BENCHMARK
ENVIRONMENTAL CORPORATION

July 11, 1996

Project No. 5052.00
Document No. L-6711

Mr. Ed Horst
Giant Refining Company
Route 3, Box 7
Gallup, New Mexico 87301

Transmittal, Final Amended Closure Plan, Public Notice, Fact Sheet, and Response to Deficiency Notice

Dear Mr. Horst:

Benchmark Environmental Corporation (Benchmark) is pleased to submit the final *Amended Closure Plan* for your Hazardous Waste Facility Permit. The closure plan addresses the procedures and requirements for clean closing the Land Treatment Area at Giant's Ciniza refinery. Benchmark has incorporated your technical comments as well as those of the New Mexico Environment Department (NMED). To facilitate communication with NMED personnel, we have included two tables summarizing the responses to NMED's technical and administrative comments.

As you know, the closure plan amendments constitute a Class III permit modification request. Therefore, we have included the public notice and administrative fact sheet to comply with NMED requirements.

Benchmark has been as thorough as possible in completing this task. However, two tables are not complete: Table 8 in the closure plan and Table 4 in Attachment 2. Both tables will list the NMED-approved health-based concentration levels once NMED has provided this information.

If we can be of additional assistance, please contact Jim Stanton at (505) 262-2694.

Sincerely,

Gary Lasswell
Project Manager

Jim Stanton
Environmental Scientist

GL/JS/CBA
Enclosure

cc with enclosure:
Susan Collins, Benchmark, Albuquerque
Marc Sides, Benchmark, Albuquerque
Central Files, Albuquerque

4501 Indian School Road N.E., Suite 105 Albuquerque, New Mexico 87110 (505) 262-2694 FAX (505) 262-2698

PUBLIC NOTICE

RESOURCE CONSERVATION AND RECOVERY ACT PERMIT
CLASS III MODIFICATION

On November 4, 1988, the New Mexico Environment Department (NMED) issued a Resource Conservation and Recovery Act (RCRA) Hazardous Waste Facility Permit to Giant Refining Company (Giant) located at Exit 39 off Interstate 40 near Gallup, New Mexico. The Permit Number is NMD000333211-2, and it expires on November 4, 1998.

Rather than seeking reissuance, Giant has proposed to modify its closure plan and, upon NMED approval, implement closure in accordance with the plan. Such a modification is a Class III permit modification, and the NMED intends to approve the modification. When closure is complete, the NMED will proceed with processing the termination of Giant's Hazardous Waste Facility Permit. Giant will continue to store hazardous waste under the requirements of 20 New Mexico Administrative Code (NMAC) 4.1, Part III, Section 262.34, which allow hazardous waste storage for less than 90 days without a permit.

The public is invited to attend an informal informational meeting scheduled for August 26, 1996 at 7:00 PM. The meeting will be held in the Conference Room at the Administrative Offices of the Giant Ciniza Refinery, Exit 39 off Interstate 40, approximately 17 miles east of Gallup, New Mexico. Staff members from Giant and the NMED will be available at the meeting to provide additional information on the proposed Class III permit modification.

The administrative record for this proposed action consists of the amended closure plan and related correspondence. The administrative record may be reviewed from August 1, 1996 through September 14, 1996, Monday through Friday, between the hours of 8:00 AM and 5:00 PM at:

Giant Ciniza Refinery Administrative Offices
Exit 39 off Interstate 40 about 17 miles east of Gallup, New Mexico
(Facility Contact: Mr. Ed Horst at (505) 722-0227)

or at:

NMED Hazardous and Radioactive Materials Bureau
2044-A Galisteo Street, Santa Fe, New Mexico 87502

For further information or to obtain a complete or partial copy of the administrative record, please contact Mr. Michael Chacon at the above Santa Fe address or call (505) 827-1561. The cost for copies is 35 cents per page.

Any person, including Giant personnel, who wishes to comment on the intent to approve the proposed Class III permit modification or who wishes to request a public hearing may do so by submitting written comments or requests to Ms. Barbara Hoditschek, RCRA Permits Program Manager at the Santa Fe address above. Any request for a public hearing must state the nature of the issues proposed to be raised in the hearing and include the requestor's name and address. Any comments and/or requests received by September 14, 1996 will be considered in formulating a final decision.

HAZARDOUS WASTE FACILITY
CLASS III PERMIT MODIFICATION FACT SHEET
FOR THE
CINIZA REFINERY LAND TREATMENT FACILITY
Giant Refining Company
August 1, 1996

Activity: Class III permit modification for the Ciniza Refinery Land Treatment Area (LTA)

Facility Name: Giant Refining Company (Giant) Ciniza Refinery

EPA ID Number: NMD000333211-2

Location: Ciniza Refinery is located just north of Interstate 40 about 17 miles east of Gallup, New Mexico. The LTA is located within the refinery property approximately 1500 feet northwest of the refinery process area.

Background Information: The New Mexico Environment Department (NMED) issued a Hazardous Waste Permit to Giant on November 4, 1988. The permit allows Giant to treat hazardous waste at the Ciniza LTA, which is still subject to the requirements of the permit even though the LTA has not received hazardous waste since November 8, 1990. Giant has requested that the LTA be closed and the permit be terminated. The NMED has determined that such action is a Class III permit modification requiring public comment.

Effect of Modification: The permit modification will have the effect of updating the permitted closure plan and, upon NMED approval, implementing closure activities in accordance with the plan. When the closure is complete, the NMED will proceed with processing the termination of the permit.

Permit Modification Availability: Copies of the proposed permit modification are available for public review weekdays between 8:00 AM and 5:00 PM at the NMED Hazardous and Radioactive Materials Bureau Library, 2044-A Galisteo Street, Santa Fe, New Mexico 87502, and at the Administrative Offices of Giant Ciniza Refinery located at Exit 39 off Interstate 40. The Facility contact person is Mr. Ed Horst at (505) 722-0227.

Public Meeting: The public is invited to attend an informal informational meeting scheduled for August 26, 1996 at 7:00 PM in the Conference Room of the Administrative Offices at the Giant Ciniza Refinery (location described above). Staff members from Giant and the NMED will be available at the meeting to provide additional information on the proposed Class III permit modification.

Comment Period and Request for Hearing: Any person, including Giant personnel, who wishes to comment on the NMED's intent to approve the proposed Class III permit modification or who wishes to request a public hearing, may do so by submitting written comments or requests to: Ms. Barbara Hoditschek, RCRA Permits Program Manager, NMED Hazardous and Radioactive Materials Bureau, 2044-A Galisteo Street, P.O. Box 26110, Santa Fe, New Mexico 87502. Any request for hearing must state the nature of the issues proposed to be raised in the hearing and include the requestor's name and address. Only comments and/or requests received by September 14, 1996 will be considered. For further information, call Mr. Michael Chacon at (505) 827-1561.

Final Decision: The NMED will consider all comments submitted on this proposed Class III permit modification before formulating a final decision. The NMED will notify Giant and each person who submitted a written comment during the public comment period of the final decision or any public hearing that may be scheduled. The final decision will require that activities at the LTA be conducted in accordance with applicable state and federal laws and with the terms approved in the permit modification.

Giant Refinery Response to NMED Notice of Deficiency for the Modification to Closure Plan Dated October 1994

Item	Regulatory Requirement	NMED Administrative Adequacy Review Comment	Response Location	Response
1.0	40 CFR §264.111 The requirements of comments 1.1 through 1.3 may be satisfied by referencing the appropriate parts of the operating permit.	1.1 The closure plan lacks a facility description.	1.1 through 1.6	New Sections 1.1 through 1.6 provide site description.
		1.2 The closure plan lacks hydrogeologic information.	1.3, Attachment 1, Section Maps, Profiles	New Section 1.3 introduces the hydrogeologic information. Attachment 1, the Section Maps, and the Profiles provide detailed hydrogeologic information.
		1.3 The closure plan lacks a description of the Land Treatment Area.	1.2	New Section 1.2 describes the purpose, location, and operating period of the Land Treatment Area.
2.0	40 CFR §264.112(b)(3)	2.1 The closure plan does not mention an estimate of maximum inventory including all hazardous wastes and residues ever on site at any time over the life of the facility.	1.5	New Section 1.5 describes the hazardous wastes treated at the Land Treatment Area and provides an estimate of the total amount of hazardous waste treated.
		2.2 Giant has stated that hazardous waste is no longer being applied to the treatment area. No mention is made of how Giant is handling it.	1.5	New Section 1.5 states that currently generated hazardous wastes are managed according to 20 NMAC 4.1, Subpart III, Section 262.34 by shipping the waste off site in less than 90 days.

Giant Refinery Response to NMED Notice of Deficiency for the Modification to Closure Plan Dated October 1994 (Continued)

Item	Regulatory Requirement	NMED Administrative Adequacy Review Comment	Response Location	Response
3.0	40 CFR §264.112(b)(4) The requirements of comments 3.1 through 3.4 may be fulfilled by referring to the appropriate parts of the operating permit.	3.1 The closure plan does not address facility decontamination.	3.4	New Section 3.4 addresses decontamination activities. Giant expects that extensive decontamination will not be necessary.
		3.2 The closure plan does not address criteria for evaluating decontamination.	3.4	New Section 3.4 states when decontamination will occur and that washwater analytical results will document decontamination effectiveness.
		3.3 The closure plan does not address decontamination procedures.	3.4	New Section 3.4 refers to the procedures in Permit Module III.D and Section 5.0 of the *Sampling and Analysis Plan* (Attachment 3).
		3.4 The closure plan does not address soil contamination as a result of routine drips and spills.	3.4	All hazardous wastes were applied to the soil. New Section 3.4 states that "In situ treatment and degradation of hazardous wastes within the LTA will result in soil decontamination and will meet the closure performance standard."
4.0	40 CFR §264.112(b)(5)	4.1 The closure plan changes the frequency of ground-water monitoring.	5.3	The amendments to this closure plan constitute a Class III permit modification. Giant proposes to monitor groundwater semiannually for two years. Giant will comply with NMED public notice requirements.

Giant Refinery Response to NMED Notice of Deficiency for the Modification to Closure Plan Dated October 1994 (Continued)

Item	Regulatory Requirement	NMED Administrative Adequacy Review Comment	Response Location	Response
5.0	40 CFR §264.115	5.1 Closure certification is lacking detail.	2.3	Specific closure certification information has been added to Section 2.3.
6.0	40 CFR §264.118(b)(1) 40 CFR §264.310(b) 40 CFR §264.90	6.1 The post-closure plan changes the ground-water monitoring activities required in the operating permit.	9.0	Post-closure information has been removed from this closure plan because the Land Treatment Area is being clean closed. If the NMED or Giant determines that the Land Treatment Area must be closed as a land disposal unit, Giant will submit a post-closure plan and survey plat.
7.0	40 CFR §264.118(b)(2)	7.1 Post-closure plan does not adequately address maintenance of the ground-water monitoring system.	9.0	Post-closure information has been removed from this closure plan because the Land Treatment Area is being clean closed. If the NMED or Giant determines that the Land Treatment Area must be closed as a land disposal unit, Giant will submit a post-closure plan and survey plat.
		7.2 The post-closure inspection plan lacks detail.	9.0	Post-closure information has been removed from this closure plan because the Land Treatment Area is being clean closed. If the NMED or Giant determines that the Land Treatment Area must be closed as a land disposal unit, Giant will submit a post-closure plan and survey plat.

Giant Refinery Response to NMED Notice of Deficiency for the Modification to Closure Plan Dated October 1994 (Concluded)

Item	Regulatory Requirement	NMED Administrative Adequacy Review Comment	Response Location	Response
8.0	40 CFR §264.280	8.1 The post-closure plan fails to address continuation of land-treatment processes.	9.0	Post-closure information has been removed from this closure plan because the Land Treatment Area is being clean closed. If the NMED or Giant determines that the Land Treatment Area must be closed as a land disposal unit, Giant will submit a post-closure plan and survey plat.
9.0	40 CFR §264.118	9.1 The post-closure plan lacks the name of the contact person or office.	9.0	Post-closure information has been removed from this closure plan because the Land Treatment Area is being clean closed. If the NMED or Giant determines that the Land Treatment Area must be closed as a land disposal unit, Giant will submit a post-closure plan and survey plat.
10.0	40 CFR §264.120	10.1 Post-closure certification is lacking in detail.	9.0	Post-closure information has been removed from this closure plan because the Land Treatment Area is being clean closed. If the NMED or Giant determines that the Land Treatment Area must be closed as a land disposal unit, Giant will submit a post-closure plan and survey plat.

Giant Refinery Response to NMED Notice of Deficiency for the Modification to Closure Plan Dated October 1994

Item	Comment Location	NMED Technical Review Comment	Response Location	Response
1	Section 1.2, 2nd Para.	[a] **("...the residual waste has degraded sufficiently...")** [b] Please explain what is meant by sufficient degradation.	3.3.1, 1st para.	This wording has been changed to "residual hazardous waste has degraded below NMED-approved health-based concentration limits".
2	Section 1.2.1.2	**("The dike should contain approximately three times the annual rainfall for the area (11 inches)...assuming the average dike height of 2.0 feet...")** The dike height will have to be increased if it is to hold three times the annual rainfall.	4.3	This wording has been changed to "The dike should contain twice the annual rainfall for the area".
3	Section 1.2.1.2	**("Assuming that a 24 hour, 100 year storm event would not exceed the annual rainfall...")** What is the basis for this assumption?	4.3	For clarification, the wording has been changed to "According to the National Oceanic and Atmospheric Administration Atlas No. 2, *Precipitation Frequency Atlas for the Western United States*, the 24-hour, 100-year storm event is 2.7 inches for the Gallup, New Mexico area".

Giant Refinery Response to NMED Notice of Deficiency for the Modification to Closure Plan Dated October 1994 (Continued)

Item	Comment Location	NMED Technical Review Comment	Response Location	Response
4	Section 1.2.2.1, 1st Para.	**("The sample is analyzed for the constituents shown in Table 1 of the Closure/Contingency Post-closure Plan.")** Several constituents in Table III-1 and Attachment F, Table 4 of the Permit, are not included in, and should be added to, Table 1 of this Plan. They are Chloromethane, 1,1-Dichloroethane, 1,2-Dichloroethane, 1,1-Dichloroethene, trans-1,2-Dichloroethene, Methylene chloride, Trichloroethene, Benzo(j)fluoranthene, 2-Chlorophenol, Indene, 2,4,6-Trichlorophenol, Antimony, Arsenic, Barium, Beryllium, Cadmium, Cobalt, Mercury, Nickel, Selenium, and Vanadium. In addition, Xylene, Di-n-butyl phthalate, and Methyl chrysene are typical petroleum refining wastes included on the "Skinner List" and should be added to Table 1.	Tables 4A through 4D	These items have been added to the closure plan's modified Skinner List. Methylene chloride had previously been listed as "Dichloromethane," but is now listed as "Methylene Chloride."
5	Section 1.2.2.1, 3rd para.	**("...if a sample...has no detectable constituents, then soil pore monitoring will be discontinued.")** Reword the sentence to indicate that monitoring will be discontinued only after the 90 day sampling is attempted.	5.2, 2nd para.	This wording has been replaced with "An attempt to retrieve samples from the lysimeters will be made according to the following time frame: • Once prior to closure • 30 days after closure • 90 days after closure"
6	Section 1.2.2.2, 4th para.	**("...soil core samples...will be...analyzed for the constituents in Table 1.")** The comments for Item 4 above apply here also.	5.1, 1st para.	The reference has been changed to Tables 4A through 4D. Also, see the response to Item 4, above.

Giant Refinery Response to NMED Notice of Deficiency for the Modification to Closure Plan Dated October 1994 (Continued)

Item	Comment Location	NMED Technical Review Comment	Response Location	Response
7	Section 1.2.2.2, 4th para.	**("Sampling locations will be established by using a random numbers table.")** In the past, GRC has submitted multiple random number scenarios and HRMB has then modified one of the scenarios to arrive at an acceptable sampling location plan. The resulting locations are no longer "random". The location selection process can be simplified by GRC and HRMB agreeing to locations chosen through best judgement.	5.1, 1st para.	This wording has been changed to "Sampling locations will be established randomly in accordance with Module III, Section G.2 of Giant's Hazardous Waste Facility Permit". Giant believes that sampling locations should be established in accordance with its permit. Further, random sapling agrees with EPA guidance and ensures representative sampling.
8	Section 1.2.2.2, 7th para.	**("if in-situ treatment has degraded hazardous constituents to corrective action levels or below, the treatment will be considered complete.")** The regulatory approved corrective action levels should be stated in the Plan.	3.1 and 3.3.1	Sections 3.1 and 3.3.1 state that hazardous waste residues will be degraded below NMED-approved health-based concentration limits. These limits are defined by NMED as either New Mexico Water Quality Control Commission standards or National Drinking Water Maximum Contaminant Levels, whichever is more conservative. If a parameter is not addressed by either WQCC standards or MCLs, the most conservative EPA guidance will be used.

Giant Refinery Response to NMED Notice of Deficiency for the Modification to Closure Plan Dated October 1994 (Continued)

Item	Comment Location	NMED Technical Review Comment	Response Location	Response
9	Section 1.2.2.3, 2nd para.	**("Cell #3 was graded to a 1-2° dip to the west, but will likely be leveled...")** The surface of the cell needs to be leveled to assure even distribution of precipitation and irrigation water and to avoid pooling of liquids.	3.3.2, 2nd para.	This wording has been changed to "Cell No. 3 will be leveled in the same manner as Cells Nos. 1 and 2 (i.e., in two tiers). Leveling minimizes the ponding of precipitation and irrigation water, controlling water percolation into the soil. Uniform water distribution ensures optimum nutrient distribution and enhances the establishment of the vegetative cover."
10	Section 1.2.2.3, 6th para.	**("There may be a lag time between evaluation and actual seeding...")** What is the estimated length of the lag time and how will GRC maintain the surface of the LTU during the lag period?	3.3.2, 3rd para.	This wording has been changed to "After considering the appropriate seeding time and making the evaluations noted in Section 3.3.1, Giant will determine the appropriate time to seed. There may be a lag time between evaluation and actual seeding in order to take advantage of seasonal weather patterns. Optimal seeding time should occur during the fall or spring immediately following evaluation. Giant will maintain the surface of the LTA as described in Sections 4.0 and 5.0 for the period time (estimated to be six months or less) specified by the NMED upon approval of this closure plan. When the correct seeding time is reached, seedbed preparations will commence."

Giant Refinery Response to NMED Notice of Deficiency for the Modification to Closure Plan Dated October 1994 (Continued)

Item	Comment Location	NMED Technical Review Comment	Response Location	Response
11	Section 1.2.2.5, 2nd para.	**("All analyses will be for Table 5 constituents.")** Table 5 includes Table 1. The deficiencies of Table 1, noted in Item 4 above, should be corrected.	5.3, 1st para.	See response to Item 4 above.
12	Section 1.2.2.5, 3rd para.	**("If no hazardous constituents are detected in the shallow monitor wells...groundwater monitoring will be discontinued.)** Hazardous constituents in groundwater samples from the shallow monitor wells (i.e. samples from the Ciniza sand) were reported in the 1994 Annual Groundwater Report. The report indicates the presence of xylene in well SMW-3 and chromium in SMW-3, SMW-5, and SMW-6. The chromium concentrations exceed the maximum concentration allowable under 20 NMAC 4.1 Subpart V, 40 CFR 264.94. Because the groundwater protection standards have been exceeded, GRC must institute a corrective action program in accordance with 20 NMAC 4.1 Subpart V, 40 CFR 264.91(a).	5.3, 1st Para.	Results from groundwater monitoring in the past year show no evidence of contamination. Previous results are questionable. Monitoring will continue throughout the two years following closure according to NMED instructions. Per discussions with NMED staff, a corrective action program will not be established unless future sampling and analysis results indicate the presence of hazardous constituents in groundwater. Therefore, this wording has been changed to "If no hazardous constituents above NMED-approved health-based concentration limits are detected in the shallow monitoring wells during the two year period, groundwater monitoring will be discontinued."

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[a] Language in bold print enclosed within parentheses is quoted directly from the October 1994 Closure/Post-Closure Plan
[b] NMED comments follow the quotes.

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RE
HAZARDOUS WASTE
PROGRAM

AMENDED CLOSURE PLAN
PERMIT NMD000333211-2

July 1996

LIBRARY COPY

Project No. 5052.00

Prepared by:

Benchmark Environmental Corporation
4501 Indian School Road N.E., Suite 105
Albuquerque, New Mexico 87110

Prepared for:

Giant Refining Company
Ciniza Refinery Environmental Department

TABLE OF CONTENTS

Section	Page
LIST OF TABLES	iv
LIST OF FIGURES	v
ATTACHMENTS	vi
1.0 GENERAL CLOSURE REQUIREMENTS	1
1.1 Site Description	1
1.2 Land Treatment Area	1
1.3 Hydrogeology	2
1.4 Surrounding Land Use	2
1.5 Description of Waste	2
1.6 Ancillary Equipment	3
2.0 ADMINISTRATIVE REQUIREMENTS	3
2.1 Closure Schedule	3
2.2 Amendment of the Closure Plan	3
2.3 Closure Certification	4
2.4 Financial and Liability Requirements	4
3.0 CLOSURE PROCEDURES	5
3.1 Closure Performance Standard	5
3.2 Required Personal Protective Equipment	5
3.3 Closure Activities	6
3.3.1 In Situ Treatment	6
3.3.2 Placement of Final Cover	7
3.4 Decontamination Activities	8
4.0 SITE CONTROL	9
4.1 Security	9
4.2 Control of Migration of Hazardous Constituents to Groundwater	9
4.3 Control of Release of Contaminated Runoff to Surface Waters	9
4.4 Inspection	10
4.5 Control of Airborne Particulates	10
4.6 Compliance With Food Chain Crop Restrictions	10
5.0 MONITORING PROCEDURES FOR CLOSURE VERIFICATION	11
5.1 Soil Core Monitoring	11
5.2 Soil Pore Moisture Monitoring	13
5.3 Groundwater Monitoring	13

TABLE OF CONTENTS (Concluded)

Section	Page
6.0 SAMPLING AND ANALYSIS	14
7.0 QUALITY ASSURANCE/QUALITY CONTROL	14
8.0 CLOSURE REPORT	15
9.0 SURVEY PLAT AND POST-CLOSURE	15

LIST OF TABLES

Table		Page
1	Hazardous Wastes Processed in the Ciniza Refinery Land Treatment Area	16
2	Schedule for Closure Activities at Ciniza Refinery, Year of Closure - 1996	17
3	Closure Cost Estimate for Ciniza Refinery	18
4A	Modified Skinner List 8240 Volatile Organics	19
4B	Modified Skinner List 8270 Semivolatile Organics	21
4C	Modified Skinner List ICP 6010 Metals	23
4D	Modified Skinner List CVAA 7471 Mercury	24
5	Groundwater Monitoring Constituents	25
6	Revegetation Seed Mixture	26
7	Soil Sampling Program for the Zone of Incorporation	27

LIST OF FIGURES

Figure		Page
1	Land Treatment Area Weekly Closure Inspection Form	28
2	Lysimeter Locations	29

ATTACHMENTS

1 Ciniza Refinery Land Treatment Area Stratigraphy Report

2 Land Treatment Area Characterization Plan

3 Sampling and Analysis Plan

1.0 GENERAL CLOSURE REQUIREMENTS [20 NMAC 4.1, SUBPART V, SECTIONS 264.110 to 264.115]

This amended closure plan describes the activities necessary to close the Ciniza Refinery's Land Treatment Area (LTA) (Permit No. NMD 000333211-2). The activities described meet the clean closure requirements of Title 20, New Mexico Administrative Code, Chapter 4, Part 1 (20 NMAC 4.1), Subpart (Subpt.) IX, 270.14(b)(13), and 20 NMAC 4.1, Subpt. V, 264, Sections 264.110 to 264.115.

1.1 Site Description [20 NMAC 4.1, Subpt. V, Section 264.111]

The Giant Refining Company (Giant)'s Ciniza Refinery is a crude oil refining facility. The Ciniza Refinery is located in McKinley County, New Mexico, at Township 15 North, Range 15 West, Sections 28 and 33. The refinery is just north of Interstate 40 and approximately 17 miles east of Gallup, New Mexico.

The Ciniza Refinery, originally owned by El Paso Natural Gas Company, was constructed in 1957. The refinery was purchased by Shell Oil Company (Shell) in 1964, and operated by Shell until 1982. The refinery was then purchased by Giant Refining Company. Giant Industries Arizona, Incorporated, the parent of Giant Refining Company, is headquartered in Scottsdale, Arizona.

1.2 Land Treatment Area [20 NMAC 4.1, Subpt. V, Section 264.111]

The Ciniza Refinery site map is shown in Figure 1.4-1 of Giant's Part B permit application. The LTA is located within the refinery property boundary. The primary purpose of the LTA is the degradation, immobilization, or stabilization of hazardous wastes using microbial activity and soil characteristics. The LTA is approximately 1,500 feet northwest of the refinery process area and is above the 100-year flood-plain, as shown in Figures 1.4-1 and 1.4-8 of Giant's Part B permit application. The LTA consists of three 480-ft x 240-ft sections located immediately east of Evaporation Pond 12B. Each section is diked and contains 2.6 acres (1.0 hectare) of available treatment surface. The top 12 inches of soil is plowed and disked to encourage aerobic microbial activity and improved chemical reaction rates. During treatment, soil nutrients are applied at the optimum carbon:nitrogen:phosphorous (C:N:P) ratio of 50:2:1. The LTA received hazardous wastes from October 10, 1980 to November 8, 1990, with treatment confined to the upper 12 inches of natural soil.

Module III, Section F.2 of Giant's Hazardous Waste Facility Permit specifies the design capacity of and conditional limits for the LTA.

1.3 Hydrogeology [20 NMAC 4.1, Subpt. V, Section 264.111]

A detailed description of the geologic conditions beneath the LTA is provided in Attachment 1 of this closure plan. The interpretation of geologic conditions is derived from the data of past investigations as well as logs from borings and well installations. Subsurface data in the LTA area have been digitized and modeled as surfaces based on general environments of deposition. The results of modeling indicate a complex subsurface below the LTA. The modeling results are presented graphically in Section Maps 1, 3, 4, and 5, as well as Profiles 1-1', 3-3', and 6-6'.

1.4 Surrounding Land Use [20 NMAC 4.1, Subpt. V, Section 264.111]

The Ciniza Refinery, located in McKinley County, is located in a remote, undeveloped, and sparsely populated area. The surrounding land use is cattle and sheep grazing at a density of less than 6 cattle or 30 sheep per section. Most of McKinley County is rural, as are adjoining portions of neighboring counties.

The refinery maintains residences for several employees 0.5 mile south of the refinery process area. A truckstop is located 1 mile south-southwest of the process area. A rural residential area, with a density of 8 to 10 residents per square mile, is 2.5 miles southwest of the refinery. A railroad is located to the north, within 2 miles; the small community of Iyanbito is to the northwest, within 3 miles; the Fort Wingate Military Reservation is to the west, within 6 miles; the Cibola National Forest is to the southwest, within 2 miles; and a highway rest area is at the I-40 exit to the south, within 1 mile. The largest residential community near the refinery is Gallup, New Mexico, which is 17 miles away.

1.5 Description of Waste [20 NMAC 4.1, Subpt. V, Section 264.111]

Giant received its Hazardous Waste Facility Permit on November 4, 1988, and has conducted activities since that date in accordance with its permit. While the LTA is permitted to treat refinery sludges carrying the U.S. Environmental Protection Agency hazardous waste numbers D001, D007, K049, K050, K051, and K052, application of hazardous waste to the LTA ceased on November 8, 1990. Approximately 2,600 tons of hazardous waste were treated at the LTA.

The refinery sludges treated at the LTA were viscous oil-water-solids mixtures. Table 1 summarizes the wastes applied to the LTA. Records of waste inventory and analysis, as well as the operational logbook documenting any activity within the LTA, will be maintained at the Ciniza Refinery until Giant is released of financial obligation by the Secretary of the New Mexico Environment Department (NMED).

Hazardous wastes currently generated at Ciniza Refinery are managed according to 20 NMAC 4.1, Subpt. III, Section 262.34. These wastes are shipped off site to approved treatment, storage, and disposal facilities for treatment and disposal. No hazardous wastes are stored for more than 90 days pursuant to 20 NMAC 4.1, Subpt. III, Section 262.34.

1.6 Ancillary Equipment [20 NMAC 4.1, Subpt. V, Section 264.111]

The equipment used to manage waste and soil at the LTA may include, but is not limited to, a tractor, disc and harrow, a back hoe, a dump truck, and a road grader. If necessary, this equipment will be decontaminated during closure as necessary to meet closure performance standards as described in Section 3.4 of this closure plan.

2.0 ADMINISTRATIVE REQUIREMENTS

2.1 Closure Schedule [20 NMAC 4.1, Subpt. V, Sections 264.112(b)(6) and 264.113]

Closure activities will be conducted in accordance with the approved closure plan as required at 20 NMAC 4.1, Subpt. V, Section 264.113(a). Table 2 provides the closure schedule. In the event closure activities cannot be completed at the LTA in accordance with the approved closure schedule, Giant will notify the Secretary of the NMED in accordance with the extension requirements cited in 20 NMAC 4.1, Subpt. V, Section 264.113(a).

2.2 Amendment of the Closure Plan [20 NMAC 4.1, Subpt. V, Section 264.112(c)]

If it is necessary to amend this closure plan, Giant will submit, in accordance with 20 NMAC 4.1, Subpt. V, Section 264.112(c), a written notification of or request for a permit modification describing any change in operation or facility design that could affect the closure plan. The written notification or request will include a copy of the amended closure plan for approval by NMED. Giant will submit a written notification of or a request for a permit modification to authorize a change in the approved plan if either of the following occur:

- Changes in operating plans or facility design affect the closure plan
- Unexpected events occur during closure that require modification of the approved closure plan

Giant will submit a written request for a permit modification with a copy of the amended closure plan at least 60 days prior to the proposed change, or no later than 60 days after an occurrence of an unexpected event that affects the closure plan. If the unexpected event occurs during closure, the permit modification will be requested within 30 days of the occurrence. If the Secretary of the NMED requests a modification of the closure plan, a plan modified in accordance with the request will be submitted within 60 days of notification or within 30 days of notification if the request occurs during final closure.

A copy of the closure plan and any approved revisions will be maintained at:

Ciniza Refinery
Route 3, Box 7
Gallup, New Mexico 87301
Telephone (505) 722-0217

2.3 Closure Certification [20 NMAC 4.1, Subpt. V, Section 264.115]

Within 60 days after completion of closure activities, Giant will submit to the Secretary of the NMED via certified mail a certification that the unit has been closed in accordance with the specifications of the approved closure plan. The certification will be attested to by a registered independent professional engineer or qualified independent soil scientist and will be signed by the appropriate Giant official in accordance with 20 NMAC 4.1, Subpt. V, Section 264.115. Documentation supporting the certification will be furnished to the Secretary of the NMED with the original certification. A copy of the certification and supporting documentation will be maintained by Giant in accordance with 20 NMAC 4.1, Subpt. V, Section 264.115.

2.4 Financial and Liability Requirements [20 NMAC 4.1, Subpt. V, Section 264.140(c)]

Financial assurance for closure will be maintained in accordance with 20 NMAC 4.1, Subpt. V, Section 264.143(i). Table 3 provides estimates for the cost of closure activities.

3.0 CLOSURE PROCEDURES

Giant will implement this closure plan to conduct final clean closure (hereinafter referred to as closure) of the LTA. Partial closure of the LTA is not expected. Closure will consist of 1) decontaminating the soil through in situ treatment; 2) verifying soil decontamination; 3) establishing the vegetative cover; 4) decontaminating ancillary equipment, as necessary; and 5) verifying equipment decontamination. Closure will be deemed complete when these activities have been accomplished and closure certification has been submitted to and approved by the NMED.

3.1 Closure Performance Standard [20 NMAC 4.1, Subpt. V, Section 264.111]

The LTA will be closed to meet the following performance standards:

- Minimize the need for further maintenance
- Control, minimize, or eliminate, to the extent necessary to protect human health and the environment, the post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated runoff, or hazardous waste decomposition products to the ground or surface waters or atmosphere
- Comply with the closure requirements of 20 NMAC 4.1, Subpt. V, Sections 264.110 to 264.115, and the requirements of 20 NMAC 4.1, Subpt. V, Sections 264.270 to 264.281, as applicable, for the closure of land treatment units

These performance standards will be met by: 1) in situ treatment of hazardous wastes and waste residues; 2) placement of a vegetative cover on the LTA; and 3) decontamination, if necessary, of the equipment that may have come into contact with hazardous waste and waste residues. In situ treatment will ensure the degradation of waste residues to established NMED-approved health-based concentration limits (defined herein as New Mexico Water Quality Control Commission [WQCC] standards or National Drinking Water Maximum Contaminant Levels [MCLs], whichever is more conservative; or if there is neither an MCL or WQCC standard for a specific parameter, the most conservative EPA guidance). Closure documentation and analytical results for soil, groundwater, and wash solution samples (see Section 3.4) combined with other LTA closure activities will be used to verify clean closure of the LTA.

3.2 Required Personal Protective Equipment

Before proceeding with any closure activities, Giant's closure coordinator will conduct a field inspection of the LTA to determine the personal protective equipment (PPE) and monitoring requirements for the subject activity.

Personnel involved in closure activities will be trained in decontamination activities, wear appropriate PPE specified by the closure coordinator, and follow good hygiene practices to protect themselves from exposure to hazardous waste and residues. The level of PPE required in the LTA will depend primarily upon environmental factors (wind, precipitation, temperature) and field conditions (e.g., soil moisture, airborne particulates). After use, contaminated PPE will be either decontaminated or managed in accordance with 20 NMAC 4.1, Subpt. V, Section 264.114.

3.3 Closure Activities [20 NMAC 4.1, Subpt. V, Sections 264.280(a) and (b)]

Closure consists of two phases of activities: in situ treatment and confirmation monitoring to ensure wastes and waste residues have been thoroughly degraded; and establishment of a vegetative cover on the LTA.

3.3.1 In Situ Treatment [20 NMAC 4.1, Subpt. V, Section 264.280(a)(i)]

In the first phase, in situ treatment will continue until any residual hazardous waste has degraded below NMED-approved health-based concentration limits. Giant expects degradation to be complete within 90 days after closure plan approval. If sampling and analysis of the zone of incorporation (ZOI) show this not to be the case, in situ treatment will continue until 150 days have elapsed, when an additional set of samples will be collected and analyzed. If necessary, additional treatment and sample collection will be performed every 90 days after the 150-day sampling event, until residual hazardous waste has degraded below NMED-approved health-based concentration limits.

After in situ degradation is complete, Giant will use a biological test, such as *Microtox*, to determine phytotoxicity. Once it has been determined that sufficient degradation has occurred and that the LTA surface is not toxic to the establishment of a final vegetative cover, the LTA soil surface will be prepared and amended for seeding.

Within 90 days of completing in situ treatment, Giant will determine soil conditions by chemical analysis to determine the suitability for seeding a vegetative cover. The following conditions must be evaluated:

1. pH - should be maintained at a level that will support native vegetation.

2. Nitrogen and Organic Matter Levels - If organic matter is of a high percentage in the soil composition, the soil may need several applications of nitrogen to maintain an adequate nitrogen level. Nitrogen fertilizer requirements are directly proportional to the amount of organic matter present and dependent on the sand content of the soil.

3. Phosphorous and Potassium Levels - Phosphorous content can be well maintained by occasional applications of fertilizer. Potassium levels in the background soil adjacent to the LTA are relatively high. No additions of potassium are expected to be necessary.

Initially, Giant will maintain the C:N:P ratio and moisture content at optimal conditions to establish and maintain a vegetative cover.

3.3.2 Placement of Final Cover [20 NMAC 4.1, Subpt. V, Section 264.280(a)(8)]

The second phase of closure is the establishment of a vegetative cover. This section describes the steps that have been or will be taken to ensure the rapid establishment of a low-maintenance vegetative cover.

Cell No. 3 will be leveled in the same manner as Cells Nos. 1 and 2 (i.e., in two tiers). Leveling minimizes the ponding of precipitation and irrigation water, controlling water percolation into the soil. Uniform water distribution ensures optimum nutrient distribution and enhances the establishment of the vegetative cover.

After considering the appropriate seeding time and making the evaluations noted in Section 3.3.1, Giant will determine the appropriate time to seed. There may be a lag time between evaluation and actual seeding in order to take advantage of seasonal weather patterns. Optimal seeding time should occur during the fall or spring immediately following evaluation. Giant will maintain the surface of the LTA as described in Sections 4.0 and 5.0 for the period of time specified by the NMED upon approval of this closure plan. When the correct seeding time is reached, seedbed preparations will commence. The LTA surface will be tilled as necessary to destroy any existing vegetation that may detrimentally compete with the grasses and to create a favorable soil density.

The following three factors must be considered for seeding:

1. Seeding Method: Broadcasting or drilling the seeds are the principal preferred methods. Broadcasting, followed by disking, provides the best soil-seed contact for establishing the seed.

2. Seeding Rate: The suggested seeding rate will be 12 lbs/acre to provide adequate density of vegetative cover.

3. Seeding Depth: Seeding depth will be 0.25 to 0.50 inch.

Table 6 lists the species of grasses to be sown. These grasses are known to thrive locally. They share the characteristics of: rapid germination and spread; resistance to fire, insects, and diseases; depth of root system to prevent erosion; vegetative thickness to minimize percolation; and low maintenance.

3.4 Decontamination Activities [20 NMAC 4.1, Subpt. V, Sections 264.112(b)(4) and 264.114]

In situ treatment and degradation of hazardous wastes within the LTA will result in soil decontamination and will meet the closure performance standard. Soil sampling and analysis will confirm that Table 7 constituents are below NMED-approved health-based concentration limits before closure will be completed. Therefore, Giant expects that extensive decontamination will not be necessary. To ensure proper management of hazardous waste residues, Giant will either

- leave reusable sampling equipment and PPE on the LTA until analytical results confirm that hazardous waste residues are below NMED-approved health-based concentration limits (as described in Section 3.3 of this closure plan), or
- decontaminate the sampling equipment and PPE in accordance with the procedures outlined in Module III, Section D, of Giant's Hazardous Waste Facility Permit and Section 5.0 of Attachment 3 to this closure plan if those items are removed before analytical results confirm that hazardous waste residues are below NMED-approved health-based concentration limits.

If the first option is chosen, soil sample analytical results will verify that decontamination is not necessary. If the second option is chosen, Giant will perform the following activities:

- Manage used washwaters, disposable PPE, and other disposable equipment in accordance with 20 NMAC 4.1, Subpt. V, Section 264.114.
- Wash reusable PPE with an appropriate detergent and triple-rinse before reuse.
- Visually inspect equipment to confirm that parts that have come into direct contact with soil sample surfaces have been sufficiently decontaminated.
- Sample washwater after use to document the success of decontamination. The constituents listed in Tables 4A through 4D must either be undetected or show concentrations below NMED-approved health-based concentration limits to indicate proper decontamination.

4.0 SITE CONTROL

4.1 Security [20 NMAC 4.1, Subpt. V, Sections 264.14(b) and (c)]

Giant will prevent the unknowing entry, and minimize the possibility of unauthorized entry, of persons or livestock onto the LTA. Access to the refinery property is restricted, as described in Section 4.0 of the Part B permit application for the facility. In addition, after seeding for the vegetative cover, Giant will fence the LTA with a five-strand wire fence, which will include a lockable metal gate. The fence will be placed immediately inside the containment dike. Signs legible from a distance of 25 feet will be posted on the completed fence and bear the legend "Danger - Unauthorized Personnel Keep Out" in English, Spanish, and Navajo. Eight signs will be visible from all angles of approach.

4.2 Control of Migration of Hazardous Constituents to Groundwater [20 NMAC 4.1, Subpt. V, Section 264.112(b)(5)]

Two structures prevent the migration of potential contaminants to groundwater. The first is the dike surrounding the LTA, as discussed in Section 4.3. Containment of runoff will prevent potentially contaminated water from flowing into contiguous areas that are not being monitored. The second structure is the vegetative cover to be established near the end of the closure period, as outlined in Section 3.3.2. While the vegetative cover is being established, the amount of irrigation water and precipitation that can percolate into the treatment zone will decrease proportionally to the increase in vegetative density. Soil particulates and root systems will also aid in the immobilization of potentially hazardous constituents. Additionally, a vegetative cover will significantly reduce windborne dispersion of particulates and wind erosion of the LTA surface.

4.3 Control of Release of Contaminated Runoff to Surface Waters [20 NMAC 4.1, Subpt. V, Sections 264.112(b)(5) and 264.280(a)(4)]

During closure, potentially contaminated surface runoff will be controlled by the existing dike around the perimeter of the LTA. The dike should contain over twice the annual rainfall for the area (11 inches) in volume, assuming the average dike height of 2.0 feet and approximately 7.8 acres of surface area. According to the National Oceanic and Atmospheric Administration Atlas No. 2, *Precipitation Frequency Atlas for the Western United States*, the 24-hour, 100-year storm event is 2.7 inches for the Gallup, New Mexico area. The dike exceeds requirements to control precipitation runoff from the LTA during a 24-hour, 25-year storm event in accordance with 20 NMAC 4.1, Pt. V, Section 264.273.

4.4 Inspection [20 NMAC 4.1, Subpt. V, Section 264.15]

Weekly, the closure coordinator(s) will visually inspect the containment dike system surrounding the LTA. Inspection activities will ensure early detection of structural defects to prevent runoff during precipitation or irrigation. The dikes will be inspected for erosion, animal burrows, or any other disturbance of the dike geometry. Additionally, the dikes will be maintained at the minimum height of two feet above the surface of the LTA and with 2:1 sideslopes to ensure each dike has sufficient capacity to control runoff during closure. If the integrity of the dikes is compromised, the closure coordinator(s) will see that corrective action is taken promptly.

Weekly, the closure coordinator(s) will visually inspect the LTA to ensure that soil desiccation is not occurring. Tilling of the ZOI will not be conducted during closure if the soil inspection indicates soil desiccation to a depth greater than three inches or when soil moisture is insufficient to prevent dust generation. Additionally, tilling of the ZOI. will not be conducted after seedbed preparation is complete and seeding activities are accomplished (see Section 3.3.2). During the weekly inspections, the closure coordinator(s) will complete an inspection form (Figure 1), which will remain on file at the Ciniza Refinery until Giant is released from financial responsibility by the Secretary of the NMED.

4.5 Control of Airborne Particulates [20 NMAC 4.1, Subpt. V, Section 264.280(a)(5)]

To prevent soil desiccation and consequent dust generation during the closure period, the soil moisture will be maintained by irrigation using an aerial spray pattern. Giant will maintain the soil moisture content at a level sufficient to establish and maintain the vegetative cover. Prior to establishing the vegetative cover, Giant will maintain the soil conditions sufficient to minimize wind erosion of the LTA soil.

Measurements of soil moisture content will be made with the scheduled sampling events (Table 7). To ensure that soil desiccation is not occurring, the closure coordinator(s) will visually inspect the LTA in accordance with Section 4.4 of this closure plan.

4.6 Compliance with Food Chain Crop Restrictions [20 NMAC 4.1, Subpt. V, Section 264.280(a)(6)]

Giant will not allow the cultivation of food chain crops on the closed LTA, except for the scientific testing of such cultivation with the intent of providing data only or with the intent of plowing under such a crop for mulch to establish the final cover (with approval of the Secretary of the NMED). In accordance

with 20 NMAC 4.1, Subpt. V, Section 264.276(b)(2)(iv), the appropriate Notice of Deed will be filed with McKinley County, New Mexico, to notify future property owners of the LTA location and the food chain crop restriction.

5.0 MONITORING PROCEDURES FOR CLOSURE VERIFICATION [20 NMAC 4.1, SUBPT. V, SECTION 264.112(b)(5)]

Three concurrent procedures to verify the prevention of hazardous constituent migration to groundwater will be utilized during closure: soil core and soil pore moisture sampling, soil core and soil pore liquid analysis, and groundwater monitoring.

The first two procedures are related to unsaturated zone monitoring. Soil core and soil pore moisture sampling will be performed as outlined in Sections 5.1 and 5.2 to detect hazardous constituents and waste residue. The second procedure, analysis of soil cores and soil pore liquids, will be used to determine the effectiveness of treatment in the ZOI.

The third procedure involves groundwater monitoring during closure. Groundwater monitoring will be the same as during the operating life of the LTA, with the exceptions of the sampling frequency and the analytes monitored for (see the Modified Skinner lists in Tables 4A through 4D). The groundwater monitoring procedure is detailed in Section 5.3.

Soil in the ZOI and groundwater will be sampled and analyzed to verify clean closure. The constituents listed in Tables 5 and 7 present in the soil and groundwater must meet NMED-approved health-based concentration limits in order for clean closure to be accomplished.

5.1 Soil Core Monitoring [20 NMAC 4.1, Subpt. V, Section 264.280(a)(7)]

The termination of in situ treatment will be determined by the concentration of constituents in the ZOI. Soil core samples will be collected in a manner consistent with the *Land Treatment Area Characterization Plan* (Attachment 2). Soil core samples will be collected as a requirement of this closure plan (30- and 90-day sampling) in addition to any other sampling required for characterization. Two soil core samples per cell will be taken from the ZOI and analyzed for the constituents listed in Tables 4A through 4D.

A coordinate grid overlaying the LTA will be used to select samples. Sampling locations will be established randomly in accordance with Module III, Section D of Giant's Hazardous Waste Facility Permit.

Table 7 shows the frequency of soil core sampling. Results of these analyses will determine the adjustments to soil moisture, nutrient levels, and pH necessary to optimize microbial degradation. In the event that constituents listed in Tables 4A through 4D and 7 exceed the NMED-approved health-based concentration levels at the 90-day sampling event, the LTA will be tilled and sampling will be repeated at 150 days after acceptance of this closure plan. If necessary, additional treatment and sample collection will be performed every 90 days after the 150-day event, until residual hazardous waste has degraded below NMED-approved health-based concentration limits.

The concentrations of the metals in surficial soils will be compared to the maximum recommended accumulation levels. If the concentrations are below maximum recommended levels, a vegetative cover can be established without great concern about the metals' phytotoxic effects. If metal concentrations are above these levels, the LTA will be tilled to a depth of two feet to distribute the metal concentrations in a larger soil mass. Tilling to a depth of two feet will not affect the soil horizon that is preventing migration, but will alleviate the phytotoxic effects of the metals. Organic constituents must be sufficiently low to allow tilling into potentially anaerobic conditions.

If in situ treatment has degraded hazardous constituents to NMED-approved health-based concentration levels or below, the treatment will be considered complete. Due to the absence of organic hydrocarbon constituents in background samples, no statistical comparisons will be made. All hazardous organics must be treated to below NMED-approved health-based concentration levels.

Soil samples taken in the ZOI during closure will be obtained with a hand auger using the sampling protocol outlined in Attachment 2. After being placed into a cooler chilled to approximately 4°C, the samples will be shipped to the analytical laboratory for analysis. Each sample will be assigned a unique identification number that includes the location and depth. All coreholes will be backfilled with bentonite.

5.2 Soil Pore Moisture Monitoring [20 NMAC 4.1, Subpt. V, Section 264.280(a)(7)]

Giant will use Model 1920 Pressure-Vacuum Soil Water Sampler lysimeters to monitor soil-pore moisture in accordance with 20 NMAC 4.1, Subpt. V, Section 264.280(a)(7). Figure 2 shows the locations of the lysimeters. In the unlikely event that water is recovered from a lysimeter cup, sampling personnel will use neoprene tubing to connect a clean glass Erlenmeyer flask to the lysimeter sample port. The sampling personnel will draw the water into the flask, properly preserve the sample, close the flask, and transfer the sample to an appropriate shipping container, which should be chilled to 4°C. Giant personnel will then ship the sample to the analytical laboratory. The total volume of waste collected will be recorded. The sample will be analyzed for the constituents shown in Tables 4A through 4D.

An attempt to retrieve samples from the lysimeters will be made according to the following time frame:

- Once prior to closure
- 30 days after closure
- 90 days after closure

5.3 Groundwater Monitoring [20 NMAC 4.1, Subpt. V, Sections 264.112(b)(5) and 264.90]

Groundwater monitoring will continue during closure. The shallow monitoring wells (SMW-3, SMW-4, SMW-5, and SMW-6), also known as the early detection wells, will be monitored semiannually for two years beginning with the spring 1996 sampling event. All analyses will be for Table 5 constituents. If no hazardous constituents above NMED-approved health-based concentration limits are detected in the shallow monitoring wells during the two-year period, groundwater monitoring will be discontinued.

Giant will document analytical results from semiannual groundwater monitoring events that indicate the presence or absence of Table 5 constituents in the groundwater beneath the LTA. In the event that constituents of concern are detected above NMED-approved health-based concentration limits in the shallow monitoring wells, Giant will perform the following activities.

- Notify the Secretary of the NMED
- Sample groundwater from the deeper zones and analyze the samples for hazardous constituents listed in Tables 4A through 4D in accordance with the shallow monitoring well schedule. Wells MW-1, MW-2, MW-4, MW-5, and OW-11 (background well) will be sampled in the deeper aquifer.

- Propose a post-closure plan for appropriate compliance monitoring and cleanup activities for the shallow monitoring wells.

6.0 SAMPLING AND ANALYSIS [20 NMAC 4.1, SUBPT. V, SECTION 264.112(b)(4)]

The *Sampling and Analysis Plan* (Attachment 3) details procedures and methods for sampling, analysis, and documentation applicable to this closure plan. While the procedures and methods are specific, any applicable procedure or method given in the current update of *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (SW-846) may be used if conditions or experience demonstrates the alternate method is more appropriate. All analytical procedures actually used will be annotated in the final closure report.

7.0 QUALITY ASSURANCE/QUALITY CONTROL [20 NMAC 4.1, SUBPT. V, SECTION 264.112(b)(4)]

Giant will designate a qualified individual(s) to oversee closure activities and report directly to senior management on the quality of the performance of this closure. This individual will personally observe a portion of the key activities, ensure sample blanks are used and analyzed, and review the analytical reports for accuracy and adequacy. A written quality assurance/quality control (QA/QC) plan will be prepared and implemented in accordance with SW-846 guidance and Permit Attachment I. Any variations from the QA/QC plan will be documented and explained. The designated individual will prepare a written statement for the final closure report commenting on the adequacy of the analytical data validation and decontamination verification.

The QA/QC activities will follow methods described in *Components of an Adequate Laboratory Quality Assurance/Quality Control Plan*, Appendix 1 to Attachment 3. Tables 4A through 4D list target detection limits, analytical methods, and instrumentation for metals, organics, and miscellaneous analytes.

8.0 CLOSURE REPORT
[20 NMAC 4.1, SUBPT. V, SECTION 264.115]

Upon completion of the closure activities, a final closure report will be submitted to the Secretary of the NMED, documenting the closure and containing, at a minimum, the following:

- The certification described in Section 2.3 of this closure plan
- Any variance(s) from approved activities and reason(s) for the variance(s)
- A tabular summary of all sampling results, showing
  - Sample identification - COMPARISON TO BACKGROUND
  - Sampling location
  - Identification of analytical procedure
  - Identification of analytical laboratory
  - Data reported
  - Detection limit for each constituent
  - Analytical precision (uncertainty, range, variance)
- A QA/QC statement on analytical data validation and decontamination verification
- The location of the file of supporting documentation, including
  - Field logbooks
  - Laboratory sample analysis reports
  - QA/QC documentation
  - Chain-of-custody records
- Disposition location of any regulated residues
- A certification of report accuracy

9.0 SURVEY PLAT AND POST-CLOSURE
[20 NMAC 4.1, SUBPT. V, SECTIONS 264.116 and 264.118]

Giant will submit a post-closure plan and survey plat to the NMED within 90 days from the date that Giant or the Secretary of the NMED determines the LTA must be closed as a land disposal unit in accordance with the requirements of 40 NMAC 4.1 Subpart V, Section 264.118.

Table 1. Hazardous Wastes Processed in the Ciniza Refinery Land Treatment Area

EPA ID	Waste Name	Process Source	Estimated Annual Quantity (tons)	Estimated Annual Range (tons)
D001	Ignitable Refinery Operations Waste[a]	Process Area	1.0	0.7 - 1.3
D007	Cooling Water Filter Sludge	Cooling Tower	6.3	4.8 - 7.8
K049	Slop Oil Emulsion Solids	Tank Farm	0.4	0.3 - 0.6
K050	Heat Exchange Bundle Cleaning Sludge	Process Area	0.2	0.15 - 0.5
K051	API Separator Sludge	API Separator	250	200 - 350
K052	Leaded Tank Bottoms	Tank Farm	0.8	0.5 - 2.25

[a]Includes filter clay from kerosene filters, unleaded fuel tank bottoms, and soils contaminated by petroleum product spills occurring within refinery grounds. Spent degreasing solvents used within the refinery and waste lubricants generated by refinery equipment and vehicle maintenance are specifically excluded from this waste category.

Table 2. Schedule for Closure Activities at Ciniza Refinery, Year of Closure - 1996

Activity	Completion Dates[a]
Acceptance of Closure Plan by NMED	Day 1
Begin Closure Activities	Day 1
Collect Background Samples	Day 20
Soil and Soil Pore Moisture Sampling	Day 30
Analyze Samples	Day 50
Soil and Soil Pore Moisture Sampling	Day 90
Analyze Samples	Day 110
Final Tilling of Soil	Day 120
Soil Sampling (if needed)	Day 150
Analyze Samples (if additional soil sampling needed)	Day 170
Commence Placement of Vegetative Cover	Day 90[b]
Decontamination of Tilling Equipment (if necessary)	Day 100[b]
Verify Equipment Decontamination (if necessary)	Day 120[b]
Fence LTA	Day 150[b]
Submit Certification of Closure to NMED	Day 180[b]

[a] Completion dates are dependent on weather conditions and optimal seeding times. Giant will notify NMED if weather conditions and/or the closure plan acceptance date lead to adverse conditions for establishing a vegetative cover. Under such circumstances, Giant and NMED will negotiate this closure schedule.

[b] Calendar days after completion of in situ treatment.

LTA = Land Treatment Area

Table 3. Closure Cost Estimate for Ciniza Refinery

Activity	Estimated Time and Materials	Estimated Cost
Till Land Farm	$(280 \times 3)^3$	$2,520
Add Soil Amendments	352,000 ft^2 @ 0.02 ft^2	$7,040
Soil Pore Liquid Sampling Within 30 Days	4 Samples @ $1,200/sample	$4,800
Soil Pore Liquid Sampling Within 90 Days	4 Samples @ $1,200/sample	$4,800
Soil Sampling - ZOI Within 30 Days	3 samples @ $1,450/sample	$4,350
Soil Sampling - ZOI Within 90 Days	3 samples @ $1,450/sample	$4,350
Soil Sampling - ZOI Within 150 Days	3 samples @ $1,450/sample	$4,350
Biological Test	8 tests @ $300/test	$2,400
Establish Vegetative Cover:		
Level Cell #3	2.6 acres @ $950/acre	$2,470
Plant Seed	7.8 acres @ $750/acre	$5,850
Water	1140 Mgal. @ $1/Mgal.	$1,140
Install Fence	2400 ft @ $5.25/ft	$12,600
Prepare Certification:		
Certify Closure	8 hours @ $125/hour	$1,000
Notice in Deed	2.6 hours @ $150/hour	$390
	Total Task	$58,060
	Overhead	$5,806
	Contingency	$5,806
	TOTAL	$69,672

Mgal. = million gallons
ZOI = Zone of Incorporation

Table 4A. Modified Skinner List 8240 Volatile Organics

Parameter	EPA Method SW-846	Description	Containers	Preservative	Holding Time/Days	Liquid Detection Limit (μg/L)	Soil Detection Limit (μg/kg)
Benzene	8240	GC/MS	G Glass	4°C	14	5.0	5.0
2-Butanone (MEK)	8240	GC/MS	G Glass	4°C	14	100.0	100.0
Carbon Disulfide	8240	GC/MS	G Glass	4°C	14	100.0	100.0
Chlorobenzene	8240	GC/MS	G Glass	4°C	14	5.0	5.0
Chloroform	8240	GC/MS	G Glass	4°C	14	5.0	5.0
Chloromethane	8240	GC/MS	G Glass	4°C	14	10.0	10.0
1,1 Dichloroethane	8240	GC/MS	G Glass	4°C	14	5.0	5.0
1,2 Dichloroethane	8240	GC/MS	G Glass	4°C	14	5.0	5.0
1,1 Dichloroethene	8240	GC/MS	G Glass	4°C	14	5.0	5.0
trans-1,2-Dichloroethene	8240	GC/MS	G Glass	4°C	14	5.0	5.0
1,4-Dioxane	8240	GC/MS	G Glass	4°C	14	[a]	[a]
Ethylbenzene	8240	GC/MS	G Glass	4°C	14	5.0	5.0
Methylene Chloride	8240	GC/MS	G Glass	4°C	14	5.0	5.0
Styrene	8240	GC/MS	G Glass	4°C	14	5.0	5.0
1,1,2,2-Tetrachloroethane[b]	8240	GC/MS	G Glass	4°C	14	5.0	5.0
Tetrachloroethene[b]	8240	GC/MS	G Glass	4°C	14	5.0	5.0
Toluene	8240	GC/MS	G Glass	4°C	14	5.0	5.0

Table 4A. Modified Skinner List 8240 Volatile Organics (Concluded)

Parameter	EPA Method SW-846	Description	Containers	Preservative	Holding Time/Days	Liquid Detection Limit (μg/L)	Soil Detection Limit (μg/kg)
1,1,1-Trichloroethane	8240	GC/MS	G Glass	4°C	14	5.0	5.0
Trichloroethene	8240	GC/MS	G Glass	4°C	14	5.0	5.0
Xylene	8240	GC/MS	G Glass	4°C	14	5.0	5.0
Ethylene Dibromide[b]	8240	GC/MS	G Glass	4°C	14	5.0	5.0
Acetone	8240	GC/MS	G Glass	4°C	14	100.0	100.0

[a]SW-846 detection limits not established.
[b]Additional constituents.

μg/L = microgram per liter
μg/kg = microgram per kilogram
GC/MS = gas chromatography/mass spectrometry

Table 4B. Modified Skinner List 8270 Semivolatile Organics

Parameter	EPA Method SW-846	Description	Container	Preservative	Holding Time/Days	Liquid Detection Limit (μg/L)	Soil Detection Limit (μg/kg)
Anthracene	8270	GC/MS	G Glass	4°C	14	10.0	660.0
Benzo(a)Anthracene	8270	GC/MS	G Glass	4°C	14	10.0	660.0
Benzo(b)Fluoranthene	8270	GC/MS	G Glass	4°C	14	10.0	660.0
Benzo(k)Fluoranthene	8270	GC/MS	G Glass	4°C	14	10.0	660.0
Benzo(a)Pyrene	8270	GC/MS	G Glass	4°C	14	10.0	660.0
Butyl Benzyl Phthalate	8270	GC/MS	G Glass	4°C	14	10.0	660.0
Chrysene	8270	GC/MS	G Glass	4°C	14	10.0	660.0
Dibenz(a,h)Anthracene	8270	GC/MS	G Glass	4°C	14	10.0	660.0
Diethyl Phthalate	8270	GC/MS	G Glass	4°C	14	10.0	660.0
7,12-Dimethylbenz(a)-Anthracene	8270	GC/MS	G Glass	4°C	14	10.0	[a]
Dimethyl Phthalate	8270	GC/MS	G Glass	4°C	14	10.0	660.0
Di-n-Octyl Phthalate	8270	GC/MS	G Glass	4°C	14	10.0	660.0
Fluoranthene	8270	GC/MS	G Glass	4°C	14	10.0	660.0
Indeno(1,2,3-cd)Pyrene	8270	GC/MS	G Glass	4°C	14	10.0	660.0
2-Methylnaphthalene	8270	GC/MS	G Glass	4°C	14	10.0	660.0
2-Methylphenol (Cresol)	8270	GC/MS	G Glass	4°C	14	10.0	660.0
3/4-Methylphenol (Cresol)	8270	GC/MS	G Glass	4°C	14	10.0	660.0
Naphthalene	8270	GC/MS	G Glass	4°C	14	10.0	660.0
4-Nitrophenol	8270	GC/MS	G Glass	4°C	14	50.0	3300.0
Phenanthrene	8270	GC/MS	G Glass	4°C	14	10.0	660.0
Pyrene	8270	GC/MS	G Glass	4°C	14	10.0	660.0

Table 4B. Modified Skinner List 8270 Semivolatile Organics (Concluded)

Parameter	EPA Method SW-846	Description	Container	Preservative	Holding Time/Days	Liquid Detection Limit (μg/L)	Soil Detection Limit (μg/kg)
Pyridine	8270	GC/MS	G Glass	4°C	14	[a]	[a]
Quinoline	8270	GC/MS	G Glass	4°C	14	[a]	[a]
Benzenethiole	8270	GC/MS	G Glass	4°C	14	20.0	[a]
Phenol	8270	GC/MS	G Glass	4°C	14	10.0	660.0
Bis(2-Ethylhexyl)phthalate[b]	8270	GC/MS	G Glass	4°C	14	2.5	1675.0
Dibenz(a,j)acridine[b]	8270	GC/MS	G Glass	4°C	14	10.0	[a]
Dibenz(a,h)-anthracene	8270	GC/MS	G Glass	4°C	14	10.0	660.0
Dichlorobenzene[b]	8270	GC/MS	G Glass	4°C	14	10.0	660.0
Methyl Naphthalene	8270	GC/MS	G Glass	4°C	14	10.0	660.0
2,4-Dimethylphenol	8270	GC/MS	G Glass	4°C	14	10.0	660.0
2,4-Dinitrophenol[b]	8270	GC/MS	G Glass	4°C	14	50.0	3300.0
Indene[c]	-	-	-	-	-	-	-
Benzo(j)fluoranthene	8270	GC/MS	G Glass	4°C	14	[a]	[a]
2-Chlorophenol	8270	GC/MS	G Glass	4°C	14	10.0	660.0
2,4,6-Trichlorophenol	8270	GC/MS	G Glass	4°C	14	10.0	660.0
Di-n-Butyl Phthalate	8270	GC/MS	G Glass	4°C	14	[a]	[a]
Benzyl Alcohol[b]	8270	GC/MS	G Glass	4°C	14	20.0	1300.0
Methyl Chrysene	8270	GC/MS	G Glass	4°C	14	10.0	660.0

[a]SW-846 detection limits not established.
[b]Additional constituents.
[c]Use a non-SW-846 method to analyze for indene because there is no established SW-846 method.
μg/L = microgram per liter
μg/kg = microgram per kilogram
GC/MS = gas chromatography/mass spectrometry

Table 4C. Modified Skinner List ICP 6010 Metals

Parameter	EPA Method SW-846	Description	Container	Preservative	Holding Time/Days	Liquid Detection Limit (μg/L)	Soil Detection Limit (μg/kg)
Antimony	6010	ICP-AES	Glass	4°C	180	32.0	[a]
Arsenic	6010	ICP-AES	Glass	4°C	180	53.0	[a]
Barium	6010	ICP-AES	Glass	4°C	180	2.0	[a]
Beryllium	6010	ICP-AES	Glass	4°C	180	0.3	[a]
Cadmium	6010	ICP-AES	Glass	4°C	180	4.0	[a]
Chromium	6010	ICP-AES	Glass	4°C	180	7.0	[a]
Cobalt	6010	ICP-AES	Glass	4°C	180	7.0	[a]
Lead	6010	ICP-AES	Glass	4°C	180	42.0	[a]
Nickel	6010	ICP-AES	Glass	4°C	180	15.0	[a]
Selenium	6010	ICP-AES	Glass	4°C	180	75.0	[a]
Vanadium	6010	ICP-AES	Glass	4°C	180	8.0	[a]

[a]Detection limits for soil samples are dependent on matrices and individual instrument performance.
μg/L = microgram per liter
μg/kg = microgram per kilogram
ICP-AES = inductively coupled plasma-atomic emission spectroscopy

Table 4D. Modified Skinner List CVAA 7471 Mercury

Parameter	EPA Method SW-846	Description	Container	Preservative	Holding Time/Days	Liquid Detection Limit (μg/L)	Soil Detection Limit (μg/kg)
Mercury	7471	CVAA	Glass	4°C	28	0.2	0.2

μg/L = microgram per liter
μg/kg = microgram per kilogram
CVAA = cold vapor atomic absorption

Table 5. Groundwater Monitoring Constituents

Constituent	Number of Replicates
pH	4
Conductivity	4
Total Organic Carbon	2
Total Organic Halides	2
Total Chrome	2
Total Lead	2
Tables 4A through 4D Constituents	2

Table 6. Revegetation Seed Mixture

Seed Type	Pls/Ac[a]
Blue Grama, Bouteloua gracilis "Lovington"	2
Sideoats Grama, Bouteloua curipendula "El Reno"	4
Buffalo Grass, Buchloeda tyloides "Texoka"	5
Alkali Sacaton, Sporbolus airoides	0.5

[a]Pounds of pure live seed per acre.

Table 7. Soil Sampling Program for the Zone of Incorporation

Parameter	Event 1[a]	Event 2[b]	Event 3[c]	Subsequent Events [d]
pH	*	*	**	**
Oil %	*	*	**	**
Moisture %	*	*	**	**
Total Nitrogen	*	*	**	**
Total Phosphorous	*	*	**	**
Tables 4A through 4D Constituents	*	**	**	**

[a]Event 1 must take place within 30 days of NMED acceptance of this plan.

[b]Event 2 must take place 60 days after Event 1.

[c]If necessary, Event 3 must take place 60 days after Event 2.

[d]If necessary, Giant will perform additional sampling events every 90 days until all data show levels below NMED-approved health-based concentration limits.

* = Required analysis
** = Not required if previous event data show levels below standards.

LTA INSPECTION FORM

Date _____ Time _____

Dike Condition _____

Surface Water _____ Ponding _____

Desiccation _____ (Inches)

Lysimeter Covers and Condition _____

Monitor Wells - Caps and Locks _____

Fences _____ Gates Locked _____

Repairs Needed _____

_____

_____

_____

Repairs Completed _____

_____

_____

_____

Signature _____

Figure 1. Land Treatment Area Weekly Closure Inspection Form

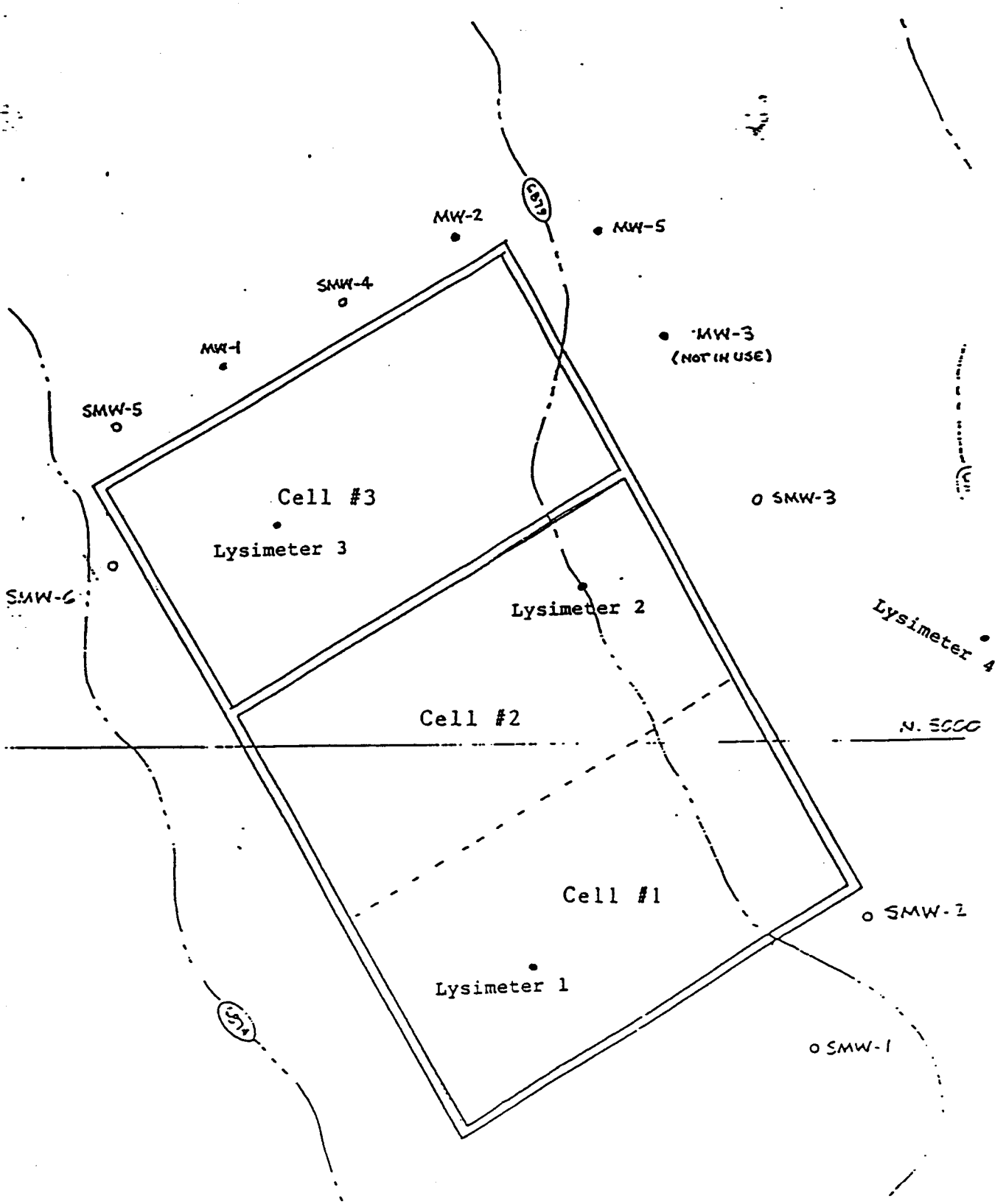

Figure 2. Lysimeter Locations

Attachment 1

Ciniza Refinery Land Treatment Area Stratigraphy Report

PRECISION ENGINEERING, INC.
P.O. BOX 422 • LAS CRUCES, NM 88004
Ph: (505) 523-7674
FAX: (505) 523-7248 • E-mail: werpei@aol.com

June 8, 1996

Mr. Ed Horst
Giant Refining Company
Ciniza Refinery
Route 3, Box 7
Gallup, New Mexico 87301

Re: LTA Subsurface Conditions

Dear Ed,

Attached is our summary of the geologic conditions at the Land Treatment Area. As you are aware our interpretation of the conditions was derived from all previous drilling that has been performed at the site as well as our work over the course of the past six years.

We would like to express our thanks to you and the rest of the Giant environmental staff. Without your assistance and professional cooperation in accumulating past data, our interpretations of the ground conditions would not have been possible.

If you have any questions or comments concerning our interpretations plese do not hesitate calling. We will be happy to discuss the matter with any project related personnel.

Sincerely,
Precision Engineering, Inc.

William H. Kingsley, P.E.

Introduction

The intent of this report is to provide a summary of stratigraphic conditions at the Land Treatment Area located in the northwest portion of the Ciniza Refinery property. The interpretations made are derived from the data of past investigations in the area as well as logs from borings and well installations performed by Precision Engineering, Inc. in the area of the refinery as well surface studies we have made on surrounding properties. All subsurface data in the area has been digitized and modeled as surfaces based on general environments of deposition.

Historical Interpretations

Past reports indicate the entire site is, in essence, a part of a highly weathered section of the Chinle Formation. An unconsolidated sandy stringer within this highly weathered shale formation was known to be water bearing. This unconsolidated sand was named the Ciniza Sand and is consistently referred to in reports after 1985. The nomenclature is local only and is not a documented bed name within the Chinle Formation. Some reports refer to the "Ciniza Sand" as a sandstone, however, it has never been shown to have any degree of cementation. Below the "Ciniza Sand" is a sandstone bed that lies within unweathered shale. This sandstone bed is known as the Sonsela Sandstone which is a documented unit name within the Chinle Formation. The bed is water bearing and represents a potential aquifer in the Ciniza area and is being used as an aquifer in the Bluewater area.

The Ciniza Sand was interpreted to vary in thickness below the Land Treatment Area. The zone was also thought to pinch out completely to the west and reach a maximum thickness of approximately five (5) feet in the south central portion of the Treatment Area.

The SMW well series was placed to monitor water quality in the "Ciniza Sand" since some water was encountered in the sands. The wells vary substantially in depth ranging from approximately forty six (46) feet at SMW-1 to seventy four (74) feet at SMW-5. Formation dip was used to explain the differences in depth initially, although it was later thought there may be two beds comprising the "Ciniza Sand".

The MW well series monitors the water from the Sonsela Sandstone. These wells range in depth from approximately one hundred twenty (120) to one hundred twenty seven (127) feet in depth.

Current Stratigraphic Interpretation

During the course of various subsurface investigations at the refinery site, including the Land Treatment Unit, inconsistencies were noted in the logs of early investigations and the

findings of more recent studies. One major inconsistency noted was that the depth to unweathered shale greatly varied from the OW series wells to all other findings. It was also noted that the upper fifty (50) to sixty (60) feet of sediments in the Land Treatment Unit did not match what should have been encountered in a weathered shale section of the Chinle Formation. As a result of the inconsistencies, the Land Treatment Area was modeled based on all borings that have been drilled in the area in an effort to accurately define the stratigraphy.

The results of the modeling show a much more complex subsurface environment than had originally been assumed. The upper fifty (50) to sixty (60) feet of sediments are not weathered in place sediments of the Chinle Formation. Although the sediments have a Chinle Formation parent material, the time of deposition is believed to be much later. Although not dated, the structure of the soils suggests a relatively recent fluvial environment of deposition. Charcoal is abundant in sandy sediments and occasionally encountered in the clay sediments. Some carbonate accumulation can be noted in the soils. No evidence of cementation of the sediments has been observed. It is believed dating would place the age of the sediments in the range of a few thousand years to a few tens of thousands of years - much younger than the Chinle Formation.

To a depth of approximately ten (10) feet the entire Land Treatment Area is comprised of a high density, high plasticity clay. Below the ten (10) foot depth and within the fluvial materials comprising the upper fifty (50) to sixty (60) feet of the valley floor below the Land Treatment Area is a sandy zone that extends roughly from the ten (10) foot depth to approximately the thirty to forty (40) foot depth. Grossly speaking the sandy unit can be subdivided in to two smaller units. The upper unit is about ten (10) feet thick and the lower unit is about ten (10) to fifteen (15) feet thick. On the south end of the Land Treatment Area the units are separated by a clay zone on the order of five (5) to ten (10) feet in thickness. On the north end of the treatment area the two zones become indistinguishable and appear as a single unit. Whether or not the upper or lower unit pinches out is not fully understood, however, it is suspected the upper unit thins and blends with the lower unit. It should be noted that the sandy zone is best described as interbedded very fine sands, silts and clays that should be expected to hydraulically interconnect. On the south end of the Treatment Area the lower sandy zone is water bearing below approximately the thirty (30) foot depth. To the north no water is encountered in this zone. The approximate extent of water in this zone may be represented by a line extending from the southwest corner of the Area to the northeast corner. Wells SMW-1, 2, and 3 derive their water from this zone. This zone is the original "Ciniza Sand" referred to in earlier work. This sandy zone represents channel deposition believed to be the result of infilling from the ancestral Rio Puerco or, more likely, derived from the Four Mile Canyon drainage system to the east of the Ciniza Refinery property. The channels of this zone trend roughly from northeast to southwest.

Below the sandy zone is a thick clay bed. The bed represents a very low energy environment likely as a result of flood plain deposits of the ancestral Rio Puerco. The clays are hard, high plasticity, moist to wet (but not water bearing) and brown to reddish

brown. Occasionally sample specimens show evidence of mud cracks indicating a wetted then dry environment after the initial deposition. No free water has ever been detected in this zone.

Immediately below the clay zone is another sand bed. The sand may or may not contain gravel made up of subrounded sandstone fragments, petrified wood, and rounded to subrounded multi-colored chert fragments one to two inches in greatest dimension. In some areas this bed is composed only of fine sand. The sands are red to brown. The bed thickness ranges from three (3) inches to one foot or more. Some logs indicate this zone up to three (3) feet in thickness, although records at Precision Engineering, Inc. only show these thicknesses apparent south and east of the Land Treatment Area. The significance of this bed is two fold. First, in all locations where this zone has been penetrated it has been water bearing. Secondly, it always lies immediately above shale or sandy shale of the upper portion of the Petrified Forest Member of the Chinle Formation. Water from this zone has never been shown to penetrate more than a few inches into the Chinle Formation. The shales below the zone are typically damp to dry; more often than not they are dry. This bed most likely represents alluvial deposition on the ancient exposed Chinle surface. It is felt this bed, at least in the refinery property area, may be used as a marker to represent the boundary between younger valley infilling and true Chinle Formation shales below.

Significantly, the thin sand bed described above is derived from a different environment of deposition. Hydraulic connection to the upper fluvial sands has, as yet, not been demonstrated and the two zones may not connect. Shallow Monitoring Wells (SMW) 4, 5, and 6 produce out of this zone. This bed has also been referred to as "Ciniza Sand" in earlier reports.

Shales and sandy shales of the Chinle formation lie below the valley fill materials. Approximately, thirty (30) to fifty (50) feet of shale lies between the valley fill and the Sonsela Sandstone bed that lies within the Chinle Formation. The sandstone is on the order of ten (10) to thirty (30) feet in thickness. The Sonsela Sandstone is water bearing at the refinery site and as stated earlier meets the definition of a potential aquifer.

The lower boundary of the Sonsela Sandstone is the extent of the modeling on this site. It is known from deep well logs that the Chinle Formation is on the order of seven hundred fifty (750) feet in thickness where deeper, established aquifers are encountered.

Summary

To summarize the current model of the stratigraphic section below the Land Treatment Area, a typical section through the area would be as follows:

The upper ten (10) feet of the site would be comprised of a dense dry to damp clay of high plasticity overlying two sequences of channel sands and silts separated by a clay zone on the order of five (5) to ten (10) feet in thickness. The channel sands would be expected

to be on the order of ten (10) to fifteen (15) feet in thickness each. The channel sands are actually interbedded sands, silts, and clays. Below the thirty (30) foot depth in the southern part of the LTA the sandy zone is water bearing. In the northern part the zones are not water bearing. A fifteen (15) to twenty (20) foot thick section of clay is encountered next. The clay is hard, highly plastic, not water bearing, and may show shrinkage cracking structure. Below this, a thin water bearing sand, gravel, or, sandy gravel composed of aggregates of mixed sources is encountered next and represents alluviation from the higher areas to the south into the valley. Below is generally unweathered shale for thirty (30) feet. The top of the shale should be encountered at an average of sixty (60) feet below the surface but may be as shallow as fifty (50) feet to the south and as deep as seventy (70) feet to the north. The water bearing Sonsela Sandstone is then encountered and should be from ten (10) to thirty (30) feet in thickness.

Attachment 2

Land Treatment Area Characterization Plan

LAND TREATMENT AREA CHARACTERIZATION PLAN

July 1996

Project No. 5052.00

Prepared by:

Benchmark Environmental Corporation
4501 Indian School Road N.E., Suite 105
Albuquerque, New Mexico 87110

Prepared for:

Giant Refining Company
Ciniza Refinery Environmental Department

TABLE OF CONTENTS

Section		Page
1.0	INTRODUCTION	1
2.0	CORING	1
3.0	SAMPLING AND ANALYSIS	2
4.0	GROUNDWATER SAMPLING	3
5.0	GENERAL	3
6.0	CLOSURE	4
7.0	EXPOSURE INFORMATION	6

LIST OF TABLES

Table		Page
1	Sample Depths	8
2	Soil Sampling Program for the Zone of Incorporation	9
3A	Modified Skinner List 8240 Volatile Organics	10
3B	Modified Skinner List 8270 Semivolatile Organics	12
3C	Modified Skinner List ICP 6010 Metals	14
3D	Modified Skinner List CVAA 7471 Mercury	15

LIST OF FIGURES

Figure		Page
1	LTA Plot	16
2	LTA Sampling Grid	17

GIANT REFINING COMPANY - CINIZA
LAND TREATMENT AREA CHARACTERIZATION PLAN

1.0 INTRODUCTION

A requirement of closure of the Land Treatment Area (LTA) is characterization of the migration of hazardous constituents within the Treatment Zone and Below the Treatment Zone (BTZ) and the presence of hazardous constituents, if any, in the Zone of Incorporation (ZOI). Loading density of hydrocarbons in the ZOI shall be determined and reported as oil and grease.

~~Although, characterization of chromium and lead migration Below the Treatment Zone has been adequately addressed by previous sampling events,. chromium and lead concentrations within the treatment zone must be characterized. Migration of organics has been observed to seven and one half feet (Report on the Special Sampling Activities at the Land Treatment Area, November 10, 1993.~~

Characterization of organic constituents (Tables 3A and 3B) must be made in the ZOI, within the Treatment Zone, and at depths below seven and one-half feet. Chromium and lead migration BTZ have been adequately characterized (report on the special sampling activities at the LTA, November 10, 1993). However, the concentrations of these constituents within the Treatment Zone must be determined.

~~To fully characterize the extent of possible contamination by organics, additional coring and sampling is necessary.~~ This document outlines the procedures that Giant will implement to complete the coring, sampling, and analysis to fully satisfy the information requirements of closure.

2.0 CORING

Giant proposes to core twelve additional points in Cells ~~#1~~ Nos. 1, 2, and 3 to a total depth of ~~ten~~ 25 feet~~.~~, with the 15-, 20-, and 25-foot samples held in archive. If organic constituents are detected in the 10-foot sample, then the 15-foot sample will be analyzed, with this procedure being followed until organics are fully characterized. Coring will be performed by Precision Engineering, Inc. (2001 Copper

Avenue, Suite 1, Las Cruces, NM, 88004) following the protocol set forth in the attached sampling plan. The sampling plan calls for the inclusion of the boring lithology of each hole.

Using best judgement in consultation with NMED staff, Giant shall randomly select four coring points in Cell ~~#1~~ No. 1, four points in Cell ~~#2~~ No. 2 and four points in Cell ~~#3~~ No. 3 as this exceeds the requirements of the Part B Permit, Attachment F, *Amended Closure ~~and Post Closure~~ Plan*, Section ~~1.2.2.1.2.~~ 5.1, Soil Core Monitoring. A total of ~~twelve~~ 12 coring points in Cells # Nos. 1, 2 and 3 will be sufficient, when combined with data obtained from other sampling events, to adequately address the presence, if any, of hazardous constituents in the ZOI, ~~Within~~ within the Treatment Zone and the BTZ.

3.0 SAMPLING AND ANALYSIS

Soil samples will be taken, at predetermined depths, in Cells ~~#1, #2, and #3~~ Nos. 1, 2, and 3 to characterize the presence of hazardous constituents. The depths are included in Table 1.

Samples taken within the ZOI will be analyzed for the constituents shown in Table 2. Analysis of constituents in Table 2 will indicate the presence and concentrations of hazardous constituents within the ZOI and will be instrumental in developing treatment practices, if necessary, for the ~~LTU~~ LTA surface. ZOI samples will also be sampled for oil and grease and total petroleum hydrocarbon.

Samples taken within the Treatment Zone will be analyzed for the constituents shown in ~~Table 3~~ Tables 3A through 3D.

Samples taken from the BTZ interval will be analyzed for the constituents shown in ~~Table 3~~ Tables 3A through 3D, which include the modified skinner list (Attachment F, Tables 4A through 4D), the constituents listed in Table III-1, and all volatile and semi-volatile constituents observed in past sampling events.

Duplicate samples will be taken from various corings, at various depths, in a number large enough to satisfy QA/QC requirements. Two equipment rinsate samples will be taken from drilling auger flights to verify that decontamination procedures are adequate.

All samples will be analyzed by Analytical Technologies, Inc. (ATI) (2709-D Pan American Freeway, NE, Albuquerque, NM 87107) using EPA approved methodology and ATI's QA/QC protocol which meets or exceeds the QA/QC guidelines included in the sampling plan (NMED: *Components of an Adequate Quality Assurance/Quality Control Program*).

4.0 GROUNDWATER SAMPLING

Groundwater sampling requirements have been met by the annual groundwater sampling event, as required by Attachment G, Section 2.A and 2.B of the Part B Permit.

The pre-detection wells, screened across the "Ciniza Sand" and numbered SMW-3 through SMW-6, are used to detect migration from the land ~~treating~~ treatment ~~facility~~ area and would allow remediation to commence long before the uppermost aquifer, the "Sonsela," would be impacted.

As the clay interval between the "Ciniza Sands" and the "Sonsela Aquifer" is from 40 to 60 feet thick and that water in the "Ciniza Sand" is believed to be fed by artesian flow from the "Sonsela Aquifer," Giant proposes to sample the "Ciniza Sands" semi-annually as required by Attachment G, Section 2.A and 2.B during closure. If hazardous constituents are ~~ever~~ detected in the "Ciniza Sands," then semi-annual sampling of the detection wells (OW-11, MW-1, MW-2, MW-4 and MW-5) would be required, in addition to the semi-annual sampling of the pre-detection wells.

Constituents analyzed would remain those that are listed in Tables G-2 and G-3 of Attachment G, groundwater monitoring plan of the Part B Permit.

5.0 GENERAL

Statistical evaluation of the samples taken from the corings will include the statistical test most appropriate for those specific samples. Samples taken from the ZOI will be tested using the coefficient of variation, which is 100 percent accurate, to determine normal or non-normal distribution of constituents in the ZOI. The mean of all samples will be included to determine the total contamination remaining in the ZOI interval. Samples taken from within the Treatment Zone will be tested using Cochran's approximation

of the Behrens-Fisher Student's T Test at the 95 percent confidence interval. Data from the background plot of the ~~LTF~~ LTA will be used as the control data for this test. ~~Samples taken from the BTZ will be tested using the tolerance interval as used and presented in other sampling events (*Report on the Special Sampling Activities at the band Treatment Facility, November, 1993*).~~ WHAT is this.

The sampling number sequence has been changed for this sampling event to reflect samples being collected from the ZOI as well as the BTZ. The sequence is:

LTA - C - 1 - 10.0 - D

LTA	=	Land Treatment Area
C	=	Characterization
1	=	Core Number
10.0	=	Depth of Sample (Feet)
D	=	Duplicate
E	=	Equipment Rinsate
	=	If blank, this is an original sample

All bore holes will be backfilled with a cement/bentonite slurry to prevent migration of contamination along the bore hole.

6.0 CLOSURE

Closure of the ~~Land Treatment Area~~ LTA requires certain chronological events to fully satisfy regulatory requirements. They are:

- Discontinuance of waste application to ~~LTU~~ LTA
- Characterization of hazardous constituents within the ZOI, Treatment Zone and BTZ through soil and soil pore moisture sampling (!)
- Remediation, if necessary
- Documentation of degradation within the ZOI (!)
- Establish a vegetative cover
- Groundwater monitoring (extended time frame)

Application of hazardous wastes was discontinued in November, 1990 and application of non-hazardous wastes to Cells ~~#1 and #2~~ Nos. 1 and 2 was discontinued on February 19, 1994.

As indicated in the *Amended Closure Plan*, Sections 5.1 and 5.2, soil and lysimeter sampling will occur within 30 days and again 90 days after the acceptance of the *Amended Closure Plan* (see Table 2).

Soil sample characterization of hazardous constituents is addressed in this plan. Soil pore moisture monitoring has continued on a weekly basis, but, in the absence of water from the lysimeters, no analytical work is done on a routine basis. A small amount of water was recovered on April 31, 1994, and was analyzed for volatile organic compounds. No VOC constituents were detected.

Soil pore monitoring will continue (that is, attempts to recover water from lysimeters) until ~~30~~ 90 days after acceptance of this plan. If, at any time, high levels of hazardous constituents are still present in the ZOI, soil pore monitoring will continue until ~~90 days after acceptance of this plan or until~~ it is determined that a vegetative cover can be planted.

Soil sampling will commence immediately after acceptance of this plan. In addition to the analysis for hazardous constituents, an optimum carbon: nitrogen: phosphorous ratio will be determined and applications of chemicals to maintain that ratio, as well as pH, will be implemented.

ZOI soil samples will be analyzed for Table ~~1~~ 2 constituents after 30 days. If constituent levels are low enough, a vegetative cover will be planted. If constituent levels are too high, remedial activities (tilling, fertilizing and watering) will continue for 60 additional days or until constituent levels have degraded enough to plant a vegetative cover.

~~Acceptable constituent levels to establish a vegetative cover are:~~

~~TPH~~	~~<200 ppm~~
~~Volatile Organic Compounds~~	~~<100 ppm~~
~~Semi Volatile Organic Compounds~~	~~<500 ppm~~
~~pH~~	~~6.0-8.0~~

Pre-detection wells (SMW-3 through SMW-6) will be sampled for constituents in ~~Table 3~~ Tables 3A through 3D on a semi-annual basis for ~~five~~ two years, and ~~then on a annual basis for five years and once~~

~~again on the fifteenth year after closure.~~ If no ~~statistically significant~~ ~~levels of~~ hazardous constituents are observed above NMED-approved health-based concentration limits at that time, groundwater monitoring ~~well~~ will be discontinued. NMED-approved health-based concentration limits are defined herein as New Mexico Water Quality Control Commission (WQCC) standards, or National Drinking Water Maximum Contaminant Levels (MCLs), whichever is more conservative. If there is neither a WQCC standard or an MCL specified for a constituent listed in Tables 2 and 3A through 3D, then the most conservative EPA guidance will be used.

Remediation of the ~~Land Treatment Area~~ LTA will include leveling to optimize precipitation distribution and surveying to establish location and elevation measurements.

Due to low levels of hazardous constituents, Giant proposes no additional remediation beyond enhancement of microbial destruction of hydrocarbon in the ZOI.

7.0 ~~RISK ASSESSMENT~~ EXPOSURE INFORMATION

Typically, ~~risk assessment~~ exposure assessment of a site includes the following important factors:

- Degree to which human health, safety, or welfare may be affected by exposure to chemical constituents
- Effects of contamination of the environment
- Site specific characteristics
- Current or future beneficial uses of the affected land and subsurface resources
- Application of appropriate regulatory standards

Fortunately, enough information is available for the ~~Land Treatment Area~~ LTA to make a reasonable ~~risk~~ exposure assessment for closure.

Danger to human receptors from exposure is negligent due to the isolated location of the site, with no human population along the path of release of potentially hazardous fugitive emissions. Personnel working within the site are exposed to extremely low levels of hazardous constituents and are fully

protected by the requirements of personal protective equipment. Dust minimization is already a requirement of operation and closure of the ~~Land Treatment Area~~ LTA.

Danger to the environment is minimal due to the low density of application of hazardous material, low precipitation to act as a carrier through percolation, extremely low permeability of the native clay layer and the depth to the uppermost potential aquifer. These site specific characteristics, coupled with the demonstration of minimal migration of hazardous constituents, show that the hazardous constituents within the site pose a minute threat to groundwater and future beneficial use of the site, but other site specific characteristics, such as the pre-detection monitor wells in the "Ciniza Sands," provide indicators of possible hazards to the environment that can be addressed on a timely basis to prevent ~~actual~~ potential contamination from taking place.

Due to the conditions presented above ~~and the fact that Giant proposes no remediation~~, the environmental and health risks associated with closure of the ~~Land Treatment Area~~ LTA are minimal and require no special considerations.

Table 1. LTA Sample Depths

	Borehole	
ZOI Samples		0.0'
Table 2		1.0'
Treatment Zone		3.0'
Table 3		5.0'
BTZ Table 3 Organics		6.0'
		10.0'
BTZ Table 3		
BTZ Table 3 Organics Archive		15.0'
BTZ Table 3 Organics Archive		20.0'
BTZ Table 3 Organics Archive		25.0'

Table 2. Soil Sampling Program for the Zone of Incorporation

Parameter	Event 1[a]	Event 2[b]	Event 3[c]	Subsequent Events [d]
pH	*	*	**	**
Oil %	*	*	**	**
Moisture %	*	*	**	**
Total Nitrogen	*	*	**	**
Total Phosphorous	*	*	**	**
Tables 3A through 3D Constituents	*	**	**	**

[a]Event 1 must take place within 30 days of NMED acceptance of this plan.

[b]Event 2 must take place 60 days after Event 1.

[c]If necessary, Event 3 must take place 60 days after Event 2.

[d]If necessary, Giant will perform additional sampling events every 90 days until all data show levels below NMED-approved health-based concentration levels.

* = Required analysis.
** = Not required if previous event data show levels below standards.

Table 3A. Modified Skinner List 8240 Volatile Organics

Parameter	EPA Method SW-846	Description	Containers	Preservative	Holding Time/Days	Liquid Detection Limit (μg/L)	Soil Detection Limit (μg/kg)
Benzene	8240	GC/MS	G Glass	4°C	14	5.0	5.0
2-Butanone (MEK)	8240	GC/MS	G Glass	4°C	14	100.0	100.0
Carbon Disulfide	8240	GC/MS	G Glass	4°C	14	100.0	100.0
Chlorobenzene	8240	GC/MS	G Glass	4°C	14	5.0	5.0
Chloroform	8240	GC/MS	G Glass	4°C	14	5.0	5.0
Chloromethane	8240	GC/MS	G Glass	4°C	14	10.0	10.0
1,1 Dichloroethane	8240	GC/MS	G Glass	4°C	14	5.0	5.0
1,2 Dichloroethane	8240	GC/MS	G Glass	4°C	14	5.0	5.0
1,1 Dichloroethene	8240	GC/MS	G Glass	4°C	14	5.0	5.0
trans-1,2-Dichloroethene	8240	GC/MS	G Glass	4°C	14	5.0	5.0
1,4-Dioxane	8240	GC/MS	G Glass	4°C	14	[a]	[a]
Ethylbenzene	8240	GC/MS	G Glass	4°C	14	5.0	5.0
Methylene Chloride	8240	GC/MS	G Glass	4°C	14	5.0	5.0
Styrene	8240	GC/MS	G Glass	4°C	14	5.0	5.0
1,1,2,2-Tetrachloroethane[b]	8240	GC/MS	G Glass	4°C	14	5.0	5.0
Tetrachloroethene[b]	8240	GC/MS	G Glass	4°C	14	5.0	5.0
Toluene	8240	GC/MS	G Glass	4°C	14	5.0	5.0

Table 3A. Modified Skinner List 8240 Volatile Organics (Concluded)

Parameter	EPA Method SW-846	Description	Containers	Preservative	Holding Time/Days	Liquid Detection Limit (μg/L)	Soil Detection Limit (μg/kg)
1,1,1-Trichloroethane	8240	GC/MS	G Glass	4°C	14	5.0	5.0
Trichloroethene	8240	GC/MS	G Glass	4°C	14	5.0	5.0
Xylene	8240	GC/MS	G Glass	4°C	14	5.0	5.0
Ethylene Dibromide[b]	8240	GC/MS	G Glass	4°C	14	5.0	5.0
Acetone	8240	GC/MS	G Glass	4°C	14	100.0	100.0

[a]SW-846 detection limits not established.

[b]Additional constituents.

μg/L = microgram per liter
μg/kg = microgram per kilogram
GC/MS = gas chromatography/mass spectrometry

Table 3B. Modified Skinner List 8270 Semivolatile Organics

Parameter	EPA Method SW-846	Description	Container	Preservative	Holding Time/Days	Liquid Detection Limit (µg/L)	Soil Detection Limit (µg/kg)
Anthracene	8270	GC/MS	G Glass	4°C	14	10.0	660.0
Benzo(a)Anthracene	8270	GC/MS	G Glass	4°C	14	10.0	660.0
Benzo(b)Fluoranthene	8270	GC/MS	G Glass	4°C	14	10.0	660.0
Benzo(k)Fluoranthene	8270	GC/MS	G Glass	4°C	14	10.0	660.0
Benzo(a)Pyrene	8270	GC/MS	G Glass	4°C	14	10.0	660.0
Butyl Benzyl Phthalate	8270	GC/MS	G Glass	4°C	14	10.0	660.0
Chrysene	8270	GC/MS	G Glass	4°C	14	10.0	660.0
Dibenz(a,h)Anthracene	8270	GC/MS	G Glass	4°C	14	10.0	660.0
Diethyl Phthalate	8270	GC/MS	G Glass	4°C	14	10.0	660.0
7,12-Dimethylbenz(a)-Anthracene	8270	GC/MS	G Glass	4°C	14	10.0	[illegible]
Dimethyl Phthalate	8270	GC/MS	G Glass	4°C	14	10.0	660.0
Di-n-Octyl Phthalate	8270	GC/MS	G Glass	4°C	14	10.0	660.0
Fluoranthene	8270	GC/MS	G Glass	4°C	14	10.0	660.0
Indeno(1,2,3-cd)Pyrene	8270	GC/MS	G Glass	4°C	14	10.0	660.0
2-Methylnaphthalene	8270	GC/MS	G Glass	4°C	14	10.0	660.0
2-Methylphenol (Cresol)	8270	GC/MS	G Glass	4°C	14	10.0	660.0
3/4-Methylphenol (Cresol)	8270	GC/MS	G Glass	4°C	14	10.0	660.0
Naphthalene	8270	GC/MS	G Glass	4°C	14	10.0	660.0
4-Nitrophenol	8270	GC/MS	G Glass	4°C	14	50.0	3300.0
Phenanthrene	8270	GC/MS	G Glass	4°C	14	10.0	660.0
Pyrene	8270	GC/MS	G Glass	4°C	14	10.0	660.0

Table 3B. Modified Skinner List 8270 Semivolatile Organics (Concluded)

Parameter	EPA Method SW-846	Description	Container	Preservative	Holding Time/Days	Liquid Detection Limit (μg/L)	Soil Detection Limit (μg/kg)
Pyridine	8270	GC/MS	G Glass	4°C	14	[a]	[a]
Quinoline	8270	GC/MS	G Glass	4°C	14	[a]	[a]
Benzenethiole	8270	GC/MS	G Glass	4°C	14	20.0	[a]
Phenol	8270	GC/MS	G Glass	4°C	14	10.0	660.0
Bis(2-Ethylhexyl)phthalate[b]	8270	GC/MS	G Glass	4°C	14	2.5	1675.0
Dibenz(a,j)acridine[b]	8270	GC/MS	G Glass	4°C	14	10.0	[a]
Dibenz(a,h)-anthracene	8270	GC/MS	G Glass	4°C	14	10.0	660.0
Dichlorobenzene[b]	8270	GC/MS	G Glass	4°C	14	10.0	660.0
Methyl Naphthalene	8270	GC/MS	G Glass	4°C	14	10.0	660.0
2,4-Dimethylphenol	8270	GC/MS	G Glass	4°C	14	10.0	660.0
2,4-Dinitrophenol[b]	8270	GC/MS	G Glass	4°C	14	50.0	3300.0
Indene[c]	-	-	-	-	-	-	-
Benzo(j)fluoranthene	8270	GC/MS	G Glass	4°C	14	[a]	[a]
2-Chlorophenol	8270	GC/MS	G Glass	4°C	14	10.0	660.0
2,4,6-Trichlorophenol	8270	GC/MS	G Glass	4°C	14	10.0	660.0
Di-n-Butyl Phthalate	8270	GC/MS	G Glass	4°C	14	[a]	[a]
Benzyl Alcohol[b]	8270	GC/MS	G Glass	4°C	14	20.0	1300.0
Methyl Chrysene	8270	GC/MS	G Glass	4°C	14	10.0	660.0

[a]SW-846 detection limits not established.
[b]Additional constituents.
[c]Use a non-SW-846 method to analyze for indene because there is no established SW-846 method.
μg/L = microgram per liter
μg/kg = microgram per kilogram
GC/MS = gas chromatography/mass spectrometry

Table 3C. Modified Skinner List ICP 6010 Metals

Parameter	EPA Method SW-846	Description	Container	Preservative	Holding Time/Days	Liquid Detection Limit (μg/L)	Soil Detection Limit (μg/kg)
Antimony	6010	ICP-AES	Glass	4°C	180	32.0	[a]
Arsenic	6010	ICP-AES	Glass	4°C	180	53.0	[a]
Barium	6010	ICP-AES	Glass	4°C	180	2.0	[a]
Beryllium	6010	ICP-AES	Glass	4°C	180	0.3	[a]
Cadmium	6010	ICP-AES	Glass	4°C	180	4.0	[a]
Chromium	6010	ICP-AES	Glass	4°C	180	7.0	[a]
Cobalt	6010	ICP-AES	Glass	4°C	180	7.0	[a]
Lead	6010	ICP-AES	Glass	4°C	180	42.0	[a]
Nickel	6010	ICP-AES	Glass	4°C	180	15.0	[a]
Selenium	6010	ICP-AES	Glass	4°C	180	75.0	[a]
Vanadium	6010	ICP-AES	Glass	4°C	180	8.0	[a]

[a]Detection limits for soil samples are dependent on matrices and individual instrument performance.

μg/L = microgram per liter
μg/kg = microgram per kilogram
ICP-AES = inductively coupled plasma - atomic emission spectroscopy

Table 3D. Modified Skinner List CVAA 7471 Mercury

Parameter	EPA Method SW-846	Description	Container	Preservative	Holding Time/Days	Liquid Detection Limit (μg/L)	Soil Detection Limit (μg/kg)
Mercury	7471	CVAA	Glass	4°C	28	0.2	0.2

μg/L = microgram per liter
μg/kg = microgram per kilogram
CVAA = cold vapor atomic absorption

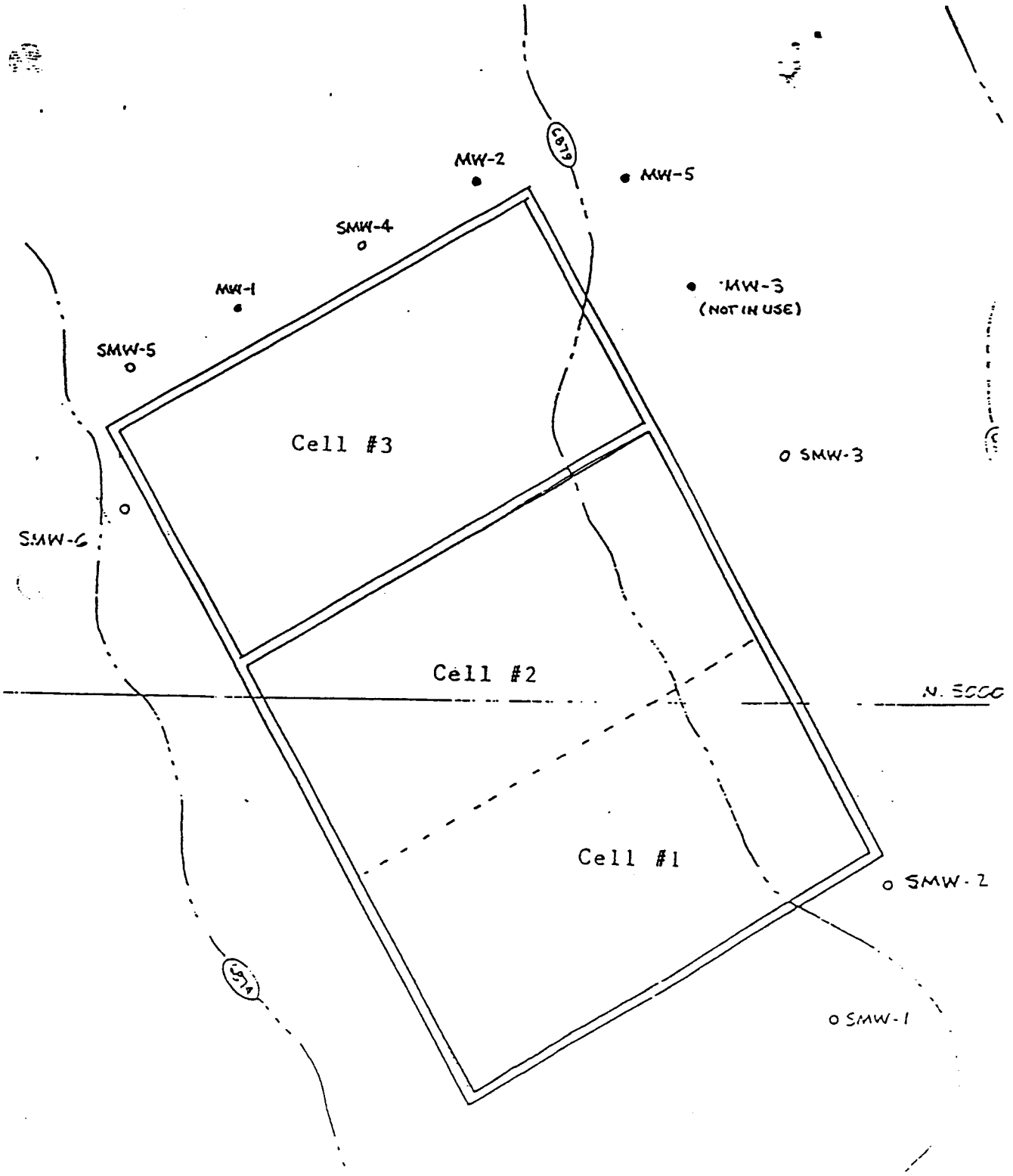

Figure 1 LTA Plot

GIANT REFINING COMPANY-CINIZA
LAND TREATMENT UNIT
SAMPLING GRID
RANDOM NUMBER SYSTEM
#43,173 AND 178 ADDED AT NMED/HRMB REQUEST

SCALE
1 GRID = 24' x

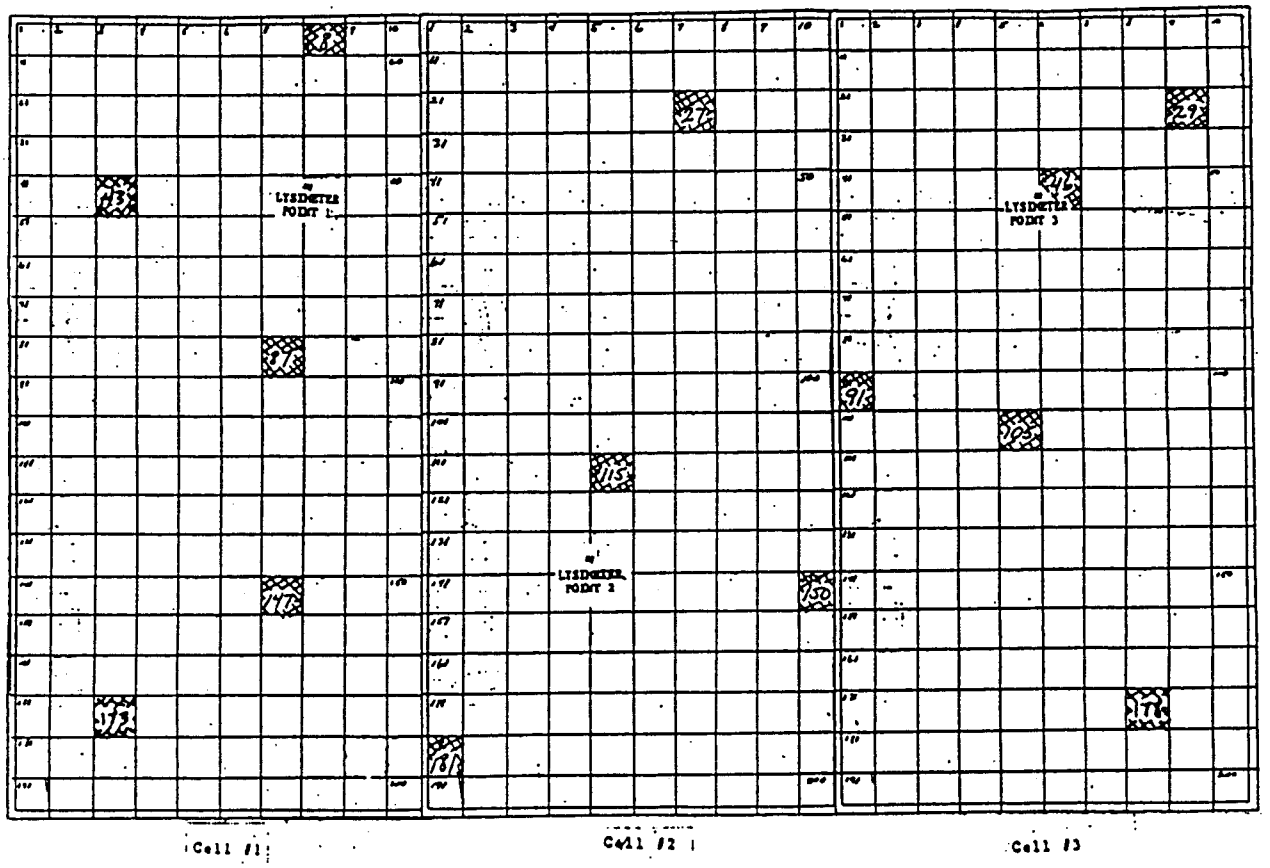

Figure 2 Sampling Grid

Attachment 3

Sampling and Analysis Plan

SAMPLING AND ANALYSIS PLAN

LAND TREATMENT AREA CHARACTERIZATION
GIANT REFINING COMPANY
CINIZA REFINERY

July 1996

Project No. 5052.00

Prepared by:

Benchmark Environmental Corporation
4501 Indian School Road N.E., Suite 105
Albuquerque, New Mexico 87110

Prepared for:

Giant Refining Company
Ciniza Refinery Environmental Department

TABLE OF CONTENTS

Section	Page
LIST OF TABLES	iv
LIST OF FIGURES	v
1.0 INTRODUCTION	1
2.0 RESPONSIBILITIES	1
2.1 Project Manager	2
2.2 Sampling Personnel	2
2.2.1 General	2
2.2.2 Soil Sampling	2
2.2.3 Sample Transfer	2
2.3 Contract Laboratory	2
3.0 SAMPLING PROCEDURES	3
3.1 Preparation	3
3.2 Pre-Sampling Operations	3
3.2.1 Calibration of Field Instruments	4
3.2.2 Ice	4
3.2.3 Sample Record	4
3.3 Soil Sampling Locations and Techniques	4
3.3.1 Boreholes/Core Samples	4
3.3.2 Soil Sampling Screening	5
3.3.3 Lithologic Logging	5
3.3.4 Disposition of Soils	5
4.0 SAMPLE LABELING	6
5.0 DECONTAMINATION PROCEDURES	6
5.1 Drilling Equipment and Vehicles	6
5.2 Sampling Equipment	7
6.0 SAMPLE CUSTODY	7
6.1 Chain of Custody Record	7
6.2 Transfer of Custody	8
6.2.1 On-Site Custody	8
6.2.2 Contract Laboratory Custody	8
7.0 ANALYTICAL PROCEDURES	8
7.1 Methods	8
7.2 Detection Limits	9
7.3 Sample Container, Preservation, and Holding Times	9
7.4 Sample Preparation	9
7.5 Laboratory QA/QC	9

TABLE OF CONTENTS (Concluded)

Section	Page
8.0 CALIBRATION PROCEDURES AND FREQUENCY	9
8.1 ICP	10
8.2 GC/MS	10
9.0 INTERNAL QUALITY CONTROL CHECKS	10
9.1 Equipment Blanks	10
9.2 Trip Blanks	11
9.3 Field Duplicates	11
10.0 EXPLANATION OF SAMPLE POINTS	11
10.1 Sample Location Criteria	11
10.2 Sample Identification Numbering System	12
APPENDIX 1	A-1

LIST OF TABLES

Table		Page
1	Field Equipment Checklist Soil Sampling	13
2	Soil Sampling Program for the Zone of Incorporation	14
3A	Modified Skinner List 8240 Volatile Organics	15
3B	Modified Skinner List 8270 Semivolatile Organics	17
3C	Modified Skinner List ICP 6010 Metals	19
3D	Modified Skinner List CVAA 7471 Mercury	20

LIST OF FIGURES

Figure		Page
1	Land Treatment Area Plot	21

GIANT REFINING COMPANY - CINIZA
LAND TREATMENT AREA CHARACTERIZATION PLAN

1.0 INTRODUCTION

It is essential to assure that data generated during the Land Treatment Area (LTA) sampling event is valid. For data to be valid, it must be supported by documented procedures so that it can be used with the appropriate level of confidence to support decisions regarding the need for, and design of, subsequent characterization and remediation activities.

Through the development and implementation of a comprehensive sample plan, all parties involved can consistently strive to achieve data of known and acceptable quality. This sampling plan includes specific Quality Assurance (QA) and Quality Control (QC) procedures to:

- Define the sampling team responsibilities
- Define sampling and analytical techniques
- Specify sample identity
- Establish precision and accuracy of reported data
- Establish detection limits for constituents of concern
- Identify any potential bias arising from sampling or analytical activities

2.0 RESPONSIBILITIES

The importance of defining responsibilities for the implementation of the procedures must be stressed. All individuals involved with the sampling program must clearly understand their responsibilities so the procedures detailed in this plan will be conducted successfully and efficiently.

2.1 Project Manager

- Maintain information for the collection of data
- Set up a sampling program that complies with regulatory requirements

- Schedule analysis and shipment of samples
- Review analytical and statistical data for completeness and validity
- Supervise contractors involved in the sampling event
- Develop a QA/QC report for submission to management
- Specify analytical methods to be used

2.2 Sampling Personnel

2.2.1 General

- Follow all procedures in this plan to prevent contamination of samples and procedural errors
- Collect samples as prescribed in this plan
- Inventory and prepare sample bottles and preservatives
- Maintain all sampling equipment
- Calibrate field instruments (if applicable)

2.2.2 Soil Sampling

- Collect site specific soil samples
- Verify and document all sampling points (to include depth and parameters)
- Follow prescribed decontamination procedures

2.2.3 Sample Transfer

- Verify all entries into chain of custody
- Assure proper storage and preservation (storage at 4°C constitutes preservation for this sampling event)
- Verify proper transfer of samples to laboratory
- Input sample results into database

2.3 Contract Laboratory

- Provide high quality analytical services

- Assure that all data generated is supported by adequate documentation that meet New Mexico Environment Department (NMED) and U.S. Environmental Protection Agency (EPA) QA/QC requirements
- Provide sample bottles, coolers, labels and chain of custody documents upon request
- Maintain standard operating procedures (SOPs) for all analytical methods performed
- Use only EPA approved methods for all analyses
- Assure that technical personnel performing analyses are qualified and adequately trained
- Provide feedback to Giant regarding analytical method limitations and QC data pertinent to the sampling program

3.0 SAMPLING PROCEDURES

Sampling can be divided into the following stages.

3.1 Preparation

Preparation for a sampling event should be initiated at least two weeks prior to the anticipated sampling date, if possible, to assure that the sampling can proceed in an organized and efficient manner. A minimum of two weeks notice shall be given to the Hazardous and Radioactive Materials Bureau (HRMB) of the NMED.

The contract laboratory should be notified of the proposed sampling schedule so that they may schedule both personnel and equipment to meet the demands of the sample analyses. The lab should provide adequate materials (i.e., coolers, bottles) for the sampling event at that time.

Sampling personnel will inventory the bottles upon receipt and notify the laboratory of any discrepancies.

The day before sampling, sampling personnel should review the field checklist (Table 1, soil sampling) to assure that all equipment is available and operational.

3.2 Pre-Sampling Operations

These steps should be taken immediately prior to sampling activities.

3.2.1 Calibration of Field Instruments

The photoionization detector (PID) should be checked for fully charged battery and calibrated with a hexane standard. This step may be eliminated if use of the PID is not warranted.

3.2.2 Ice

One gallon bags of ice will be obtained and placed into the coolers before sampling begins.

3.2.3 Sample Record

A sample record will be kept in the LTA operations log book. The following information should be recorded in the field notes:

- Location of sample (include drawing of site)
- Sample identification number system
- Date and time of sampling
- Sample collection method
- Field measurements
- Comments and observations
- Sampling personnel

It is important that specific observations be recorded concerning site conditions. These include:

- Weather conditions
- Physical surrounding (water, plant growth)
- Evidence of contamination
- Odors or color abnormalities

3.3 Soil Sampling Locations and Techniques

The purpose of the soil sampling plan is to characterize the extent of the migration of hazardous constituents.

Soil sampling locations will be selected in order to adequately determine if migration has occurred. The number and depth of samples in this plan have been selected to adequately characterize potential migration of certain constituents.

3.3.1 Boreholes/Core Samples

Boreholes for samples will be advanced by a drilling rig employing hollow-stem augers. There will be no compositing of soil samples. Core samplers are used in conjunction with hollow-stem augers to collect soil samples. A 5 foot, 2½ inch diameter, split core barrel will be placed in the lead auger. The tube

is pushed into the soil at the same drilling rate as the auger. After the tube is pulled from the soil, it is detached from the drill rod and opened to remove the soil core. The sample must be transferred to the sample container in a timely manner in order to maintain the integrity of the sample and to prevent the loss of volatile organic constituents (VOCs). Only after the sample has been collected should field observations and measurements (such as PID readings) be completed. Split core barrels will be used for obtaining samples of consolidated soil and to penetrate some types of rock. Measurements will be taken to the nearest 0.1 inch with an engineer's tape measure.

3.3.2 Soil Sampling Screening

Should visual inspection or detection of odors warrant its use, a PID will be used to screen for volatiles. Since prior sampling has not shown significant contamination, the use of a PID is not expected. If the PID is used, all readings will be recorded in the log book.

3.3.3 Lithologic Logging

Detailed logs will be maintained for each boring. Listed below is a general description of terms to be used to describe the soil characteristics for each boring.

- Lithology
- Color (i.e., light, dark, mottled, mixed)
- Size (fine, medium, coarse)
- Moisture (dry, moist, wet)
- Odor (or no odor)
- Other Descriptive Terms:
  - Lens <1 inch
  - Layer >1 inch
  - Interbedded
  - Slickensided - Soils having inclined planes of weakness, glossy in appearance

Lithologic logs of the entire core shall be used. Samples for VOCs shall be obtained before logging to preclude potential loss of VOCs.

3.3.4 Disposition of Soils

All drill cuttings generated by borehole advancement for soil samples will be spread within the LTA.

4.0 SAMPLE LABELING

As soon as the sample containers have been properly filled with sample material, the bottle labels should be completed with the following information:

- Sample identification number
- Location
- Date/time of collection
- Preservation technique
- Analytical parameters

The label will be filled out with waterproof, indelible ink. All information except sample number and date/time of collection shall be completed prior to going into the field. The sample number and date/time will be completed when the sample is taken.

5.0 DECONTAMINATION PROCEDURES

The following procedures are applicable to decontamination of:

- Drilling equipment and vehicles
- Sampling equipment

5.1 Drilling Equipment and Vehicles

Decontamination of large drilling equipment and vehicles is required to prevent cross contamination of boreholes from which samples will be retrieved for chemical analysis. This procedure also provides for the protection of personnel subsequent to demobilization from the LTA.

- Wash and mechanically clean augers and split spoon with biodegradable soap and brush. Rinse with potable water.

- Steam augers and split spoon

- Protect equipment, if necessary, when transporting drilling equipment between boreholes, by covering or shielding.

During decontamination of drilling equipment and accessories, it is especially critical to clean the inside of hollow-stem auger flights, drill rods and bits. Decontamination can be limited to those parts that may come into direct contact with soil sample surfaces.

5.2 Sampling Equipment

Sampling equipment includes all sampling devices and containers that are used to collect or contain a sample prior to final sample analysis. Before its use, all sampling equipment that may contribute to the contamination of a sample must be thoroughly cleaned.

Sampling equipment can generally be cleaned by hand. The following procedure will be used for sampling equipment:

- Scrub with biodegradable soap and potable water
- Rinse with deionized water followed by isopropanol
- Allow to air-dry
- Protect, if necessary, to prevent contamination while transporting from borehole to borehole by covering or shielding

6.0 SAMPLE CUSTODY

Assuring the integrity of a sample from the time of collection to data reporting is essential. Chain of custody procedures are intended to document sample possession from the time of collection to final disposition.

A sample is considered to be under a person's custody if it is in the person's physical possession, in view of the person after taking possession, secured by that person so that no one may tamper with it, or secured by that person in an area that is restricted to authorized personnel.

6.1 Chain of Custody Record

The chain of custody record shall include the following information:

- Facility name
- Type and number of samples
- Sample location and ID
- Collection dates/times
- Analysis required
- Number of containers for each sample
- Additional remarks or comments as needed

- Sampler's signature
- Signatures of all individuals involved in the chain of possession
- Inclusive dates and times of possession

The original chain of custody form must accompany the samples. One copy of the chain of custody form should be kept in the project files.

6.2 Transfer of Custody

This section describes the disposition of the samples after collection.

6.2.1 On-Site Custody

The sample collector will prepare the samples by placing them in a cooler with ice to maintain the samples at 4°C. The information regarding date and time of sample preparation is entered on the chain of custody form at this time.

6.2.2 Contract Laboratory Custody

The delivery person will relinquish the samples to the laboratory. The laboratory will notify Giant of samples receipt and condition.

The laboratory personnel will be responsible for documenting custody within their laboratory. If a subcontractor is used for any or all analyses, Giant shall be informed and custody change shall be documented.

7.0 ANALYTICAL PROCEDURES

7.1 Methods

To adequately evaluate analytical data, certain methodologies were selected. These EPA-approved methods listed in Giant's Part B Permit shall be used for analyses of soil samples.

The constituents and applicable methods are listed in Tables 2 and 3A through 3D, respectively.

7.2 Detection Limits

It is imperative that the analytical procedures chosen have detection limits appropriate to the intended use of the data and that are consistent with previous sampling events in the LTA. Detection limits for this plan are included in Tables 3A through 3D.

7.3 Sample Container, Preservation, and Holding Times

Sample container selection, preservation techniques, and holding times must be addressed for every sampling activity. This is to ensure that the sample does not deteriorate or become contaminated. Sample deterioration can occur through biological degradation or chemical precipitation. Sample contamination can occur through adsorption, absorption, or leaching effects due to the interaction of the sample and the container material. Sample container selection, preservation techniques, and holding times are listed in Tables 3A through 3D.

7.4 Sample Preparation

Proper sample preparation is an integral part of any analytical program. Any additional preparation above and beyond normal SOPs should be confirmed with Giant's project manager.

7.5 Laboratory QA/QC

A copy of the laboratory's QA/QC program as submitted to Giant is kept on file. The recommended QA/QC program submitted to Giant by the NMED is attached as Appendix 1. If necessary, Giant requests that the laboratory's QA/QC program be modified to conform to the NMED QA/QC program.

8.0 CALIBRATION PROCEDURES AND FREQUENCY

It is recognized that instrument calibration procedures vary from instrument to instrument. Manufacturer's guidelines should be followed. The frequency of calibration for a number of instruments is addressed below. This information is obtained from EPA SW-846, Third Edition, "Test Methods for Evaluating Solid Waste." This section is not intended to be comprehensive in nature. The laboratory is responsible for detailing its own QA/QC protocol in addition to the items listed here.

8.1 ICP

- Calibrate the instrument according to manufacturer's recommended procedures.
- Two types of blanks are required: calibration blanks and reagent blanks.
- Check calibration using a blank and two standards.
- Check calibration every ten samples and at the end of each run by analyzing the blank and check standard. The standard should be within 10 percent of the expected result. If not, terminate the analysis, correct the problem and recalibrate. The calibration blank should be within three standard deviations of the mean blank. If not, terminate the analysis, correct the problem, recalibrate, and reanalyze the previous ten samples.
- Analyze the interference check sample at the beginning and end of an analytical run or twice during every 8-hour work shift.
- Replicate samples and spiked samples should be run at a frequency of 20 percent. The relative percent difference (RPD) shall be ± 20 percent for sample values greater than ten times the detection limit. Spike recovery is to be ± 20 percent of the actual value.
- Serial dilution checks should be done where applicable.

8.2 GC/MS

- Initial demonstration of capability.
- Meet tuning criteria per SW-846, Third Edition.
- Internal and surrogate standards added to blank, standards, and samples.
- Blank and standard calibration verification should be performed at the end of each run.

9.0 INTERNAL QUALITY CONTROL CHECKS

9.1 Equipment Blanks

Equipment blanks will be analyzed to check for contamination due to improper/insufficient decontamination procedures. These blanks will be used for nondedicated boring and sampling equipment.

To ensure equipment has been sufficiently decontaminated, deionized water will be poured over and through the sampling equipment, caught in a clean stainless steel bowl, and poured into the sample bottles. Two equipment blanks will be taken randomly during this sampling event.

9.2 Trip Blanks

A trip blank will be analyzed to check for container contamination. The trip blank will be prepared and labeled by the laboratory. One 40-ml septum vial will be filled with reagent grade water, transported to the site with the empty sample bottles, carried with the sample bottles during all sampling activities, and returned to the laboratory for analysis. The trip blank shall not be opened at any time prior to analysis.

9.3 Field Duplicates

To measure the precision of the sampling activities, duplicate samples will be collected and analyzed. Duplicates will be collected at a frequency of 5 percent of the total number of samples taken (i.e., 100 samples total, 5 duplicates). One duplicate will be analyzed for Appendix IX volatile and semivolatile constituents; the remainder will be analyzed for ICP chromium and lead.

In order to evaluate the precision of the analysis, it is necessary to calculate the RPD between the two results of the duplicate analysis. The RPD calculation is as follows:

$$RPD = \frac{(S1 - S2)}{(S1 + S2)/2 \times 100\%}$$

where:

$S1$ = Sample Result 1

$S2$ = Sample Result 2

RPD should be less than or equal to 10 percent for values five times greater than the Method Detection Limit (MDL) and plus or minus the detection limit for values less than five times the MDL.

10.0 EXPLANATION OF SAMPLE POINTS

10.1 Sample Location Criteria

Proposed sample points were selected to best characterize the potential migration of contamination beneath the treatment zone.

10.2 Sample Identification Numbering System

The sample identification numbering system is used to identify individual samples. Sample numbers may include a code number or letter attached to the end to identify the type of sample.

Samples for a typical sampling event would be labeled as:

LTA	-	*C*	-	11	-	5.0	-	*D*
(1)		(2)		(3)		(4)		(5)

(1) *LTA* = Land Treatment Area
(2) *C* = Characterization
(3) 11 = Core Number
(4) 5.0 = Depth of Sample
(5) *D* - Duplicate
E - Equipment Wash
If no letter appears here, it is the original sample

Table 1
Field Equipment Checklist
Soil Sampling

	Item		Remarks
____	PID meter (optional)	____	Calibrated
____	Site map with sample locations		
____	Sample bottles		
____	Ice chests		
____	Trip blanks		
____	Isopropanol		
____	Deionized water		
____	Squeeze bottles		
____	Personal protective equipment		
____	Chain of custody and sample record forms		
____	Plastic bags (to provide clean surfaces)		
____	Disposable gloves		
____	Paper towels		
____	Tape (for labels and dispenser)		
____	Sharpie, pens, pencils		
____	Blue ice or ice		
____	Zip-lock bags, 1 gallon		
____	Tape measure		

Table 2. Soil Sampling Program for the Zone of Incorporation

Parameter	Event 1[a]	Event 2[b]	Event 3[c]	Subsequent Events [d]
pH	*	*	**	**
Oil %	*	*	**	**
Moisture %	*	*	**	**
Total Nitrogen	*	*	**	**
Total Phosphorous	*	*	**	**
Tables 3A through 3D Constituents	*	**	**	**

[a]Event 1 must take place within 30 days of NMED acceptance of this plan.

[b]Event 2 must take place 60 days after Event 1.

[c]If necessary, Event 3 must take place 60 days after Event 2.

[d]If necessary, Giant will perform additional sampling events every 90 days until all data show levels below NMED-approved health-based concentration levels.

* = Required analysis.
** = Not required if previous event data show levels below standards.

Table 3A. Modified Skinner List 8240 Volatile Organics

Parameter	EPA Method SW-846	Description	Containers	Preservative	Holding Time/Days	Liquid Detection Limit (µg/L)	Soil Detection Limit (µg/kg)
Benzene	8240	GC/MS	G Glass	4°C	14	5.0	5.0
2-Butanone (MEK)	8240	GC/MS	G Glass	4°C	14	100.0	100.0
Carbon Disulfide	8240	GC/MS	G Glass	4°C	14	100.0	100.0
Chlorobenzene	8240	GC/MS	G Glass	4°C	14	5.0	5.0
Chloroform	8240	GC/MS	G Glass	4°C	14	5.0	5.0
Chloromethane	8240	GC/MS	G Glass	4°C	14	10.0	10.0
1,1 Dichloroethane	8240	GC/MS	G Glass	4°C	14	5.0	5.0
1,2 Dichloroethane	8240	GC/MS	G Glass	4°C	14	5.0	5.0
1,1 Dichloroethene	8240	GC/MS	G Glass	4°C	14	5.0	5.0
trans-1,2-Dichloroethene	8240	GC/MS	G Glass	4°C	14	5.0	5.0
1,4-Dioxane	8240	GC/MS	G Glass	4°C	14	[a]	[a]
Ethylbenzene	8240	GC/MS	G Glass	4°C	14	5.0	5.0
Methylene Chloride	8240	GC/MS	G Glass	4°C	14	5.0	5.0
Styrene	8240	GC/MS	G Glass	4°C	14	5.0	5.0
1,1,2,2-Tetrachloroethane[b]	8240	GC/MS	G Glass	4°C	14	5.0	5.0
Tetrachloroethene[b]	8240	GC/MS	G Glass	4°C	14	5.0	5.0
Toluene	8240	GC/MS	G Glass	4°C	14	5.0	5.0

Table 3A. Modified Skinner List 8240 Volatile Organics (Concluded)

Parameter	EPA Method SW-846	Description	Containers	Preservative	Holding Time/Days	Liquid Detection Limit (μg/L)	Soil Detection Limit (μg/kg)
1,1,1-Trichloroethane	8240	GC/MS	G Glass	4°C	14	5.0	5.0
Trichloroethene	8240	GC/MS	G Glass	4°C	14	5.0	5.0
Xylene	8240	GC/MS	G Glass	4°C	14	5.0	5.0
Ethylene Dibromide[b]	8240	GC/MS	G Glass	4°C	14	5.0	5.0
Acetone	8240	GC/MS	G Glass	4°C	14	100.0	100.0

[a]SW-846 detection limits not established.
[b]Additional constituents.

μg/L = microgram per liter
μg/kg = microgram per kilogram
GC/MS = gas chromatography/mass spectrometry

Table 3B. Modified Skinner List 8270 Semivolatile Organics

Parameter	EPA Method SW-846	Description	Container	Preservative	Holding Time/Days	Liquid Detection Limit (µg/L)	Soil Detection Limit (µg/kg)
Anthracene	8270	GC/MS	G Glass	4°C	14	10.0	660.0
Benzo(a)Anthracene	8270	GC/MS	G Glass	4°C	14	10.0	660.0
Benzo(b)Fluoranthene	8270	GC/MS	G Glass	4°C	14	10.0	660.0
Benzo(k)Fluoranthene	8270	GC/MS	G Glass	4°C	14	10.0	660.0
Benzo(a)Pyrene	8270	GC/MS	G Glass	4°C	14	10.0	660.0
Butyl Benzyl Phthalate	8270	GC/MS	G Glass	4°C	14	10.0	660.0
Chrysene	8270	GC/MS	G Glass	4°C	14	10.0	660.0
Dibenz(a,h)Anthracene	8270	GC/MS	G Glass	4°C	14	10.0	660.0
Diethyl Phthalate	8270	GC/MS	G Glass	4°C	14	10.0	660.0
7,12-Dimethylbenz(a)-Anthracene	8270	GC/MS	G Glass	4°C	14	10.0	
Dimethyl Phthalate	8270	GC/MS	G Glass	4°C	14	10.0	660.0
Di-n-Octyl Phthalate	8270	GC/MS	G Glass	4°C	14	10.0	660.0
Fluoranthene	8270	GC/MS	G Glass	4°C	14	10.0	660.0
Indeno(1,2,3-cd)Pyrene	8270	GC/MS	G Glass	4°C	14	10.0	660.0
2-Methylnaphthalene	8270	GC/MS	G Glass	4°C	14	10.0	660.0
2-Methylphenol (Cresol)	8270	GC/MS	G Glass	4°C	14	10.0	660.0
3/4-Methylphenol (Cresol)	8270	GC/MS	G Glass	4°C	14	10.0	660.0
Naphthalene	8270	GC/MS	G Glass	4°C	14	10.0	660.0
4-Nitrophenol	8270	GC/MS	G Glass	4°C	14	50.0	3300.0
Phenanthrene	8270	GC/MS	G Glass	4°C	14	10.0	660.0
Pyrene	8270	GC/MS	G Glass	4°C	14	10.0	660.0

Table 3B. Modified Skinner List 8270 Semivolatile Organics (Concluded)

Parameter	EPA Method SW-846	Description	Container	Preservative	Holding Time/Days	Liquid Detection Limit (μg/L)	Soil Detection Limit (μg/kg)
Pyridine	8270	GC/MS	G Glass	4°C	14	[a]	[a]
Quinoline	8270	GC/MS	G Glass	4°C	14	[a]	[a]
Benzenethiole	8270	GC/MS	G Glass	4°C	14	10.0	[a]
Phenol	8270	GC/MS	G Glass	4°C	14	10.0	660.0
Bis(2-Ethylhexyl)phthalate[b]	8270	GC/MS	G Glass	4°C	14	2.5	1675.0
Dibenz(a,j)acridine[b]	8270	GC/MS	G Glass	4°C	14	10.0	[a]
Dibenz(a,h)-anthracene	8270	GC/MS	G Glass	4°C	14	10.0	660.0
Dichlorobenzene[b]	8270	GC/MS	G Glass	4°C	14	10.0	660.0
Methyl Naphthalene	8270	GC/MS	G Glass	4°C	14	10.0	660.0
2,4-Dimethylphenol	8270	GC/MS	G Glass	4°C	14	10.0	660.0
2,4-Dinitrophenol[b]	8270	GC/MS	G Glass	4°C	14	50.0	3300.0
Indene[c]	-	-	-	-	-	-	-
Benzo(j)fluoranthene	8270	GC/MS	G Glass	4°C	14	[a]	[a]
2-Chlorophenol	8270	GC/MS	G Glass	4°C	14	10.0	660.0
2,4,6-Trichlorophenol	8270	GC/MS	G Glass	4°C	14	10.0	660.0
Di-n-Butyl Phthalate	8270	GC/MS	G Glass	4°C	14	[a]	[a]
Benzyl Alcohol[b]	8270	GC/MS	G Glass	4°C	14	20.0	1300.0
Methyl Chrysene	8270	GC/MS	G Glass	4°C	14	10.0	660.0

[a]SW-846 detection limits not established.
[b]Additional constituents.
[c]Use a non-SW-846 method to analyze for indene because there is no established SW-846 method.
μg/L = microgram per liter
μg/kg = microgram per kilogram
GC/MS = gas chromatography/mass spectrometry

Table 3C. Modified Skinner List ICP 6010 Metals

Parameter	EPA Method SW-846	Description	Container	Preservative	Holding Time/Days	Liquid Detection Limit (μg/L)	Soil Detection Limit (μg/kg)
Antimony	6010	ICP-AES	Glass	4°C	180	32.0	[a]
Arsenic	6010	ICP-AES	Glass	4°C	180	53.0	[a]
Barium	6010	ICP-AES	Glass	4°C	180	2.0	[a]
Beryllium	6010	ICP-AES	Glass	4°C	180	0.3	[a]
Cadmium	6010	ICP-AES	Glass	4°C	180	4.0	[a]
Chromium	6010	ICP-AES	Glass	4°C	180	7.0	[a]
Cobalt	6010	ICP-AES	Glass	4°C	180	7.0	[a]
Lead	6010	ICP-AES	Glass	4°C	180	42.0	[a]
Nickel	6010	ICP-AES	Glass	4°C	180	15.0	[a]
Selenium	6010	ICP-AES	Glass	4°C	180	75.0	[a]
Vanadium	6010	ICP-AES	Glass	4°C	180	8.0	[a]

[a]Detection limits for soil samples are dependent on matrices and individual instrument performance.
μg/L = microgram per liter
μg/kg = microgram per kilogram
ICP-AES = inductively coupled plasma - atomic emission spectroscopy

Table 3D. Modified Skinner List CVAA 7471 Mercury

Parameter	EPA Method SW-846	Description	Container	Preservative	Holding Time/Days	Liquid Detection Limit (μg/L)	Soil Detection Limit (μg/kg)
Mercury	7471	CVAA	Glass	4°C	28	0.2	0.2

μg/L = microgram per liter
μg/kg = microgram per kilogram
CVAA = cold vapor atomic absorption

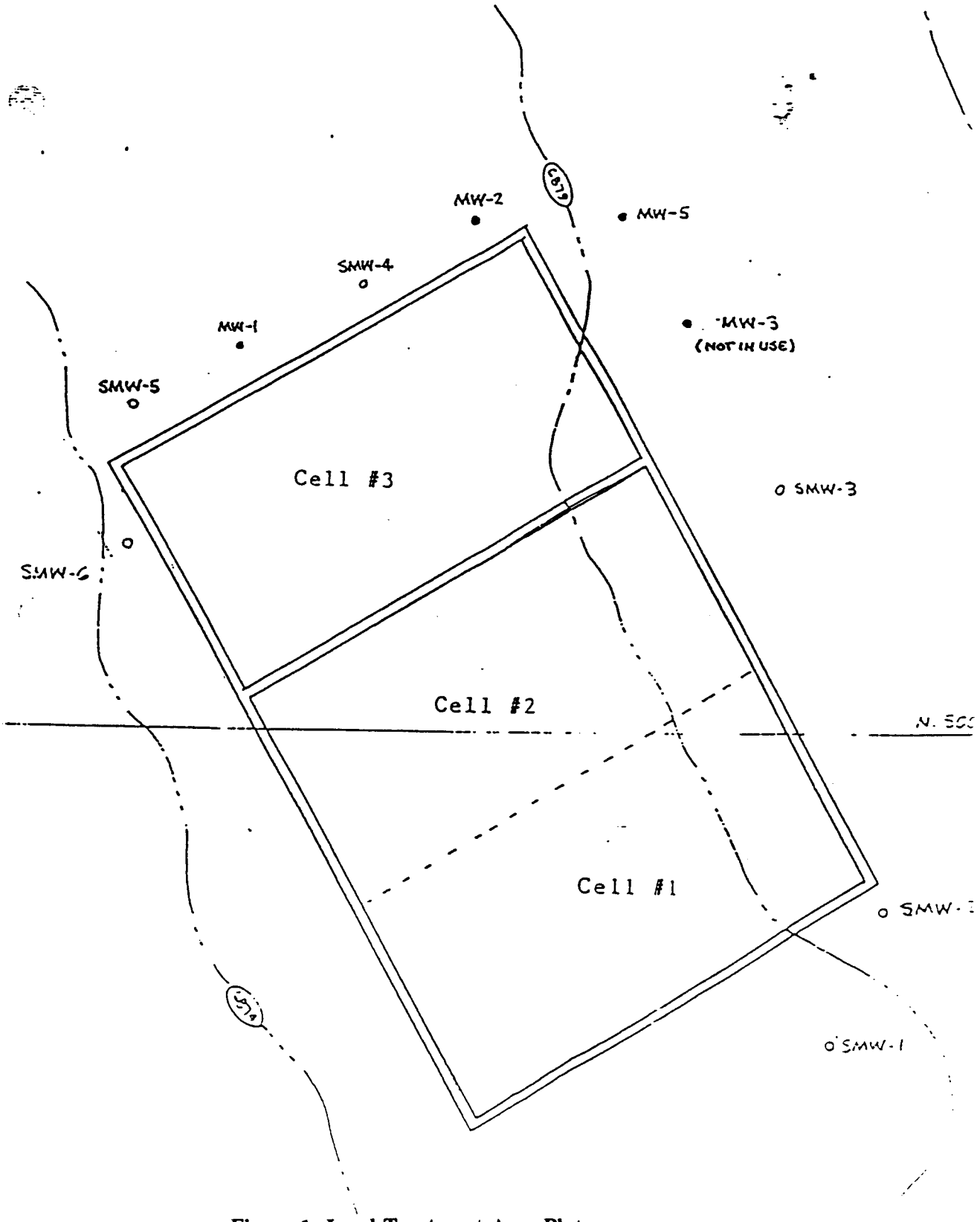

Figure 1 Land Treatment Area Plot

APPENDIX 1

Components of an Adequate Laboratory Quality Assurance/Quality Control Plan

New Mexico Hazardous and Radioactive Materials Bureau
Technical Support Group
(505) 827-4300

1. All constituents identified above the Method Detection Limit (MDL) must be reported.

   The MDL is defined as the estimated concentration at which the signal generated by a known constituent is three standard deviations above the signal generated by a blank, and represents the 99 percent confidence level that the constituent does exist in the sample.

2. The "tune" of the GC/MS for volatile organic constituents must be checked and adjusted (if necessary) each 12-hour shift by purging 50 mg of a 4-bromofluorobenzene (BFB) standard. The resultant mass spectra must meet the criteria given in Table 1 before sample analysis proceeds.

3. The "tune" of the GC/MS for semivolatile organic constituents must be checked and adjusted (if necessary) each 12-hour shift by injecting 50 mg of a Decafluorotriphenylphosphine (DFTPP) standard. The resultant mass spectra must meet the criteria given in Table 2 before analysis proceeds.

4. For every 20 samples, perform and report:

   a. Duplicate spike for organics
   b. Duplicate sample analysis for inorganics
   c. Reagent blank, results provided for organic work
   d. Surrogate and spike recoveries (see item 10)
   e. One check sample at or near the Practical Quantitation Limit for a subset of the parameters

5. Analytical results must not be "blank corrected."

6. Any deviation from EPA-approved methodology must have a written Standard Operating Procedure and NMED approval.

7. Detection limits must be generally in line with those listed in Appendix IX of §264.

8. The laboratory must document:

   a. That all samples were extracted, distilled, digested, or prepared (if appropriate) and analyzed within specified holding times.

   b. That if a sample for volatile analysis is received with headspace, this is reported.

   c. The date of sample receipt, extraction and analysis for each sample.

   d. Any problems or anomalies with the analysis should be documented.

   e. That all solids were analyzed dry or that the reported results are corrected to reflect dry weight equivalence.

9. The name and signature of the lab manager must appear on each report.

10. The reported surrogate and spike recoveries must fall within: 1) the historical (statistically based) acceptance limits, generated at the laboratory or, 2) the limits tabulated by the appropriate method from the current edition of SW-846, whichever limit is narrower. The actual historical recoveries must be submitted to HRMB with the analysis.

Table 1
BFB Key Ions and Abundance Criteria

Mass	Ion Abundance Criteria
50	15.0 - 40.0 percent of the base peak
75	30.0 - 60.0 percent of the base peak
95	base peak, 100 percent relative abundance
96	5.0 - 9.0 percent of the base peak
173	less than 2.0 percent of mass 174
174	greater than 50.0 percent of the base peak
175	5.0 - 9.0 percent of mass 174
176	greater than 95.0 percent but less than 101.0 percent of mass 174
177	5.0 - 9.0 percent of mass 176

Table 2
DFTBB Key Ions and Abundance Criteria

Mass	Ion Abundance Criteria
51	30.0 - 60.0 percent of mass 198
68	less than 2.0 percent of mass 69
70	less than 2.0 percent of mass 69
127	40.0 - 60.0 percent of mass 198
197	less than 1.0 percent of mass 198
198	base peak, 100 percent relative abundance
199	5.0 - 9.0 percent of mass 198
275	10.0 - 30.0 percent of mass 198
365	greater than 1.00 percent of mass 198
441	present but less than mass 443
442	greater than 40.0 percent of mass 198
443	17.0 - 23.0 percent of mass 442