHELLE COOK

Company: BURRO PIPELINE CORPORATION

Title: Agent

Telphone No. 915-683-5203

Remarks:

Closure

CLOSURE STANDARDS RECOMMENDATIONS
TIPPERARY CORPORATION
LANE SALT LAKE
WATER DISPOSAL FACILITY

The results of testing conducted at the pit site reveal that the contamination within the pits consists primarily of iron sulfide, sodium chloride, paraffins and non-polynuclear aromatic hydrocarbons.

An impermeable redbed layer lies at an approximate depth of 15' below ground level preventing any vertical migration of contamination. The perched water table immediately below the pits can be considered to be of no potential beneficial use as it is situated immediately adjacent to an extended salt flat connected to Lane Salt Lake. The waters within this perched table flow into Lane Salt Lake which is described as a closed playa containing high natural concentrations of the major cations, sulfates and chlorides.

Using the ranking system outlined in the New Mexico Unlined Surface Impoundment Closure Guidelines, we find that the nearest private or other water source is approximately 1,300 ft., the distance to the surface water body is again approximately 1,300 ft. and the distance to the nearest ground water of potentially beneficial use is the Ogallala existing at a depth of approximately 4,150 ft. Based on these criteria, the ranking score for the site would be zero.

We propose to close the pits to the following standards:

Benzene	10 ppm
BTEX	50 ppm
TPH	5,000 ppm

The closure protocol and detailed testing procedures are included for your review and approval.

REMEDIATION PROCEDURE
TIPPERARY CORPORATION
LANE SALT LAKE WATER DISPOSAL FACILITY

Preliminary

1. Contact Mr. Wayne Price of the New Mexico Oil Conservation Division and review the remediation procedure. Determine what, if any, additional or ancillary testing may be required. Document any changes with copies to both Mr. Price and Tipperary.

2. Contact the land owner, Mr. Carl Lane and advise him of the activities scheduled for the facility.

   A. Determine acceptable hours of operation, explain type of equipment planned to be employed, discuss any rules relating to site access, easements, speed limits, protection of livestock, etc.

   B. Exchange phone numbers. Provide him with local residence, mobil, beeper, and Houston Corporate numbers.

   C. Determine what, if any, surplus materials may be desired from the location.

   D. Discuss the re-contouring of the pit area.

3. Locate the nearest emergency medical treatment facility. Obtain phone numbers.

4. Obtain insurance certificates of all sub-contractors expected to be employed on the site.

5. Perform a geo-magnetic search of the perimeter of the facility to determine the location of all buried lines. Mark the location and direction of all such lines with pin flags. Check with the operator to insure that all lines are inactive. Any active lines shall be marked with red pin flags each five feet for a minimum distance of fifty feet outside the working perimeter of the site.

Dismantlement

6. Verify the calibration of an AIM 3000 multi gas detector for combustibles and H_2S. Similarly calibrate and record the accuracy of the Ludlam 2350 Geiger Counter.

what
solid
waste
disposal
areas ?

7. Starting at the southern pit, scan the area immediately adjacent to the perimeter fencing for combustibles. If unsafe levels are found, immediately cease operations. If the level is acceptable, tie a line to one corner of the net and extend the line to the opposite corner. Post a roustabout to haul in the line.

8. Carefully torch cut the restraining clips that affix the netting to the perimeter fencing. Work each side in approximate 20' sections. As the clips are removed, the netting shall be pulled back to the opposite corner. Keep the line taught to avoid the netting falling into the surface of the pit. **THE MULTI GAS DETECTOR SHALL BE EMPLOYED AT ALL TIMES DURING OPEN FLAME OPERATIONS.**

9. Place the netting in a solid waste disposal area.

10. Torch cut the horizontal supports of the perimeter fencing of the southern pit. Place the supports in a solid waste disposal area designated for metal.

11. Using a backhoe, remove the vertical posts from all but the northern side of the southern pit. Place in the metals disposal area.

12. Scan all gathering lines for the presence of NORM. If levels fall above 50 µr / hr., immediately cease all operations and contact Tipperary for further instructions. If radiation levels are determined to be acceptable, remove all collection and gathering lines between the present location of the tanks and the southern edge of the southern pit. **THIS OPERATION IS TO BE A TWO MAN JOB. A SPOTTER WITH A MULTI GAS DETECTOR SHALL BE EMPLOYED DURING ALL LINE EXCAVATION TO INSURE THAT NO HAZARDOUS OR EXPLOSIVE CONDITIONS ARE PRESENT DURING THIS ACTIVITY.**

Place all gathering lines within the metals disposal area.

13. Prepare a grid on 20' centers between the tank area and the southern edge of the south pit. Perform a geo magnetic search along the grid lines to insure that all lines have been removed. Any undiscovered line shall be marked and the operating company employee alerted to assist in identifying the line contents.

Remediation

14. Using a bull dozer of at least a D-5 size equivalent, strip the topsoils from the area under the tanks and south of the south pit to a sufficient depth to remove all hydrocarbon concentrations exceeding 1,000 ppm TPH. Establish a grid on fifty foot centers and conduct TPH, VOC, and BTEX speciation at the grid intersections. In addition, a minimum of five such test suites shall be conducted on the soils underlying the tank storage area.

15. Mix and blend all excavated materials to achieve a composite average of less than 100 ppm TPH. If additional topsoils are required, they should be obtained from substrate materials. **Do not go outside the facility perimeter for additional materials at this or any other stage of the remediation process without the express, written permission of the land owner and Tipperary Corporation.**

Spread and compact as much remediated materials as necessary to provide a pathway for heavy equipment to the pit edge. Stockpile the balance on the stripped surface.

16. Bring a track hoe to location. Excavate the paraffinic layer of the pit and send to a composting pile created on the previously remediated section. Add remediated soils, manure, hay surfactant and flocculent to achieve an average 5,000 ppm TPH concentration. Set the material aside to compost.

17. Using the track hoe and bulldozer remove the pit contents and place on the previously remediated section of the pad. Mix and blend with remediated materials to achieve an average TPH concentration of less than 1,000 ppm. Each side wall of the pit shall be tested for TPH, VOC and BTEX in at least two locations to insure that all contamination has been removed. Test the bottom of the pit on twenty foot centers. The side walls and pit bottom shall test to less than 1,000 ppm TPH.

18. **At the end of each day's activities, the location shall be contoured to assure that in the event of heavy rainfall, all contaminated materials are situated within containment and that any run-off shall be towards the previously unremediated sections of the site.**

19. Replace the remediated materials into the southern pit. Document the TPH concentration of the remediated materials each 30 cubic yards prior to replacement.

20. Compact the location to insure that seepage does not occur from the center pit. Erect a new berm as required.

Sampling

21. Remove the vertical posts from the north perimeter of the south pit and place in the metals disposal area. Remove the netting and perimeter fencing of the center pit in accordance with the instructions outlined in steps 8-11 of this procedure.

22. Remove the paraffinic layers and place into composting pile as outlined in steps 16 of this procedure.

23. If groundwater is encountered, revert to Whole Earth Quality Procedures QP-29, QP-30 and QP-31 for measurement of TPH, VOC and speciated BTEX.

24. Excavate as much of the center pit as possible using the bull dozer. When the trackhoe is required (due to shallow groundwater) the excavated materials will be placed at the southern edge of the excavation and moved to the remediation area with the bulldozer.

25. Repeat the remediation and restoration activities outlined in steps 17-20 of this procedure. Due to the size of the pit, it may be necessary to create a temporary dam in the center of the pit and only work one side at a time. If so necessary, use the existing berm wall materials to create the dam. Completely remediate one side of the original pit, refill with remediated materials and re-compact. The damming materials shall then be completely removed and the side wall interface with the previously remediated section retested.

The sump pump may be employed during the excavation process of the second pit to keep the excavation as free as possible from standing water. **Care shall be taken to insure that the fluid levels of the northern pit do not exceed the berm's capacity to retain them. Any indication of seepage from the berm walls on to the pit perimeter shall be cause to cease discharge into the pit.**

26. Leave the excavation open.

27. Remove all perimeter fencing from the northern pit. Use the pit's south berm wall to create a dam roughly trisecting the pit. Excavate a vertical delineation hole outside the western berm wall to define the lateral extent of contamination. Excavating from the perimeter inwards, towards the dam, excavate all contaminated materials. The sump pump inlet shall be manned and used to continuously remove all fluids from the excavation so that soil testing can be accomplished. The fluid discharge shall be directed to the open excavation in the second pit.

If
pump
out
dispose
of where?

28. Once all contamination has been excavated from the final pit, the soils shall be remediated and redeposited into the excavations.

29. Obtain new ground water sample from the northeast corner of the location and submit for confirmation testing at Environmental Labs of Texas. Test for BTEX, and lead.

30. Upon completion of all excavation and remediation activities, recontour the location to provide a gradual slope to the lake. Compact the soils within and immediately adjacent to the main drainage channel.

31. Collect all trash such as bird netting, support wires, transite lines, etc. and transport to Waste management in Hobbs. Each shipment shall be manifested by Whole Earth prior to leaving location.

32. Any surplus steel shall be manifested by Whole Earth and sent to a metals recycler.

General Rules

33. A safety meeting shall be held **and documented** each day prior to the beginning of operations.

34. All visitors to the site shall be required to check in to the lab / office and sign a log sheet. The information required on the sheet shall be name, emergency phone contact, time in and out.

35. All visitors to the site shall be required to wear an OSHA approved hard hat, steel toed boots, long pants and shirts with at least short sleeves. If not affiliated with Whole Earth, Tipperary, sub-contractors, or the New Mexico OCD, all visitors will require an escort while on location.

36. All chemicals, extractants, and materials brought into contact with them shall be removed by Whole Earth at the completion of the project and either recycled or disposed of in an approved facility.

Procedures

LANE SALT LAKE
SITE ASSESSMENT
TESTING PROCEDURES AND PROTOCOLS

Whole Earth Environmental, Inc., a Texas Corporation, was contracted by the Tipperary Corporation to conduct a site assessment of the Lane Salt Lake Disposal Facility in accordance with a sampling plan as proposed in early March and amended on March 20, 1995. A field investigation which included on site sampling was performed on March 30, 1995. Present at the March 30 sampling were Mr. Robert Fehlmann of Tipperary Corporation, Messrs. Mike Griffin and Kyle Hanson of Whole Earth Environmental, and Mr. Gary Wink of the New Mexico Oil Conservation Division.

Collection Points and Sample Methods

The soil samples were obtained at seven locations surrounding the pits at depths ranging from surface composites to 10' (plat map enclosed). Samples from inside the berm on the southern-most pit were collected from depths of 6' and 4' and were subsequently tested at Whole Earth's Farmington, New Mexico office for VOC's and BTEX by means the following instruments:

VOC's
Environmental Instruments Model 580D PID

BTEX
Photovac PID

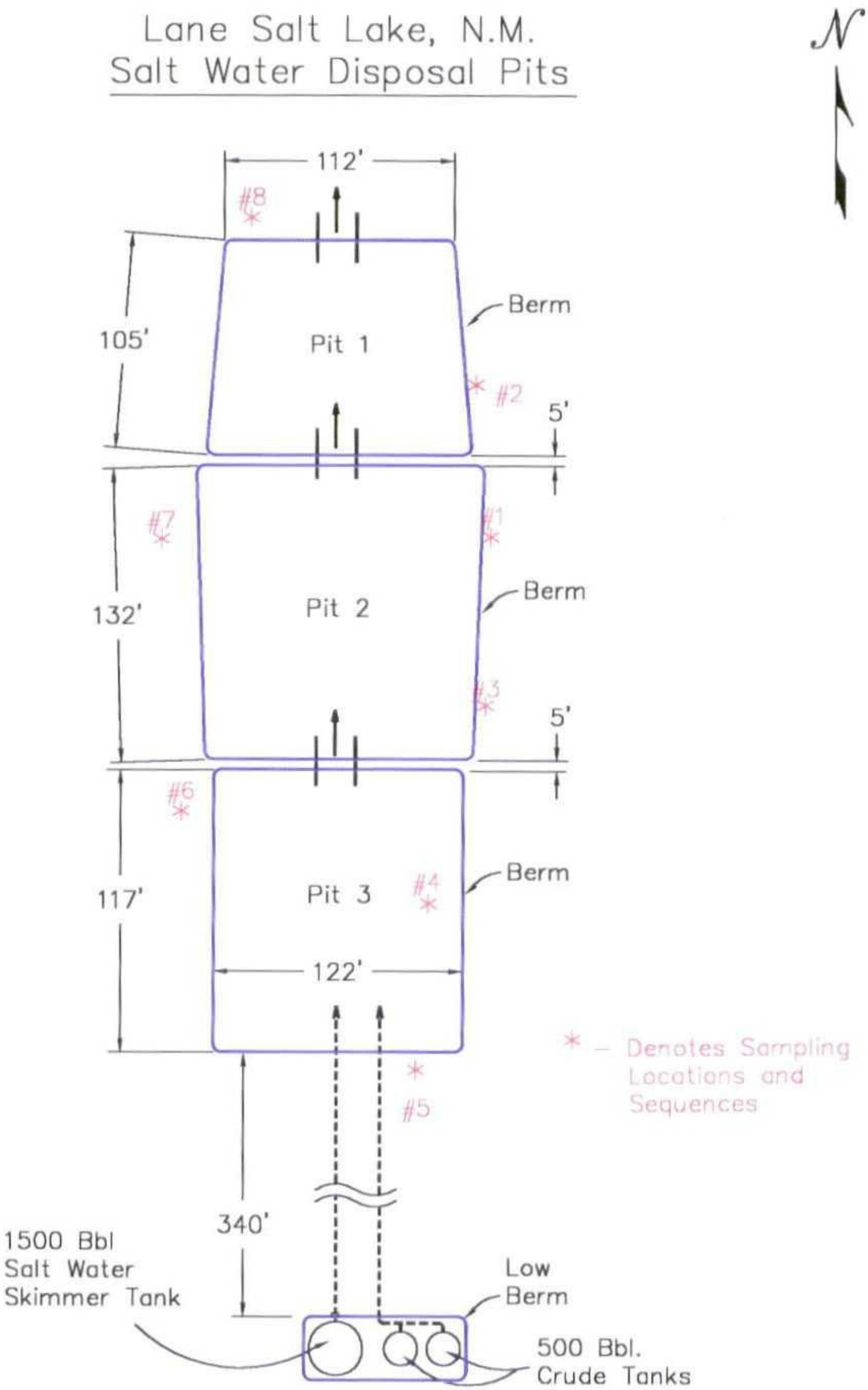
The sensitivity for both instruments is 0.1 ppm benzene at 0-200 ppm concentrations. Samples were shipped packed in "dry ice" and were sealed within commercial freezer storage bags. A chain of custody transfer document accompanied the shipment to the laboratory. Both instruments were calibrated immediately prior to the samples being examined. The Whole Earth field sampling procedures employed on the project are included within this section.

Due to the presence of perimeter fencing and netting, we were unable to determine the extent of vertical migration directly under the pits. However, we are certain that an impermeable Triassic redbed exists at a distance of approximately 15' bgl.

Water samples were obtained from a depth of approximately 4' from the northeast edge of the northern pit and submitted with a chain of custody transfer to Environmental Labs of Texas.

Lateral distances were determined by means of a rotating plot wheel measuring device.

Lane Salt Lake, N.M.
Salt Water Disposal Pits



WHOLE EARTH

QP-06

WHOLE EARTH ENVIRONMENTAL
QUALITY PROCEDURE

Procedure for Conducting Field TPH Analysis

Completed By:	Approved By:	Effective Date: / /

1.0 Purpose

To define the procedure to be used in conducting total percentage hydrocarbon testing in accordance with EPA Method 418.1 (modified) using the "MEGA" TPH Analyzer.

2.0 Scope

This procedure is to be used for field testing and on site remediation information.

3.0 Procedure

3.1 The G.A.C. "MEGA" TPH analyzer is an instrument that measures concentrations of aliphatic hydrocarbons by means of infra-red spectrometry. It is manufactured to our specifications and can accurately measure concentrations from two parts per million through 100,000 parts per million. The unit is factory calibrated however minor calibration adjustments may be made in the field. Quality Procedure 06A defines the field calibration methods to be employed.

3.2 Prior to taking the machine into the field, insert a 500 ppm and 5,000 ppm calibration standard into the sample port of the machine. Zero out the Range dial until the instrument records the exact standard reading.

3.3 Once in the field, insert a large and small cuvette filled with clean Freon 113 into the sample port of the machine. Use the range dial to zero in the reading. If the machine does not zero, do not attempt to adjust the span dial. Immediately implement Quality Procedure 06A .

3.4 Place a 100 g. weight standard on the field scale to insure accuracy. Zero out the scale as necessary.

3.5 Tare a clean 100 ml. sample vial with the Teflon cap removed. Add 20 g. (+/- .01 g), of sample soil into the vial taking care to remove rocks or vegetable matter from the sample to be tested. If the sample is wet, add up to 5 g. silica gel or anhydrous sodium sulfate to the sample after weighing.

3.6 Dispense 20 ml. Freon 113 into the sample vial.

3.7 Cap the vial and shake for five minutes.

3.8 Carefully decant the liquid contents of the vial into a filter/dessicant cartridge and affix the cartridge cap. Recap the sample vial and set aside.

3.9 Insert the metal tip of the pressure syringe into the cap opening and slowly pressurize. **WARNING: APPLY ONLY ENOUGH PRESSURE ON THE SYRINGE TO EFFECT FLOW THROUGH THE FILTERS. TOO MUCH PRESSURE MAY CAUSE THE CAP TO SEPARATE FROM THE BODY OF THE CARTRIDGE.** Once flow is established through the cartridge direct the flow into the 5 cm. cuvette until the cuvette is full. Reverse the pressure on the syringe and remove the syringe tip from the cartridge cap. Set the cartridge aside in a vertical position.

3.10 The cuvette has two clear and two frosted sides. Hold the cuvette by the frosted sides and carefully insert into the sample port of the machine. Read the right hand digital read-out of the instrument. If the reading is less than 1,000 ppm. the results shall be recorded in the field Soil Analysis Report. If the result is higher than 1,000 ppm, continue with the dilution procedure.

4.0 Dilution Procedure

4.1 When initial readings are greater than 1,000 ppm using the 5 cm. cuvette, pour the contents of the 5 cm. cuvette into a 1 cm. cuvette. Insert the 1. cm cuvette into the metal holder and insert into the test port of the instrument.

4.2 Read the left hand digital read-out of the machine. If the results are less than 10,000 ppm, record the results into the field Soil Analysis Report. If greater than 10,000 ppm, continue the dilution process.

4.3 Pour the contents of the small cuvette into a graduated glass pipette. Add 10 ml. pure Freon 113 into the pipette. Shake the contents and pour into the 1 cm. cuvette. Repeat step 4.2. adding two zeros to the end of the displayed number. If the reported result is greater than 100,000 ppm. the accuracy of further readings through additional dilutions are questionable.

4.4 Pour all sample Freon into the recycling container.

WHOLE EARTH

QP-17

WHOLE EARTH ENVIRONMENTAL
QUALITY PROCEDURE

Procedure for Measuring and Reporting
TPH / VOC Results for San Juan Basin
Pit Closures

Completed By:	Approved By:	Effective Date: / /

1.0 Purpose

This procedure outlines the methods to be employed in measuring and recording the results of TPH and VOC confirmation testing for the San Juan Basin area's closure protocol.

2.0 Scope

This procedure shall only be used for all pit closures contained within New Mexico or the San Juan Basin. This procedure does not address remediation methods.

3.0 Procedure

3.1 After excavation, soil samples shall be obtained from the bottom and each of the four sides of each pit and subjected to TPH analysis in accordance with Whole Earth Quality Procedure **QP-06.**

3.2 Each test sample shall be identified as North Wall, South Wall, East Wall South Wall or Bottom. The results of each acceptable test shall be placed in the appropriate blank space on the attached field form.

3.3 Upon completion of the TPH testing, a minimum of five additional samples shall be obtained from different sections of the testing area and subjected to VOC analysis in accordance with Whole Earth Quality Procedure **QP-18**. If the results of the VOC analysis indicate a VOC concentration greater than 100 ppm, a speciated analysis for BTEX shall be performed in accordance with Whole Earth **QP-19.**

3.4 The test results for each of the five samples shall be recorded on the field form within the appropriate blank space.

3.5 The balance of the information needed to complete the field form shall be filled in prior to the Auditor leaving the location.

4.0 Records

4.1 If the information is recorded electronically by means of a field laptop computer, the file shall be labeled by the well name and a hard copy report printed within twenty-four hours of the field tests being completed.

4.2 If the field form is hand written, it shall be turned in to the Field Superintendent at the end of each day and shall then be entered into the computer data base within forty-eight hours of the tests being completed.

WHOLE EARTH

QP-18

WHOLE EARTH ENVIRONMENTAL
QUALITY PROCEDURE

Sampling and Testing Protocol
VOC in Soil

Completed By: Approved By: Effective Date: / /

1.0 Purpose

This procedure is to be used to determine the concentrations of Volatile Organic Compounds in soils.

2.0 Scope

This procedure is to be used as the standard field measurement for soil VOC concentrations. It is not to be used as a substitute for full spectrographic speciation of organic compounds.

3.0 Procedure

3.1 Sample Collection and Preparation

3.1.1 Collect at least 500 g. of soil from the sample collection point. Take care to insure that the sample is representative of the general background to include visible concentrations of hydrocarbons and soil types. If necessary, prepare a composite sample of soils obtained at several points in the sample area. Take care to insure that no loose vegetation, rocks or liquids are included in the sample(s).

3.1.2 The soil sample(s) shall be immediately inserted into a one quart or larger polyethylene freezer bag and sealed. When sealed, the bag should contain a nearly equal space between the soil sample and trapped air.

3.1.3 The sealed samples shall be allowed to set for a minimum of five minutes at a minimum temperature of 75^0F.

3.1.4 The sealed sample bag should be massaged to break up any clods, and to provide the soil sample with as much exposed surface area as practically possible.

3.2 Sampling Procedure

3.2.1 The instrument to be used in conducting VOC concentration testing shall be an Environmental Instruments 13471 OVM / Datalogger. Prior to use the instrument shall be zeroed out in accordance with the appropriate maintenance and calibration procedure.

3.2.2 Carefully open one end of the collection bag and insert the probe tip into the bag taking care that the probe tip not touch the soil sample or the side walls of the bag.

3.2.3 Set the instrument to retain the highest result reading value. Record the reading onto the Field Analytical Report Form and additionally enter the location code into the instrument data logger.

3.2.4 If the instrument provides a reading exceeding 100 ppm, proceed to conduct BTEX Speciation in accordance with Whole Earth **QP-19.**

4.0 After testing, the soil samples shall be returned to the sampling location, and the bags collected for off-site disposal. **IN NO CASE SHALL THE SAME BAG BE USED TWICE. EACH SAMPLE CONTAINER MUST BE DISCARDED AFTER EACH USE.**

concentrations of hydrocarbons and soil types. [illegible]
sample of soils obtained at several points in the sample area. Take care to insure that no loose vegetation, rocks or liquids are included in the sample(s).

3.1.2 The soil sample(s) shall be immediately inserted into a one quart or larger polyethylene freezer bag and sealed. When sealed, the bag should contain a nearly

WHOLE EARTH

QP-19

WHOLE EARTH ENVIRONMENTAL
QUALITY PROCEDURE

Sampling and Testing Protocol
BTEX Speciation in Soil

Completed By: Approved By: Effective Date: / /

1.0 Purpose

This procedure is to be used to determine the concentrations of Benzene, Toluene, Ethyl-Benzene and Xylene (BTEX) in soils.

2.0 Scope

This procedure is to be used as the standard field measurement for soil BTEX concentrations. It is not to be used as a substitute for full spectrographic speciation of organic compounds.

3.0 Procedure

3.1 Sample Collection and Preparation

3.1.1 Collect at least 500 g. of soil from the sample collection point. Take care to insure that the sample is representative of the general background to include visible concentrations of hydrocarbons and soil types. If necessary, prepare a composite sample of soils obtained at several points in the sample area. Take care to insure that no loose vegetation, rocks or liquids are included in the sample(s).

3.1.2 The soil sample(s) shall be immediately inserted into a one quart or larger polyethylene freezer bag and sealed. When sealed, the bag should contain a nearly equal space between the soil sample and trapped air.

3.1.3 The sealed samples shall be allowed to set for a minimum of five minutes at a minimum temperature of 75^{0}F.

3.1.4 The sealed sample bag should be massaged to break up any clods, and to provide the soil sample with as much exposed surface area as practically possible.

3.2 Sampling Procedure

3.2.1 The instrument to be used in conducting VOC concentration testing shall be a Photovac Ion-chromatograph with BTEX Module. Prior to use the instrument shall be zeroed out in accordance with the appropriate maintenance and calibration procedure.

3.2.2 Carefully open one end of the collection bag and insert the probe tip into the bag taking care that the probe tip not touch the soil sample or the side walls of the bag. If VOC analysis was conducted on the sample prior to BTEX analysis, care should be taken to insure that a sufficient air volume exists in the bag to provide accurate results. **If the available air space within the bag is insufficient to run a full analysis, the sample shall be discarded.**

3.2.3 Set the instrument to retain the highest result reading value. Record the reading onto the Field Analytical Report Form and additionally enter the location code into the instrument data logger.

4.0 After testing, the soil samples shall be returned to the sampling location, and the bags collected for off-site disposal. **IN NO CASE SHALL THE SAME BAG BE USED TWICE. EACH SAMPLE CONTAINER MUST BE DISCARDED AFTER EACH USE.**

Results

	Sample @ Pit Edge 05/02/95	Monitor Well #1 03/16/95	Monitor Well #2 03/16/95	Monitor Well #3 03/16/95	Windmill 03/16/95	New Mexico Water Standards
Aluminum	0.45	ND	ND	0.27	ND	5.00
Arsenic	0.10					0.10
Barium	**12.68**	0.02	0.02	0.01	0.02	1.00
Berryllium	<.05	ND	ND	ND	ND	
Boron	**68.96**					0.75
Cadmium	<.01	0.01	0.02	0.04	0.02	0.01
Calcium	320.00	14.20	31.70	26.90	92.40	
Chromium	0.01	ND	ND	ND	ND	0.05
Cobalt	<.05	0.02	0.02	0.02	0.02	0.05
Copper	<.05	0.09	0.03	0.04	0.06	1.00
Iron	**6.28**	**5.17**	**14.80**	**9.26**	ND	1.00
Lead	<.1					0.05
Magnesium	2,215.00	23.30	30.80	38.20	19.30	
Manganese	1.52	ND	0.10	ND	ND	0.20
Mercury	ND	<.002	<.002	<.002	<.002	0.002
Molybdenum	<.05					1.00
Nickle	<.05	0.02	0.02	0.02	0.03	0.20
Potassium	8,200.00	31.00	14.00	33.80	4.59	
Selenium	**7.60**	<.01	<.01	<.01	<.01	0.05
Silver	0.04					0.05
Sodium	33,000.00	202.00	202.00	358.00	86.80	
Zinc	0.13	0.22	0.03	0.83	0.10	10.00

NOTES:
1. All results in Mg / L (ppm)
2. Shaded areas indicate samples not run
3. ND = Non Detect

	Sample @ Pit Edge 05/02/95	Lake Sample 05/17/67	Monitor Well #1 03/16/95	Monitor Well #2 03/16/95	Monitor Well #3 03/16/95	Windmill 03/16/95	New Mexico Water Standards
Calcium	320.00		15.00	46.00	29.00	86.00	
Magnesium	2,215.00		24.00	35.00	38.00	21.00	
Sodium	33,000.00		202.00	202.00	358.00	87.00	
Potassium	8,200.00		31.00	19.00	46.00	6.60	
Carbonate	<5.00		7.00	0.00	11.00	0.00	
Bicarbonate	305.00		412.00	259.00	156.00	205.00	
Sulfate	18.00		96.00	265.00	499.00	189.00	600.00
Chloride	53,175.00	157,883.00	156.00	199.00	340.00	99.00	250.00
TDS	12,880.00		736.00	895.00	**1,399.00**	591.00	1,000.00
Hardness	9,920.00		138.00	260.00	230.00	302.00	
pH	7.22		8.54	8.13	8.74	7.79	6-9

NOTES:

1. All results in Mg / L (ppm)
2. Shaded areas indicate samples not run
3. ND = Non Detect

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"Don't Treat Your Soil Like Dirt!"

WHOLE EARTH ENVIRONMENTAL, INC.
16337 PARK ROW
HOUSTON, TEXAS 77084-5191
FAX: 713-578-1190

Receiving Date: 04/14/95
Sample Type: LIQUID
Project # NEW MEXICO PIT, TATUM

Analysis Date: 05/17/95
Sampling Date: 04/14/95
Sample Condition: Intact/ plastic
with Headspace

	ELT# 3939b	
CHLORIDES	53175	mg/l
SULFATES	18	mg/l
TDS	12880	mg/l
pH	7.22	s.u.
CARBONATES	<5	mg/l
BICARBONATES	305	mg/l
HARDNESS	9920	mg/l

METHODS: EPA 310.2, 325.1, 375.4,150.1

Raland K Tuttle
Raland K. Tuttle

5-26-95
Date

Tipperary Corporation
Lane Salt Lake Brine Disposal Facility
Organics Analysis

	Sample & Pit Edge 05/02/95	Monitor Well #1 03/16/95	Monitor Well #2 03/16/95	Monitor Well #3 03/16/95	Windmill 03/16/95	New Mexico Water Standards
Benzene	<.001					0.01
Toluene	<.001					0.75
Ethylbenzene	<.001					0.75
Xylenes	<.001					0.62
TPH	589					
Naphthalene	<.002	<5.0	<5.0	<5.0	<5.0	0.03
Acenaphtylene	<.002	<5.0	<5.0	<5.0	<5.0	0.03
Acenapthene	<.002	<5.0	<5.0	<5.0	<5.0	0.03
Fluorine	<.002	<5.0	<5.0	<5.0	<5.0	0.03
Phenathene	<.002	<5.0	<5.0	<5.0	<5.0	0.03
Anthracene	<.002	<5.0	<5.0	<5.0	<5.0	0.03
Fluoranthene	<.002	<5.0	<5.0	<5.0	<5.0	0.03
Pyrene	<.002	<5.0	<5.0	<5.0	<5.0	0.03
Chrysene	<.002	<5.0	<5.0	<5.0	<5.0	0.03
Benzo(a)anthracene	<.002	<5.0	<5.0	<5.0	<5.0	0.03
Benzo(k)flurothene	<.002	<5.0	<5.0	<5.0	<5.0	0.03
Benzo(b)fluroanthene	<.002	<5.0	<5.0	<5.0	<5.0	0.03
Benzo(a)pyrene	<.002	<5.0	<5.0	<5.0	<5.0	0.0007
Ideno(1,2,3cd)pyrene	<.002	<5.0	<5.0	<5.0	<5.0	0.03
Dibenz(a,h)anthracene	<.002	<5.0	<5.0	<5.0	<5.0	0.03
Benzo(g,h,i)perylene	<.002	<5.0	<5.0	<5.0	<5.0	0.03

NOTES:

1. All results in Mg / L (ppm)
2. Shaded areas indicate samples not run
3. ND = Non Detect

WHOLE EARTH

ANALYTICAL REPORT FORM

Well Name: N / A

Date of Collection: 03 / 30 / 95

Pit Type: Brine Discharge

Date of Analysis: 03 / 30 /95

Client: Tipperary Corp.

Analyst: K. Hanson

TPH Analyzer S/N: 01159

VOC Analyzer S/N: ________

Chromatograph S / N ___________

ANALYSIS: TPH / VOC Confirmation Testing for New Mexico Pit Closures

ANALYTICAL METHOD: Extraction by Means of EPA 418.1 (WEQP-06), Volatilization by means of WEQP-18 & Speciation by means of WEQP-19

SAMPLE PREPARATION: Solvent Extraction / Volatilization

	SP # 1 @ 2'	SP # 1 @ 8'			
TPH	23	14			
VOC					
Benzene					
Toluene					
Ethyl-Benzene					
Xylene					

Temperature of sample:______ °F

Notes:1. All results shown in mg/L (ppm).

WHOLE EARTH

ANALYTICAL REPORT FORM

Well Name: N / A

Date of Collection: 03 / 30 / 95

Pit Type: Brine Discharge

Date of Analysis: 03 / 30 /95

Client: Tipperary Corp.

Analyst: K. Hanson

TPH Analyzer S/N: 01159

VOC Analyzer S/N: ________

Chromatograph S / N ____________

ANALYSIS: TPH / VOC Confirmation Testing for New Mexico Pit Closures

ANALYTICAL METHOD: Extraction by Means of EPA 418.1 (WEQP-06), Volatilization by means of WEQP-18 & Speciation by means of WEQP-19

SAMPLE PREPARATION: Solvent Extraction / Volatilization

	SP # 2 @ Surface	SP # 2 @ 3'	SP # 2 @ 5'		
TPH	970	681	17		
VOC					
Benzene					
Toluene					
Ethyl-Benzene					
Xylene					

Temperature of sample:_______ °F

Notes:1. All results shown in mg/L (ppm).

WHOLE EARTH

ANALYTICAL REPORT FORM

Well Name: N / A

Date of Collection: 03 / 30 / 95

Pit Type: Brine Discharge

Date of Analysis: 03 / 30 /95

Client: Tipperary Corp.

Analyst: K. Hanson

TPH Analyzer S/N: 01159

VOC Analyzer S/N: ________

Chromatograph S / N ___________

ANALYSIS: TPH / VOC Confirmation Testing for New Mexico Pit Closures

ANALYTICAL METHOD: Extraction by Means of EPA 418.1 (WEQP-06), Volatilization by means of WEQP-18 & Speciation by means of WEQP-19

SAMPLE PREPARATION: Solvent Extraction / Volatilization

	SP # 3 @ 10'				
TPH	Non Detect				
VOC					
Benzene					
Toluene					
Ethyl-Benzene					
Xylene					

Temperature of sample: ______ °F

Notes: 1. All results shown in mg/L (ppm).

WHOLE EARTH

ANALYTICAL REPORT FORM

Well Name: N / A

Date of Collection: 03 / 30 / 95

Pit Type: Brine Discharge

Date of Analysis: 03 / 30 /95

Client: Tipperary Corp.

Analyst: K. Hanson

TPH Analyzer S/N: 01159

VOC Analyzer S/N: 49556-283

Chromatograph S / N SA920043

ANALYSIS: TPH / VOC Confirmation Testing for New Mexico Pit Closures

ANALYTICAL METHOD: Extraction by Means of EPA 418.1 (WEQP-06), Volatilization by means of WEQP-18 & Speciation by means of WEQP-19

SAMPLE PREPARATION: Solvent Extraction / Volatilization

	SP # 4 @ 6"	SP # 4 @ 4'			
TPH	8,760	756			
VOC	107	66			
Benzene	3	1			
Toluene	1	Non-detect			
Ethyl-Benzene	2	Non-detect			
Xylene	1	Non-detect			

Temperature of sample:_______ °F

Notes:1. All results shown in mg/L (ppm).

WHOLE EARTH

ANALYTICAL REPORT FORM

Well Name: N / A

Date of Collection: 03 / 30 / 95

Pit Type: Brine Discharge

Date of Analysis: 03 / 30 /95

Client: Tipperary Corp.

Analyst: K. Hanson

TPH Analyzer S/N: 01159

VOC Analyzer S/N: 49556-283

Chromatograph S / N SA920043

ANALYSIS: TPH / VOC Confirmation Testing for New Mexico Pit Closures

ANALYTICAL METHOD: Extraction by Means of EPA 418.1 (WEQP-06), Volatilization by means of WEQP-18 & Speciation by means of WEQP-19

SAMPLE PREPARATION: Solvent Extraction / Volatilization

	SP # 5 @ 6'				
TPH	3,720				
VOC					
Benzene					
Toluene					
Ethyl-Benzene					
Xylene					

Temperature of sample:_______ °F

Notes:1. All results shown in mg/L (ppm).

WHOLE EARTH

ANALYTICAL REPORT FORM

Well Name: N / A

Date of Collection: 03 / 30 / 95

Pit Type: Brine Discharge

Date of Analysis: 03 / 30 /95

Client: Tipperary Corp.

Analyst: K. Hanson

TPH Analyzer S/N: 01159

VOC Analyzer S/N: 49556-283

Chromatograph S / N SA920043

ANALYSIS: TPH / VOC Confirmation Testing for New Mexico Pit Closures

ANALYTICAL METHOD: Extraction by Means of EPA 418.1 (WEQP-06), Volatilization by means of WEQP-18 & Speciation by means of WEQP-19

SAMPLE PREPARATION: Solvent Extraction / Volatilization

	SP # 5 @ 6'	SP # 6 @ 4'			
TPH	6,392	3,750			
VOC					
Benzene					
Toluene					
Ethyl-Benzene					
Xylene					

Temperature of sample:______ °F

Notes:1. All results shown in mg/L (ppm).

WHOLE EARTH

ANALYTICAL REPORT FORM

Well Name: N / A

Date of Collection: 03 / 30 / 95

Pit Type: Brine Discharge

Date of Analysis: 03 / 30 /95

Client: Tipperary Corp.

Analyst: K. Hanson

TPH Analyzer S/N: 01159

VOC Analyzer S/N: 49556-283

Chromatograph S / N SA920043

ANALYSIS: TPH / VOC Confirmation Testing for New Mexico Pit Closures

ANALYTICAL METHOD: Extraction by Means of EPA 418.1 (WEQP-06), Volatilization by means of WEQP-18 & Speciation by means of WEQP-19

SAMPLE PREPARATION: Solvent Extraction / Volatilization

	SP # 7 @ 4'				
TPH	214				
VOC					
Benzene					
Toluene					
Ethyl-Benzene					
Xylene					

Temperature of sample:______ °F

Notes:1. All results shown in mg/L (ppm).

WHOLE EARTH

ANALYTICAL REPORT FORM

Well Name: N / A

Date of Collection: 03 / 30 / 95

Pit Type: Brine Discharge

Date of Analysis: 03 / 30 /95

Client: Tipperary Corp.

Analyst: K. Hanson

TPH Analyzer S/N: 01159

VOC Analyzer S/N: 49556-283

Chromatograph S / N SA920043

ANALYSIS: TPH / VOC Confirmation Testing for New Mexico Pit Closures

ANALYTICAL METHOD: Extraction by Means of EPA 418.1 (WEQP-06), Volatilization by means of WEQP-18 & Speciation by means of WEQP-19

SAMPLE PREPARATION: Solvent Extraction / Volatilization

	SP # 8 @ 10'				
TPH	405				
VOC					
Benzene					
Toluene					
Ethyl-Benzene					
Xylene					

Temperature of sample:_______ °F

Notes:1. All results shown in mg/L (ppm).

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"Don't Treat Your Soil Like Dirt!"

WHOLE EARTH ENVIRONMENTAL, INC.
MR. MIKE GRIFFIN
16337 PARK ROW
HOUSTON, TEXAS 77084-5191
FAX: 713-578-1190

Receiving Date: 04/14/95
Sample Type: Water/SEDIMENT
Project #:NEW MEXICO PIT, TATUM

Analysis Date: 05/21/95
Sampling Date: 04/14/95
Sample Condition: Intact

Field Code: NEW MEXICO PIT WATER M.W.

PAH (ppm)	DETECTION LIMIT	ELT# 3939B	BLANK	%EA	%IA
Naphthalene	0.002	ND	ND	101	99
Acenaphthylene	0.002	ND	ND	99	100
Acenaphthene	0.002	ND	ND	106	103
Fluorene	0.002	ND	ND	108	107
Phenanthrene	0.002	ND	ND	102	101
Anthracene	0.002	ND	ND	98	97
Fluoranthene	0.002	ND	ND	106	103
Pyrene	0.002	ND	ND	102	101
Benzo[a]anthracene	0.002	ND	ND	105	101
Chrysene	0.002	ND	ND	106	102
Benzo[b]fluoranthene	0.002	ND	ND	99	96
Benzo[k]fluoranthene	0.002	ND	ND	105	102
Benzo [a]pyrene	0.002	ND	ND	98	99
Indeno[1,2,3-cd]pyrene	0.002	ND	ND	111	109
Dibenz[a,h]anthracene	0.002	ND	ND	103	102
Benzo[g,h,i]perylene	0.002	ND	ND	106	101

SYSTEM MONITORING COMPOUNDS	% Recovery
2-Fluorophenol	98
Phenol-d5	103
Nitrobenzene-d5	107
2-Fluorobiphenyl	96
2,4,6-Tribromophenol	94
Terphenyl-d14	97

Method: SW 846-8270
ND= NOT DETECTED

Raland K Tuttle
Raland K. Tuttle

5/22/95
Date

ENVIRONMENTAL
LAB OF , INC.

"Don't Treat Your Soil Like Dirt!"

WHOLE EARTH ENVIRONMENTAL, INC.
16337 PARK ROW
HOUSTON, TEXAS 77084-5191
FAX: 713-578-1797

Receiving Date: 04/14/95	Analysis Date: 05/25/95
Sample Type: LIQUID	Sampling Date: 04/14/95
Project # NEW MEXICO PIT, TATUM	Sample Condition: Intact/ plastic with Headspace
FIELD CODE: NM PIT WATER/ MW	

METHOD: EPA SW 846-6010 **ICP ELEMENT SCAN**	ELT# **3939B**
	mg/l
ALUMIUM	0.45
ARSENIC	0.1
BARIUM	12.68
BERYLLIUM	<0.05
BORON	68.96
CADMIUM	<0.01
CALCIUM	320
CHROMIUM	0.01
COBALT	<0.05
COPPER	<0.05
IRON	6.28
LEAD	<0.1
MAGNESIUM	2215
MANGANESE	1.52
MOLYBDENUM	<0.05
NICKEL	<0.05
POTASSIUM	8200
SILVER	0.04
SODIUM	33000
STRONTIUM	1166
THALLIUM	0.1
ZINC	0.13

Raland K Tuttle
Raland K. Tuttle

5-26-95
Date

ENVIRONMENTAL LAB OF , INC.

"Don't Treat Your Soil Like Dirt!"

WHOLE EARTH ENVIRONMENTAL
MR. MIKE GRIFFIN
16337 PARKROW
HOUSTON, TEXAS 77084-5191
FAX: 713-578-1797

Receiving Date:04/14/95
Sample Type: LIQUID
Project : TATUM NM PIT

Analysis Date: 05/16/95
Sampling Date: 04/14/95
Sample Condition: Plastic/ headspa

ELT#	FIELD CODE	BENZENE ppm	TOLUENE ppm	ETHYLBENZENE ppm	m,p-XYLENE ppm	o-XYLENE ppm	TPH ppm
3939B	NM PIT WATER	ND	ND	ND	0.01	ND	589
	%EA	85	94	96	110	93	NR
	%IA	107	95	97	112	95	97
	RPD	10	7	7	6	8	0

ND= NOT DETECTED <1ppm

METHODS: SW 846-8020,5030, EPA 418.1

Raland K Tuttle
Raland K. Tuttle

5-19-95
Date

ENVIRONMENTAL
LAB OF , INC.

"Don't Treat Your Soil Like Dirt!"

WHOLE EARTH ENVIRONMENTAL, INC.
16337 PARK ROW
HOUSTON, TEXAS 77084-5191
FAX: 713-578-1797

Receiving Date: 04/14/95
Sample Type: LIQUID
Project # NEW MEXICO PIT, TATUM
FIELD CODE: NM PIT WATER/ MW

Analysis Date: 05/24/95
Sampling Date: 04/14/95
Sample Condition: Intact/ plastic with Headspace

ELT#	FIELD CODE	Se ppm	Hg ppm
3939B	NEW MEXICO PIT WATER	7.6	ND
	%IA	100	100
	RPD	9	0

METHOD: EPA SW-846-7470,7740

Raland K Tuttle
Raland K. Tuttle

5-25-95
Date

Photos

PHOTO-DOCUMENTATION

Contained within this section are digitized representations of photographs taken at the site. They are intended to provide graphic illustration of various issues relating to the remediation process.

1. The first illustration is an overview of the site showing the orientation of the pits and their proximity to the salt flats to the north and east.

2. The second illustration is a detail of the northern pit showing the paraffinic nature of the contamination.

3. The third illustration is that of a soil sample obtained from a depth of approximately four feet below ground level. The blue / gray color is typical of aromatic contamination. Once exposed to the air, the hydrocarbons quickly dissipate.

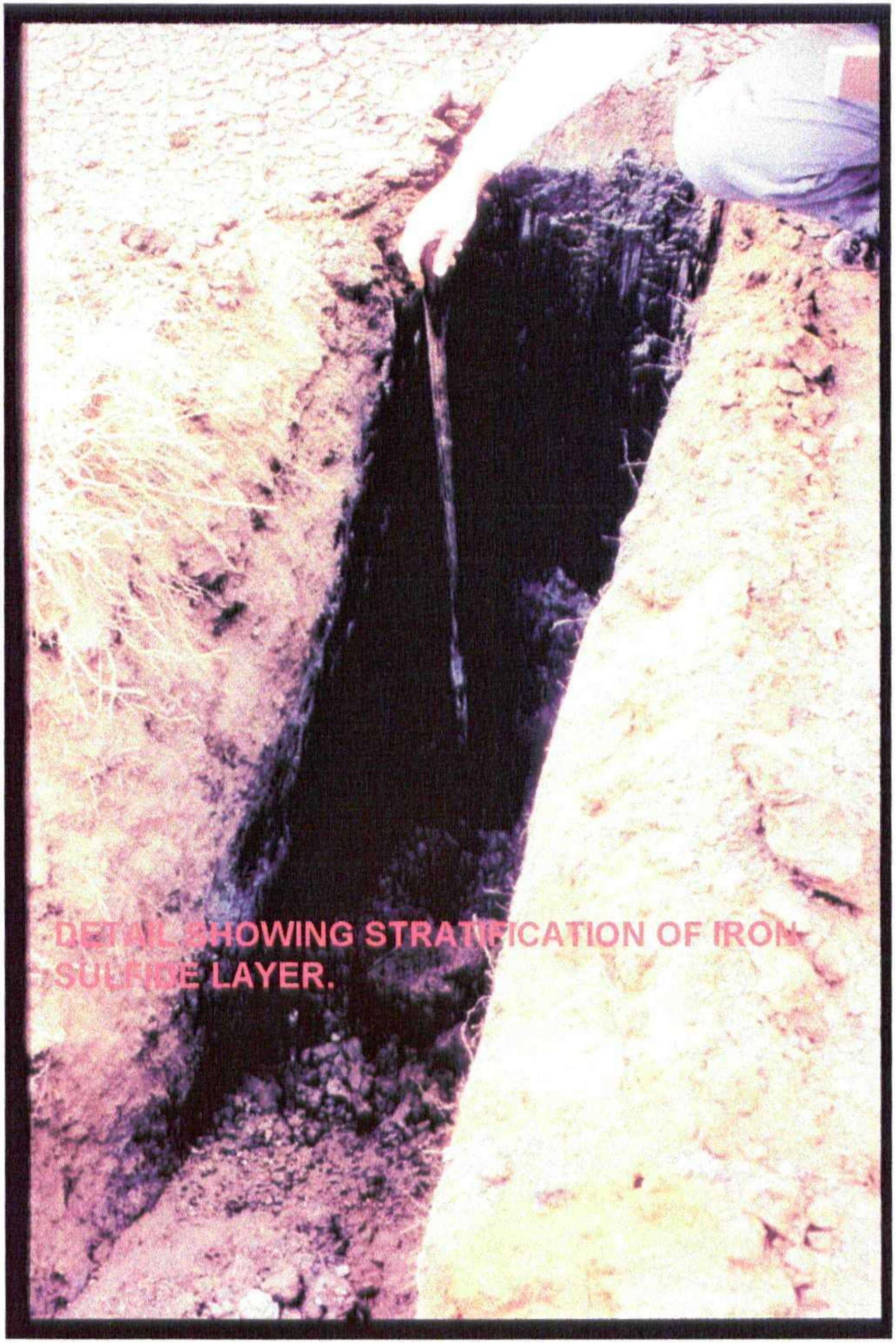
4. The fourth illustration shows the clear separation of the paraffinic layer from that of the sub-strate materials.

5. The fifth illustration shows the extent of staining at the perimeter of the pit from iron sulfide.

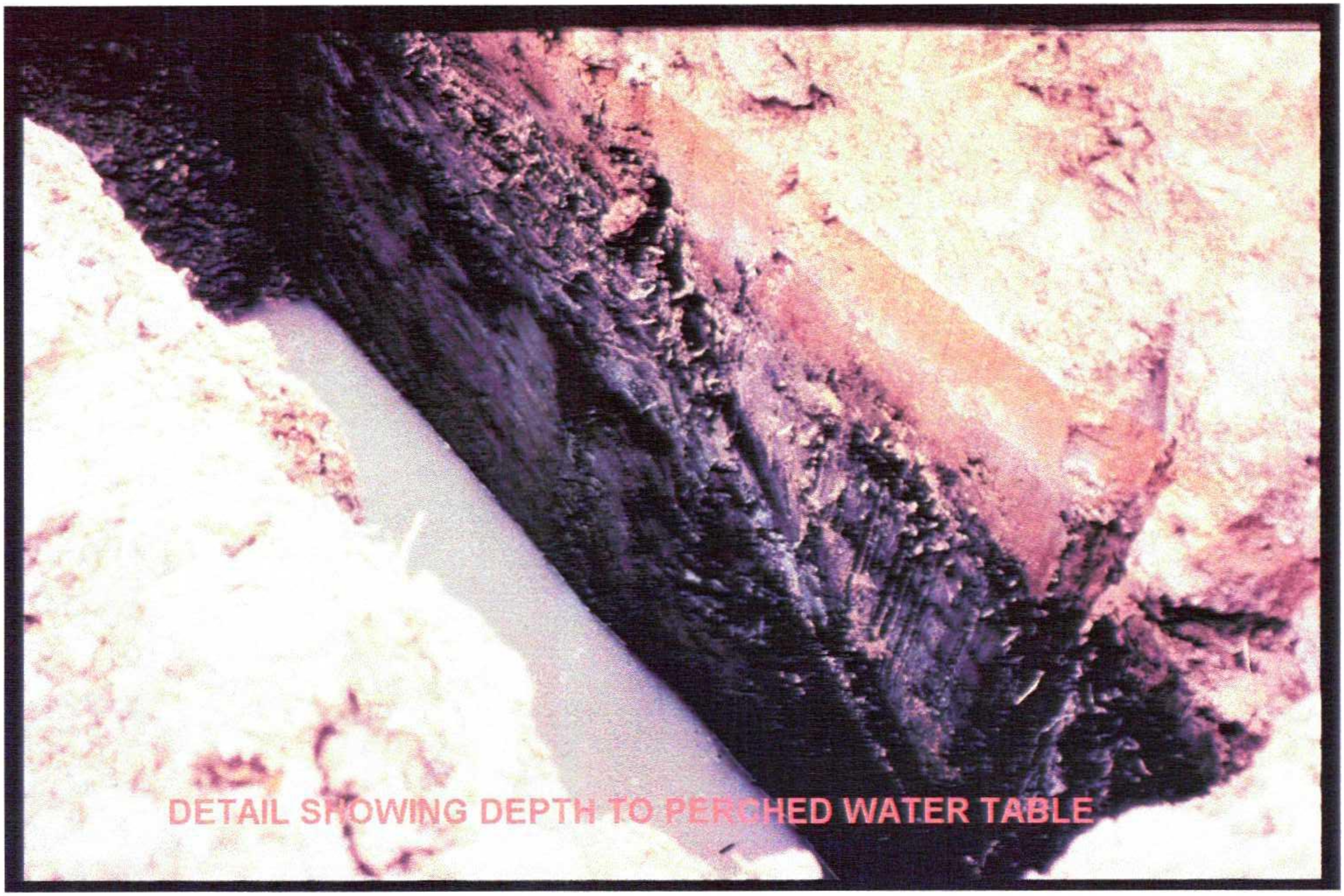
6. The final illustration is that of the northern pit showing the depth to the perched water table.

DETAIL OF SUBSTRATE. CONTAMINATION CONSISTS PRIMARILY OF AROMATIC HYDROCARBONS

DETAIL SHOWING SEPARATION OF PARAFFINIC CONTAMINATION
FROM UNDERLYING SOILS



DETAIL SHOWING STRATIFICATION OF IRON SULFIDE LAYER.



DETAIL SHOWING DEPTH TO PERCHED WATER TABLE