Giant Red 1995.

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MEMORANDUM

TO: Michael Chacón, RCRA Permitting Program

THROUGH: Ron Kern, RCRA Technical Compliance Program Manager RAK

FROM: Bob Sweeney, RCRA Technical Compliance Program

DATE: August 31, 1995

SUBJECT: **Closure/Contingency Post-Closure Plan for the Land Treatment Unit at Giant Refining Company's Ciniza Refinery**

The RCRA Technical Compliance Program (TCP) was requested by the RCRA Permitting Program to review the October 1994 document **"Closure/Contingency Post-Closure Plan"** for the Ciniza refining facility of Giant Refining Company (GRC), Gallup, New Mexico. The document was submitted to comply with the Hazardous Waste Facility Permit (permit number NMD 000333211-2) issued for the Land Treatment Unit by the New Mexico Environment Department on November 4, 1988. TCP technical comments and recommendations are included on the attached pages (Attachment I).

cc (with attachment):
Barbara Hoditschek, RCRA Permitting Program Manager
→ GRC 1995 Red File
RCRA TCP GRC File

5. Section 1.2.2.1, 3rd paragraph. **("...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.

6. Section 1.2.2.2, 4th paragraph. **("...soil core samples...will be...analyzed for the constituents in Table 1.")** The comments for Item 4 above apply here also.

7. Section 1.2.2.2, 4th paragraph. **("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.

8. Section 1.2.2.2, 7th paragraph. **("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.

9. Section 1.2.2.3, 2nd paragraph. **("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.

10. Section 1.2.2.3, 6th paragraph. **("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?

11. Section 1.2.2.5, 2nd paragraph. **("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.

12. Section 1.2.2.5, 3rd paragraph. **("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

CLOSURE/CONTINGENCY

POST-CLOSURE PLAN

GIANT REFINING COMPANY

CINIZA REFINERY

PERMIT NMD000333211-2

OCTOBER, 1994

PREPARED BY:

LYNN SHELTON
SENIOR ENVIRONMENTAL COORDINATOR

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ATTACHMENTS:

Attachment 1 LTA Characterization Plan

Attachment 2 Sampling and Analysis Plan

The following **Closure/Contingency Post-Closure Plan** for Giant Refining Company - Ciniza's **RCRA Land Treatment Area (LTA)** satisfies the requirements of the New Mexico hazardous waste management regulations.

1. GENERAL CLOSURE REQUIREMENTS

1.1 Inventory of Wastes

Records of waste analysis and waste inventory, as residual, as well as the operational log book which documents any activity within the **LTA**, will be maintained at the facility during **Closure/Contingency Post-Closure Plan** until Giant is released of financial obligation by the director.

1.2 Closure Plan

The closure plan consists of two phases: in-situ treatment and monitoring of residual waste and establishment of a vegetative cover.

In-situ treatment of residual waste will continue upon approval of the **Closure/Contingency Post-Closure Plan** and will continue until 90 to 150 days have elapsed, depending on whether the residual waste has degraded sufficiently by the elapse of 90 days, and if not, in-situ treatment will continue until 150 days has elapsed.

A biological test, such as **Microtox**, will be used to determine phytotoxicity at the end of the 90 days.

Once it has been determined that sufficient degradation has occurred, and the **LTA** surface will not be toxic to the establishment of a final vegetative cover, the **LTA** surface can be prepared for seeding and, if necessary, post-closure care.

1.2.1 Objectives of the Closure Plan

1.2.1.1 Control of Migration of Hazardous Constituents to Groundwater

Three concurrent procedures to prevent the migration of hazardous constituents to groundwater will be utilized during closure.

The first two procedures concern Unsaturated Zone Monitoring. Soil core and soil pore moisture sampling as outlined in their respective sections will be performed to detect hazardous constituents and waste residue. Analysis of soil cores and soil pore liquids will be used to determine the effectiveness of treatment in the **Zone of Incorporation** during the closure period.

The third procedure involves groundwater monitoring during closure. This procedure will essentially be the same as the procedure during the operating life of the **LTA**, except for the frequency and the change to the Modified Skinner List of organic and metal constituents presented in Table 1 of this plan. The details of the groundwater monitoring procedure are outlined in that respective section.

There are two structures to prevent the migration of contaminants to groundwater. The first is the dike surrounding the **LTA**, as discussed in the section "Control of Release of Contaminated Run-Off to Surface Waters". Containment of run-off will act to prevent potentially contaminated water from flowing into contiguous areas that are not being monitored. The second structure is the vegetative cover to be established at the end of the closure period. During the time that the vegetative cover is being established, which is outlined in the section "Placement of the Final Cover", the amount of irrigation water and precipitation that can percolate into the treatment zone and act as a carrier for hazardous waste constituent migration will decrease with the spread of the cover. The amount of reduction is proportional to the increase in vegetative density. A dense vegetative cover will act to decrease the vertical permeability at the surface of the **Zone of Incorporation** and reduce percolation. It will also aid in the immobilization of hazardous constituents as a function of their affinity to soil particles and root systems. Additionally, a vegetative cover will significantly reduce windborne dispersion of constituents and wind erosion.

1.2.1.2 Control of Release of Contaminated Run-Off to Surface Waters

During closure, potentially contaminated surface run-off will be controlled by the existing dike around the perimeter of the **LTA**. The dike should contain approximately three times the annual rainfall for the area (11 inches) in volume assuming the average dike

height of 2.0 feet and approximately 7.2 acres of surface area. Assuming that a 24 hour, 100 year storm event would not exceed the annual rainfall of 11 inches, the dike should be able to control run-off from the **LTA** during any expected storm event. The closure coordinator(s) will inspect the dikes and repair any erosion that has occurred. Additionally, the dikes will be maintained at the minimum height of 2.0 feet above the surface of the **LTA** to insure that sufficient capacity within the dike is available to control run-off during closure.

1.2.1.3 Control of Airborne Particulates

To prevent soil desiccation and consequent dust generation during the closure period, the soil moisture will be maintained by irrigation. Measurements of soil moisture content will be made with the scheduled sampling events (Table 2). The amount of irrigation can be estimated assuming that 70% of available soil water content is approximately 307,800 gallons (7.2 acres, 2 foot **Zone of Incorporation**) or 3 inches of collected water in any open container placed under an aerial spray pattern. The closure coordinator(s) will visually inspect the LTA on a weekly basis during the duration of closure to insure that soil desiccation is not occurring. Tilling of the **Zone of Incorporation** will not be conducted during closure if the soil inspection indicates soil desiccation to a depth greater than 3 inches or when soil moisture is insufficient to prevent dust generation.

1.2.1.4 Compliance With Food-Chain Crop Restrictions

Giant will not allow the cultivation of food-chain crops on the **LTA** during closure or post-closure 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 director). Appropriate Notice of Deed in accordance with HWMR-6, Part V, Section 264.119, will be filed with McKinley County, New Mexico.

1.2.2 Requirements For Land Treatment During Closure Period

1.2.2.1 Lysimeter Monitoring

The locations of the lysimeters are shown in Figure 1. The lysimeters are Model 1920 Pressure-Vacuum Soil Water Samplers. In the unlikely event that water is recovered from a lysimeter cup, the water is received by a clean glass Erlenmeyer flask connected by neoprene tubing to the lysimeter sample port. The sample is then transferred to an appropriate shipping container, properly preserved, chilled to 4° Celsius, and shipped to the analytical lab. The total volume of water collected is recorded. The sample is analyzed for the constituents shown in Table 1 of the **Closure/Contingency Post-Closure Plan.**

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

1. Once prior to closure
2. 30 days after closure
3. 90 days after closure

If no samples are retrieved or if a sample is retrieved but has no detectable constituents, then soil pore monitoring will be discontinued.

No compositing of samples between lysimeter arrays is allowed.

1.2.2.2 Soil Core Monitoring

During closure, the termination of in-situ treatment will be determined by the concentration of hazardous constituents in the **Zone of Incorporation.**

Soil core samples will be collected in a manner consistent with the "Characterization Plan Attachment I, Sampling and Analysis Plan, October 1994" which is attached.

Soil core samples will be collected as a requirement of this **Closure/Post-Closure Plan** (30 and 90 day sampling) in addition to any other sampling that was required for characterization.

Two soil core samples per cell will be taken from the ZOI and analyzed for the constituents in Table 1. A

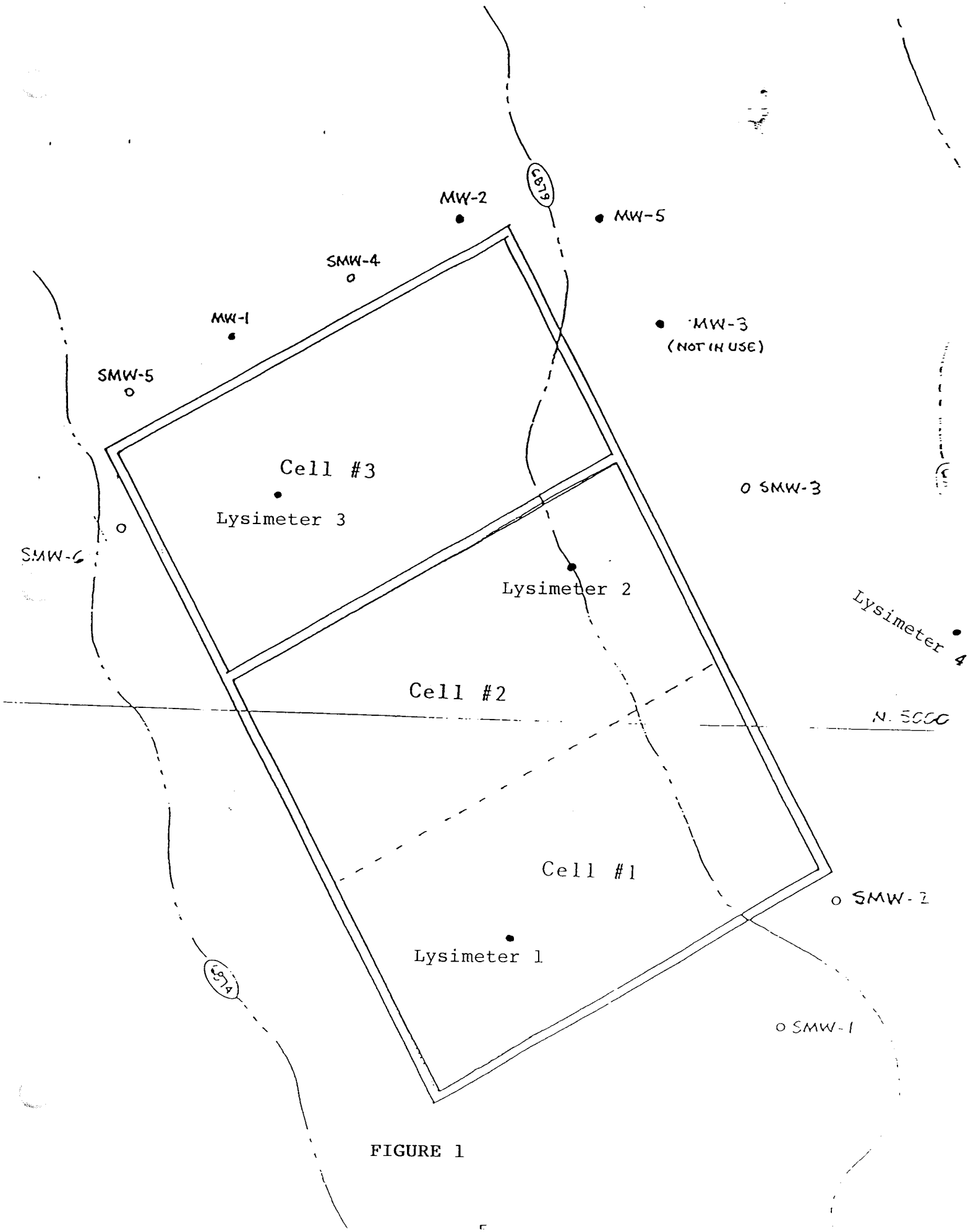
MW-2
MW-5
SMW-4
MW-1
MW-3
(NOT IN USE)
SMW-5
Cell #3
Lysimeter 3
SMW-3
SMW-6
Lysimeter 2
Lysimeter 4
Cell #2
N. 5000
Cell #1
SMW-2
Lysimeter 1
SMW-1

FIGURE 1

coordinate grid overlaying the **LTA** will be used to select samples. Sampling locations will be established by using a random numbers table.

The frequency of soil core sampling is shown in Table 2. Results of the analysis in Table 2 will determine the adjustments to soil moisture, nutrient levels, and pH necessary to optimize microbial degradation. In the event that hazardous constituents exceed the corrective action levels (Table 3) at the 90 day sampling event, the **LTA** will be tilled and sampling will be repeated at 150 days after acceptance of this plan.

If metal concentrations are above corrective action 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. Organic constituents must be sufficiently low to allow tilling into potentially anaerobic conditions.

If in-situ treatment has degraded hazardous constituents to corrective action 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 corrective action levels.

When in-situ treatment is considered complete with levels of hazardous constituents below corrective action levels and a biological test, such as Microtox, has indicated that the soil is not phytotoxic, a vegetative cover will be established using plant seed described in Table 5.

Soil samples taken in the **ZOI** during closure will be obtained with a hand auger, using the sampling protocol outlined in the "Characterization Plan, Attachment I, Sampling and Analysis Plan, October, 1994". After placing into a cooler chilled to approximately 4°C, the samples will be shipped to the analytical laboratory for analysis. Each sample will be given a unique identification number that includes the location and depth. All core holes will be backfilled with bentonite.

1.2.2.3 Placement of Final Cover

The second phase of the closure plan is the establishment of a vegetative cover. The site must be treated until it is determined by analysis that the soil conditions in the

ZOI are conducive to plant growth. The following steps were or will be taken to insure the rapid establishment of a low maintenance vegetative cover.

After Giant made the decision to discontinue application of non-hazardous waste (hazardous waste application was discontinued in November, 1990), Cells #1 and #2 were leveled in two tiers to insure optimum distribution of precipitation. Cell #3 was graded to a 1-2° dip to the west, but will likely be leveled in the same manner as Cells #1 and #2. The benefits of this leveling is the optimum distribution of nutrients and precipitation, as well as enhanced control of percolation due to the absence of ponding of precipitation.

At the completion of the 90 day sampling and analysis, the following conditions will be evaluated to determine the suitability of seeding a vegetative cover:

a) pH - should be maintained at 6.0 - 8.0

b) Nitrogen and Organic Matter - Nitrogen fertilizer requirements are directly proportional to the amount of organic matter present and are dependent on the sandiness of the soil. If organic matter is of a high percentage in the soil composition at the time of closure, it is possible that Giant may need several applications of nitrogen to maintain an adequate nitrogen level.

c) Phosphorous and Potassium Levels - Phosphorous levels are dependent on pH. At 6.0 - 8.0 pH, 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.

Determination of soil conditions will be made by chemical analysis. Initially, a ratio of carbon: nitrogen:phosphorous will be maintained at 100:10:1, with a moisture content of 20-25%.

The species of grasses to be sewn are listed in Table 4. 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.

After considering the appropriate seeding time, and

making the above evaluations, 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. When the correct seeding time is reached, seed bed preparations will commence. The **LTA** surface will be tilled to destroy any existing vegetation that may detrimentally compete with the grasses and to create a favorable soil density.

Three factors must be considered for seeding. They are:

1) seeding method
2) seeding rate
3) seeding depth

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

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

Seeding Depth: Seeding depth will be .25 to .50 inches.

After seeding for the vegetative cover, Cells #1, #2, and #3 will be fenced with a five strand barbed wire fence, with a lockable metal gate, placed immediately inside the containment dike.

Records of analytical data and closure activities will be kept at the facility until Giant is released from financial responsibility by the Director.

1.2.2.4 Maintenance of Run-Off Management System

The containment dike system surrounding the **LTA** must be inspected weekly to assure prevention of run-off during a precipitation event. The dike will be inspected for erosion, animal burrows or any other disturbance of the dike geometry. An inspection form (Figure 2) will be completed weekly during closure and remain on file at the facility until Giant is released from financial responsibility by the Director. If the integrity of the dike is compromised, the closure coordinator(s) will see that corrective action is taken promptly.

FIGURE 2

RCRA LAND TREATMENT UNIT

WEEKLY CLOSURE INSPECTION

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 _____

1.2.2.5 Groundwater Monitoring

Groundwater monitoring will continue during and after closure. The 1994 semi-annual groundwater sampling event will document the presence or absence of contamination in the Ciniza sands and in the Sonsela aquifer.

After closure, the shallow monitor wells (SMW-3, SMW-4, SMW-5, and SMW-6), also known as the early detection wells, will be monitored semi-annually for five years, annually for the second five year period and once in the fifteenth year. All analyses will be for Table 5 constituents.

If no hazardous constituents are detected in the shallow monitor wells during the fifteen year period after closure, groundwater monitoring will be discontinued. If hazardous constituents are ever detected in the shallow monitor wells, Giant will notify the Director and will commence sampling of groundwater from the Sonsela aquifer, for constituents in Table 1, following the same schedule as for the shallow monitoring wells. Additionally, Giant will propose clean-up activities for the shallow monitoring wells. Wells in the Sonsela aquifer that will be sampled are MW-1, MW-2, MW-4, MW-5, and OW-11 (background well).

1.3 Closure Schedule

Year of Closure - 1994

Day 1	Acceptance of Closure Plan
+ 30	Soil and Soil Pore Moisture Sampling
+ 90	Soil and Soil Pore Moisture Sampling
+120	Final Tilling of Soil
	Commence Placement of Vegetative Cover (If Appropriate)
	Decontamination of Tilling Equipment
	Fence LTA
+150	Soil Sampling (If Needed)

+210	Submit Certification of Closure to NMED
	Prepare Survey Plot and Submit to McKinley County Clerk and NMED

1.4 Time Allowed For Closure

Giant will complete in-situ treatment of the **ZOI** within 90 days of acceptance of this plan, unless 150 days is necessary for further degradation of hazardous constituents.

Giant will complete closure within 180 days of acceptance of this plan, unless an extension is granted by the Director. Giant must justify an extension by demonstrating that:

a) Giant has taken all steps to prevent threats to human health and the environment; and

b) the potential for significant in-situ treatment of hazardous constituents still exists and it would be technically inappropriate to establish a vegetative cover. (This is a possible issue due to seasonal weather concerns.)

1.5 Certification of Closure

Giant will submit certification of closure to the Director of the Environment Department or his/her designee within 60 days of completion of the closure and within 60 days of completion of final closure of the entire facility.

The certification will state that the **LTA** has been closed in accordance with the approved closure plan. The certification will be sent by registered mail and signed by an independent registered professional engineer (PE) or an independent qualified soil scientist.

Giant will furnish documentation to support the engineer's or soil scientist's certification upon request until Giant has been released from financial assurance requirements.

1.6 Survey Plat

A survey plat performed by a professional land surveyor will indicate the location and dimensions of the **LTA** with respect to permanently surveyed bench marks. The survey plat will

contain a note, prominently displayed, stating that disturbance of the closed hazardous waste facility is restricted in accordance with HWMR-5, Part V, Subpart G.

1.7 Closure Cost Estimate

The closure costs for the LTA are estimated at $68,916. An overview of individual tasks is presented below:

Activity	Estimated Time and Materials	Estimated Cost
Till Land Farm	$(280 \times 3)^3$	$2,520
Add Soil Amendments	352,000 sq/ft @ .02 sq/ft	$7,040
Soil Pore Liquid Sampling Within 30 Days	4 Samples @ $1,200 ea	4,800
Within 90 Days	4 Samples @ $1,200 ea	4,800
Soil Sampling - ZOI Within 30 Days	3 @ $1,450 ea	4,350
Within 90 Days	3 @ $1,450 ea	4,350
Within 150 Days	3 @ $1,450	4,350
Biological Test	8 @ $300 ea	2,400
Establish Vegetative Cover:		
Level Cell #3	2.4 acres @ $950	2,280
Plant Seed	7.2 acres @ $750	5,400
Water	1140 Mgal @ $1 gal	1,140
Install Fence	2400 ft @ $5.25 ft	12,600

Prepare Certification:		
Certify Closure	8 hrs @ $125 ea	1,000
Notice in Deed	8 hrs @ $150 ea	400
Total Task		**$57,430**
Overhead		**5,743**
Contingency		**5,743**
TOTAL		**$68,916**

TABLE 1
MODIFIED SKINNER LIST
8240 VOLATILE ORGANICS

PARAMETER	EPA METHOD SW-846	DESCRIPTION	CONTAINER	PRESERVATIVE	HOLDING TIME/DAYS	DETECTION LIMIT	UNITS
Benzene	8240	GC/MS	G GLASS	4°C	14	5.0	ug/kg
2-Butanone (MEK)	8240	GC/MS	G GLASS	4°C	14	10.0	ug/kg
Carbon Disulfide	8240	GC/MS	G GLASS	4°C	14	5.0	ug/kg
Chlorobenzene	8240	GC/MS	G GLASS	4°C	14	5.0	ug/kg
Chloroform	8240	GC/MS	G GLASS	4°C	14	5.0	ug/kg
1,4-Dioxane	8240	GC/MS	G GLASS	4°C	14	500	ug/kg
Ethylbenzene	8240	GC/MS	G GLASS	4°C	14	5.0	ug/kg
Styrene	8240	GC/MS	G GLASS	4°C	14	5.0	ug/kg
1,1,2,2-Tetrachloroethane *	8240	GC/MS	G GLASS	4°C	14	5.0	ug/kg
Tetrachloroethene *	8240	GC/MS	G GLASS	4°C	14	5.0	ug/kg
Toluene	8240	GC/MS	G GLASS	4°C	14	5.0	ug/kg
1,1,1-Trichloroethane	8240	GC/MS	G GLASS	4°C	14	5.0	ug/kg
Ethylene Dibromide *	8240	GC/MS	G GLASS	4°C	14	5.0	ug/kg
Acetone	8240	GC/MS	G GLASS	4°C	14	5.0	ug/kg
Dichloromethane *	8240	GC/MS	G GLASS	4°C	14	5.0	ug/kg
Benzyl Alcohol *	8240	GC/MS	G GLASS	4°C	14	5.0	ug/kg

TABLE 1 (CONT'D)
MODIFIED SKINNER LIST
8270 SEMI-VOLATILE ORGANICS

PARAMETER	EPA METHOD SW-846	DESCRIPTION	CONTAINER	PRESERVATIVE	HOLDING TIME/DAYS	DETECTION LIMIT	UNITS
Anthracene	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
Benzo(A)Anthracene	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
Benzo(B)Fluoranthene	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
Benzo(K)Fluoranthene	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
Benzo(A)Pyrene	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
Butyl Benzyl Phthalate	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
Chrysene	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
Dibenz(A,H)Anthracene	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
Diethyl Phthalate	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
7,12-Dimethylbenz (A)-^Anthracene	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
Dimethyl Phthalate	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
Di-N-Octyl Phthalate	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
Fluoranthene	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
Indeno(1,2,3-CD)Pyrene	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
1-Methylnaphthalene	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
2-Methylphenol (Cresol)	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
3/ thylphenol (Cresol)	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
N halene	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
4-Nitrophenol	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
Phenanthrene	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
Pyrene	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
Pyridine	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
Quinoline	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
Benzenethiole	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
Phenol	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
Bis(2-Ethylhexyl)phthalate *	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
Dibenz(a,h)acridine *	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
Dichlorobenzene *	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
Methyl Naphthalene *	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
2,4-Dimethylphenol	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
2,4-Dinitrophenol *	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg

* Additional Constituents

Note: This list is a modification of Table 4, Part B Permit, Attachment F, Closure and Post-Closure Plan

TABLE 1 (CONT'D)
MODIFIED SKINNER LIST
METALS
ICP 6010

PARAMETER	EPA METHOD SW-846	DESCRIPTION	CONTAINER	PRESERVATIVE
Chromium	6010	-	GLASS	4°C
Lead	6010	-	GLASS	4°C

TABLE 2

SOIL SAMPLING PROGRAM

ZOI

Parameters	Event 1[1]	Event 1 + 60 Days[1]
pH	*	*
Oil %	*	*
Moisture %	*	*
Total Nitrogen	*	*
Total Phosphorous	*	*
Table 1 Constituents	*	**

** = Not required if Event 1 data shows levels below standards.

(1) Event 1 must take place within 30 days of acceptance of this plan and again 60 days later (90 days after acceptance of this plan).

TABLE 3

Giant will remediate hazardous constituents to or below the corrective action levels listed in the U.S. EPA's current Risk Assessment Guidance for Superfund.

Giant has not received that list, but will submit it for inclusion in this space as soon as possible.

TABLE 4

REVEGETATION SEED MIXTURE

	Pls/Ac*
Blue Grama, Bouteloua gracilis "Lovington"	2
Sideoats Grams, Bouteloua curtipendula "El Reno"	4
Buffalo Grass, Buchloeda tyloides "Texoka"	5
Alkali Sacaton, Sporbolus airoides	.5

* Pounds of Pure Live Seed Per Acre

TABLE 5

GROUNDWATER MONITORING CONSTITUENTS

pH *

Conductivity *

Total Organic Carbon **

Total Organic Halides **

Total Chrome

Total Lead

Table 1 Constituents

* Four Replicates

** Two Replicates

2.0 CONTINGENCY POST-CLOSURE REQUIREMENTS

2.1 Explanation of Site Conditions and Conditions Requiring Implementation of the Contingency Post-Closure Plan

Because Giant fully expects a clean closure to be warranted based on the analytical results of the LTA characterization, it is highly unlikely that any post-closure activities will be performed. Long term monitoring of the shallow monitoring wells (SMW-3, SMW-4, SMW-5, and SMW-6) will continue as a requirement of closure.

In the event that hazardous constituents are detected in the shallow monitoring wells, notification will be made to the Director and, if it is found to be necessary, the following contingency post-closure activities will commence.

2.2 Requirements for Post-Closure Activities

2.2.1 Groundwater Monitoring

If the contingency post-closure plan is implemented, Giant will perform quarterly groundwater sampling of the shallow monitor wells and annual groundwater sampling of the monitor wells (MW-1, MW-2, MW-4, and MW-5) to determine the concentrations of hazardous constituents and their migration path. This sampling will continue until it has been shown that there is no additional migration, that the contamination has been remediated, or that Giant has been released from this sampling obligation by the Director or his/her designee.

Analysis of groundwater under the contingency post-closure plan will be for those constituents listed in Table 1 of the closure plan.

2.2.2 Soil Sampling

If the contingency post-closure plan is implemented, Giant will perform a transport and fate study of residual hazardous constituents in the Vadose Zone beneath the LTA. This study will indicate any remediation activities necessary to remediate hazardous constituent migration.

It is highly unlikely that such a scenario will occur due to the low levels of constituents that will remain in the

LTA after closure. However, a transport and fate study will be useful in performing a Risk Assessment, which is described later.

Indications of surficial contamination will be death of plant growth, leaching, and other visual means. In the event of surficial contamination, the ZOI will be sampled using the protocol for soil sampling included in the closure plan.

2.2.3 Maintenance of Access Restrictions

To insure that the surface of the LTA remains undisturbed during closure and beyond, the five strand barbed wire fence will be maintained along with the lockable metal swing gate so as to restrict access to the LTA.

It will be the responsibility of the closure coordinator(s) to insure that the gates are locked at all times when authorized personnel are not servicing the LTA.

2.2.4 Inspection and Maintenance Procedures

The closure coordinator(s) will supervise inspection and maintenance activities. The inspection frequencies and maintenance procedures are listed below.

The vegetative cover will be inspected, mowed, or replaced as necessary. Erosion damage will be repaired immediately by backfilling. Fertilizer will be applied annually if needed. Herbicides and pesticides will not be used, so that the possibility of contamination to the soil surface will not occur.

The containment dike will be inspected to insure that no erosion has taken place or that burrowing animals have not compromised the integrity of the containment dike.

The warning signs will be inspected to insure that adequate warning is made to all personnel that come into the LTA area.

The groundwater monitoring wells (listed in Section 2.2.1 of this plan) will be inspected for: locked caps, concrete pad around casing, and general well condition.

Soil pore sampling stations (lysimeters) will be

inspected annually for structural integrity.

All inspections and maintenance will be documented in enough detail to determine compliance. The documentation will be kept on file at the facility or at some location where it can be examined conveniently.

2.2.5 Risk Assessment

If the contingency post-closure plan is implemented, Giant will conduct a baseline risk assessment for the facility using EPA's current Risk Assessment Guidance for Superfund.

2.3 Post-Closure Use of Property

Giant will not allow post-closure use of the **LTA**. The integrity of the containment dike; fencing, gates and locks, and vegetative cover must remain intact for the duration of post-closure.

2.4 Length of Post-Closure Period

The contingency post-closure period will continue until remediation is complete and Giant is released from post-closure requirements by the Director or his/her designee.

2.5 Post-Closure Notices

Giant will submit, within 60 days of closure, to the Mckinley County zoning authority, and the Director, a record of the type and quantity of hazardous waste treated in the **LTA**.

Giant will, within 60 days of closure, record a notation in the deed to the **LTA** property that:

a) the land has been used to manage hazardous waste;

b) its use is restricted under HWMR-6, Part V, Subpart G; and

c) the survey plat and record of waste disposal required by HWMR-6, Part V, Section 264.119 has been filed with the McKinley County zoning authority and with the Director.

Giant will submit to the Director a signed certification specifying that the notation in the deed has been recorded in accordance with HWMR-6, Part V, Section 264.119, together with a copy of the document in which the notation has been placed.

2.6 Certification of Post-Closure

Giant will, within 60 days after completion of contingency post-closure care, submit a letter of certification, by registered mail, to the Director. The letter of certification will state that the post-closure activities were performed in accordance with the approved contingency post-closure plan. The signatures of the closure coordinator and the independent certified registered professional engineer will appear on the letter of certification.

The certified registered professional engineer will provide, upon request by NMED or USEPA, documentation to support certification, until Giant is released from financial assurance requirements.

2.7 Post-Closure Cost Estimate

Post-Closure Activity	Estimated Costs
Conduct Site Inspections Semi-Annually $20 x 15 yrs	$ 300
Maintain Security Devices (Fence Repair) $100 x 15 yrs	1,500
Maintain Run-On/Run-Off Controls (Maintain Dikes) $1,000 x 15 yrs	15,000
Risk Assessment	5,000
Groundwater Sampling (5 Wells @ $800 x 15 yrs)	60,000
Subtotal	$81,800
Overhead	8,180
Contingency	8,180
TOTAL	$98,160

APPENDIX ATTACHMENT 1

LAND TREATMENT UNIT CHARACTERIZATION

LAND TREATMENT UNIT CHARACTERIZATION

GIANT REFINING COMPANY
CINIZA

JUNE OCTOBER, 1994

PREPARED BY:

LYNN SHELTON

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GIANT REFINING COMPANY - CINIZA
LAND TREATMENT UNIT
CHARACTERIZATION PLAN

Introduction:

A requirement of closure of the **Land Treatment Unit** (LTU) 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 Unit, November 10, 1993).~~

Characterization of organic constituents (Table 3) must be made in the **Zone of Incorporation (ZOI)**, **within the Treatment Zone**, and at depths below seven and one-half feet. Chromium and lead migration **Below the Treatment Zone (BTZ)** have been adequately characterized (report on the special sampling activities at the Land Treatment Unit, 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.

Coring:

Giant proposes to core twelve additional points in Cells #1, 2, and 3 to a total depth of ~~ten~~ twenty five feet~~.~~, with the fifteen, twenty, and twenty five feet samples held in archive. If organic constituents are detected in the ten foot sample, then the fifteen 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.

Giant shall randomly select four coring points in Cell #1, four points in Cell #2 and four points in Cell #3 as this exceeds the requirements of the Part B Permit, Attachment F, Closure and Post-Closure Plan, Section 1.2.2.1.2., Soil Core Monitoring. A total of twelve coring points in Cells #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 the Treatment Zone and the BTZ.**

Sampling and Analysis:

Soil samples will be taken, at predetermined depths, in Cells #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 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.

Samples taken from the BTZ interval will be analyzed for the constituents shown in Table 3, which includes the modified skinner list as well as 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).

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 unit 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.

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 or variation, which is 100% 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% confidence interval. Data from the background plot of the 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 Land Treatment Unit, November, 1993).~~

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
(1)		(2)		(3)		(4)		(5)

(1) LTA = Land Treatment Area (Unit)
(2) C = Characterization
(3) 1 = Core Number
(4) 10.0 = Depth of Sample (Feet)
(5) 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.

Closure:

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

1) Discontinuance of waste application to LTU
2) Characterization of hazardous constituents within the **ZOI, Treatment Zone and BTZ** through soil and soil pore moisture sampling
3) Remediation, if necessary
4) Documentation of degradation within the ZOI
5) Establish a vegetative cover
6) 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 was discontinued on February 19, 1994.

As indicated in the Part B Permit, Attachment F, Closure/Post-Closure, Sections 1.2.2.1.1. and 1.2.2.1.2, lysimeter and soil sampling will occur 30 days after last waste application and again 90 days after last waste application. Giant will use the time frame of acceptance of this plan plus 30 or 90 days. 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 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 on a semi-annual basis for five 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 at that time, groundwater monitoring well be discontinued.

Remediation of the Land Treatment Unit 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.

Risk Assessment:

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

1) Degree to which human health, safety, or welfare may be affected by exposure to chemical constituents

2) Effects of contamination of the environment

3) Site specific characteristics

4) Current or future beneficial uses of the affected land and subsurface resources

5) Application of appropriate regulatory standards

Fortunately, enough information is available for the Land Treatment Unit to make a reasonable risk assessment for closure.

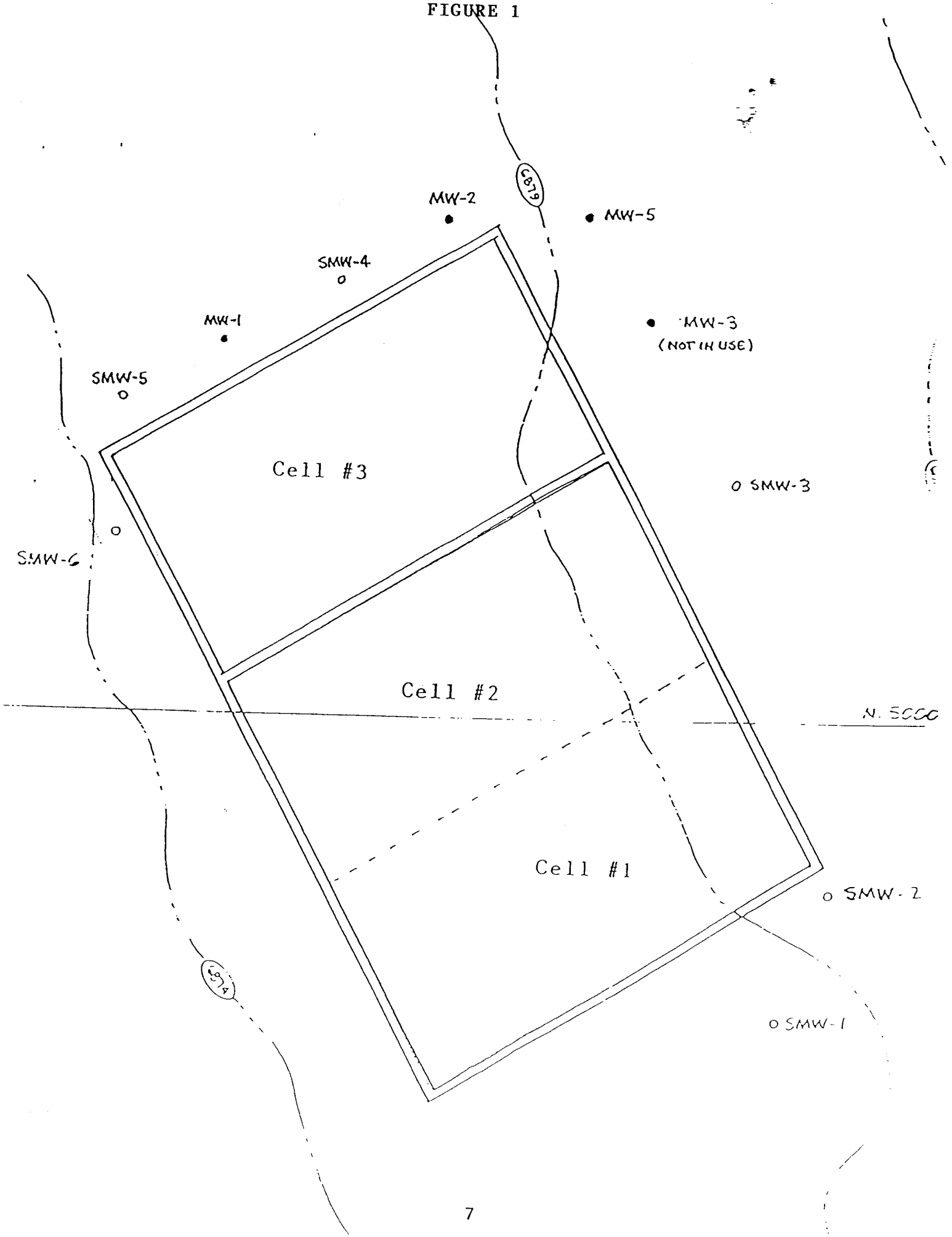
Danger to human receptors from exposure is negligent due to the isolated location of the site, with no human population along the

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 Unit.

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 contamination from taking place.

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

FIGURE 1


MW-2
MW-5
SMW-4
MW-1
MW-3
(NOT IN USE)
SMW-5
Cell #3
SMW-3
SMW-6
Cell #2
N. 5000
Cell #1
SMW-2
SMW-1

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 24

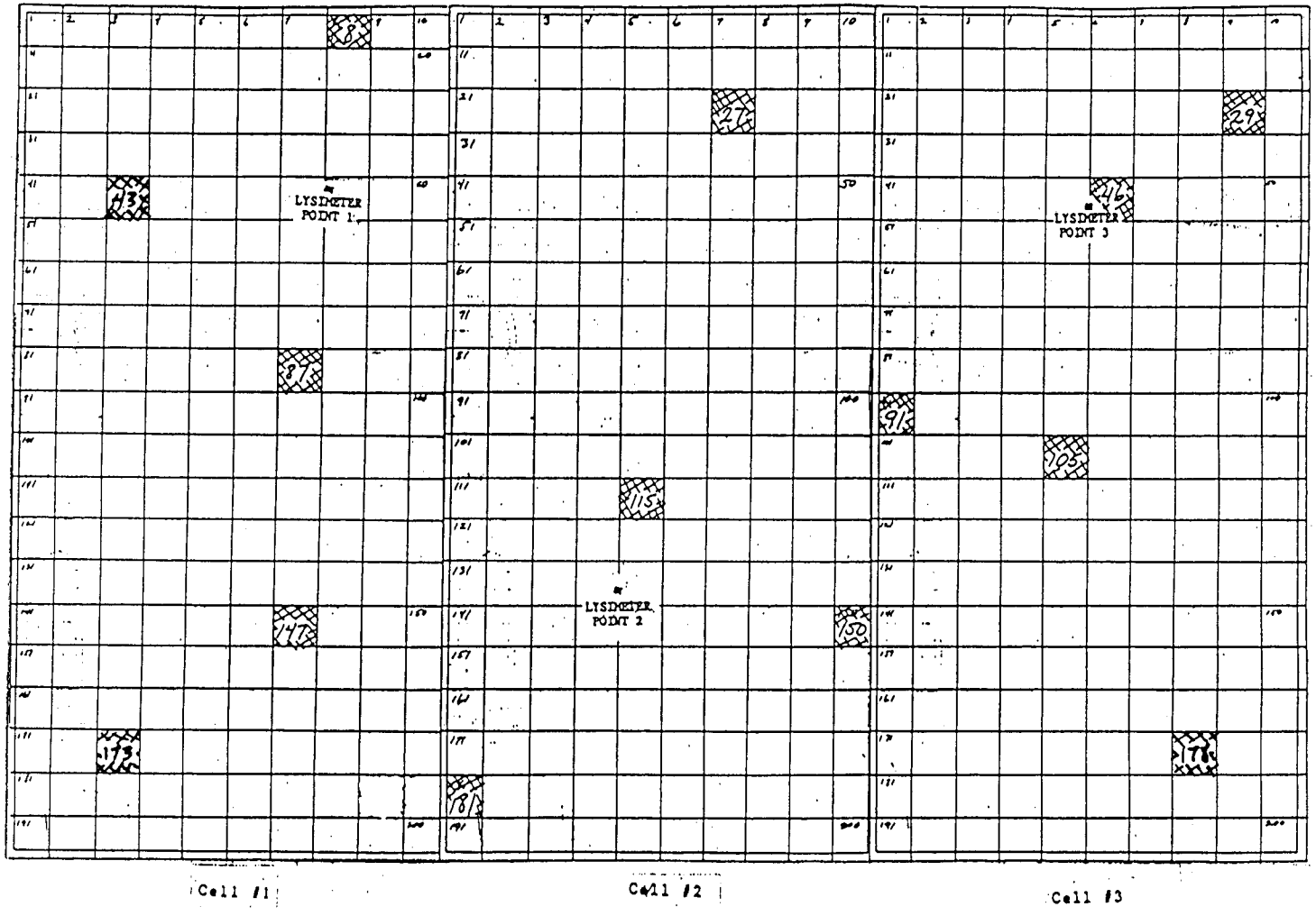


FIGURE 2
7a

TABLE 1

	Borehole
ZOI Samples - Table 2	0.0'
	1.0'
Treatment Zone Table 3	3.0'
	5.0'
BTZ Table 3 Organics	6.0'
BTZ Table 3	10.0'
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

ZOI

Parameters	Event 1[1]	Event 1 + 60 Days[1]
pH	*	*
Oil %	*	*
Moisture %	*	*
Total Nitrogen	*	*
Total Phosphorous	*	*
Table 3 Constituents	*	**

** = Not required if Event 1 data shows levels below standards.

[1] Event 1 must take place within 30 days of acceptance of this plan and again 60 days later or 90 days after acceptance of this plan.

TABLE 3
MODIFIED SKINNER LIST
8240 VOLATILE ORGANICS

PARAMETER	EPA METHOD SW-846	DESCRIPTION	CONTAINER	PRESERVATIVE	HOLDING TIME/DAYS	DETECTION LIMIT	UNITS
Benzene	8240	GC/MS	G GLASS	4°C	14	5.0	ug/kg
2-Butanone (MEK)	8240	GC/MS	G GLASS	4°C	14	10.0	ug/kg
Carbon Disulfide	8240	GC/MS	G GLASS	4°C	14	5.0	ug/kg
Chlorobenzene	8240	GC/MS	G GLASS	4°C	14	5.0	ug/kg
Chloroform	8240	GC/MS	G GLASS	4°C	14	5.0	ug/kg
1,4-Dioxane	8240	GC/MS	G GLASS	4°C	14	500	ug/kg
Ethylbenzene	8240	GC/MS	G GLASS	4°C	14	5.0	ug/kg
Styrene	8240	GC/MS	G GLASS	4°C	14	5.0	ug/kg
1,1,2,2-Tetrachloroethane *	8240	GC/MS	G GLASS	4°C	14	5.0	ug/kg
Tetrachloroethene *	8240	GC/MS	G GLASS	4°C	14	5.0	ug/kg
Toluene	8240	GC/MS	G GLASS	4°C	14	5.0	ug/kg
1,1,1-Trichloroethane	8240	GC/MS	G GLASS	4°C	14	5.0	ug/kg
Ethylene Dibromide *	8240	GC/MS	G GLASS	4°C	14	5.0	ug/kg
Acetone	8240	GC/MS	G GLASS	4°C	14	5.0	ug/kg
Dichloromethane *	8240	GC/MS	G GLASS	4°C	14	5.0	ug/kg
Benzyl Alcohol *	8240	GC/MS	G GLASS	4°C	14	5.0	ug/kg

Additional Compounds Constituents

TABLE 3
MODIFIED SKINNER LIST
8270 SEMI-VOLATILE ORGANICS

PARAMETER	EPA METHOD SW-846	DESCRIPTION	CONTAINER	PRESERVATIVE	HOLDING TIME/DAYS	DETECTION LIMIT	UNITS
Anthracene	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
Benzo(A)Anthracene	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
Benzo(B)Fluoranthene	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
Benzo(K)Fluoranthene	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
Benzo(A)Pyrene	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
Butyl Benzyl Phthalate	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
Chrysene	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
Dibenz(A,H)Anthracene	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
Diethyl Phthalate	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
7,12-Dimethylbenz (A)-^Anthracene	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
Dimethyl Phthalate	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
DI-N-Octyl Phthalate	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
Fluoranthene	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
Indeno(1,2,3-CD)Pyrene	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
1-Methylnaphthalene	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
2-Methylphenol (Cresol)	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
3/4-[illegible]thylphenol (Cresol)	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
N[illegible]lene	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
[illegible].ophenol	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
Phenanthrene	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
Pyrene	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
Pyridine	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
Quinoline	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
Benzenethiole	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
Phenol	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
Bis(2-Ethylhexyl)phthalate *	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
Dibenz(a,h)acridine *	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
Dichlorobenzene *	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
Methyl Naphthalene *	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
2,4-Dimethylphenol	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
2,4-Dinitrophenol *	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg

Additional Constituents

Note: This list is a modification of Table 4, Part B Permit, Attachment F, Closure and Post-Closure Plan

TABLE 3
MODIFIED SKINNER LIST
METALS
ICP 6010

PARAMETER	EPA METHOD SW-846	DESCRIPTION	CONTAINER	PRESERVATIVE
Chromium	6010	-	GLASS	4°C
Lead	6010	-	GLASS	4°C

ATTACHMENT 2

SAMPLING AND ANALYSIS PLAN

SAMPLING AND ANALYSIS PLAN

LAND TREATMENT UNIT CHARACTERIZATION
GIANT REFINING COMPANY
CINIZA

JUNE OCTOBER, 1994

PREPARED BY:

LYNN SHELTON

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Figure 1 Land Treatment Unit

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Appendix 1 NMED: Components of an Adequate Quality Assurance / Quality Control Program

1.0 INTRODUCTION

It is essential to assure that data generated during the land treatment unit 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

The QA/QC program outlined in this plan must be adhered to during all data collection activities. It is important to remember that QA/QC is a dynamic process and that this plan is subject to periodic updates. This plan outlines QA/QC procedures designed to meet or exceed U.S. EPA and New Mexico Environment Department guidelines.

2.0 RESPONSIBILITIES

The importance of defining responsibilities for the implementation of the procedures must be stressed. Each individual 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 data base

2.3 Contract Laboratory

- Provide high quality analytical services
- Assure that all data generated is supported by adequate documentation that meet NMED and USEPA QA/QC requirements
- Provide sample bottles, coolers, labels and chain of custody documents upon request
- Maintain standard operating procedures (S.O.P.'s) for all analytical methods performed
- Use only USEPA 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 quality control 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 New Mexico Environment Department.

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 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 LTU 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

TABLE 1

Field Equipment Checklist
Soil Sampling

	ITEM		REMARKS
_____	PID Meter (Optional)	_____	Calibrated
_____	Site Map with Sample Locations		
_____	Sample Bottles		
_____	Ice Chests		
_____	Trip Blanks		
_____	Methanol		
_____	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		

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 five foot, 2 1/2" 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 augers. 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 (VOC). Only after the sample has been collected should field observation 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 .1 inch with an engineers tape measure.

3.3.2 Soil Sampling Screening

Should visual inspection or detection of odors warrant its use, a photo-ionization detector 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.

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

Lithologic logs of the entire core shall be used. Samples for volatile organic constituents 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 land treatment unit.

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 land treatment unit.

- Wash and mechanically clean augers and split spoon with bio-degradable 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 which are used to collect or contain a sample prior to final sample analysis. Before its use, all sampling equipment which 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 bio-degradable soap and potable water
- Rinse with deionized water followed by propanol
- 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 a 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:

1) Facility Name
2) Type and Number of Samples
3) Sample Location and ID
4) Collection Dates/Times
5) Analysis Required
6) Number of Containers for Each Sample
7) Additional Remarks or Comments as Needed
8) Sampler's Signature
9) Signatures of All Individuals Involved in the Chain of Possession
10) Inclusive Dates and Times of Possession

A sample form is shown in Figure 1. The original chain of custody form must accompany the samples. One copy of the chain of custody 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 will be responsible for documenting custody within their laboratory. If a subcontractor is used for any or all analysis, Giant shall be informed and custody change shall be documented.

7.0 ANALYTICAL PROCEDURES

7.1 Methods

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

The list of constituents and methods are listed in Table 2.

7.2 Detection Limits

It is imperative that the analytical procedures chosen have detection limits appropriate to the intended use of the data and which are consistent with previous sampling events in the land treatment unit. Detection limits for this plan are included in Table 2.

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 assure 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 Table 2.

7.4 Sample Preparation

Proper sample preparation is an integral part of any analytical program. Any additional preparation above and beyond normal S.O.P.'s 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 New Mexico Environment Department is attached as Appendix 1. If necessary, Giant requests that the laboratory's QA/QC be modified to conform to the NMED QA/QC program.

8.0 CALIBRATION PROCEDURES AND FREQUENCY

8.1 Laboratory Instrumentation

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.

8.1.1 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% of the expected result. If not, terminate the analysis, correct the problem and re-calibrate. The calibration blank should be within three standard deviations of the mean blank. If not, terminate the analysis, correct the problem, re-calibrate, 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%. The relative percent difference (RPD) shall be ± 20% for sample values greater than ten times the detection limit. Spike recovery is to be ± 20% of the actual value.
- Serial dilution checks should be done where applicable.

8.1.2 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 non-dedicated boring and sampling equipment.

To assure 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 lab 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% of the total number of samples taken (i.e., 100 samples total, 5 duplicates). One duplicate will be analyzed for Appendix IX volatile and semi-volatile constituents, the remainder for ICP chromium and lead.

In order to evaluate the precision of the analysis, it is necessary to calculate the relative percent deviation (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

Where S2 = Sample Result 2

RPD should be less than or equal to 10% 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.

Sample numbers for the 1994 sampling event are 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

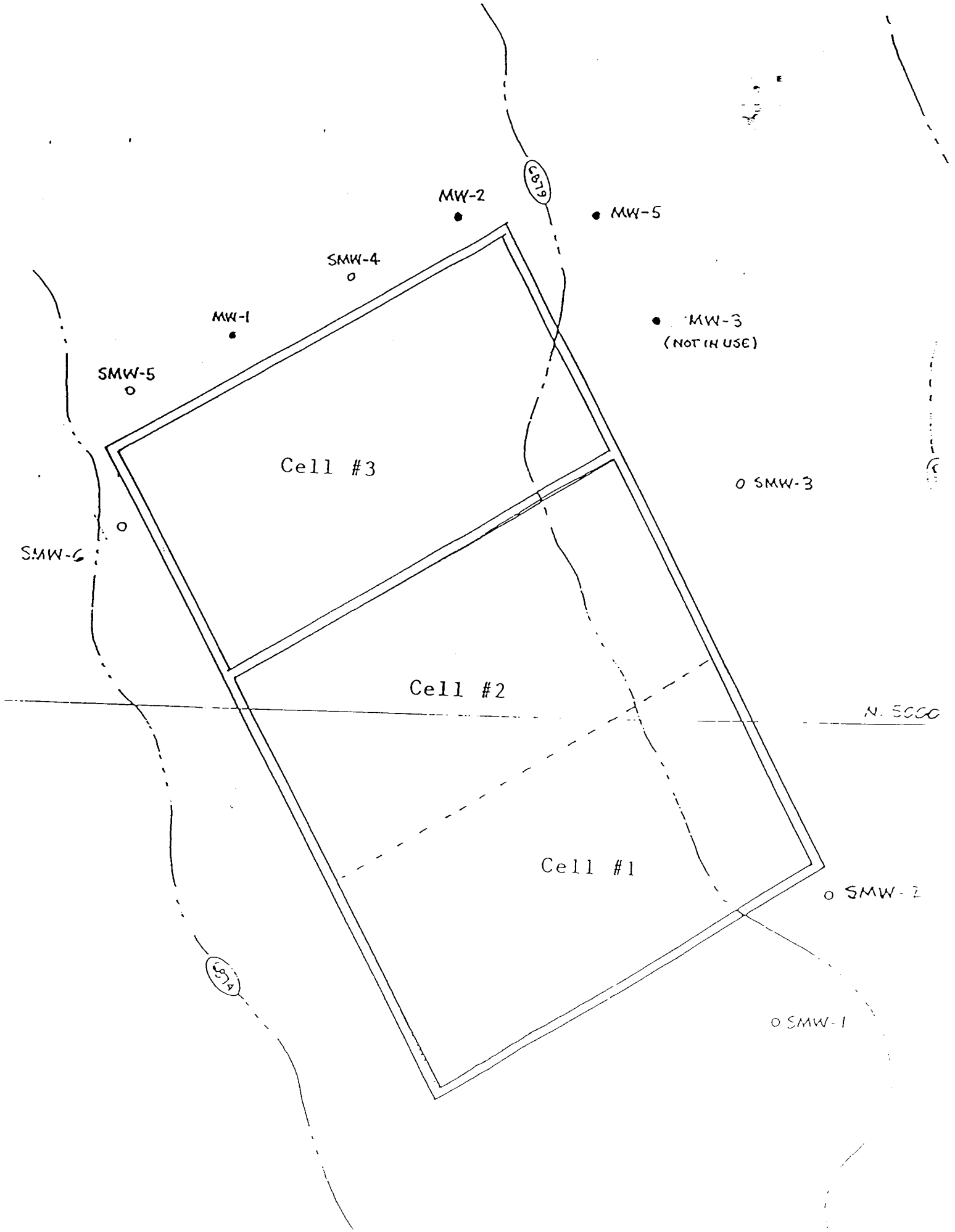
MW-2
MW-5
SMW-4
MW-1
MW-3
(NOT IN USE)
SMW-5
Cell #3
SMW-3
SMW-6
Cell #2
N. 5000
Cell #1
SMW-2
SMW-1

TABLE 2

SOIL SAMPLING PROGRAM

ZOI

Parameters	Event 1[1]	Event 1 + 60 Days[1]
pH	*	*
Oil %	*	*
Moisture %	*	*
Total Nitrogen	*	*
Total Phosphorous	*	*
Table 3 Constituents	*	**

** = Not required if Event 1 data shows levels below standards.

[1] Event 1 must take place within 30 days of acceptance of this plan and again 60 days later or 90 days after acceptance of this plan.

TABLE 3
MODIFIED SKINNER LIST
8240 VOLATILE ORGANICS

PARAMETER	EPA METHOD SW-846	DESCRIPTION	CONTAINER	PRESERVATIVE	HOLDING TIME/DAYS	DETECTION LIMIT	UNITS
Benzene	8240	GC/MS	G GLASS	4°C	14	5.0	ug/kg
2-Butanone (MEK)	8240	GC/MS	G GLASS	4°C	14	10.0	ug/kg
Carbon Disulfide	8240	GC/MS	G GLASS	4°C	14	5.0	ug/kg
Chlorobenzene	8240	GC/MS	G GLASS	4°C	14	5.0	ug/kg
Chloroform	8240	GC/MS	G GLASS	4°C	14	5.0	ug/kg
1,4-Dioxane	8240	GC/MS	G GLASS	4°C	14	500	ug/kg
Ethylbenzene	8240	GC/MS	G GLASS	4°C	14	5.0	ug/kg
Styrene	8240	GC/MS	G GLASS	4°C	14	5.0	ug/kg
1,1,2,2-Tetrachloroethane *	8240	GC/MS	G GLASS	4°C	14	5.0	ug/kg
Tetrachloroethene *	8240	GC/MS	G GLASS	4°C	14	5.0	ug/kg
Toluene	8240	GC/MS	G GLASS	4°C	14	5.0	ug/kg
1,1,1-Trichloroethane	8240	GC/MS	G GLASS	4°C	14	5.0	ug/kg
Ethylene Dibromide *	8240	GC/MS	G GLASS	4°C	14	5.0	ug/kg
Acetone	8240	GC/MS	G GLASS	4°C	14	5.0	ug/kg
Dichloromethane *	8240	GC/MS	G GLASS	4°C	14	5.0	ug/kg
Benzyl Alcohol *	8240	GC/MS	G GLASS	4°C	14	5.0	ug/kg

* Additional Compounds Constituents

TABLE 3
MODIFIED SKINNER LIST
8270 SEMI-VOLATILE ORGANICS

PARAMETER	EPA METHOD SW-846	DESCRIPTION	CONTAINER	PRESERVATIVE	HOLDING TIME/DAYS	DETECTION LIMIT	UNITS
Anthracene	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
Benzo(A)Anthracene	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
Benzo(B)Fluoranthene	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
Benzo(K)Fluoranthene	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
Benzo(A)Pyrene	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
Butyl Benzyl Phthalate	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
Chrysene	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
Dibenz(A,H)Anthracene	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
Diethyl Phthalate	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
7,12-Dimethylbenz (A)-^Anthracene	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
Dimethyl Phthalate	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
DI-N-Octyl Phthalate	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
Fluoranthene	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
Indeno(1,2,3-CD)Pyrene	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
1-Methylnaphthalene	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
2-Methylphenol (Cresol)	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
3/4 [illegible]hylphenol (Cresol)	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
N[illegible]alene	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
[illegible].ophenol	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
Phenanthrene	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
Pyrene	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
Pyridine	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
Quinoline	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
Benzenethiole	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
Phenol	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
Bis(2-Ethylhexyl)phthalate *	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
Dibenz(a,h)acridine *	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
Dichlorobenzene *	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
Methyl Naphthalene *	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
2,4-Dimethylphenol	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg
2,4-Dinitrophenol *	8270	GC/MS	G GLASS	4°C	14	10.0	ug/kg

Additional Constituents

Note: This list is a modification of Table 4, Part B Permit, Attachment F, Closure and Post-Closure Plan

TABLE 3
MODIFIED SKINNER LIST
METALS
ICP 6010

PARAMETER	EPA METHOD SW-846	DESCRIPTION	CONTAINER	PRESERVATIVE
Chromium	6010	–	GLASS	4°C
Lead	6010	–	GLASS	4°C

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% 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 twelve (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 semi-volatile organic constituents must be checked and adjusted (if necessary) each twelve (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

BFB 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