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REPORTS

DATE:
Oct. 1993

TIERRA

Environmental Company, Inc.
909 West Apache
Farmington, New Mexico 87401

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OIL CONSERVATION DIV.
SANTA FE

ELIMINATION OF HYDROCARBON EXPOSED SOIL

PREPARED FOR

NASSAU RESOURCES, INC.
2855 SOUTHSIDE RIVER RD.
P.O. BOX 809
FARMINGTON, NEW MEXICO, 87499

JOHN A. BRIMHALL #1
WELL SITE

OCTOBER, 1993

INDEX

REPORT

ELIMINATION OF HYDROCARBON EXPOSED SOIL

John A. Brimhall #1
Sept. 24-Oct. 15, 1993

CAPSULE

PROBLEM:
Quantification, removal and remediation of petroleum hydrocarbon exposed soil from around a plugged oil well near Fruitland, NM. Crude oil from the well was the apparent origin of the hydrocarbons. However, the exact source, volume, cause and time of the discharge is unknown. This was not a recent spill because the hydrocarbons had undergone considerable degradation-based on the opinions and experience of the environmental consultants. The hydrocarbons were layered in an area approximately 120 X 100 ft. East of the well head. The layer was generally two-three ft. thick below two ft. of sandy soil. No hydrocarbons penetrated 6 ft. in depth. The well is:

Jerome P. McHugh
John A. Brimhall #1
NE NE Sect. 10 T29N R15W
30-045-2514

OIL COMPANY OPERATOR:
Nassau Resources, Inc.
2855 Southside River Road
P. O. Box 809
Farmington, NM 87499
Field Superintendent: Murphy Brasuel
(505) 326-7793

LAND OWNER:
Gordon Nielson
P. O. Box 1014
Springfield, VA 22151
(703) 323-1374

OIL CONSERVATION DIV. (OCD) of NEW MEXICO, DISTRICT 3
1000 Rio Brazos Road
Aztec, NM 87413
(505) 334-6178
Environmental Geologist: Denny Foust

GENERAL CONTRACTOR:
Frank's Oilfield Service, Inc.
P. O. Box 5073
Farmington, NM 87499
President: Jesus Villalobos
(505) 632-5948

ENVIRONMENTAL CONSULTANT:
Tierra Environmental Corporation
909 W. Apache
Farmington, NM 87401
COO & V.P.: Phillip Nobis
(505) 325-0924

BACKGROUND

Mr. and Mrs. Gordon Nielson, the landowners, reported a possible oil contamination problem around the plugged oil well, John A. Brimhall #1 to Frank Chavez and Denny Foust of the New Mexico Oil Conservation Division (OCD), Dist. 3 and to Murphy Brasuel, Field Superintendent of Nassau Resources, Inc., the oil company operator. The land, leased

by Ralph Wheeler, a local dairyman and rancher is located on property near Fruitland, NM.

Mr. Brasuel initiated immediate action to identify, define and remedy the problem. The initial action of Mr. Brasuel was the retention and deployment of an oil service contracting company, Frank's Oilfield Service, Inc., to excavate and remove any soils from the location that might contain petroleum hydrocarbons.

Tierra Environmental Corporation, represented by Tony Tucker, was also immediately retained by Mr. Brasuel on Sept. 24, 1993, to inspect, evaluate and recommend procedures to remediate or remove petroleum hydrocarbon contaminated or exposed soil from around the plugged well. Dr. Dan Hoover of Tierra was dispatched to the location on the morning of Sept. 25, 1993, for a preliminary evaluation of the problem.

Frank's Oilfield Services, Inc. had excavated approximately 400-500 cu. yds. of soil, stockpiled East and Northwest of the well head. Two recently dug pits, Northwest and East of the well head were observed (See Fig.). The excavated areas were approximately six ft. deep and were filling with ground water. A slight oily film was observed on the East pit water.

The Northwest Pit (centered 40 ft. Northwest of the well head), approximately 30 ft. long (W-E) and 20 ft. wide (N-S) appeared free of oil and the excavated tan soil did not present a hydrocarbon smell. The East Pit (centered 60 ft. East of the well head) was approximately 50 ft. long (N-S) and 30 ft. wide (E-W). The black streaked soil excavated from the East Pit exhibited a strong hydrocarbon smell.

Soil samples from the two excavations and water samples from each pit were obtained by Dr. Hoover for field analyses. Representatives of the principal parties, Brasuel, Nielson and Villalobos met with Dr. Hoover to apprise the problem and agree on an initial course of action. The suggestions of Dr. Hoover, tentatively accepted by the principals, included:

*Excavation activities were halted until Monday, Sept. 27, 1993 - allowing time to quantitatively analyze the soil and receive counsel from the local OCD Environmental

Geologist, Denny Foust.

*Sampled soils and waters were qualitatively analyzed immediately at the Tierra Field Laboratory for levels of Total Petroleum Hydrocarbons (TPH) to provide a degree of insight into the problem The results were communicated to the principal parties within four hours.

*All principals met at the location for a "comprehensive planning session", Monday morning, Sept. 27, 1993, with select Tierra Environmental Specialist to develop a cost-effective course of action. The specialist included: Phil Nobis (COO & V.P.), Dr. Dan Hoover (Director of Research), Ron Castleberry (Environmental Specialist) and Larry Hunter (Operations Specialist). In addition, the local OCD Environmental Geologist, Denny Foust, was asked to conduct an on-site inspection and provide counsel if his schedule permits. Otherwise, Mr. Foust will be consulted via telephone.

The field laboratory results obtained by Dr. Hoover and communicated to Mr. Murphy and Mr. Villalobos were:

Soil from the East Pit Excavation -
Hanby [1] TPH [2]= 1500 - 2000 ppm wt

OVM [3] TPH = 300 ppm

Retort = 19% water, <1% oil, 80% solids. pH = 7.5

Water from the East Pit -
Hanby aromatics = 0 ppm wt

Note: (1) Hanby = qualitative color method of detecting hydrocarbons in soils and water. (2) TPH = Total Petroleum Hydrocarbons. (3) OVM = Organic Vapor Meter or Photo Ionization Detector (PID) for volatile hydrocarbons @ 70-80 °F.

PLANNING & ORIENTATION

The principals met with the Tierra specialists on Monday morning, Sept. 27, 1993 - as agreed to on Saturday. An intensive and comprehensive discussion resulted in the establishment of the following "Guidelines for Action" - subject to the critique of Mr. Brasuel and Mr. Foust:

*Fresh samples of excavated soil and pit water analyzed via field methods Saturday were submitted to an independent laboratory for an EPA accepted Infrared (IR) TPH and BTEX analyses.
(**BTEX** = Benzene, Toluene, Ethylbenzene, Xylene.)

*If the independent soil analyses IR TPH = > 100 ppm wt, soil around the location will be systematically evaluated for TPH with a combination of visual inspection, field analyses (OVM) and quantitative laboratory analyses (IR). Soils exhibiting an OVM reading > 1.0 ppm will be removed or subjected to the IR TPH analyses by the independent laboratory. The limit OCD allows for TPH in soils in 100 ppm wt. All soils exhibiting an IR TPH > 100 ppm wt were removed to the Tierra Landfarm for remediation - subject to approval by Mr. Foust of the OCD. The suspect soil and ground water was analyzed for TPH and BTEX.

Remediation of the soil via in-situ land farming is an option requiring an undetermined length of time, commensurate with continual husbandry - subject to the approval of Mr. Foust of the OCD. Mr. Brasuel did not entertain this approach because remediation would be retarded by approaching winter conditions and he desired to quickly restore the area to agricultural productivity.

*The water seeping into the pits was analyzed for TPH & BTEX, removed and hauled to a disposal facility.

*Pits resulting from the excavations were treated with QUAD-5, an oxygen donor and microbial enhancer - followed by filling with clean soil.

*All on-site activities will be documented with photographs and written log.

*Monitor wells may be drilled, sampled quarterly, and analyzed for BTEX & TPH for a period of one year according to the directive of the local OCD Environmental Geologist.

*The entire project will be supervised by Tierra Environmental Corp. with the interactive counsel of the OCD. Environmental Geologist, Land Owner, Field Superintendent of Nassau Resources, Inc., and the President of Frank's Oilfield Services, Inc.

*A comprehensive report with corresponding photographs, signed by the appropriate Nassau Resources, Inc., and Tierra Environmental Corp. representative will be prepared for the OCD, Land Owner and Frank's Oilfield Service, Inc., at the

conclusion of the excavation and restoration of the location.

METHOD

The initial action is to define the problem. Within this context, the soil already excavated was visually examined. There was no evidence of hydrocarbons in the Northwest Pit soil. However, the soil from the East Pit was found to contain a substantial amount of black material with a definite hydrocarbon odor. The black soil appeared to comprise a layer 2-3 ft. thick below a two foot layer of sandy soil. This is not observed below a depth of ~ five ft. Six ft. deep exploratory holes are dug 40-60 ft. Southeast, Southwest and West of the well head. These holes are allowed to partially fill with ground water, which is sampled and sent to the laboratory for BTEX and TPH analyses. The soil surrounding the well head - 30 ft. in all directions - is also spot tested, 2-3 ft. deep with the OVM instrument.

In order to define the boundaries of the hydrocarbon layer, six ft. deep trenches were extended from the North and South sides and Southwest corner of the East Pit until the boundaries of the black soil were established - about 20 ft. to the North and South of the initial East Pit (See Fig.).

The East wall of the East Pit was also extended about 15 ft. before encountering clean soil. The water was continuously pumped from the pit and hauled to a disposal facility. A trac-hoe was then utilized to excavate the black soil westward toward the well head - further defining the boundaries as digging continued. The OVM instrument for measuring volatile TPH is utilized to continually verify the hydrocarbon boundaries as the digging proceeds. In general, OVM reading of 2-300 ppm indicated a laboratory IR TPH value of $>1{,}000$ ppm wt.

When the OVM reading fell below 1.0 ppm - composite samples were sent to the laboratory for IR TPH analyses. If the analyses indicated TPH values below 100 ppm wt. = the soil was designated as clean.

RESULTS

A composite soil sample from the East Pit excavation was submitted to the independent laboratory on 9-27-93. The soil exhibited an IR TPH of 1,496 ppm wt (See Table). An OVM TPH reading on the same soil

sample was >300 ppm. The digging of these trenches on 9-27-93 helped define the East, Northeast and Southeast boundaries of the hydrocarbon exposed soil.

The exploratory trench excavated a distance of 20 ft. from the South wall of the East Pit was streaked black, odorous of hydrocarbons during the initial 15 ft. Successive OVM reading indicated TPH values >250 ppm. The OVM TPH reading diminished to <1.0 ppm during the final five ft. of excavation - with no black streaks evident in the soil. A similar trench was excavated from the North end of the East Pit, with similar results. A final trench, ten ft. long, was excavated to the South from the Southwest corner of the East Pit. The OVM TPH values on this excavated soil was consistently >250 ppm.

Composite samples of tan soil from the excavation, bottom and walls of the Northwest Pit repeatedly produced OVM TPH values <1.0 ppm - indicating this area was free of petroleum hydrocarbons. These findings were verified by the analytical results on similar soil samples by the independent laboratory - with the IR TPH = 23 ppm wt, BTEX = 331 ug/L and dichlorobenzenes = 899 uh/L. (See Table). This pit was verbally cleared for closure with clean soil by Mr. Foust.

Utilizing the method described above, the excavation proceeded toward the well head until all of the hydrocarbon exposed soil was removed (See Fig.). The systematic excavation of soil continued from 9-27-93 through 10-5-93 - greatly expanding the East Pit to an area 120 X 100 X 6 ft. deep (See Fig.). The boundaries of hydrocarbon exposed soil were continually defined with the OVM - culminating around the well head. Each section of the East Pit was sprayed with QUAD-5, a bioremediation enhancer, after the area was designated as clean.

The black hydrocarbon exposed soil was generally confined to a 2-3 ft. section below a two ft. layer of clean appearing tan, top soil. However, the layers were unavoidably mixed during the excavation. The OVM readings on the hydrocarbon exposed soil ranged from 250-450 ppm, which may relate to an IR TPH of 1,500 - 2,000 ppm wt.

A total of 1,722 cu. yds. of hydrocarbon containing soil (<100 ppm wt) was

excavated and trucked to the Tierra Environmental Corp. Crouch Mesa Landfarm for bioremediation. A certificate of bioremediation will be presented to Nassau Resources, Inc. when the soil is judged to be remediated by the OCD.

PROGNOSIS & CONCLUSION

The excavated soil was replaced with clean virgin top soil and fertilized with 400 lbs. per acre of 16-20-0 fertilizer. Although the ground water appears within the limits allowed for BTEX and TPH, monitor wells may be required around the well site. This determination will be made by OCD officials. The ground water from these wells would be analyzed for BTEX and TPH, quarter, for one year.

The operation is documented with photographs, which will be included with this report. All indications are that this eclectic effort has been a success.

Nassau Resources, Inc. Authorized Representative:

Thomas Brasel

Date: 10-21-93

Tierra Environmental Corp. Authorized Representative:

Phillip C. Nobi

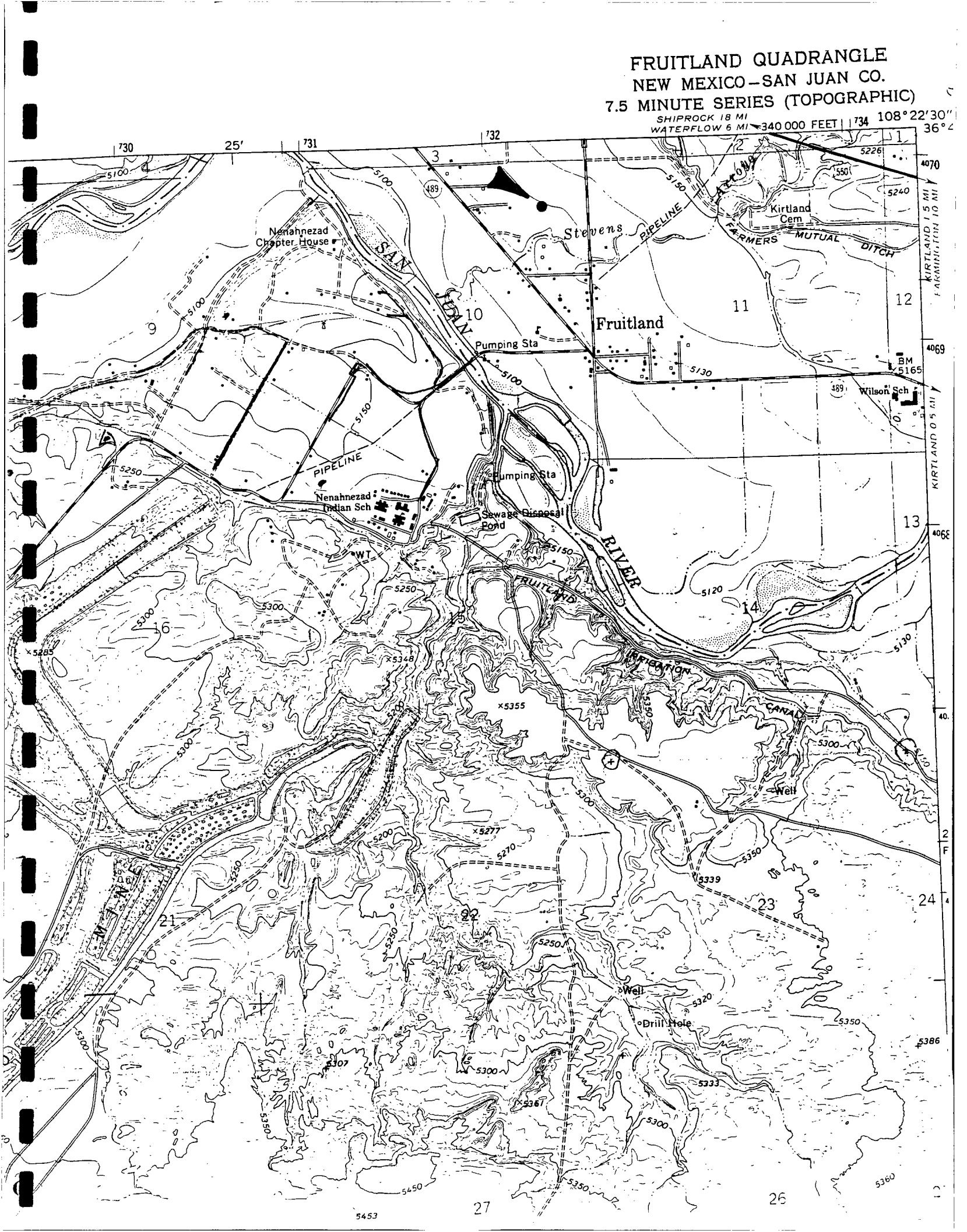
Date: 10/21/93

Report Prepared By:

L. Daniel Hoover

L. Daniel Hoover, Ph.D.
Date: October 15, 1993

LOCATION MAP

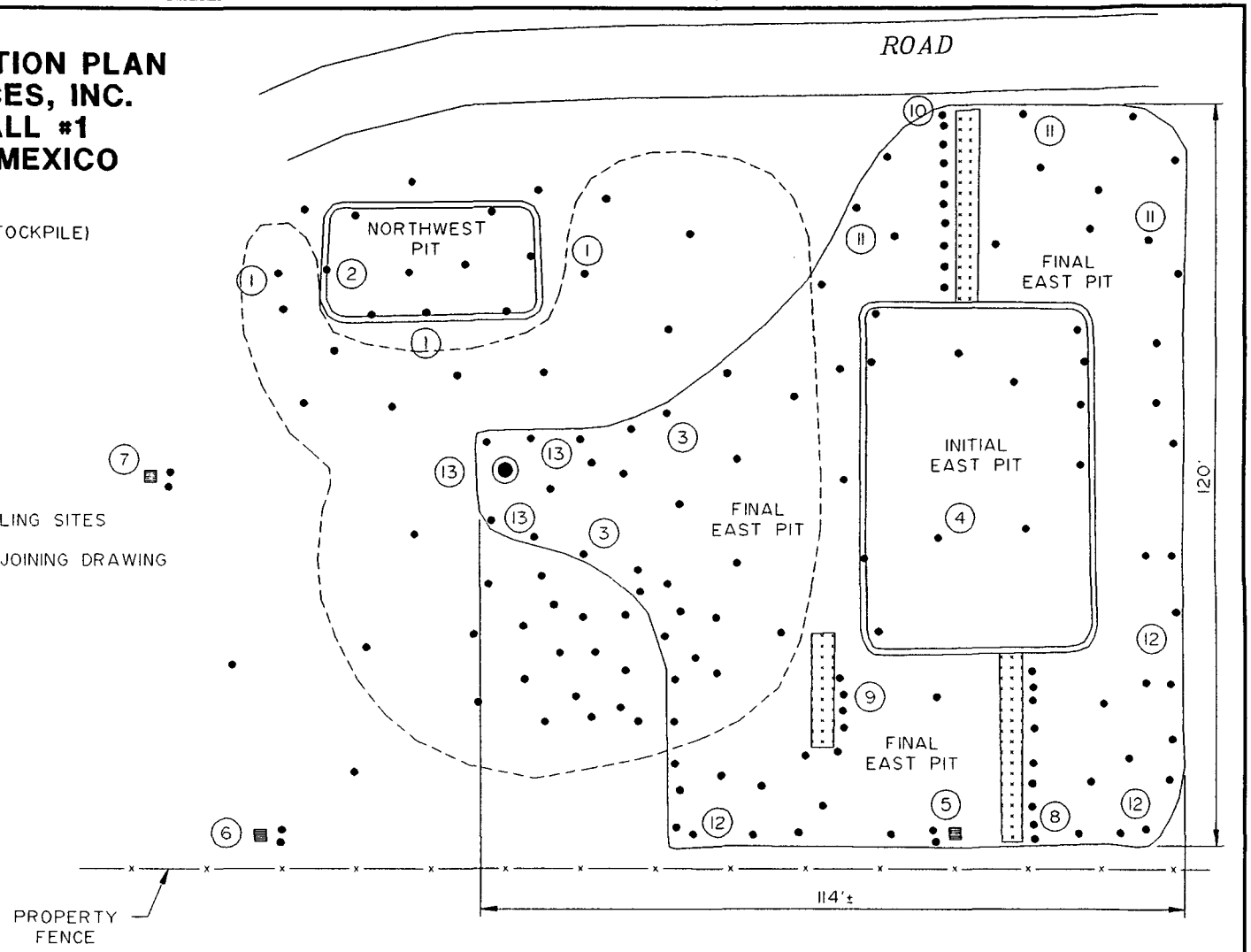

FRUITLAND QUADRANGLE
NEW MEXICO—SAN JUAN CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
SHIPROCK 18 MI
WATERFLOW 6 MI
340 000 FEET
108°22'30"
36°
730
25'
731
732
734
Nenahnezad Chapter House
SAN JUAN
Stevens PIPELINE
ATCO
Kirtland Cem
FARMERS MUTUAL DITCH
KIRTLAND 1.5 MI
FARMINGTON 10 MI
Fruitland
Pumping Sta
BM 5165
Wilson Sch
PIPELINE
Nenahnezad Indian Sch
Pumping Sta
Sewage Disposal Pond
WT
FRUITLAND
RIVER
IRRIGATION CANAL
Well
Drill Hole
MESA VERDE
KIRTLAND 0.5 MI
5453

SITE DIAGRAM

FIGURE

WELL SITE REMEDIATION PLAN
NASSAW RESOURCES, INC.
JOHN A. BRIMHALL #1
FRUITLAND, NEW MEXICO

- ---- = AREA OF EXCAVATED SOIL (STOCKPILE)
- ═══ = BOUNDARY OF INITIAL PITS
- ——— = FINAL BOUNDARY OF PIT
- ◉ = WELL HEAD
- ▭ = EXPLORATORY DITCHES
- —·— = PROPERTY FENCE
- • = SAMPLING SITES
- ▪ = 6' DEEP GROUND WATER SAMPLING SITES
- (n) = SAMPLE TEST SITES - SEE ADJOINING DRAWING



NOT TO SCALE

BY

TIERRA

Environmental Company, Inc.
909 West Apache
Farmington, New Mexico 87401 FILE: 3537 DATE: 10/13/93

LAB ANALYSIS

TABLE
SELECT SOIL & WATER ANALYSES

DATE & Number	SAMPLE	HANBY-TPH, ppm	OVM-TPH, ppm	IR-TPH ppm	BTEX-u/L 1,2,3,4,5**	Dichloro-benzene u/L *
9-27-3 (#1)	Soil-Northwest Pit	0	<1.0	24	-	-
9-27-3 (#2)	Water - Northwest Pit	0	0	5	0,0,0,0,0	6
9-27-3 (#3)	Soil- East Pit Initial	1500-2000	310	1,469	-	-
9-27-3 (#4)	Water- East Pit Initial	15	-	23	6,53,42,48, 162	899
9-27-3 (#5)	Water-Southeast Expl Hole	-	-	12	0,0,0,0,3	33
9-27-3 (#6)	Water-Southwest Expl Hole	-	-	5	0,2,3,4,12	82
9-27-3 (#7)	Water- West Expl Hole	-	-	7	0,0,0,0,4	42
9-27-3 (#8)	Soil- South Expl Trench		<1.0	16	-	-
9-27-3 (#9)	Soil-Southwest Expl Trench	-	102	482	-	-
9-27-3 (#10)	Soil- North Expl Trench 5' from end. @ End	-	250 <1.0	-	-	-
9-30-3 (#11)	Soil-East Pit, Expan North	-	<1.0	36	0,0,0,0,0	0
10-4-3 (#12)	Soil-East Pit, Expan South	-	<1.0	11	0,0,0,0,0	0
10-5-93 (#13)	Soil- around Well Head	-	<1.0	20	0,0,0,0,0	0

* Dichlorobenzenes were found in some of the water samples. The source was other than from natural hydrocarbons.

** BTEX = (1)Benzene, (2)Toluene, (4)Ethylbenzene, (5)m-p-o Xylenes; (3) = Chlorobenzene

NOTE : GROUND WATER CONTAMINANT LIMITS (New Mexico Water Quality Control Standards; Sect 74-6-4, NM Water Quality Act, Chap. 326

Benzene - 0.01 mg/L
Toluene - 0.75 mg/L
Ethylbenzene - 0.75 mg/L
Total Xylenes - 0.62 mg/L
Chlorobenzene is not listed

Comment: The OVM readings @ 75-80 ^{0}F on soil were obtained continuously and most are not listed in the Table. In all soils with black streaks - the readings ranged between 50 and 450, indicating a level of IR measured TPH in the soil in excess of the allowable 100 ppm Wt. The soil was removed until the remaining soil exhibited an OVM reading of <1.0, and this soil was sent to the independent laboratory for TPH analyses with an EPA approved Infrared spectrophotometer.

ON SITE TECHNOLOGIES, LTD.

TOTAL PETROLEUM HYDROCARBONS

Attn:	*Dan Hoover, Ph.D*	Date:	9/28/93
Company:	*Tierra Environmental Corporation*	*Lab ID:*	*1263*
Address:	*909 W Apache*	*Sample No.*	
City, State:	*Farmington, NM 87401*	*Job No.*	*2-1000*

Project Name:	***Tierra Environmental***		
Project Location:			
Sampled by:	DH	Date:	9/27/93
Analyzed by:	TW	Date:	9/27/93
Type of Sample:	*Soil*		

Laboratory Analysis

Laboratory Identification	***Sample Identification***	***Total Petroleum Hydrocarbons***
0587-1263	*Tierra Environmental 6 ft. South Soil* Soil – Southwest Exploratory Trench	482 *ppm wt.*
0588-1263	*Tierra Environmental 6 ft. SW Soil* Soil - South Exploratory Trench	16 *ppm wt.*
0589-1263	*Tierra Environmental West Soil Pile* Soil Northwest Pit	24 *ppm wt.*
0590-1263	*Tierra Environmental East Soil Pile* Soil East Pit Initial	1496 *ppm wt.*

End of Trench

Method - *EPA Method 418.1 Total Petroleum Hydrocarbons*

Approved by: Dan G

Date: 9/29/93

FAX: (505) 327-1496 ▪ 24 HR. – (505) 327-7105 ▪ OFF.: (505) 325-8786

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ON SITE TECHNOLOGIES, LTD.

TOTAL PETROLEUM HYDROCARBONS

Attn:	*Dan Hoover, Ph.D*	Date:	9/30/93
Company:	*Tierra Environmental Corporation*	*Lab ID:*	*1268*
Address:	*909 W Apache*	*Sample No.*	
City, State:	*Farmington, NM 87401*	*Job No.*	*2-1000*

Project Name:	***Tierra Environmental***		
Project Location:			
Sampled by:	DH	Date:	9/30/93
Analyzed by:	TW	Date:	9/30/93
Type of Sample:	*Soil*		

Laboratory Analysis Soil - East Pit, Expan North

Laboratory Identification	***Sample Identification***	***Total Petroleum Hydrocarbons***
0603-1268	*Tierra Environmental East (North) Pit*	36 *ppm wt.*

Closure

Method - *EPA Method 418.1 Total Petroleum Hydrocarbons*

Approved by: Jan Gt
Date: 9/30/93

FAX: (505) 327-1496 ▪ 24 HR. – (505) 327-7105 ▪ OFF.: (505) 325-8786
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TOTAL PETROLEUM HYDROCARBONS

Attn:	*Dan Hoover, Ph.D*	Date:	9/28/93
Company:	*Tierra Environmental Corporation*	*Lab ID:*	*1263*
Address:	*909 W Apache*	*Sample No.*	
City, State:	*Farmington, NM 87401*	*Job No.*	*2-1000*

Project Name:	***Tierra Environmental***		
Project Location:			
Sampled by:	DH	Date:	9/27/93
Analyzed by:	TW	Date:	9/27/93
Type of Sample:	*Soil*		

Laboratory Analysis

Laboratory Identification	***Sample Identification***	***Total Petroleum Hydrocarbons***
0591-1263	*Tierra Environmental West Pond Water* Water - Northwest Pit	5 *ppm wt.*
0592-1263	*Tierra Environmental East Pond Water* Water - East Pit initial	23 *ppm wt.*
0593-1263	*Tierra Environmental East Hole Water* Water - Southeast Expl Hole	12 *ppm wt.*
0594-1263	*Tierra Environmental West Hole Water* water - Southwest Expl. Hole	5 *ppm wt.*
0595-1263	*Tierra Environmental Far West Hole Water* Water - West Expl. Hole	7 *ppm wt.*

Closure

Method *- EPA Method 418.1 Total Petroleum Hydrocarbons*

Approved by: Jan C
Date: 9/28/93

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PRIORITY POLLUTANTS / AROMATIC VOLATILE ORGANICS

Attn:	*Dan Hoover, Ph.D*	Date:	10/7/93
Company:	*Tierra Environmental Corporation*	*Lab ID:*	*1276*
Address:	*909 W Apache St*	*Sample ID:*	*#0615*
City, State:	*Farmington, NM 87499*	*Job No.*	*2-1000*

Project Name:	***Tierra Environmental***			
Project Location:	***Around Well Head and Walls***			
Sampled by:	DH	Date:	10/5/93	Time:
Analyzed by:	DC	Date:	10/7/93	
Sample Matrix:	*Soil*			

Aromatic Volatile Organics

Component	****Measured Concentration ug/L***
Benzene	*ND*
Toluene	*ND*
Chlorobenzene	*ND*
Ethylbenzene	*ND*
m,p-Xylene	*ND*
o-Xylene	*ND*
1,3-Dichlorobenzene	*ND*
1,4-Dichlorobenzene	*ND*
1,2-Dichlorobenzene	*ND*
TOTAL	*0 ug/L*

Soil - Around Well Head

Closure

ND - Not Detectable
*** - Method Detection Limit, 2.0 ug/L*

Method *- SW-846 EPA Method 8020 Aromatic Volatile Organics by Gas Chromatography*

Approved by:
Date: 10/7/93

FAX: (505) 327-1496 ▪ 24 HR. – (505) 327-7105 ▪ OFF.: (505) 325-8786
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ON SITE TECHNOLOGIES, LTD.

PRIORITY POLLUTANTS / AROMATIC VOLATILE ORGANICS

Attn:	*Dan Hoover, Ph.D*	Date:	10/7/93
Company:	*Tierra Environmental Corporation*	*Lab ID:*	*1276*
Address:	*909 W Apache St*	*Sample ID:*	*#0616*
City, State:	*Farmington, NM 87499*	*Job No.*	*2-1000*

Project Name:	***Tierra Environmental***			
Project Location:	***Top Soil Sample***			
Sampled by:	DH	Date:	10/5/93	Time:
Analyzed by:	DC	Date:	10/7/93	
Sample Matrix:	*Soil*			

Aromatic Volatile Organics

Component	****Measured Concentration ug/L***
Benzene	*ND*
Toluene	*ND*
Chlorobenzene	*ND*
Ethylbenzene	*ND*
m,p-Xylene	*ND*
o-Xylene	*ND*
1,3-Dichlorobenzene	*ND*
1,4-Dichlorobenzene	*ND*
1,2-Dichlorobenzene	*ND*
TOTAL	*0 ug/L*

closure

ND - Not Detectable
*** - Method Detection Limit, 2.0 ug/L*

***Method** - SW-846 EPA Method 8020 Aromatic Volatile Organics by Gas Chromatography*

Approved by: [signature]
Date: 10/7/93

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ON SITE TECHNOLOGIES, LTD.

PRIORITY POLLUTANTS / AROMATIC VOLATILE ORGANICS

Attn:	*Dan Hoover, Ph.D*	Date:	9/28/93
Company:	*Tierra Environmental Corporation*	*Lab ID:*	*1263*
Address:	*909 W Apache St.*	*Sample ID:*	*#0594*
City, State:	*Farmington, NM 87499*	*Job No.*	*2-1000*

Project Name:	***Tierra Environmental***			
Project Location:	***West Hole Water***			
Sampled by:	DH	Date:	9/27/93	Time:
Analyzed by:	DC	Date:	9/28/93	
Sample Matrix:	*Liquid/ Water*			

Aromatic Volatile Organics

Component	****Measured Concentration ug/L***
Benzene	*ND*
Toluene	*2*
Chlorobenzene	*3*
Ethylbenzene	*4*
m,p-Xylene	*8*
o-Xylene	*4*
1,3-Dichlorobenzene	*10*
1,4-Dichlorobenzene	*61*
1,2-Dichlorobenzene	*11*
TOTAL	*103 ug/L*

BTEX = 17 ppb

Water - Southwest Expl Hole

Closure

ND - Not Detectable
*** - Method Detection Limit, 2.0 ug/L*

Method *- SW-846 EPA Method 8020 Aromatic Volatile Organics by Gas Chromatography*

Approved by: Jan Fox
Date: 9/28/93

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ON SITE TECHNOLOGIES, LTD.

PRIORITY POLLUTANTS / AROMATIC VOLATILE ORGANICS

Attn:	*Dan Hoover, Ph.D*	Date:	9/28/93
Company:	*Tierra Environmental Corporation*	*Lab ID:*	*1263*
Address:	*909 W Apache St.*	*Sample ID:*	*#0591*
City, State:	*Farmington, NM 87499*	*Job No.*	*2-1000*

Project Name:	***Tierra Environmental***			
Project Location:	***West Pond Water***			
Sampled by:	DH	Date:	9/27/93	Time:
Analyzed by:	DC	Date:	9/28/93	
Sample Matrix:	*Liquid/ Water*			

Aromatic Volatile Organics

Component	****Measured Concentration ug/L***
Benzene	*ND*
Toluene	*ND*
Chlorobenzene	*ND*
Ethylbenzene	*ND*
m,p-Xylene	*ND*
o-Xylene	*ND*
1,3-Dichlorobenzene	*ND*
1,4-Dichlororbenzene	*6*
1,2-Dichlorobenzene	*ND*
TOTAL	*6 ug/L*

Water - Northwest Pit

Closure

ND - Not Detectable
*** - Method Detection Limit, 2.0 ug/L*

***Method** - SW-846 EPA Method 8020 Aromatic Volatile Organics by Gas Chromatography*

Approved by: Jan Gt
Date: 9/28/93

FAX: (505) 327-1496 ▪ 24 HR. – (505) 327-7105 ▪ OFF.: (505) 325-8786
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ON SITE TECHNOLOGIES, LTD.

PRIORITY POLLUTANTS / AROMATIC VOLATILE ORGANICS

Attn:	*Dan Hoover, Ph.D*	Date:	10/7/93
Company:	*Tierra Environmental Corporation*	*Lab ID:*	*1268*
Address:	*909 W Apache St*	*Sample ID:*	*#0603*
City, State:	*Farmington, NM 87499*	*Job No.*	*2-1000*

Project Name:	***Tierra Environmental***			
Project Location:	***East North Pit***			
Sampled by:	DH	Date:	9/30/93	Time:
Analyzed by:	DC	Date:	10/7/93	
Sample Matrix:	*Soil*			

Aromatic Volatile Organics

Component	***Measured Concentration ug/L	
Benzene	*ND*	
Toluene	*ND*	
Chlorobenzene	*ND*	
Ethylbenzene	*ND*	
m,p-Xylene	*ND*	
o-Xylene	*ND*	
1,3-Dichlorobenzene	*ND*	
1,4-Dichlorobenzene	*ND*	
1,2-Dichlorobenzene	*ND*	
	TOTAL	*0 ug/L*

Soil - East Pit, Expan North

Closure

ND - Not Detectable
*** - Method Detection Limit, 2.0 ug/L*

***Method** - SW-846 EPA Method 8020 Aromatic Volatile Organics by Gas Chromatography*

Approved by: Jan Cx
Date: 10/7/93

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PRIORITY POLLUTANTS / AROMATIC VOLATILE ORGANICS

Attn:	*Dan Hoover, Ph.D*	Date:	10/7/93
Company:	*Tierra Environmental Corporation*	*Lab ID:*	*1273*
Address:	*909 W Apache St*	*Sample ID:*	*#0612*
City, State:	*Farmington, NM 87499*	*Job No.*	*2-1000*

Project Name:	***Tierra Environmental***				
Project Location:	***E. Pit E,S, - Walls***				
Sampled by:	RC	Date:	10/4/93	Time:	1200
Analyzed by:	DC	Date:	10/7/93		
Sample Matrix:	*Soil*				

Aromatic Volatile Organics

Component	****Measured Concentration ug/L***
Benzene	*ND*
Toluene	*ND*
Chlorobenzene	*ND*
Ethylbenzene	*ND*
m,p-Xylene	*ND*
o-Xylene	*ND*
1,3-Dichlorobenzene	*ND*
1,4-Dichlorobenzene	*ND*
1,2-Dichlorobenzene	*ND*
TOTAL	*0 ug/L*

Soil - East Pit, Expan South

ND - Not Detectable
*** - Method Detection Limit, 2.0 ug/L*

***Method** - SW-846 EPA Method 8020 Aromatic Volatile Organics by Gas Chromatography*

Approved by: [signature]
Date: 10/7/93

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PRIORITY POLLUTANTS / AROMATIC VOLATILE ORGANICS

Attn:	*Dan Hoover, Ph.D*	Date:	9/28/93
Company:	*Tierra Environmental Corporation*	*Lab ID:*	*1263*
Address:	*909 W Apache St.*	*Sample ID:*	*#0595*
City, State:	*Farmington, NM 87499*	*Job No.*	*2-1000*

Project Name:	***Tierra Environmental***			
Project Location:	***Far West Hole Water***			
Sampled by:	DH	Date:	9/27/93	Time:
Analyzed by:	DC	Date:	9/28/93	
Sample Matrix:	*Liquid/ Water*			

Aromatic Volatile Organics

Component	***Measured Concentration ug/L
Benzene	*ND*
Toluene	*ND*
Chlorobenzene	*ND*
Ethylbenzene	*ND*
m,p-Xylene	*4*
o-Xylene	*ND*
1,3-Dichlorobenzene	*3*
1,4-Dichlorobenzene	*35*
1,2-Dichlorobenzene	*4*
TOTAL	*46 ug/L*

BTEX = 4 ppb

West Exploratory Hole

ND - Not Detectable
*** - Method Detection Limit, 2.0 ug/L*

***Method** - SW-846 EPA Method 8020 Aromatic Volatile Organics by Gas Chromatography*

Approved by:
Date: 9/28/93

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ON SITE TECHNOLOGIES, LTD.

PRIORITY POLLUTANTS / AROMATIC VOLATILE ORGANICS

Attn:	*Dan Hoover, Ph.D*	Date:	9/28/93
Company:	*Tierra Environmental Corporation*	*Lab ID:*	*1263*
Address:	*909 W Apache St.*	*Sample ID:*	*#0592*
City, State:	*Farmington, NM 87499*	*Job No.*	*2-1000*

Project Name:	***Tierra Environmental***			
Project Location:	***East Pond Water***			
Sampled by:	DH	Date:	9/27/93	Time:
Analyzed by:	DC	Date:	9/28/93	
Sample Matrix:	*Liquid/ Water*			

Aromatic Volatile Organics

Component	****Measured Concentration ug/L***
Benzene	*6*
Toluene	*53*
Chlorobenzene	*42*
Ethylbenzene	*48*
m,p-Xylene	*111*
o-Xylene	*51*
1,3-Dichlorobenzene	*110*
1,4-Dichlororbenzene	*681*
1,2-Dichlorobenzene	*108*
TOTAL	*1210 ug/L*

Before Treatment

ND - Not Detectable
*** - Method Detection Limit, 2.0 ug/L*

Method *- SW-846 EPA Method 8020 Aromatic Volatile Organics by Gas Chromatography*

Approved by:
Date: 9/28/93

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PRIORITY POLLUTANTS / AROMATIC VOLATILE ORGANICS

Attn:	*Dan Hoover, Ph.D*	Date:	9/28/93
Company:	*Tierra Environmental Corporation*	*Lab ID:*	*1263*
Address:	*909 W Apache St.*	*Sample ID:*	*#0593*
City, State:	*Farmington, NM 87499*	*Job No.*	*2-1000*

Project Name:	***Tierra Environmental***			
Project Location:	***East Hole Water***			
Sampled by:	DH	Date:	9/27/93	Time:
Analyzed by:	DC	Date:	9/28/93	
Sample Matrix:	*Liquid/ Water*			

Aromatic Volatile Organics

Component	****Measured Concentration ug/L***
Benzene	*ND*
Toluene	*ND*
Chlorobenzene	*ND*
Ethylbenzene	*ND*
m,p-Xylene	*3*
o-Xylene	*ND*
1,3-Dichlorobenzene	*4*
1,4-Dichlorobenzene	*26*
1,2-Dichlorobenzene	*3*
TOTAL	*36 ug/L*

BTEX = 3 ppb

Southeast Expl. hole

ND - Not Detectable
*** - Method Detection Limit, 2.0 ug/L*

***Method** - SW-846 EPA Method 8020 Aromatic Volatile Organics by Gas Chromatography*

Approved by: [signature]
Date: 9/28/93

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For Navajo Prospect Kirtland N.M.

ON SITE TECHNOLOGIES, LTD.

TOTAL PETROLEUM HYDROCARBONS

Attn:	*Ron Castleberry*	Date:	10/7/93
Company:	*Tierra Environmental Corporation*	*Lab ID:*	*1273*
Address:	*909 W Apache St.*	*Sample No.*	*#0612*
City, State:	*Farmington, NM 87499*	*Job No.*	*2-1000*

Project Name:	***Tierra Environmental***		
Project Location:	***E. Pit E,S - Walls***		
Sampled by:	RC	Date:	10/4/93
Analyzed by:	TW	Date:	10/4/93
Type of Sample:	*Soil*		

Laboratory Analysis Soil - East Pit, Expan South

Laboratory Identification	***Sample Identification***	***Total Petroleum Hydrocarbons***
0612-1273	*Tierra Environmental E. Pit E,S, - Walls*	11 *ppm wt.*

Method - *EPA Method 418.1 Total Petroleum Hydrocarbons*

Approved by:
Date: 10/7/93

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ON SITE TECHNOLOGIES, LTD.

TOTAL PETROLEUM HYDROCARBONS

Attn:	*Dan Hoover, Ph.D*	Date:	10/7/93
Company:	*Tierra Environmental Corporation*	*Lab ID:*	*1276*
Address:	*909 W Apache St.*	*Sample No.*	
City, State:	*Farmington, NM 87499*	*Job No.*	*2-1000*

Project Name:	***Tierra Environmental***		
Project Location:			
Sampled by:	DH	Date:	10/5/93
Analyzed by:	TW	Date:	10/5/93
Type of Sample:	*Soil*		

Laboratory Analysis

Laboratory Identification	***Sample Identification***	***Total Petroleum Hydrocarbons***
0615-1276	*Tierra Environmental Around Well Head and Walls*	20 *ppm wt.*
0616-1273	*Tierra Environmental Top Soil*	16 *ppm wt.*

Method *- EPA Method 418.1 Total Petroleum Hydrocarbons*

Approved by: Jan Green
Date: 10/7/93

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PHOTOGRAPHS


JOHN DEERE