GW - 14

GENERAL CORRESPONDENCE

YEAR(S):

1991 - 1989

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NAVAJO REFINING COMPANY
GROUND WATER DISCHARGE PLAN
LEA REFINERY, LOVINGTON, NEW MEXCIO

July 9, 1991

Prepared For:

New Mexico Oil Conservation Division
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1.0 EXECUTIVE SUMMARY:

Navajo Refining Company (Navajo) proposes to renew Discharge Plan GW-14, originally issued by the New Mexico Oil Conservation division (NMOCD) to the Southern Union Refining Company, for the Lea Refinery, located approximately five (5) miles Southeast of Lovington, New Mexico.

The Lea Refinery is a crude-oil refining facility with a rated capacity of 37,000 barrels per stream day. The refinery will produce finished petroleum products, as well as feedstocks for Navajo's Artesia, New Mexico refinery.

Water for all on-site uses will be produced from two (2) wells at the facility, and the normal refining processes will discharge an average of 121 gallons per minute of wastewater. Wastewater, treated to remove free-phase and dissolved hydrocarbons, will have a total dissolved solids content of approximately 1,300 milligrams per liter (mg/l). Following treatment the wastewater will be pumped approximately 20,000 ft. by pipeline do discharge into the gathering system for the City of Lovington (POTW). Lea Refining's effluent will make up approximately 20% of the total wastewater treated by the City. The treated water from the city POTW is used for agricultural irrigation.

The only wastewater that will be disposed of on-site is sanitary sewage, which is treated in septic tanks. The wastewater collection and treatment system is fully enclosed. Two (2) wastewater storage tanks with a capacity of 3.3 million gallons each are available to contain all process effluent in the case of an emergency or scheduled maintenance.

The site is underlain by the Ogallala Aquifer. Ground water most likely to be impacted by any release is at a depth of 60 to 80 feet, and has a TDS of 450 mg/l.

2.0 LOCATION, PURPOSE, RESPONSIBLE PARTIES AND BACKGROUND:

2.1 LOCATION:

The Lea Refinery is located in Lea County, New Mexico, approximately 5 miles Southeast of Lovington, along New Mexico Highway 18. The site occupies approximately 600 acres in the SW quarters of Section 31, T. 16 S., R. 37 E.; the SE quarters of Section 36, T. 16 S., R 36 E.; the NW quarters of Section 6, T. 176 S., R 37 E.; and the NE quarters of Section 1, T. 17 S., R. 36 E. (Figure 2-1). Wastewater will be discharged to the City of Lovington POTW in compliance with a pre-treatment program administered by Region VI EPA.

2.2 PURPOSE:

Pursuant to Section 3-102 of the New Mexico Water Quality Control Commission (NMWQCC) Regulations (1988), Navajo Refining Company (Navajo) is required to submit a Discharge Plan for wastewater produced by the Lea Refinery.

It is the intent of Navajo to recondition and restart the Lea Refinery, previously owned by Southern Union Company. This document constitutes Navajo's application to revise and renew Discharge Plan GW-14, originally issued to Southern Union Company.

2.3 RESPONSIBLE PARTIES:

All inquiries concerning this Discharge Plan should be directed to:

Navajo Refining Company
Attn: Mr. David Griffin
P.O. Box 159
501 East Main Street
Artesia, New Mexico 88210
(505) 748-3311

2.4 BACKGROUND:

The present Refinery, then known as the Lovington Refinery, was constructed in 1973-1974 by corporations controlled by Mr. Walter Famariss. At that time, Southern Union Company also constructed product storage and shipping facilities on the South side of the refinery.

In 1975, the Refinery was purchased by Southern Union Oil Products Company, which was subsequently merged into Southern Union Refining Company. The refinery was operated until 1984, when it was mothballed in anticipation of a future restart.

A Discharge Plan was prepared for the facility by G. A. Baca and Associates, Ltd. (Baca, 1981) and approved by NMOCD as Discharge Plan GW-14.

Navajo Refining Company has purchased the facility and is in the process of reconditioning the refinery. Restart of petroleum processing is anticipated in the Fall of 1991.

The Refinery has a rated capacity of 37,000 barrels per stream day (BPSD). Navajo will operate the refinery to produce primarily feedstocks for its Artesia refinery.

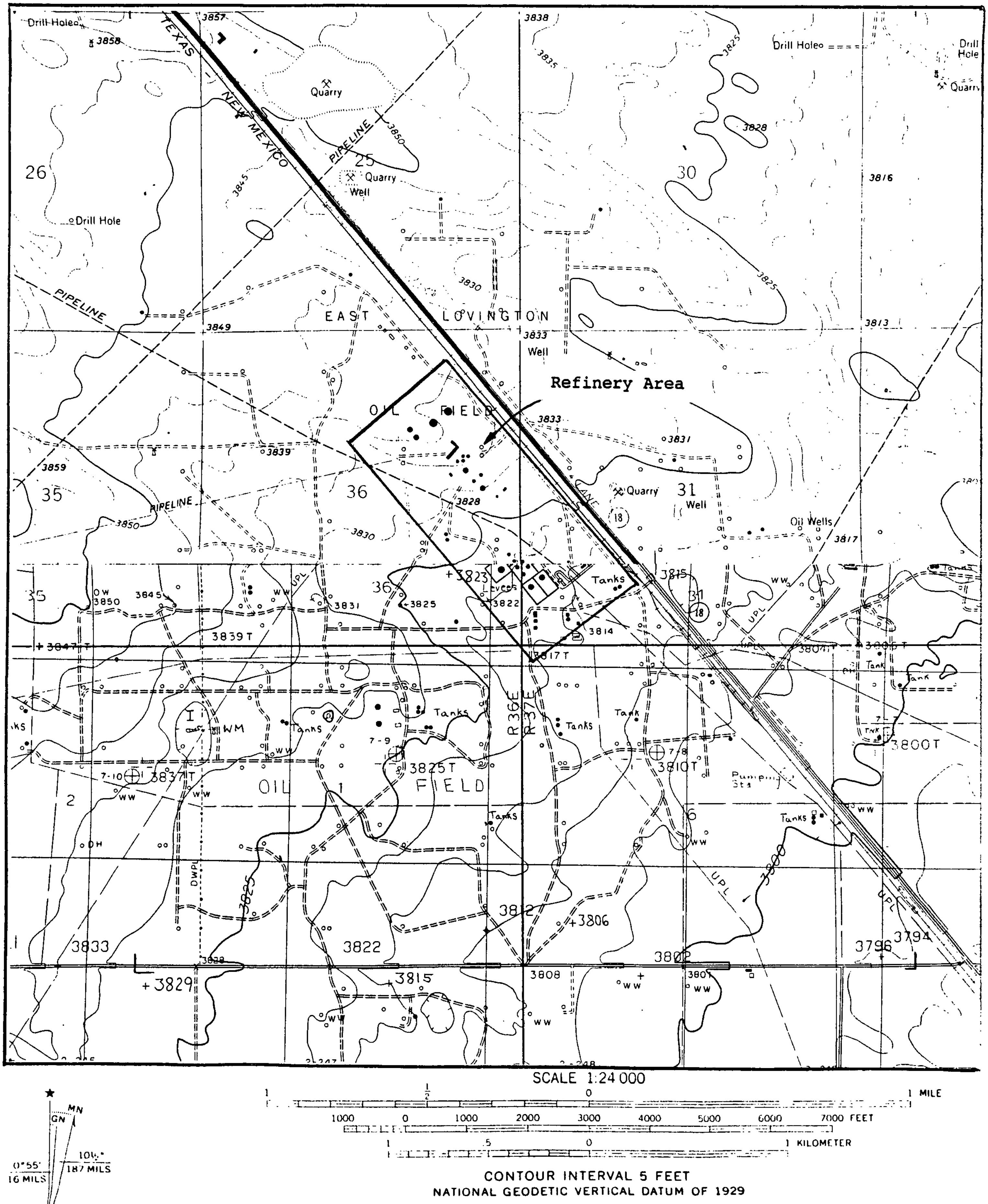

Figure 2-1. LOCATION MAP, LEA REFINERY, LOVINGTON, NEW MEXICO

3.0 ENVIRONMENTAL SETTING AND CONDITIONS:

The Lea Refinery is situated in the Eastern Plains of New Mexico, at an elevation of approximately 3,800 feet above mean sea level (MSL). The topography is quite flat, and the climate is arid to semiarid. The site is underlain by aeolian and fluvial sands of the Tertiary Ogallala Formation, which hosts the principal shallow, regional aquifer. Groundwater most likely to be affected by refinery discharges is at depths of 60 to 80 feet, and has an average total dissolved solids (TDS) content of 450 milligrams per liter (mg/l).

3.1 Regional and Local Hydrogeology:

3.3.1 Regional Hydrogeology:

Lea County is in the Western part of the Permian Basin area of New Mexico and West Texas, and is underlain by rocks ranging in age from Precambrian to Recent (Table 3-1). The thick subsurface deposits of Precambrian to Permianage rocks have produced large quantities of oil and gas, and contain ground water in the form of brines with TDS contents of over 40,000 mg/l. No significant quantities of potable water are produced from any units older than the Triassic. Pre-Tertiary bedrock typically strikes Northerly to Northeasterly, and dips Easterly to Southeasterly at 1 to 5 degrees (Nicholson and Clebsch, 1961).

In Lea County, potable water is produced from three (3) units, the Triassic Dockum Group, the Tertiary Ogallala Formation, and Quaternary to Recent alluvium. Water quality and availability are generally better in the Ogallala and alluvial deposits, and a large proportion of the area's ground water is produced form these units.

The most productive Triassic aquifer is the Santa Rosa Sandstone, which supplies water to Western Lea County. Ground water is recharged to this aquifer along outcrops subparallel to the Lea-Eddy county line east of the Refinery, and flows southwesterly, generally along the structural dip of the beds. This unit has relatively low porosity and permeability, and well yields are typically low.

Overlying the Mesozoic units is the Ogallala Formation, which is the major regional aquifer. This formation consists of calcareous, unconsolidated sands with local caliche beds. The Ogallala Formation ranges from 100 to 250 feet in thickness, with a saturated thickness of 25 to 175 feet. The unit is quite porous and permeable, and depths to water may be as shallow as 20 feet in some areas.

Important quantities of ground water are also found in thicker deposits of alluvium, located in stream valleys and other topographic lows. The Ogallala and the Alluvium are essentially in hydraulic connection, and ground water is freely exchanged between these aquifers. Ground water from all aquifers is used for irrigation, oil and natural gas processing, public water supplies, stock watering, and rural domestic consumption.

3.3.2 Local Hydrogeology:

The shallowest aquifer underlying the Lea Refinery is hosted by the Ogallala Formation and/or younger alluvial deposits. Ground water lies at depths of 60 to 80 feet under unconfined conditions. In 1988, Pilko and Associates performed a ground water study at the facility, including the installation and sampling of 14 temporary monitor wells (Pilko and Associates, 1989). Copies of lithologic logs for these wells are attached as Appendix A. The wells have since been plugged and abandoned.

Table 5-1 Stratigraphic Units in Southern Lea County

		Geologic age	Geologic unit	Thickness (ft)	General character	Water-bearing properties
Cenozoic	Quaternary	Recent and Pleistocene	Sand	0–30±	Dune sand, unconsolidated stabilized to drifting, semiconsolidated at depth; fine- to medium-grained.	Above the zone of saturation, hence, does not yield water to wells. Aids recharge to underlying formations by permitting rapid infiltration of rainwater.
			Alluvium	0–400±	Channel and lake deposits; alternating thickbedded calcareous silt, fine sand, and clay; thickest in San Simon Swale; less than 100 feet thick in most places.	Saturated and highly permeable in places in east end of Laguna Valley. Forms continuous aquifer with Ogallala formation. Wells usually yield less than 30 gpm. Locally above the water table.
Cenozoic	Tertiary	Pliocene	Ogallala	0–300±	Semiconsolidated fine-grained calcareous sand capped with thick layer of caliche; contains some clay, silt, and gravel.	Major water-bearing formation of the area. Unsaturated in many localities, such as north side of Grama Ridge, west side of Eunice Plain, Antelope Ridge area, and Rattlesnake Ridge. Greatest saturated thickness along east side of Eunice Plain, west of Monument Draw, where wells yield up to 30 gpm. Highest yields, up to 700 gpm, obtained from wells along south edge of Eunice Plain, east of Jal.
Mesozoic	Cretaceous		Undifferentiated	35±	Small isolated and buried residual blocks of limestone, about 3 miles east of Eunice.	Possibly small isolated bodies of water locally.
Mesozoic	Triassic Dockum group		Chinle formation	0–1,270±	Claystone, red and green; minor fine-grained sandstones and siltstones; underlies all of eastern part of southern Lea County area; thins westward; absent in extreme west.	Yields small quantities of water from sandstone beds. Yields are rarely over 10 gpm. Water has high sulfate content.
			Santa Rosa sandstone	140–300±	Sandstone, chiefly red but locally white, gray, or greenish-gray; fine- to coarse-grained; exposed in extreme west; underlies Cenozoic rocks in western part of area, and is present at depth in eastern part.	Yields small quantities of water over most of the area. Some wells are reported to yield as much as 100 gpm. Water has high sulfate content.
Paleozoic	Permian or Triassic		Undifferentiated	90–400+	Siltstone, red, shale, and sandstone; present at depth under all of southern Lea County.	No wells are known to be bottomed in the red beds. Probably can yield very small quantities of high-sulfate water.
Paleozoic	Ordovician through Permian			6,500–17,000±	Thick basin deposits ranging in character from evaporites to coarse clastics; thinnest on the east side of the area over the Central basin platform, thickest toward the southwest.	No presently usable water supply available from these rocks. Source of highly mineralized oil-field waters.
Precambrian					Granite, granodioritic and other igneous and metamorphic rocks; complex structure.	Not hydrologically significant.

TABLE 3-2 SUPPLY WATER ANALYSES

PARAMETER	CONCENTRATION (mg/l)	STANDARD (mg/l)
Arsenic	0.01	0.1
Barium	0.3	1.0
Cadmium	<0.001	0.01
Chromium	0.001	0.05
Cyanide	<0.1	0.2
Fluoride	1.0	1.6
Lead	<0.001	0.05
Mercury	<0.0004	0.002
Nitrate (NO^3 as N)	3.5	10.0
Selenium	<0.01	0.05
Silver	<0.01	0.05
Uranium	<0.5	5.0
Radium-226 (pCi/l)	<0.6	30 pCi/l Combined
Radium-228 (pCi/l)	4.2	
Chloride	79.0	250
Copper	0.002	1.0
Iron	0.02	1.0
Manganese	0.002	0.2
Phenols	<0.001	0.005
Sulfate	74.5	600
Total Dissolved Solids	453.0	1000
Zinc	<0.01	10
pH	7.1	6 to 9
Aluminum	<0.1	5.0
Boron	0.2	0.75
Cobalt	<0.01	0.05
Molybdenum	0.001	1.0
Nickel	<0.01	0.2

[illegible] igneous and metamorphic rocks; complex structure. Not hydrologically significant.

Based on the logs of these wells, subsurface materials above the water table consist of fine-grained sand with local seams of caliche and silt.

Measurements of water levels in these monitor wells indicate a southeasterly flow direction with a water-table gradient of 0.002 ft/ft (Figure 3-1). Analyses (September, 1981) of water from the refinery supply wells (Table 3-2) indicate that the water quality is within primary drinking-water standards, with a total dissolved solids content of 453 mg/l. The Lea Refinery and the City of Lovington draw their water from wells completed in this shallow aquifer.

Refinery water is drawn from two wells, located near the refinery office (Figure 3-1). The northern well is completed at a depth of 235 feet, and the southern well at 248 feet. Both wells were drilled to the top of a locally continuous clay strata, which is the base of the local shallow aquifer. The casings of both wells are perforated from 78 to 228 feet, and both pumps are set at 175 feet. At the time of the Pilko studies, the refinery wells had not been pumped for approximately 4 years, therefore the water table shown in Figure 3-1 shows no effects from these wells.

3.3.3 Local Wells and Water Usage:

All water wells registered with the New Mexico State Engineer's Office (NMSEO) that lie within 1 mile of the Refinery boundary are shown in Figure 3-2. Well locations shown on Figure 3-2 are taken from the legal descriptions in the well logs, and are at best accurate to the nearest quarter section. Where possible, well locations have been identified by their correspondence to well symbols on the topographic base map. Also, features identified as water wells or windmills on the topographic map have been identified, even if they were not listed in the NMSEO records. It is possible that additional unmapped or unregistered wells exist.

There are no perennial streams or permanent bodies of surface water within one mile of the facility. Surface water does accumulate in several intermittent lakes or playas to the northwest and east of the site. The southeasterly slope of the land's surface (see Figure 3-1) will prevent any potential release of wastewater or stormwater from reaching these areas.

3.4 SURFACE DRAINAGE AND FLOODING POTENTIAL:

Annual rainfall in the Lovington area averages 14 inches per year, most of which falls as late summer and autumn rains. The local topography is relatively flat, and slopes to the southeast at approximately 25 feet per mile (see Figure 3-1). There is no well-integrated, natural drainage system in the area; surface runoff is controlled by small arroyos and swales which drain to the southeast along the general topographic slope.

The refinery's tanks are bermed to contain any stormwater which falls within the area immediately surrounding the tank perimeters, and the same berms serve to prevent run-on of off-site stormwater. Process and loading areas are paved and bermed, and stormwater from these areas is diverted to the wastewater treatment system (see Section 4.4.3). Table 3-3 shows the estimated maximum rainfall events for 2, 5, 10, 25, 50 and 100-year storm events (United States Department of Agriculture, 1973). This table also includes a calculated total discharge per acre in gallons for each event.

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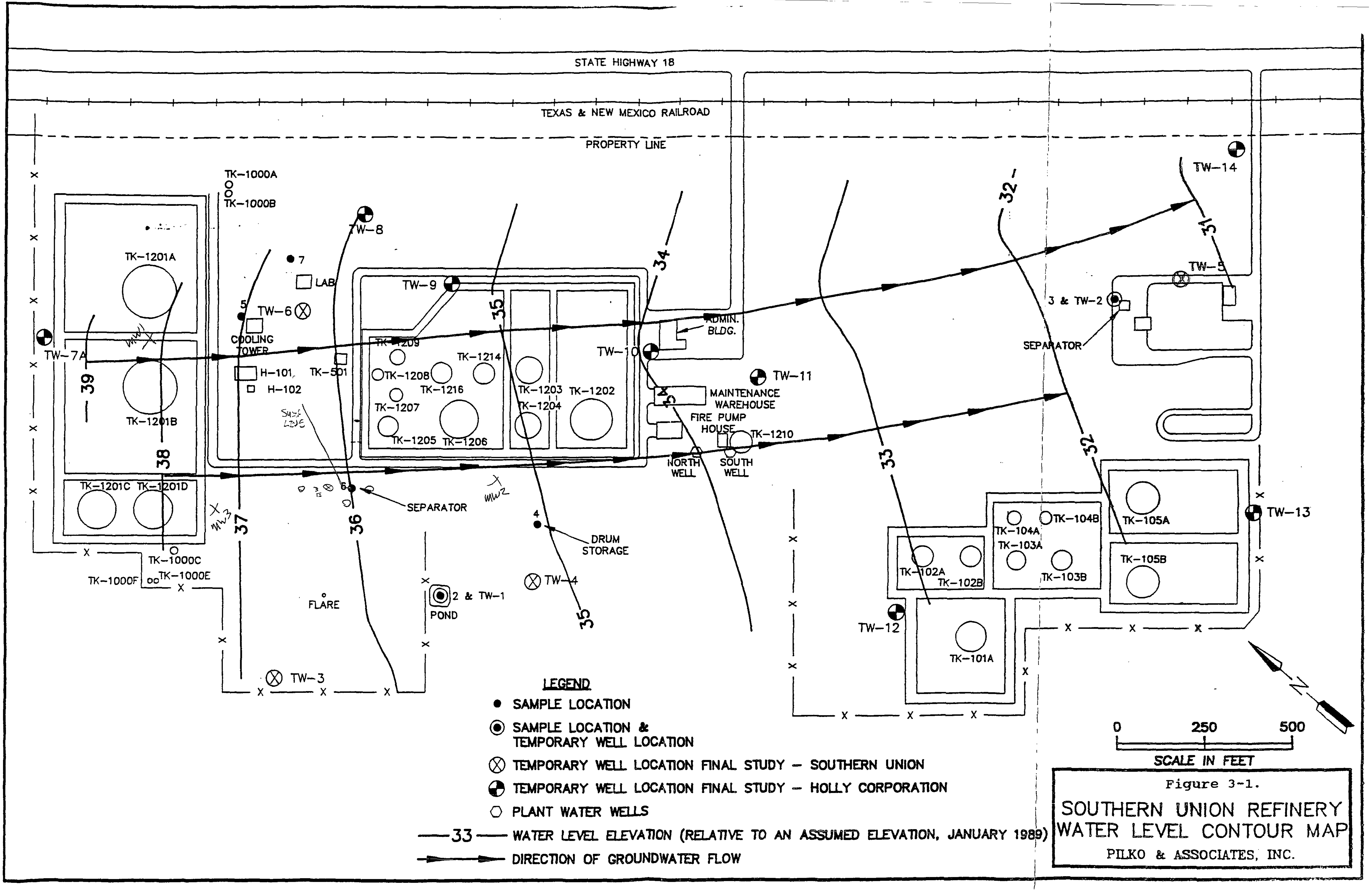


Figure 3-1.

SOUTHERN UNION REFINERY WATER LEVEL CONTOUR MAP

PILKO & ASSOCIATES, INC.

TABLE 3-3 24-HOUR PRECIPITATION EVENTS

EVENT FREQUENCY (YEARS)	PRECIPITATION (INCHES)	GALLONS PER ACRE
2	2.6	70,800
5	3.4	92,500
10	4.0	109,000
25	4.8	131,000
50	5.0	136,000
100	6.0	163,000

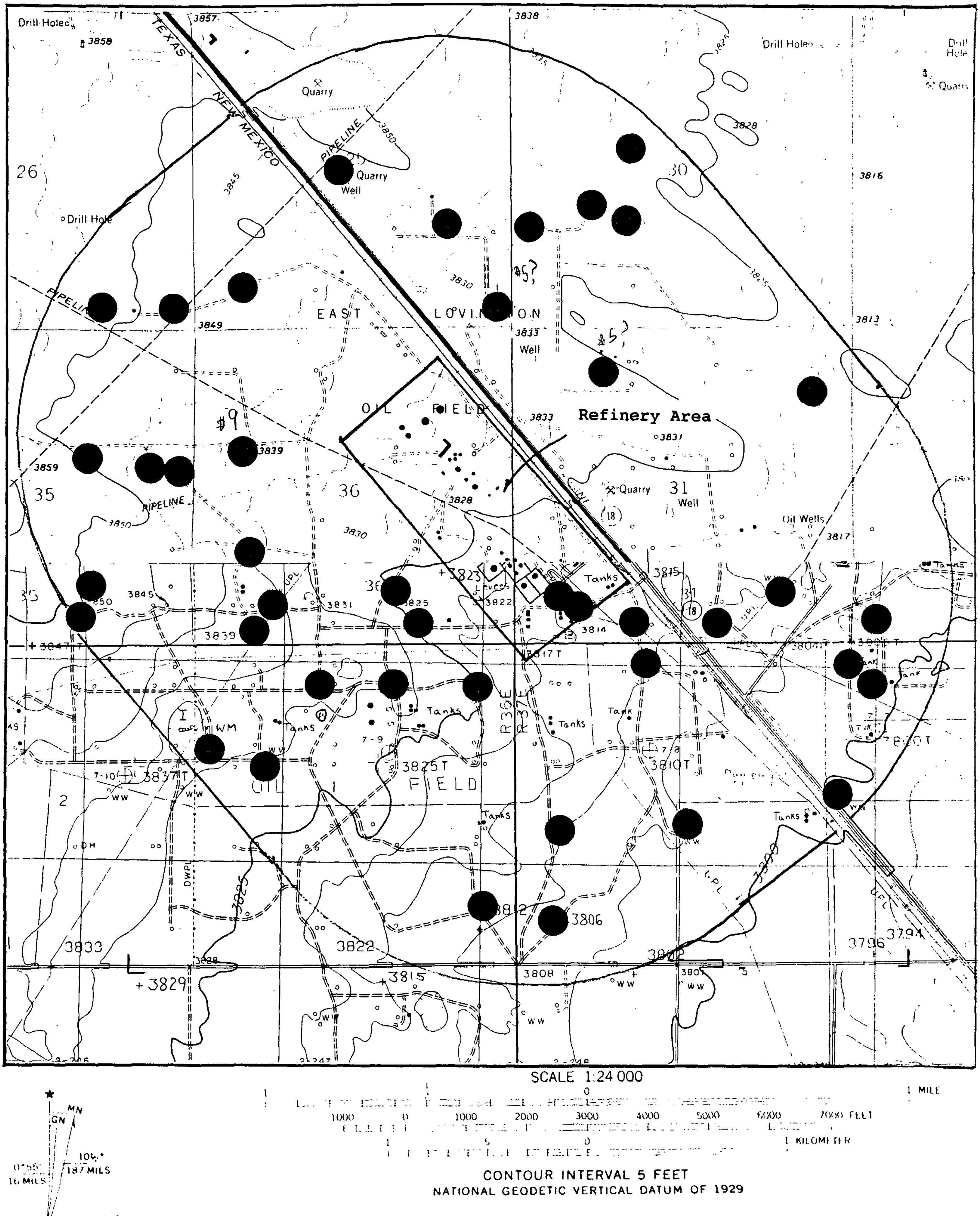


Figure 3-2. WATER WELLS IN ONE-MILE RADIUS OF LEA REFINERY

4.0 PROCESS DESCRIPTION AND WASTEWATER GENERATION:

4.1 WATER SUPPLY AND TREATMENT:

The Lea Refinery uses approximately 111,500,000 gallons of water per year (gpy). Approximately 42% of this water (47,000,000 gpy) is lost to evaporation, and the remaining 58% is disposed of in the City of Lovington POTW. Figure 4-1 is a flow diagram which illustrates the water flow and water balance at the refinery. Plate 1 shows the locations of the major features of the water-supply and wastewater management systems.

4.1.1 Water Supply:

Water is supplied by 2 wells completed in the local Ogallala Aquifer. Together, these wells extract approximately 212 gallons per minute (gpm) on a yearly average. Water chemistry is shown in Table 3-2. Water is held in Tank 1210 (Plate 1) prior to distribution to sanitary, fire protection, water treatment and cooling systems. Water for steam generation and Merox processing is processed through a demineralizer; all other processes use untreated water.

4.1.2 Water Treatment:

Prior to use in the boilers and Merox process, water is treated in a full demineralization process. The water first passes through a cation zeolite catalyst where all cations are exchanged for hydrogen ions (H^+). The water then passes through a decarbonator stripper where CO_2 is stripped from the water prior to entering the anion catalyst part of the process. In the anion section all remaining anions (Cl^- & $SO_4^=$, etc.) are exchanged for hydronium ions (OH^-). The hydrogen ions (H^+) and the hydronium ions (OH^-) combine to make water (H_2O). The cation zeolite catalyst is regenerated with hydrochloric acid (HCl) and the anion zeolite catalyst is regenerated with sodium hydroxide ($NaOH$). The waste from regeneration of the zeolite catalyst goes directly to sewer. The waste acid from the cation units and the waste caustic from the anion units will neutralize each other in Tank 1201D. These regenerate waste streams do not pass through the refinery oil-water separator (Corrugated Plate Separator #1) since they contain no oil and potentially could affect the efficiency of the separator due to differences in pH. Based on the manufacturer's specifications and projected demineralized water demand, the waste water generated should average about 8 gpm, although the waste is actually generated only when zeolite units are regenerated.

4.2 COOLING AND STEAM GENERATION PROCESSES:

Refining processes require heating and cooling of process units to achieve optimum operating temperatures. Temperature control is achieved by circulation of steam or cooling water, as appropriate to the process. Steam is also used as an energy source for vacuum jets, to operate turbine pump, and for wastewater stripping. Steam production and cooling systems generate wastewater in the form of blowdown water (as described below), which is rejected to maintain the correct TDS in the boilers and cooling towers.

4.2.1 Cooling Towers:

The refinery cooling needs are met by a 10,000 gpm recirculating cooling tower, which draws approximately 130 gpm of water during average operation. of this 130 gpm, 90 gpm is lost to evaporation and 40 gpm is rejected as blowdown. Chemical additives employed to prevent fouling and corrosion are listed in Table 4-1, and Material Safety Data Sheets are included as Appendix B. None of these chemicals or their ingredients are

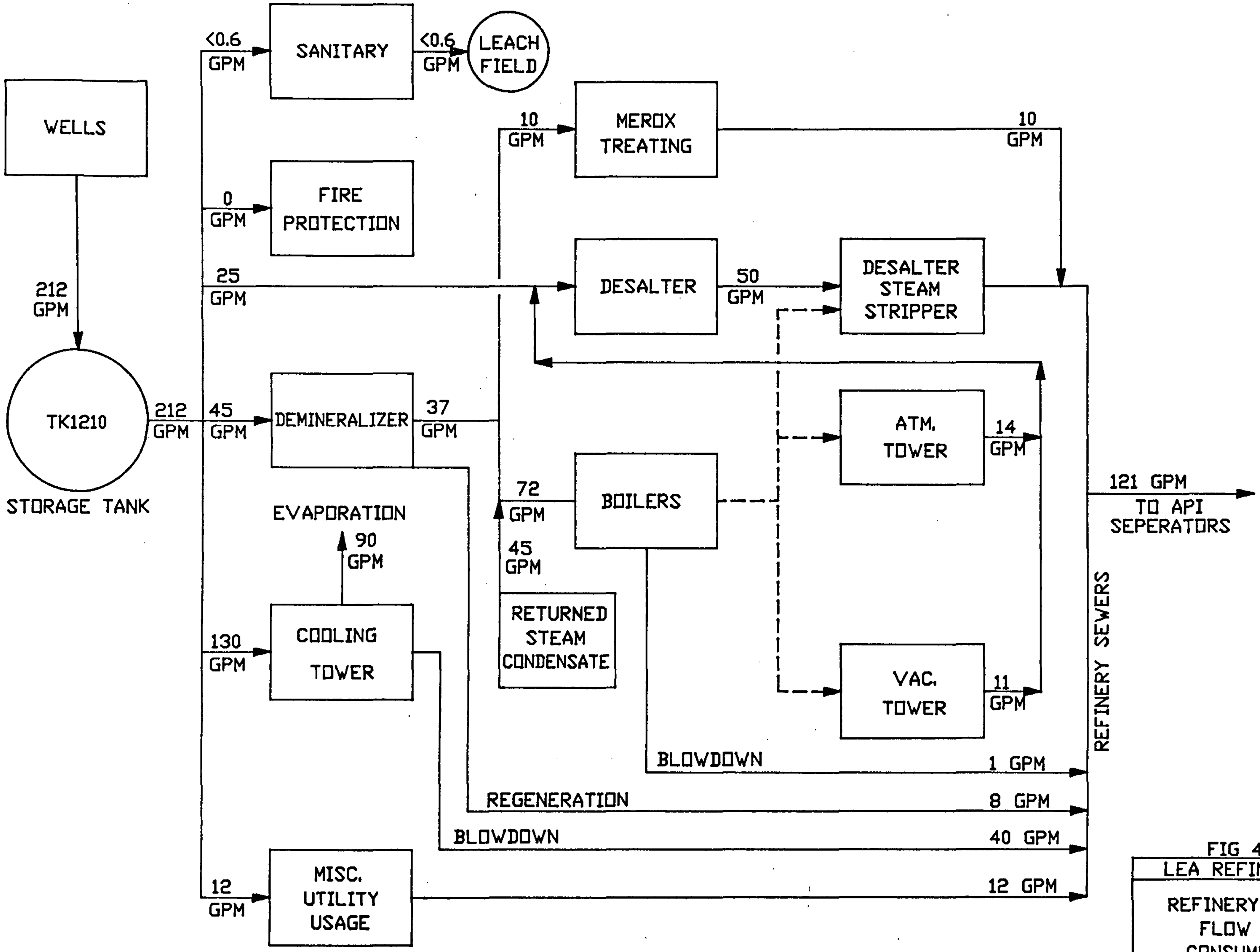


FIG 4-1
LEA REFINING CO.

REFINERY WATER
FLOW AND
CONSUMPTION

listed as carcinogenic under OSHA Standards (40 CFR 1910.1200). This table also includes a calculation of the loading of these chemicals in the blowdown waste stream. These additives increase the wastewater TDS by approximately 46 ppm.

Prior to the 1984 shutdown, chromium compounds were used as corrosion and biological control agents in the cooling towers. Soils in the vicinity of the cooling towers that exhibited elevated chromium levels have been excavated and removed to a permitted disposal facility. No chromium compounds will be used

TABLE 4-1 COOLING TOWER AND BOILER ADDITIVES

COOLING TOWERS		
ADDITIVE	**USAGE IN GAL/YEAR**	**FUNCTION**
Unichem 1300	2200	Scale Control
Unichem 512	520	Biocide
Unichem 570	520	Biocide
Chlorine Tablets	175	Bacteria Control
TOTAL GALLONS/YEAR	3415	
TDS LOADING* (ppm)	46	
BOILERS AND WATER TREATMENT		
ADDITIVE	**USAGE GAL/YEAR**	**FUNCTION**
Unichem 3030	2550	Corrosion Control
Unichem 3140	1800	Oxygen Scavenger
Unichem 3235	1800	Neutralizing Amine
Unichem 3510	730	Corrosion Control
Unichem 3310	185	Corrosion Control
Unichem 4500	96	Zeolite Cleaner
TOTAL GALLONS/YEAR	7161	
TDS LOADING* (ppm)	97	
* TDS Loading based on 74,000,000 gallons/year of wastewater discharge.		

4.2.2 Steam Generation:

Steam is expected to be produced at a rated capacity of 36,000 pounds per hour (lb/hr), using both fired boilers and waste-heat recovery. The steam is used for general process heating, fractionation stripping and vacuum-jet motive steam. Steam generation consumes an annual average of 25 gpm of treated water, along with an estimated 45 gpm of returned steam condensate. Only steam from non-contact process heating is condensed and recycled into the boiler makeup water. Contact steam, from the stripping and vacuum-jet processes, may contain hydrocarbons and is therefor routed to the desalter prior to stripping for benzene removal and discharge to the oily sewer system. Since such high purity water is used to make steam only a very small amount of boiler blowdown will occur. This is estimated to be only 1 gpm or perhaps less.

A number of chemicals are used to prevent scaling and corrosion, and to maintain boiler water at an optimal pH of 11.0. These are listed in Table 4-1, and Material Safety Data Sheets are included as Appendix B. None of these chemicals or their ingredients are listed as carcinogenic under OSHA Standards (40 CFR 1910.1200).

Boiler blowdown water has traces of TDS, as well as traces of additive chemicals. Table 4-1 also includes a calculation of the approximate loading of these chemicals in the final waste stream. In total, boiler additives increase the TDS of the wastewater by approximately 100 ppm by volume.

4.3 PETROLEUM REFINING PROCESSES:

Treated water from the demineralizer is used for Merox treating; most other refining processes that consume water use it in the form of steam except desalting, which uses a combination of raw water makeup and condensed contact waters. All process wastewaters are routed to the wastewater treatment system prior to discharge to the Lovington POTW.

4.3.1 Desalting:

Crude oil feedstocks contain sodium, magnesium and calcium salts, primarily as chlorides, as well as minor amounts of suspended solids. In the desalting process, water is mixed with the crude oil to dissolve these salts and to scavenge the suspended solids. The water is removed by settling in the presence of an electric field. Conditioning chemicals and their levels of usage are listed in Table 4-2.

This process consumes approximately 50 gpm of water, and produces an equal quantity of wastewater. This wastewater has elevated TDS in the form of salts, spent treatment chemicals (approximately 175 ppm) and small amounts of dissolved and suspended hydrocarbons.

TABLE 4-2 DESALTER AND MEROX ADDITIVES

DESALTER		
ADDITIVE	**USAGE GALLONS/YEAR**	**FUNCTION**
Petrolite 7140	3650	Demulsifier
Petrolite 7210	730	Wetting Agent
Petrolite 4030	9125	Antifoulant
Petrolite 1202	2190	Film Control
Petrolite 1100	912	Neutralizer
TOTAL GALLONS/YEAR	12,957	
TDS LOADING* (ppm)	175	
MEROX ADDITIVE		
ADDITIVE	**USAGE**	**FUNCTION**
Sodium Hydroxide	128 tons/year	REAGENT
UOP Merox FB	85 gal/year	CATALYST
TDS LOADING* (ppm)	418 mg/l	
* TDS loading based on 74,000,000 gallons/year of wastewater discharge		

4.3.2 Merox Treating:

The Merox process uses a proprietary catalyst to convert mercaptans, which are corrosive and cause odor problems, into disulfides that can be returned to the products (naphtha and kerosene). Mercaptans are extracted with sodium hydroxide and then oxidized by air injection in the presence of the catalyst. Treated water is used to wash excess sodium hydroxide from the product stream, and the water is separated by settling.

This process consumes approximately 10 gpm of treated water. The wastewater contains rejected sodium hydroxide which increases the TDS and the pH, traces of spent catalytic reagent (see Table 4-2), and small amounts of dissolved and suspended hydrocarbons.

4.3.3 Atmospheric Fractionation, Stabilization and Vacuum Distillation:

These processes separate the various petroleum fractions from crude oil by distillation, either at atmospheric pressure or under vacuum. Steam is used for either direct (contact) or indirect (non-contact) heating, and for vacuum generation by jetting.

Wastewater is generated by condensation of steam in the presence of crude oil and products. The atmospheric tower produces approximately 14 gpm, and the vacuum jets approximately 11 gpm. These wastewaters have elevated TDS, and also contain dissolved and suspended hydrocarbons, but are of sufficient quality to serve as makeup to the desalter, thus reusing and conserving water in the process.

4.4 OTHER WASTEWATER STREAMS:

4.4.1 Sanitary Sewers:

The refinery sanitary sewers produce approximately 0.6 gpm of wastewater. This stream is not commingled with process wastewater, and is routed to onsite septic systems with buried leach fields. The sanitary system is separate from the process and loading area drains, and receives no non-sanitary discharges.

4.4.2 Fire Protection:

Fire protection water is taken from the main water holding tanks, prior to the treatment system. In normal operations this system neither consumes water nor generates wastewater. Relatively minor amounts of water may be discharged to grade during periodic system testing; this water will enter the wastewater treatment and disposal system in the paved process areas, or infiltrate and evaporate in the unpaved areas.

4.4.3 Storm Water:

Based on an average annual rainfall of 14 inches per year, runoff will average approximately 381,000 gallons per year, or 1044 gpd (0.73 gpm) for the paved process areas and 285,750 gallons per year (0.54 gpm) from the loading-rack area. Combined, this represents only 1% of total wastewater production.

The paved process and loading-rack areas are drained by separate storm-sewer networks that are connected to the wastewater treatment and disposal system (Plate 1). Stormwater from these, areas may contain hydrocarbons, and will not be allowed to discharge to grade. Primary storm surge capacity is provided by the bermed, paved areas, and discharge to the separators will be regulated by several mechanisms to prevent releases.

The 100-year storm event (6 inches in 24 hours) will produce a total of approximately 300,000 gallons of runoff from the process and loading areas, or about 1.5 times the normal daily discharge. Surge-control capacity for the process areas is provided by the bermed, paved areas and by pumpage to the first of two (2) 3.3 million-gallon holding tanks, adequate to contain approximately 20 times the 100-year maximum daily precipitation. In the loading-rack area, the paved areas will retain the storm surge until it can be safely pumped to the treatment system. In both the process and loading-rack areas, the stormwater that will accumulate in the paved areas can be safely drained and treated in a matter of hours.

PROCESS AREAS:

Paved process areas have an area of approximately 1 acre. For individual storm events, each inch of rainfall will produce approximately 27,225 gallons of runoff per acre (assuming 100% runoff). The storm sewers are designed for a rainfall rate of 1.5 inches per hour, or 40,838 gallons per hour (680 gpm). Because this flow will exceed the capacity of the oil-water separator, a steam-powered pump operated by a high-low level switch has been installed in the collection sump that feeds the separator (see Section 5.2). This pump has a capacity of 1000 gpm, and the excess wastewater will be passed through a 6" inch line to the 3.3-million-gallon holding tank (Tank 1201 D; Plate 1). If rainfall exceeds the 1.5-inch-per-hour capacity of the sewer system, it will accumulate and be held in the paved areas until it drains.

If process units produce 121 gpm, and the storm sewers contribute 680 gpm, the total flow to the sump will be 801 gpm. The emergency removal capacity will be the sum of the normal separator capacity of 300 gpm, plus the pump capacity of 1000 gpm, for a total of 1300 gpm. Thus the system has a safety factor of 499 gpm, or 162%.

The estimated 100-year storm event for the Lovington area is 6 inches in a 24hour period. This would produce approximately 163,350 gallons of water in the 1-acre process area. Berms around the process areas will contain the water for the 4 hours required for the sewer system to drain this amount of water.

LOADING RACK AREA:

A paved area of approximately 0.75 acres, located south of the refinery, is used as a truck-loading rack. This area is also equipped with a storm-sewer system, a sump and a pump to transfer any collected water or spillage to the refinery oil-water separator system.

The loading area will produce approximately 20,400 gallons of runoff per inch of rainfall, and the sewer system also has a capacity of 1.5 inches of rain per hour, or 30,628 gallons per hour (510 gpm). As is the case in the process area, the average depth of retained water in a 100-year storm event will be 6 inches. This represents a volume of 122, 500 gallons. The paved and bermed area will be drained at a rate which will not exceed the capacity of the sump and transfer pump.

TANK-BERM AREA:

Areas surrounding the crude oil and product storage tanks are surrounded by berms which are designed to retain the tank volume plus a safety factor of one third; these berms also prevent inflow or runoff of stormwater. Direct precipitation will accumulate inside the berms, where it will normally be dispersed by evaporation and infiltration. If floating hydrocarbons are noted on stormwater inside tank berms, the oily water will be removed by vacuum truck and transported to the separator.

4.4.4 Tank Drains:

Tanks used to store crude oil and products accumulate small volumes of water from condensation and separation of water contained in the hydrocarbons. This water is periodically drained into small holding tanks, collected by vacuum trucks, and discharged to the separator. Quantities of this wastewater are difficult to estimate, but are typically on the order of 500 to 1000 gallons per day (0.25 to 0.5 percent of total wastewater).

5.0 WASTEWATER CHARACTERISTICS, TREATMENT AND DISPOSAL:

5.1 WASTEWATER CHARACTERISTICS:

Table 5-1 presents the results of an analysis of a wastewater sample collected and analyzed in September, 1981. The chemistry of the wastewater which will be produced following restart should be quite similar, as no major process changes will be made. Chromium, which was present in the 1981 wastewater, will not be used as a cooling tower additive, therefore it should be absent from wastewater produced in the new operations.

After process operations resume, regular sampling and analysis will be performed to assure that wastewater meets all standards for discharge to the Lovington POTW. The methods, parameters and monitoring schedule are discussed in Section 6.2.

5.2 WASTEWATER COLLECTION:

Refinery wastewater will be collected by the system shown in Plate 1, which also shows the stormwater sewer system. Process wastewater is routed according to the flow diagram (Figure 5-1).

Wastewater flow is buffered by a 3.3-million-gallon storage tank, which can contain approximately 16 days of normal wastewater production (Tank 1201 D; see Plate 1). This tank will be used to control stormwater surges or upsets in the treatment system, so that secondary separation and additional holding capacity in Tank 1201C will assure that discharge will not exceed pre-treatment standards (40 CFR 419.17) or the capacity of the Lovington POTW to treat the effluent.

5.2.1 Process Areas:

Wastewater from process operations and sewers is first routed to a collection sump, equipped with high-low level sensors which activate the oily-water pumps. These pumps convey the oily wastewater to an oil-water separator. The oily phase is then pumped to the slop-oil recovery system. Clear water is diverted to a second sump, also equipped with level sensors. Pumps then transport the clear water to Tank 1201D.

5.2.2 Loading Rack Area:

Stormwater and washdown water from the loading rack also flows to a collection sump by gravity. This sump contains high-low sensors, which operate a pump that transfers the water to the refinery separator.

TABLE 5-1 WASTEWATER CHEMISTRY

PARAMETER	CONCENTRATION (mg/l)	STANDARD (mg/l)
Arsenic	0.1	0.1
Barium	0.5	1.0
Cadmium	<0.001	0.01
Chromium	0.053	0.05
Cyanide	0.26	0.2
Fluoride	1.7	1.6
Lead	0.005	0.05
Mercury	<0.0009	0.002
Nitrate (NO3 as N)	0.8	10.0
Selenium	<0.01	0.05
Silver	<0.01	0.05
Uranium	14.0	5.0
Radium-226 (pCi/l)	<0.6	30 pCi/l Combined
Radium-228 (pCi/l)	3.1	
Chloride	505	250
Copper	0.005	1.0
Iron	4.6	1.0
Manganese	0.002	0.2
Phenols	0.327	0.005
Sulfate	292	600
Total Dissolved Solids	1300	1000
Zinc	0.1	10
pH	9.8	6 to 9
Aluminum	<0.1	5.0
Boron	2.0	0.75
Cobalt	<0.01	0.05
Molybdenum	<0.001	1.0
Nickel	<0.01	0.2
Benzene	1.0	0.01
Ethylbenzene	<1.0	0.75

5.3 WASTEWATER TREATMENT:

All oily wastewater from the refinery and the loading rack discharge to a sump ahead of Corrugated Plate Separator #1 (CPS) as shown on Figure 5-1. There are two sets of pumps located at this sump and under normal flow conditions one set of pumps (main and spare) lifts the oily water into the CPS.

A corrugated plate separator consists of a pack of parallel corrugated plates that act to separate oil, water and sediment in the feed water. The separated oil is skimmed off the unit and pumped to slop oil storage from which it will be reprocessed in he refinery. The sediment, in the form of an oily sludge, settles in a sump at the bottom of the unit where it is pumped into an elevated above ground storage tank. The accumulated sludge will be properly manifested offsite for hazardous waste incineration. The clear water exits the separator into a sump where the demineralizer regeneration waste combines with it. The clear water is then pumped to tank 1201D.

In the event of a power failure, the pumps that charge the separator will not operate. As the level in the oily water sump rises a steam driven pump will come on and begin transferring the wastewater directly to Tank 1201D. Due to the infrequent occurrence of powerfailures and the large capacity (is long holding time) of Tank 1201D, the occasional transfer of unseparated wastewater should not effect the quality of the final discharge. The steam turbine pump also serves as a large capacity pump needed during storm events. The corrugated plate separator can only process 300 ppm, therefore storm flows in excess of 300 gpm will be transferred directly to Tank 1201D by the turbine pump.

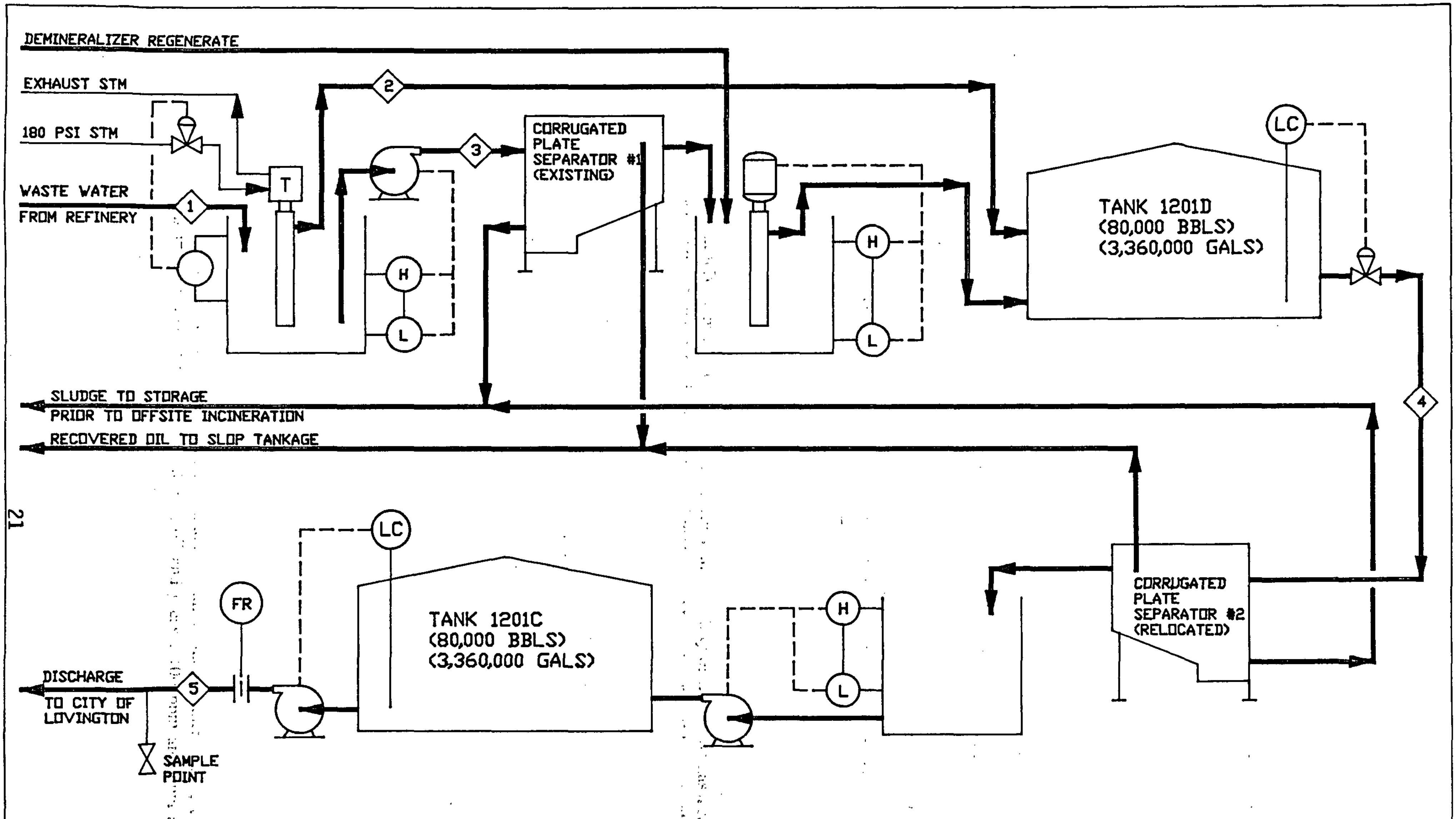
Water in Tank 1201D will gravity feed into a second corrugated plate separator (CPS #2) where any remaining oil and sludge will be drawn off to their respective storage and handling systems. After this secondary separator step, the water will be lifted into Tank 1201C, where it will be held until rateably pumped the 3.7 miles to Lovington. The City of Lovington has a sewer main on the South end of town that will receive the refinery effluent and transfer it to the treatment works.

5.4 WASTEWATER DISPOSAL:

Treated wastewater from the refinery will be pumped approximately 20,000 ft. through a HDPE pipeline that ties into the City of Lovington sanitary sewer system. This pipeline will be equipped with a pig launcher and catcher system so that the capacity of the line can be maintained in the unexpected event of any settling or precipitation restricting the flow. It is not anticipated that the line will be pigged more than just a few times a year.

Once the refinery effluent enters the Lovington sewer system it will be commingled with the city sanitary wastewater and processed through the city POTW. All treated effluent from the city is stored and used for irrigation of a 640 acre farm which borders the treatment plant. Navajo contracted the consulting firm of Parkhill, Smith and Cooper (PSC) in El Paso, Texas to evaluate the addition of the refinery effluent to the city POTW. Their study indicates that no detrimental effects on treatment or final disposal will occur due to the refinery effluent. PSC is preparing a permit modification for submittal by the City of Lovington to NMEID Groundwater Bureau supporting these findings.

Discharge of the refinery effluent to the City of Lovington will be directly regulated by EPA Region VI in Dallas, Texas under the Federal Pre-treatment Regulations (40 CFR 403 and 40 CFR 419.17). These pre-treatment regulations require, among other things, that Navajo meet maximum discharge standards of 100 ppm oil and grease, 100 ppm ammonia and 1 ppm total chromium. The pre-treatment regulations require Navajo to sample and analyze the effluent twice a year to demonstrate compliance.



FLOW RATE	① COMBINED WASTE WATER FROM REFINERY & TERMINAL	② STORM SURGE POWER FAILURE PUMP DISCHARGE	③ CHARGE TO CORRUGATER PLATE SEPARATOR #1	④ CHARGE TO CORRUGATER PLATE SEPARATOR #2	⑤ CHARGE TO LOVINGTON POTW
MAX.	1000 GPM	1000 GPM	300 GPM	300 GPM	300 GPM
AVG.	121 GPM	0 GPM	121 GPM	121 GPM	121 GPM

FIG 5-1

LEA REFINING CO.

FLOW DIAGRAM FOR WASTER WATER PRETREATMENT PRIOR TO DISCHARGE TO LOVINGTON POTW

5.5 OTHER WASTES:

The Refinery will also generate solid wastes and potentially hazardous wastes. Solid wastes (domestic and industrial trash) are collected in dumpsters and transported to a landfill by a local contractor.

Wastes which are hazardous will be collected at their points of generation, properly containerized manifested, and transported to a licensed treatment, storage and disposal facility in accordance with the regulations of the Resource Conservation and Recovery Act (RCRA) . At no time will the Refinery facility be used for the treatment, storage or disposal of hazardous wastes.

Hazardous wastes will include separator sludges, sludge from cleaning heat exchangers, slop oil emulsion solids and possibly waste or off-specification chemicals. All of these wastes will be managed under RCRA regulations, in accordance with the rules applicable to generators of those wastes (40 CFR 260-262).

6.0 MONITORING, REPORTING AND OTHER REQUIREMENTS:

6.1 GROUND WATER AND VADOSE-ZONE MONITORING:

Because no wastewater will be disposed of on site, no ground water or vadose zone monitoring is proposed.

6.2 EFFLUENT MONITORING:

Effluent monitoring and reporting requirements under EPA's Pre-treatment Program are found in 40 CFR 403.12. Section 403.12.b.4 requires flow measurement that will show average daily and maximum daily flow in gallons per day discharged to the POTW. Navajo will install a flow recorder on the pipeline to Lovington to comply with this requirement.

Protocols for sample collection and analysis are given in Section 403.12.b.5 and require that 24 hour composite samples be collected for analysis. Table 6-1 identifies the sampling schedule and analytical methods. In addition to the categorical standards given in 40 CFR 419.17 for oil and grease, ammonia and chromium, Navajo will be analyzing wastewater samples for pH, sulfide and BTEX. Reporting requirements under Section 403.12.e require the above analyses to be done twice a year for reporting in June and December of each year. Additionally Navajo must analyze and report to EPA within 90 days of startup to demonstrate initial compliance.

6.3 LEAK DETECTION, SPILL PREVENTION AND CONTINGENCY PLANS:

Prior to the restart of the refinery, all process and wastewater tanks, lines and appurtenances will be inspected and tested according to manufacturer's and industry standards. Repair will be performed as necessary to assure safe and efficient operation before processing begins.

The refinery will operate on a 24-hour schedule, and will be under the continuous observation and supervision of experienced staff. Any significant problems with the wastewater system will be immediately reported to the plant operator, who will issue a work order for prompt repair.

6.3.1 Wastewater Systems:

A key part of release prevention are the two (2) 3.3 million gallon holding tanks (1201C and 1201 D; Plate 1). These tanks can hold up to 37 days of wastewater production, or

40 times the 100-year storm runoff for the process areas. Secondary containment for effluents will be provided by the paved process areas, which are bermed to prevent inflow from adjacent areas, as well as to prevent release of wastewater to grade.

Before reaching the collection sumps, wastewater will flow by gravity through the refinery sewer system. All sewer lines will be cleaned and inspected prior to process startup. If blockage or flow problems are noted during operation, vacuum trucks or portable pumps will be used to convey wastewater to the treatment system until repairs can be made.

Pumps and pressurized lines will convey untreated wastewater, recovered slop oil and treated wastewater through the rest of the collection and treatment system. These lines will be inspected and tested prior to use.

6.3.2 Process, Loading and Tank Areas:

Any spill or other release in the process areas or loading racks will be controlled and retained by the pavement and berms. Lost materials will be recovered by the separators and returned to the appropriate part of the

TABLE 6-1 WASTEWATER SAMPLING SCHEDULE AND MEHTODS

PARAMETER	SAMPLING INTERVAL	EPA METHOD
Oil & Grease	1 Every 6 Months	413.1
Ammonia	1 Every 6 Months	350.1, 350.2 or 350.3
Chromium	1 Every 6 Months	218.1 or 218.2
pH	1 Every 6 Months	9040
Sulfide	1 Every 6 Months	376.1 or 376.2
BTEX	1 Every 6 Months	602 or 8020

Treatment and process chemicals (see Section 4.0) will be stored in approved containers in the paved process areas. Regular inspection of these containers will detect any releases. If a release is noted, it will be cleaned up in accordance with safety and environmental concerns identified in the manufacturer's MSDS data (Appendix B).

Cleanup wastes will be recycled or disposed of in accordance with manufacturer's instructions and/or applicable regulations.

Potential spills of products or feedstocks outside the paved areas will be controlled by industry-standard practices. In general, these releases will be controlled by temporary earth berms or other emergency structures until the materials are recovered by vacuum truck or other methods. Any impacted soils or other materials will be removed to the extent practical. Analyses (by methods described in SW-846 for the appropriate parameters) to determine their contents and regulatory status will be done and then the waste will be properly disposed of.

In the event of fire or explosion, quantities of fire-fighting water and other chemicals may be used. In the paved areas, these will be collected by the sewers and transported to the normal wastewater treatment system. In the tank areas, these wastewaters will be retained by the tank berms, removed by vacuum truck or temporary pumps, and discharged to the wastewater system.

6.4 REPORTING AND RECORD KEEPING:

All records pertaining to wastewater analyses and volumes, and any other aspects of Discharge Plan compliance, will be maintained at the Lea Refinery office for a period of 5 years.

Results of monitoring activities (wastewater volumes and analyses) will be reported to the NMOCD on a semiannual basis.

7.0 REFERENCES CITED:

G. A.. Baca and Associates, Ltd., 1981, Southern Union Refining Company Lovington Refinery Waste Water Discharge Plan; G. A.. Baca and Associates, Ltd., 36 p. with Plate.

New Mexico Water Quality Control Commission Regulations (as Amended Through November 25, 1988); New Mexico Water Quality Control Commission, Santa Fe, New Mexico, 91 p.

Nicholson, A. and Clebsch, A., 1961, Geology and Ground-Water Conditions in Southern Lea County, New Mexico; New Mexico Bureau of Mines and Mineral Resources Ground Water Report 6, 123 p.

Pilko and Associates, Inc., 1989, Groundwater Monitoring Well Installation, Sampling, and Analysis of Lovington, New Mexico Refinery (Prepared for Holly Corporation); Pilko and Associates, Inc., Houston, Texas, 8 p. with Appendices.

U.S. Department of Agriculture Soil Conservation Service, 1973, Peak Rates of Discharge for Small Watersheds; Engineering Manual for Conservation Practices, Chapter 2, U.S. Department of Agriculture, Washington, D.C., 32 p.

U.S. Code of Federal Regulations, Section 40 (Protection of the Environment), as revised 1990; U.S. Environmental Protection Agency, Washington, D.C.

U.S. Environmental Protection Agency, 1986-1991, Test Methods for Evaluating Solid Waste (SW-846), Third Edition, U.S. Environmental Protection Agency. Washington, D.C.

APPENDIX A

293-1

LOG & AS-BUILT DIAGRAM

GEOLOGIST: Darryl Carlson
DRILLER: Southwest Engineering
DRILLING METHOD: Hollowstem Auger

COMPLETION DATE: 11-9-88
TOP OF CASING ELEV.: 114.4'
GROUND SURFACE ELEV.: 98.6'

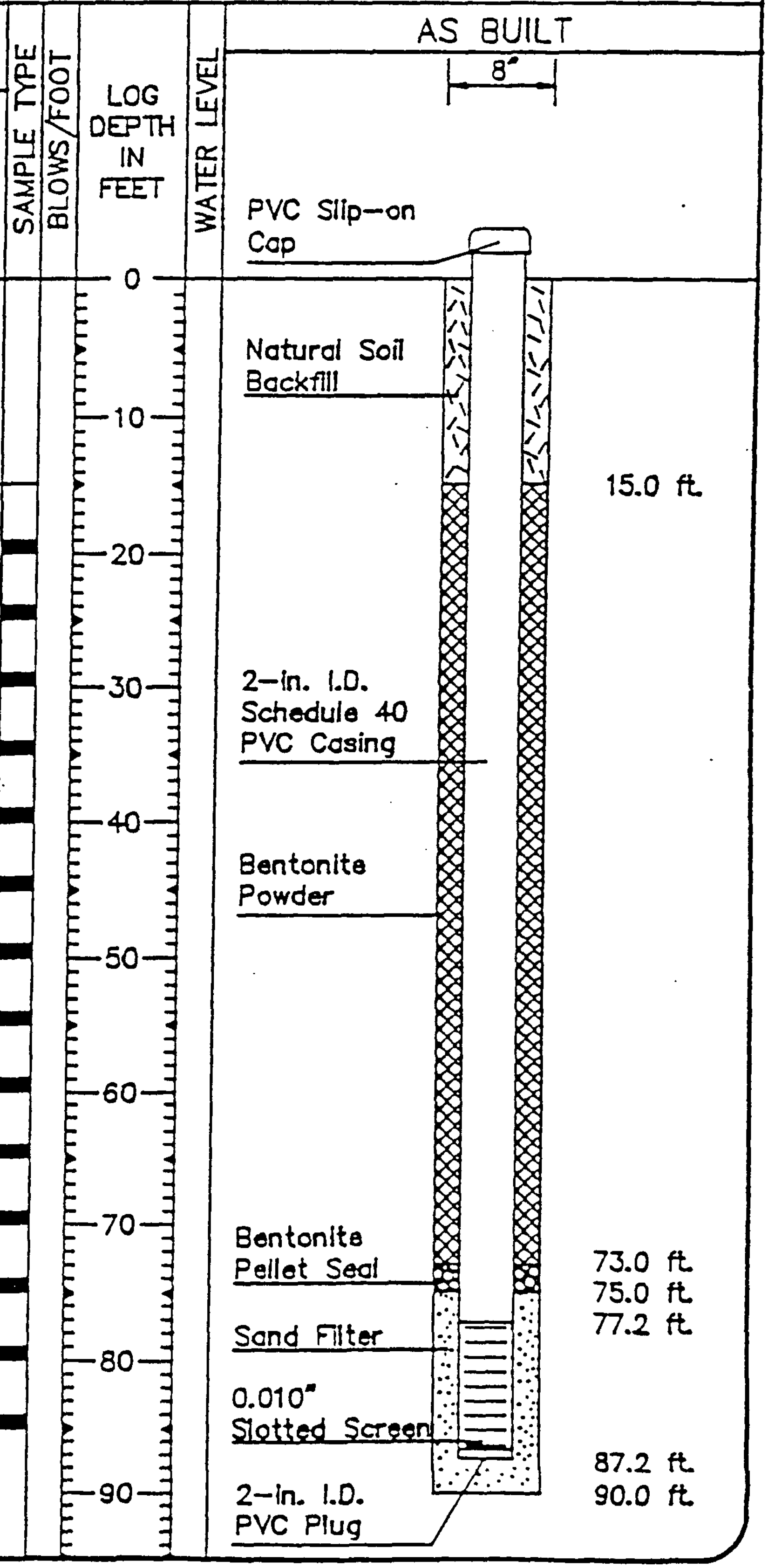
GEOLOGIC LOG

GROUND SURFACE

Borehole previously sampled 0'–15'

Dense, tan, fine SAND (Sa)
- slight chemical odor
- slight chemical odor
- with thin cemented seam at 30', and slight odor
- with thin cemented seam at 35'–36', chemical odor slightly stronger at 32'–35'
- questionable odor at 40'
- no detectable odor at 45'
- no detectable odor at 50'
- no detectable odor at 55'
- weakly cemented 58'–60' no detectable odor at 60'
- weakly cemented seams at 61', 63', 65', no detectable odor at 65'
- with numerous cemented seams 65'–70', no detectable odor at 70'
- with fewer cemented seams moist with no detectable odor at 75'
- no detectable odor at 80' saturated below 81'
- no detectable odor at 85'

Total Depth = 90 ft.



PILKO & ASSOCIATES, INC.

TW-1
Southern Union Refinery
Overflow Pond

Job No. 293
Nov., 1988
Page 1 of 1

LOG & AS-BUILT DIAGRAM

GEOLOGIST: Darryl Carlson
DRILLER: Southwest Engineering
DRILLING METHOD: Hollowstem Auger

COMPLETION DATE: 11-10-88
TOP OF CASING ELEV.: 100.0'
GROUND SURFACE ELEV.: 84.7'

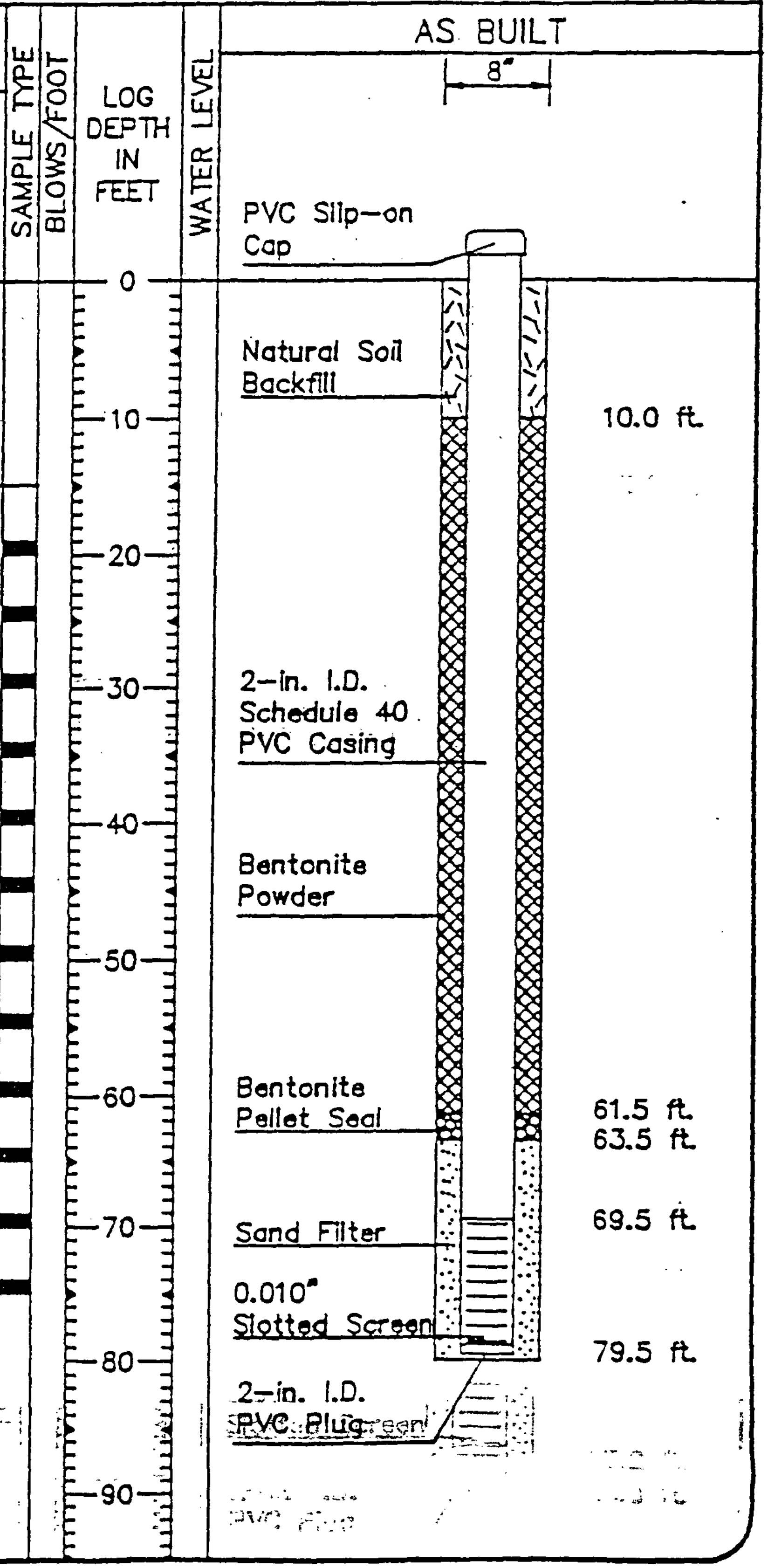
GEOLOGIC LOG

GROUND SURFACE

Borehole previously sampled 0'-15'

Dense, tan, fine SAND (Sa)
- damp, fuel odor (kerosene?) 15'-20'
- fuel odor 20'-25'
- fuel odor 25'-30'
- light gray, slightly silty and weakly cemented 28'-34'
- slight fuel odor 30'-32'
- no detectable odor 32'-35'
- tan below 35'
- no detectable odor 35'-40'
- no detectable odor 40'-45'
- light gray and weakly cemented 44'-46'
- no detectable odor 45'-50'
- no detectable odor 50'-55'
- weakly cemented 58'-60'
- no detectable odor 55'-60'
- weakly cemented 63'-65'
- no detectable odor 60'-65'
- moist below 65'
- no detectable odor 65'-70'
- wet at 70'
- no detectable odor 70'-75'

Total Depth = 80 ft.



PILKO & ASSOCIATES, INC.

TW-2

Southern Union Refinery
API Truck Rack

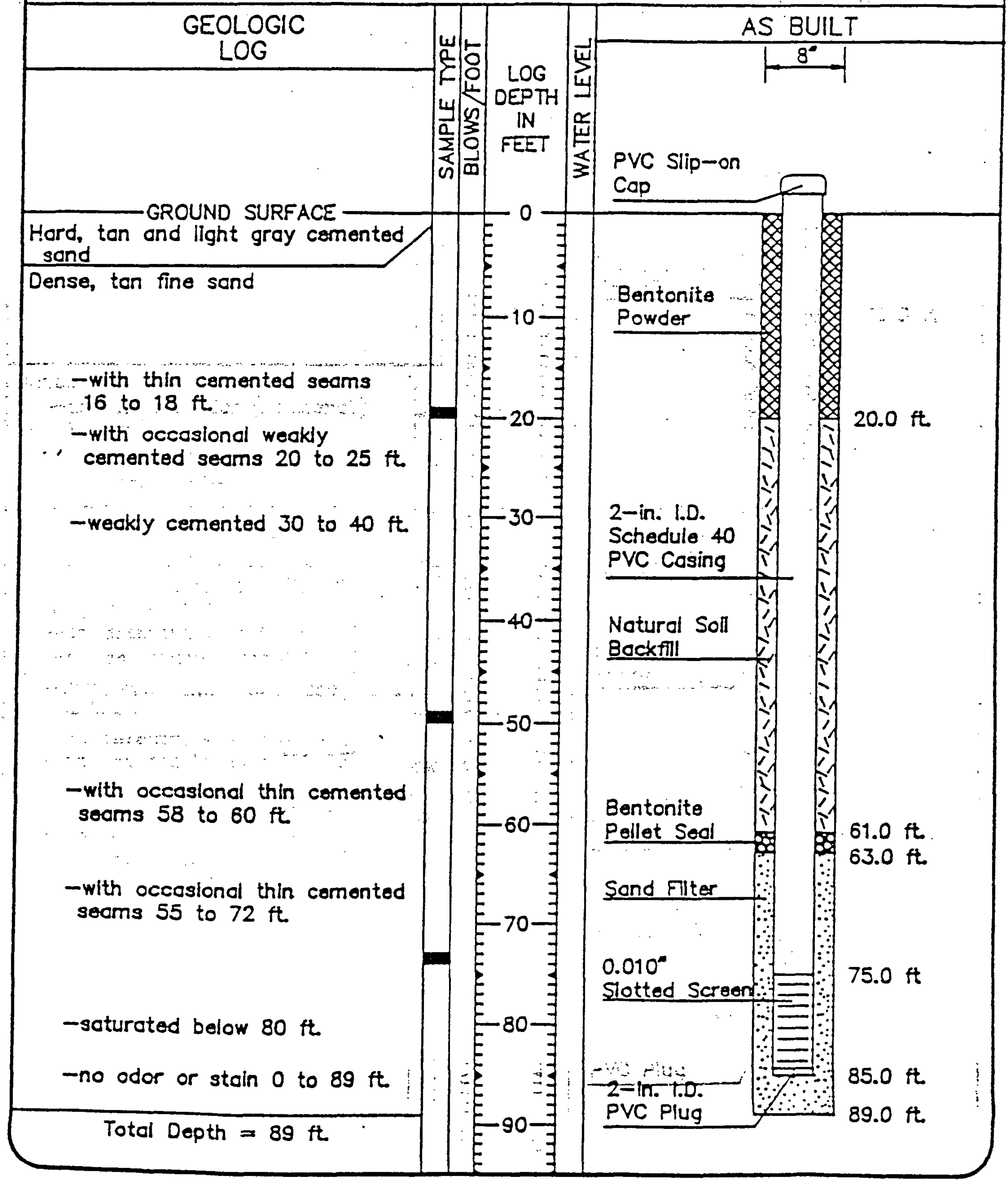
Job No. 293
Nov., 1988
Page 1 of 1

7599-2

LOG & AS-BUILT DIAGRAM

GEOLOGIST: Darryl Carlson
DRILLER: Southwest Engineering
DRILLING METHOD: Hollowstem Auger

COMPLETION DATE: 1-20-89
TOP OF CASING ELEV.: 115.85'
GROUND SURFACE ELEV.: Not Determined



GEOLOGIC LOG

GROUND SURFACE

Hard, tan and light gray cemented sand

Dense, tan fine sand
- with thin cemented seams 16 to 18 ft.
- with occasional weakly cemented seams 20 to 25 ft.
- weakly cemented 30 to 40 ft.
- with occasional thin cemented seams 58 to 60 ft.
- with occasional thin cemented seams 55 to 72 ft.
- saturated below 80 ft.
- no odor or stain 0 to 89 ft.

Total Depth = 89 ft.

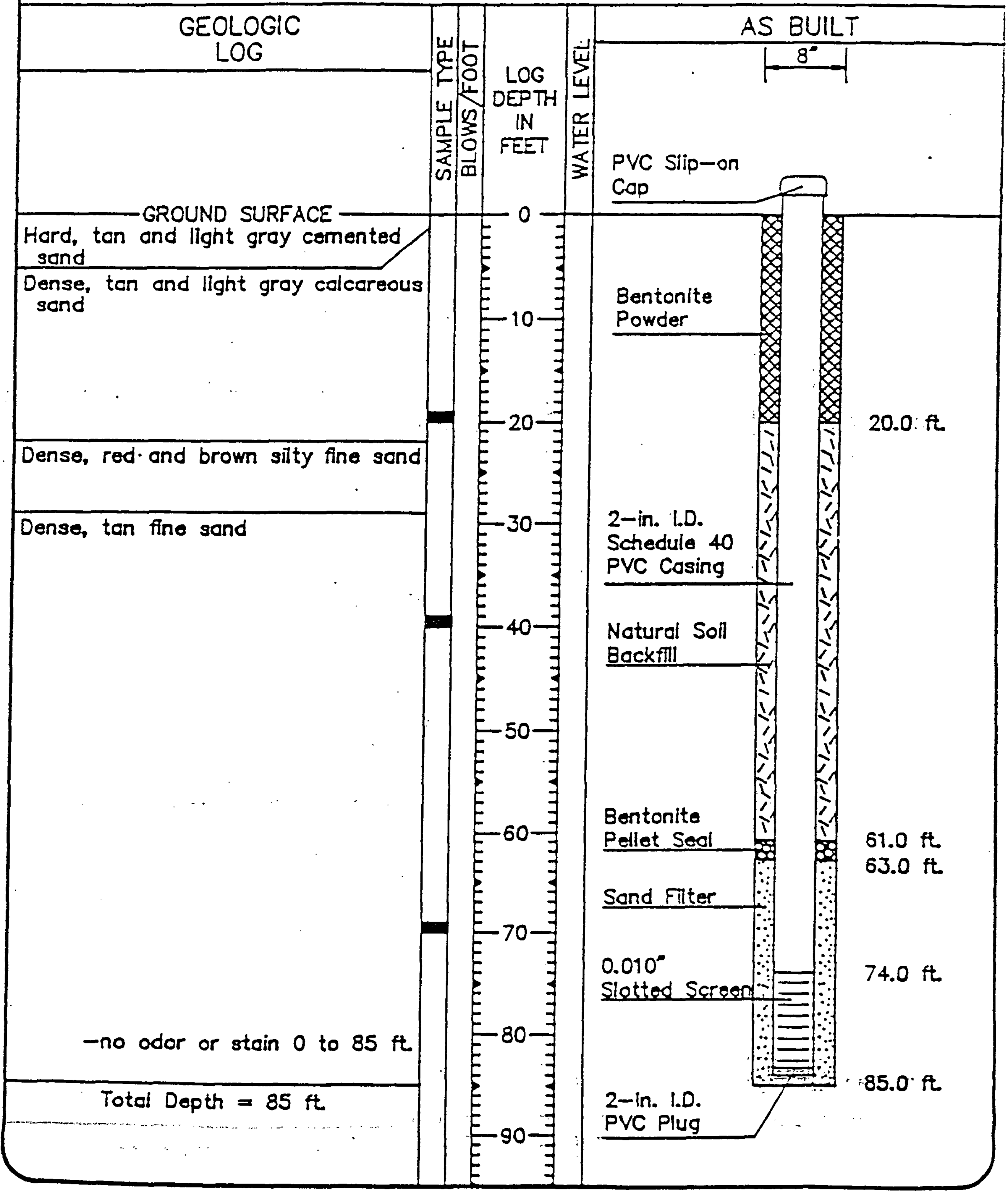
PILKO & ASSOCIATES, INC.	TW-3 Southern Union Refinery New Mexico	Job No.: 7599 Jan., 1989 Page 1 of 1

7599-1

LOG & AS-BUILT DIAGRAM

GEOLOGIST: Darryl Carlson
DRILLER: Southwest Engineering
DRILLING METHOD: Hollowstem Auger

COMPLETION DATE: 1-21-89
TOP OF CASING ELEV.: 109.76'
GROUND SURFACE ELEV.: Not Determined



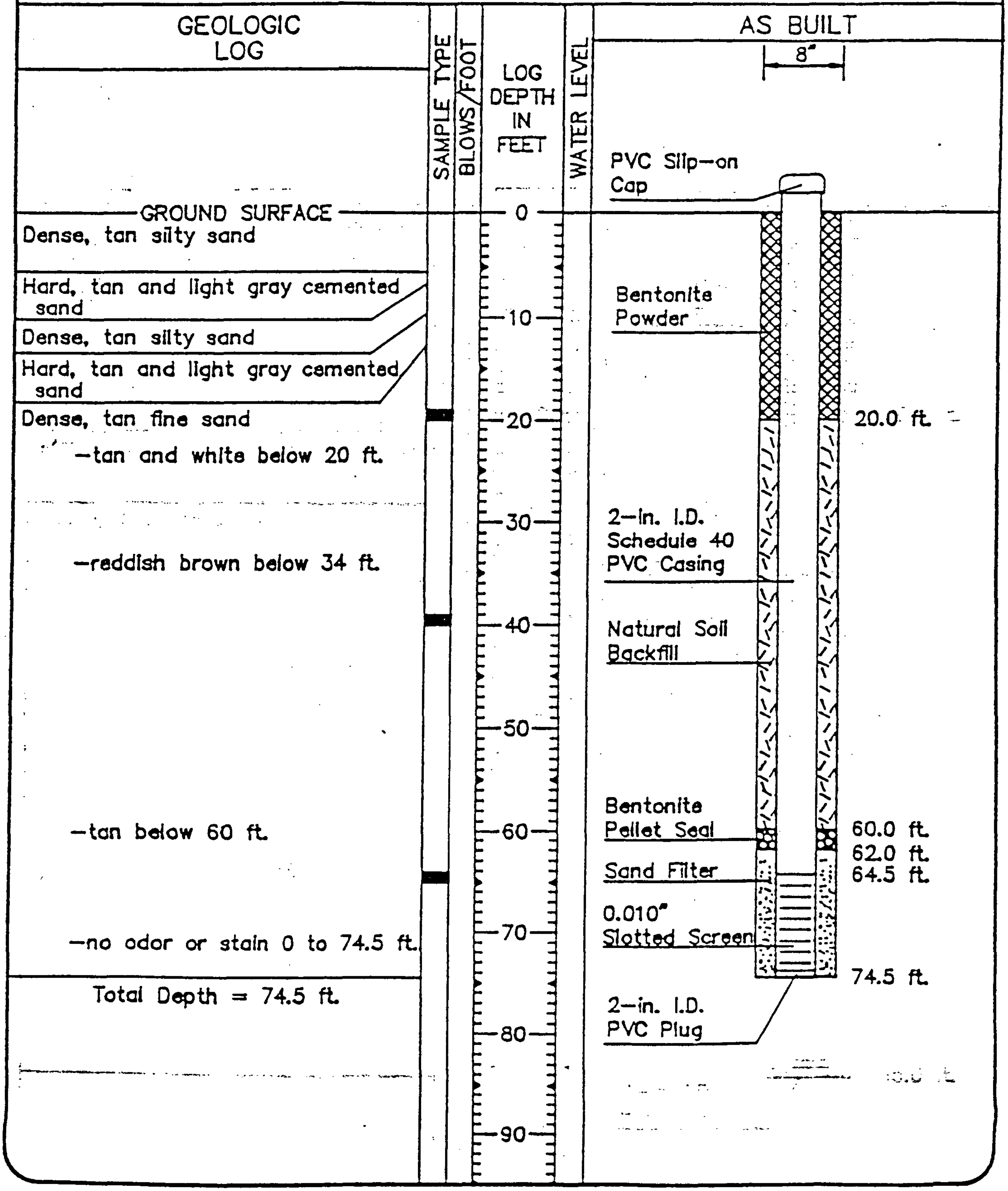
PILKO & ASSOCIATES, INC.	TW-4 Southern Union Refinery New Mexico	Job No.: 7599 Jan., 1989 Page 1 of 1

7599-3

LOG & AS-BUILT DIAGRAM

GEOLOGIST: John Buchanan
DRILLER: Southwest Engineering
DRILLING METHOD: Hollowstem Auger

COMPLETION DATE: 1-16-89
TOP OF CASING ELEV.: 98.73'
GROUND SURFACE ELEV.: Not Determined



PILKO & ASSOCIATES, INC.

TW-5
Southern Union Refinery
New Mexico

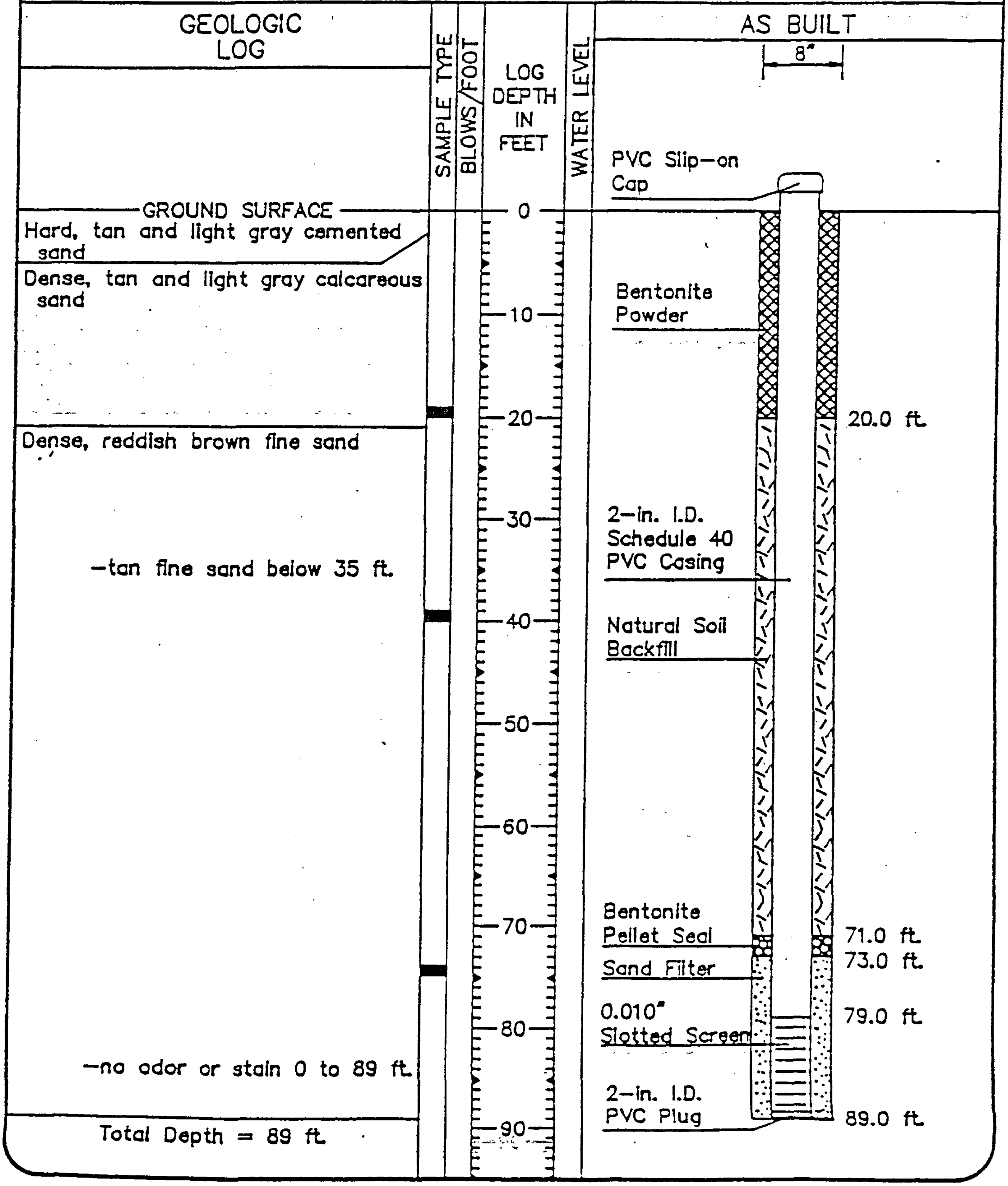
Job No.: 7599
Jan., 1989
Page 1 of 1

7599-4

LOG & AS-BUILT DIAGRAM

GEOLOGIST: John Buchandn
DRILLER: Southwest Engineering
DRILLING METHOD: Hollowstem Auger

COMPLETION DATE: 1-19-89
TOP OF CASING ELEV.: 115.90'
GROUND SURFACE ELEV.: Not Determined



Hard, tan and light gray cemented sand

Dense, tan and light gray calcareous sand

Dense, reddish brown fine sand

-tan fine sand below 35 ft.

-no odor or stain 0 to 89 ft.

Total Depth = 89 ft.

PILKO & ASSOCIATES, INC.

TW-6
Southern Union Refinery
New Mexico

Job No.: 7599
Jan., 1989
Page 1 of 1

7599-12

LOG & AS-BUILT DIAGRAM

GEOLOGIST: Darryl Carlson

DRILLER: Southwest Engineering

DRILLING METHOD: Hollowstem Auger

COMPLETION DATE: 1-14-89

TOP OF CASING ELEV.: None

GROUND SURFACE ELEV.:

GEOLOGIC LOG

GROUND SURFACE

Hard, tan and light gray cemented sand

Dense, tan fine sand

-with occasional weakly cemented seams 15 to 20 ft.

-with occasional thin weakly cemented seams 30 to 32 ft.

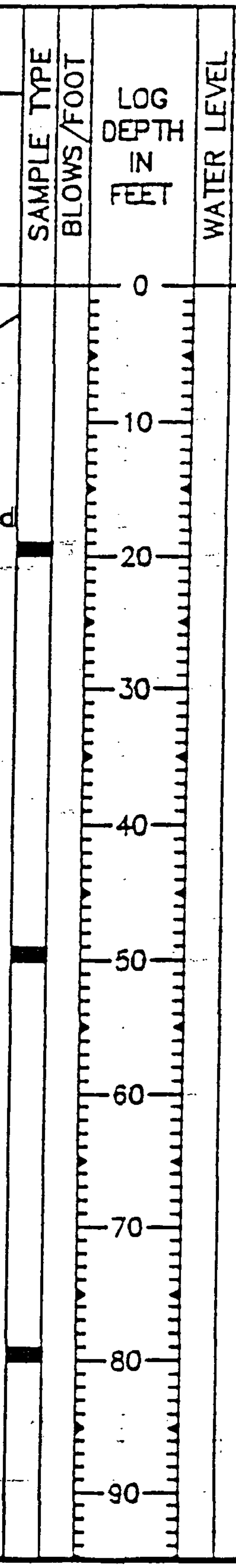
-with numerous thin weakly cemented seams 40 to 53 ft.

-weakly cemented 60 to 85 ft.
-occasional ferrous stains from naturally occuring nodules

-no odor or stain 0 to 95 ft.

-moist 80 to 85 ft.
-saturated below 85 ft.
-with occasional thin weakly cemented seams below 85 ft.

Total Depth = 95 ft.



AS BUILT

Note: This location was abandoned due to the loss of 45 ft. of auger. A well was installed at location TW-7A, approx. 20 ft. west. The borehole was backfilled with soil to 20 ft. and bentonite powder to the surface.

PILKO & ASSOCIATES, INC.

TW-7
Southern Union Refinery
New Mexico

Job No.: 7599
Jan., 1989
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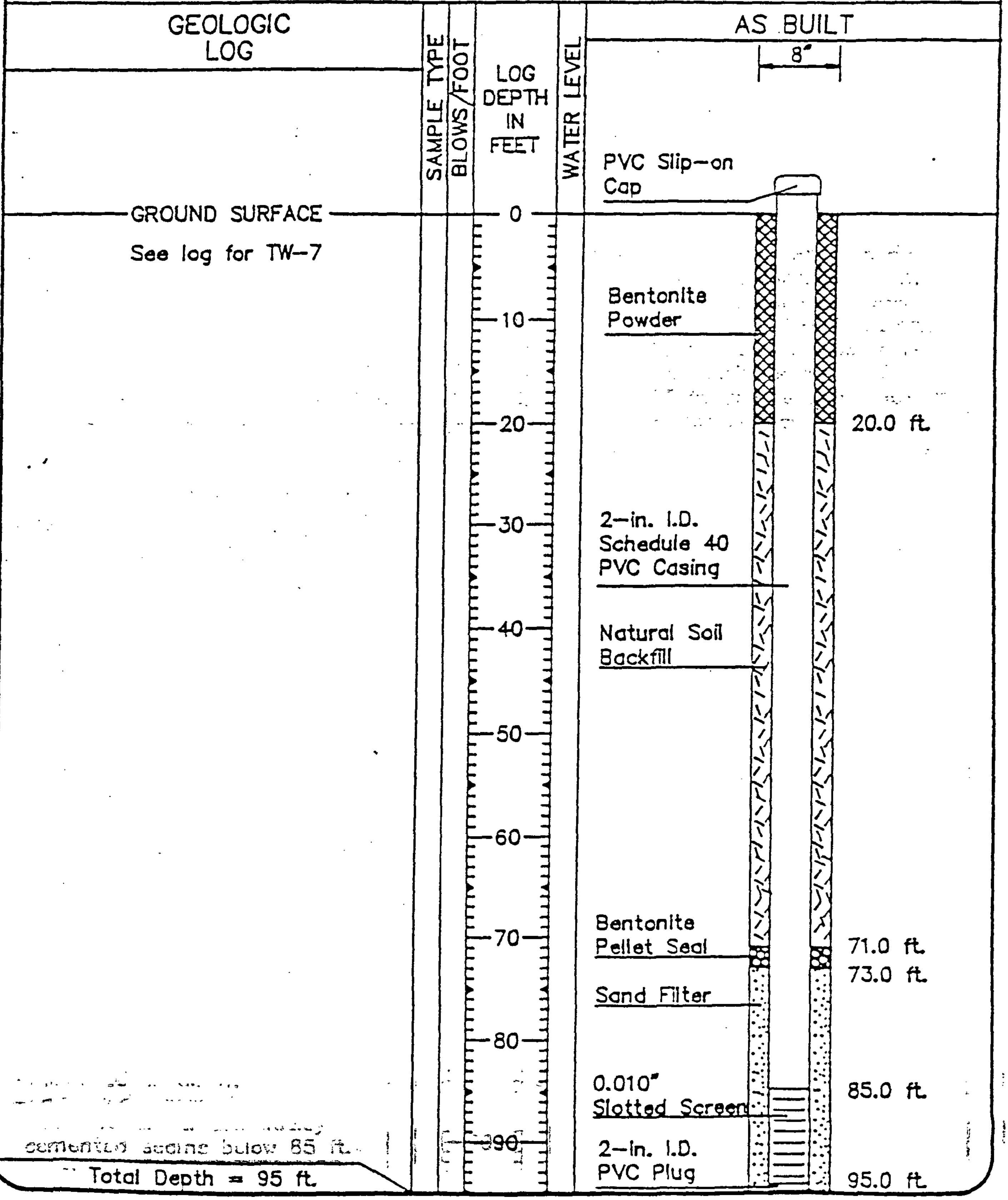
7599-13

LOG & AS-BUILT DIAGRAM

GEOLOGIST: Darryl Carlson
DRILLER: Southwest Engineering
DRILLING METHOD: Hollowstem Auger

COMPLETION DATE: 1-20-89
TOP OF CASING ELEV.: 121.98'
GROUND SURFACE ELEV.: Not Determined



PILKO & ASSOCIATES, INC.

TW-7A
Southern Union Refinery
New Mexico

Job No.: 7599
Jan., 1989
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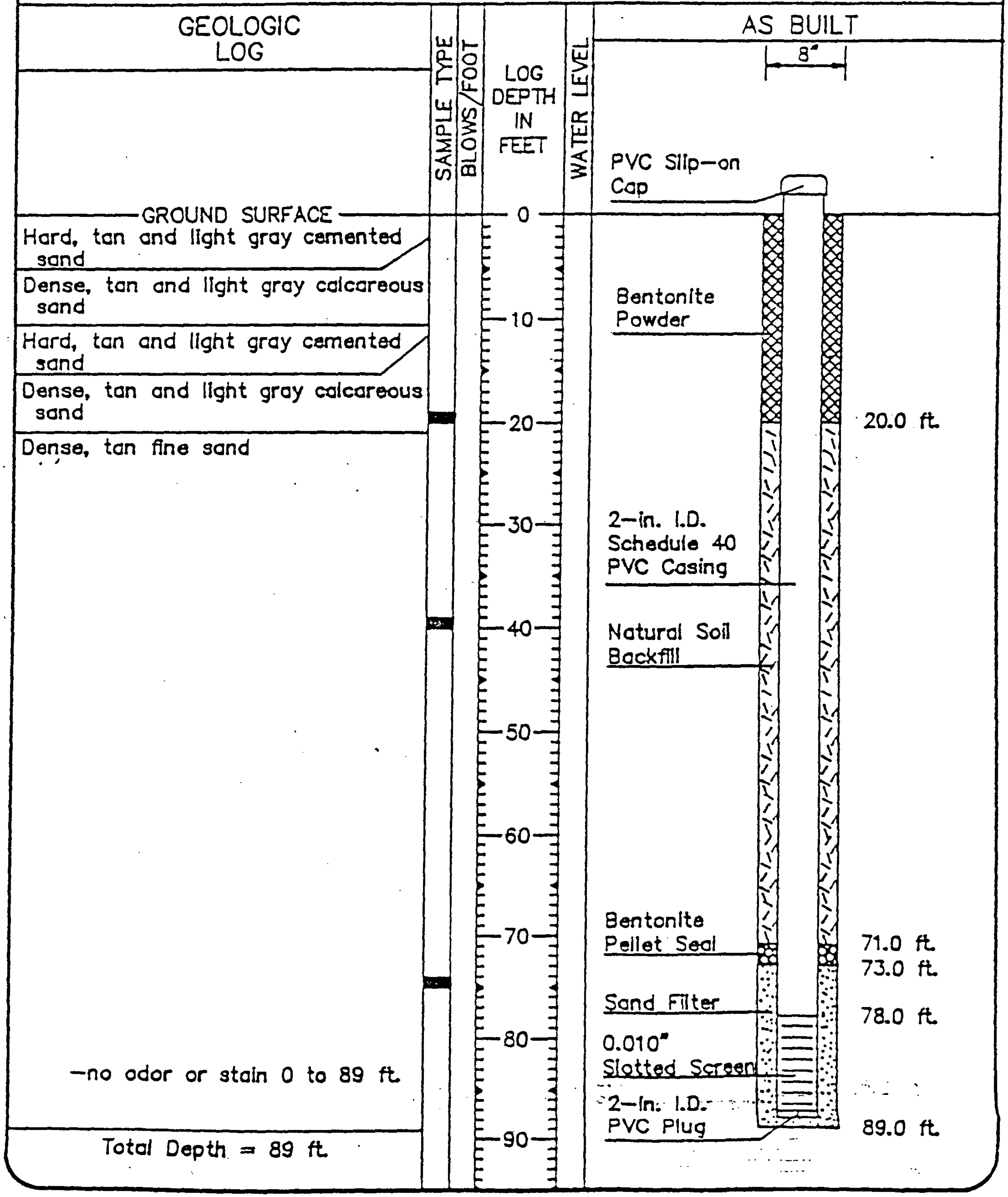
7599-5

LOG & AS-BUILT DIAGRAM

GEOLOGIST: John Buchanan
DRILLER: Southwest Engineering
DRILLING METHOD: Hollowstem Auger

COMPLETION DATE: 1-26-89
TOP OF CASING ELEV.: 113.64'
GROUND SURFACE ELEV.: Not Determined



Hard, tan and light gray cemented sand

Dense, tan and light gray calcareous sand

Hard, tan and light gray cemented sand

Dense, tan and light gray calcareous sand

Dense, tan fine sand

—no odor or stain 0 to 89 ft.

Total Depth = 89 ft.

PILKO & ASSOCIATES, INC.

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Southern Union Refinery
New Mexico

Job No.: 7599
Jan., 1989
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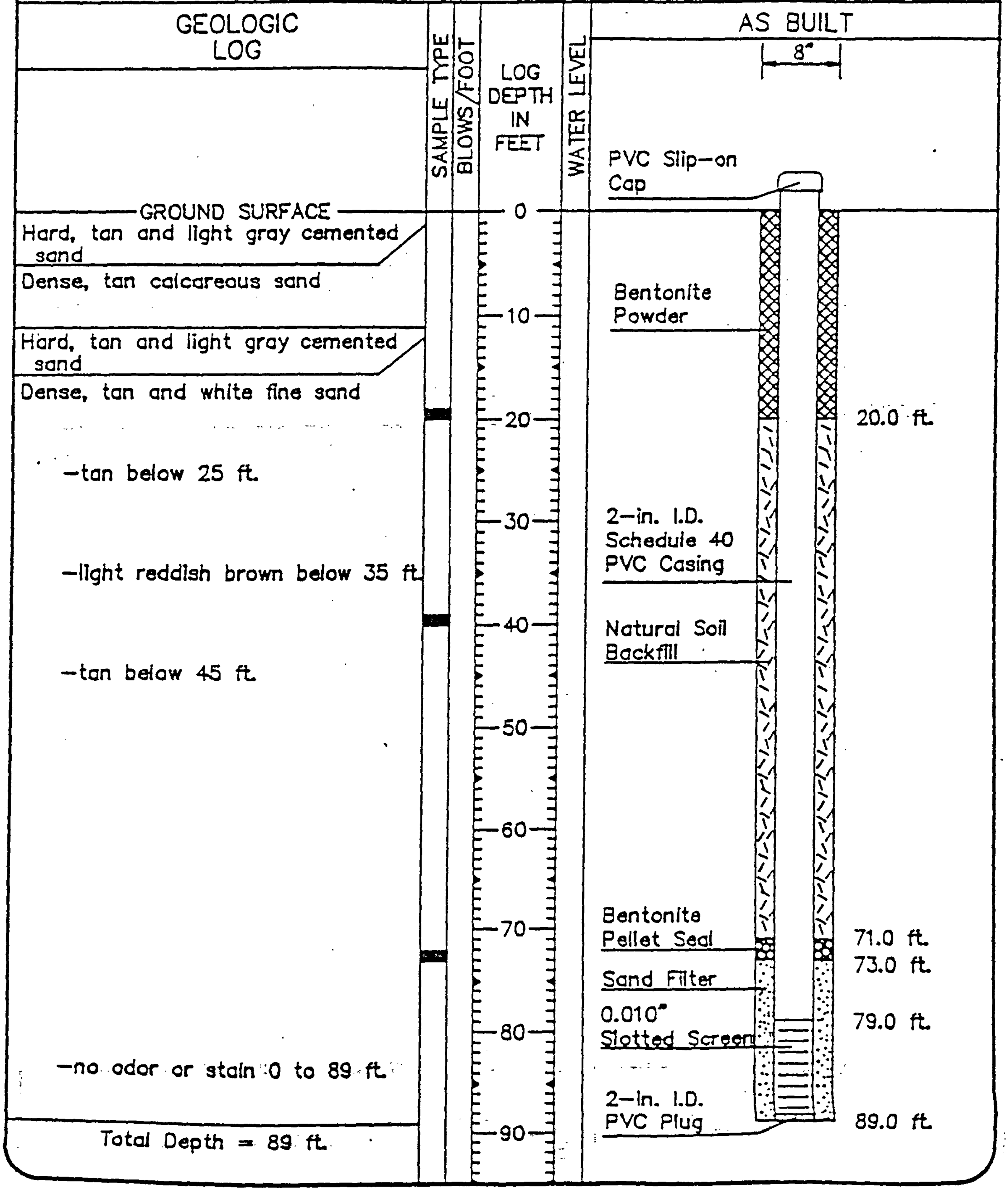
7599-6

LOG & AS-BUILT DIAGRAM

GEOLOGIST: John Buchanan
DRILLER: Southwest Engineering
DRILLING METHOD: Hollowstem Auger

COMPLETION DATE: 1-21-89
TOP OF CASING ELEV.: 113.88'
GROUND SURFACE ELEV.: Not Determined



PILKO & ASSOCIATES, INC.

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Southern Union Refinery
New Mexico

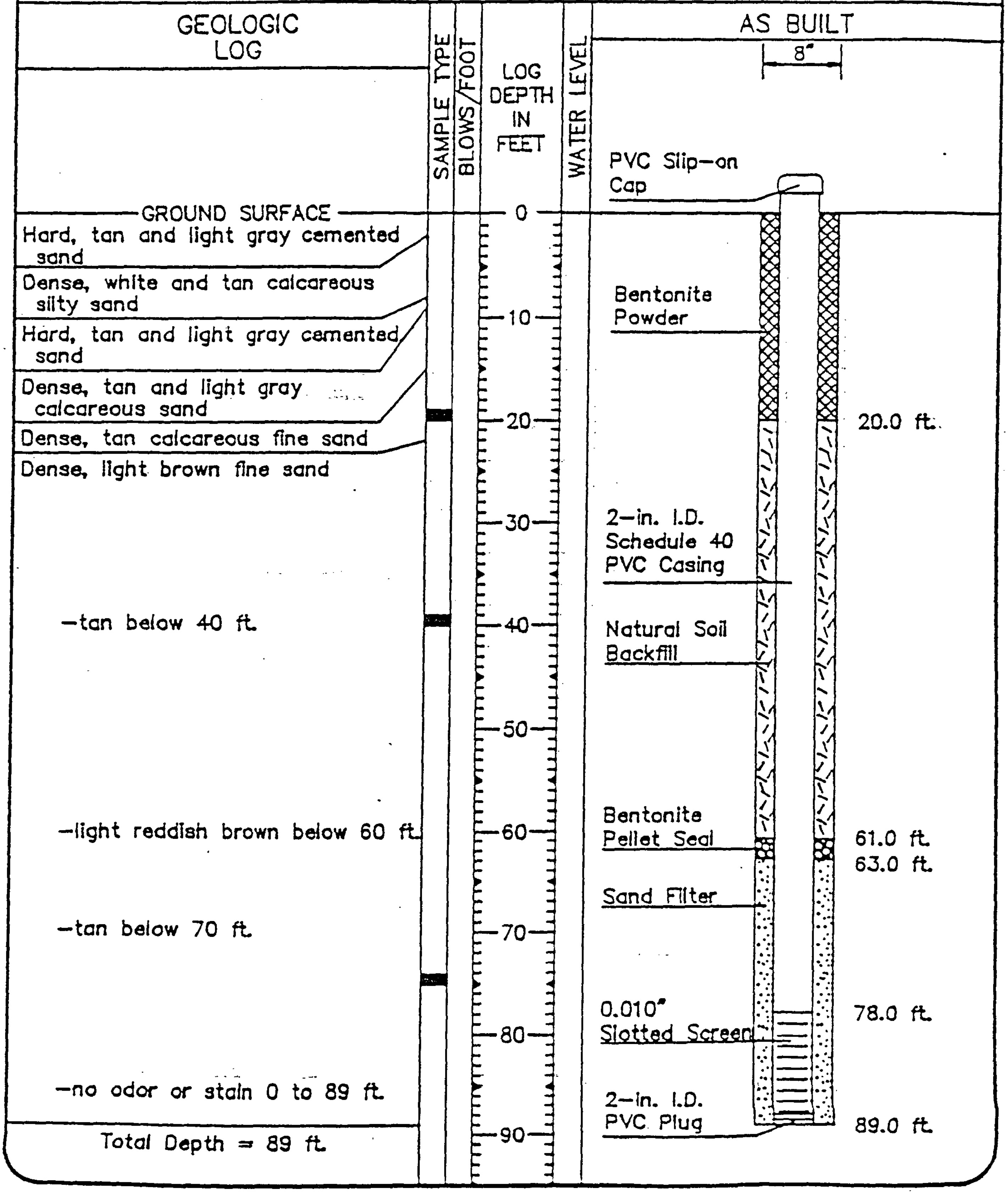
Job No.: 7599
Jan., 1989
Page 1 of 1

7599-7

LOG & AS-BUILT DIAGRAM

GEOLOGIST: Darryl Carlson
DRILLER: Southwest Engineering
DRILLING METHOD: Hollowstem Auger

COMPLETION DATE: 1-21-89
TOP OF CASING ELEV.: 111.48'
GROUND SURFACE ELEV.: Not Determined



Hard, tan and light gray cemented sand

Dense, white and tan calcareous silty sand

Hard, tan and light gray cemented sand

Dense, tan and light gray calcareous sand

Dense, tan calcareous fine sand

Dense, light brown fine sand

-tan below 40 ft.

-light reddish brown below 60 ft.

-tan below 70 ft.

-no odor or stain 0 to 89 ft.

Total Depth = 89 ft.

PILKO & ASSOCIATES, INC.

TW-10
Southern Union Refinery
New Mexico

Job No.: 7599
Jan., 1989
Page 1 of 1

LOG & AS-BUILT DIAGRAM

GEOLOGIST: Darryl Carlson

DRILLER: Southwest Engineering

DRILLING METHOD: Hollowstem Auger

COMPLETION DATE: 1-21-89

TOP OF CASING ELEV.: 103.88'

GROUND SURFACE ELEV.: Not Determined

GEOLOGIC LOG

GROUND SURFACE

Hard, tan and light gray cemented sand

Dense, tan and light gray calcareous sand

Dense, light brown calcareous silty fine sand

Dense, light brown silty fine sand

-weakly cemented 35 to45 ft.

-with weakly cemented seams 45 to 50 ft.

Dense, tan fine sand

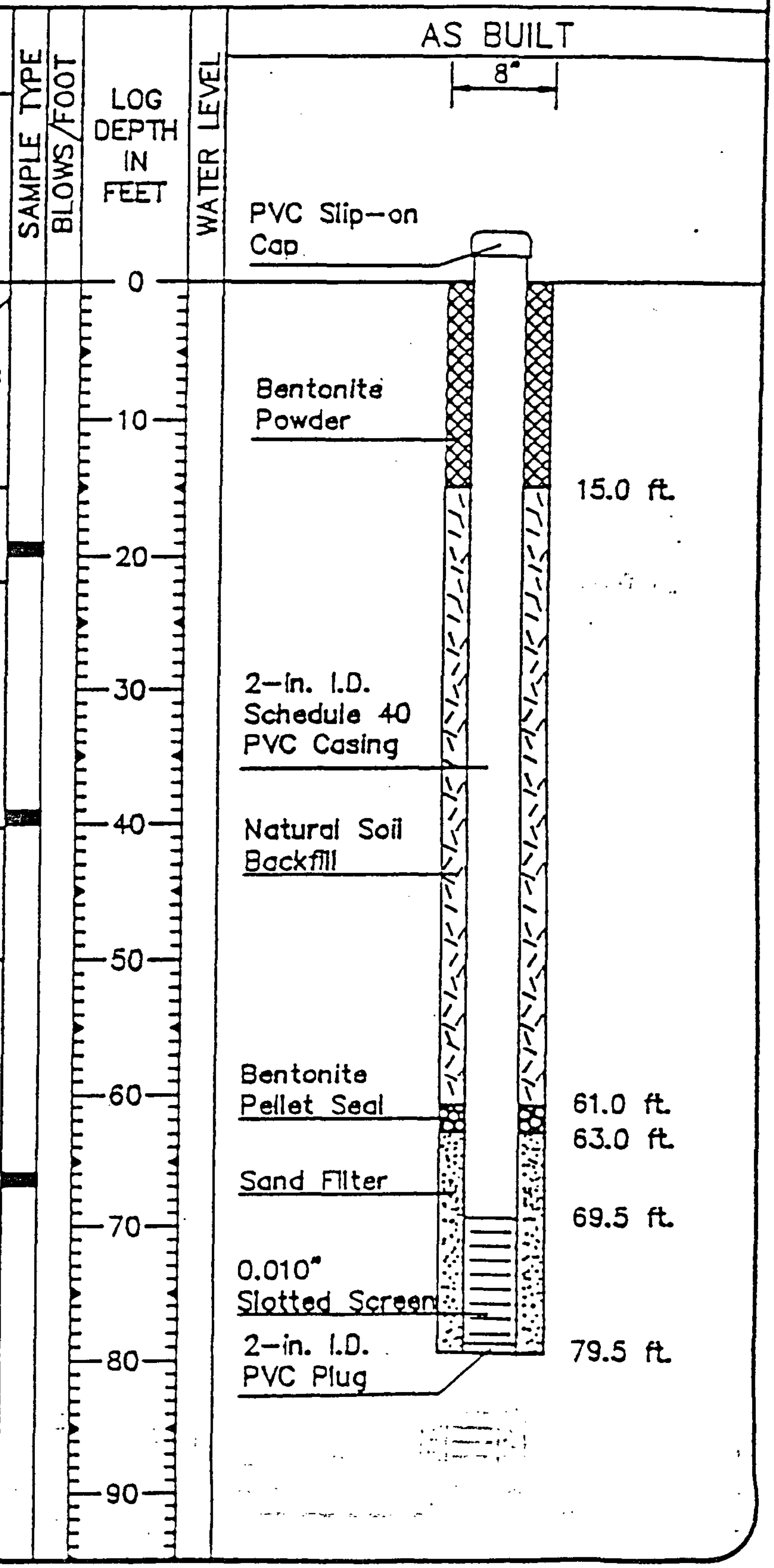
-weakly cemented 56 to 63 ft.

-cemented 63 to 68 ft.

-moist below 69 ft.

-no odor or stain 0 to 79.5 ft.

Total Depth = 79.5 ft.



PILKO & ASSOCIATES, INC.

TW-11

Southern Union Refinery
New Mexico

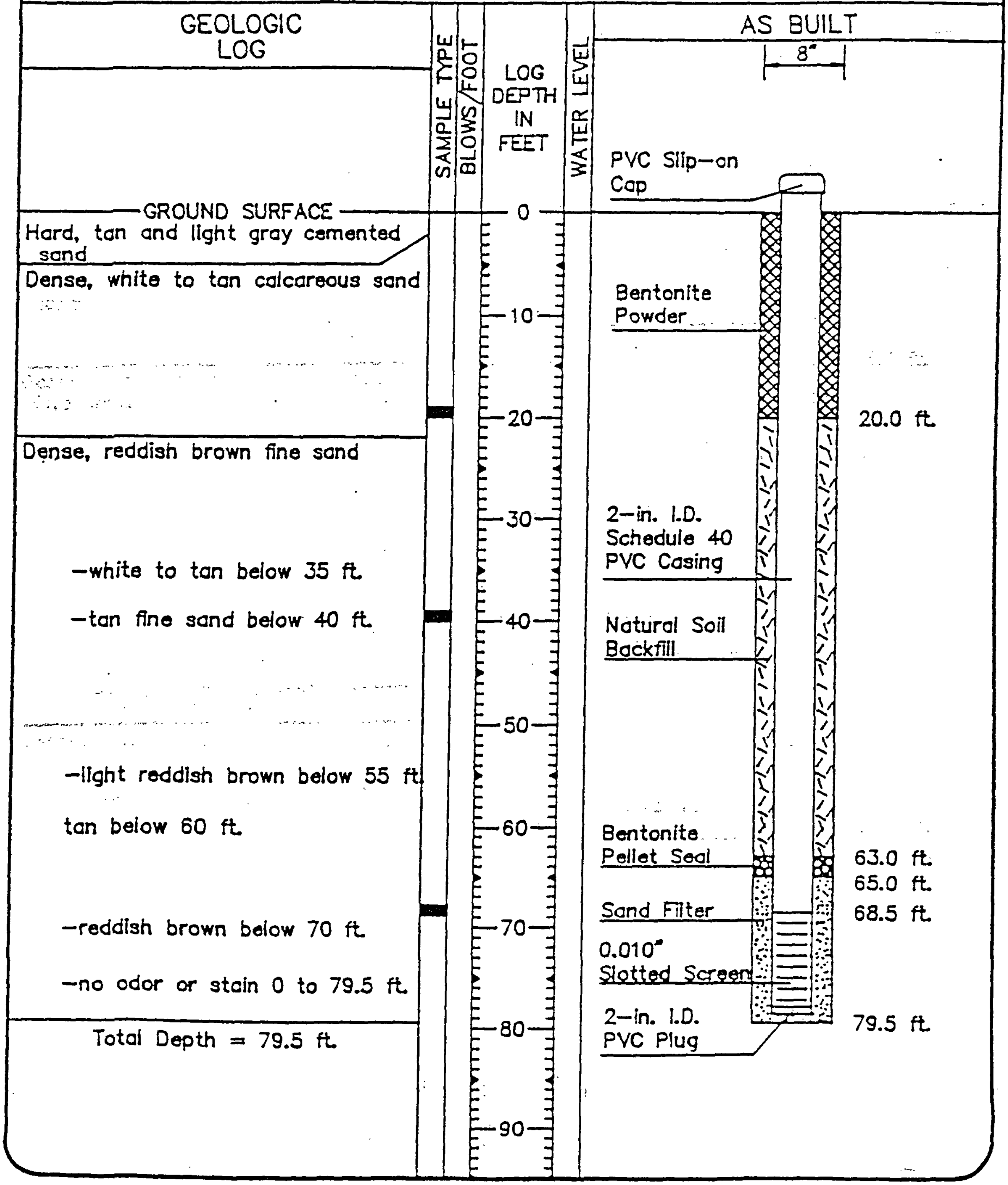
Job No.: 7599
Jan., 1989
Page 1 of 1

7599-9

LOG & AS-BUILT DIAGRAM

GEOLOGIST: Darryl Carlson
DRILLER: Southwest Engineering
DRILLING METHOD: Hollowstem Auger

COMPLETION DATE: 1-19-89
TOP OF CASING ELEV.: 104.01'
GROUND SURFACE ELEV.: Not Determined



PILKO & ASSOCIATES, INC.

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Southern Union Refinery
New Mexico

Job No.: 7599
Jan., 1989
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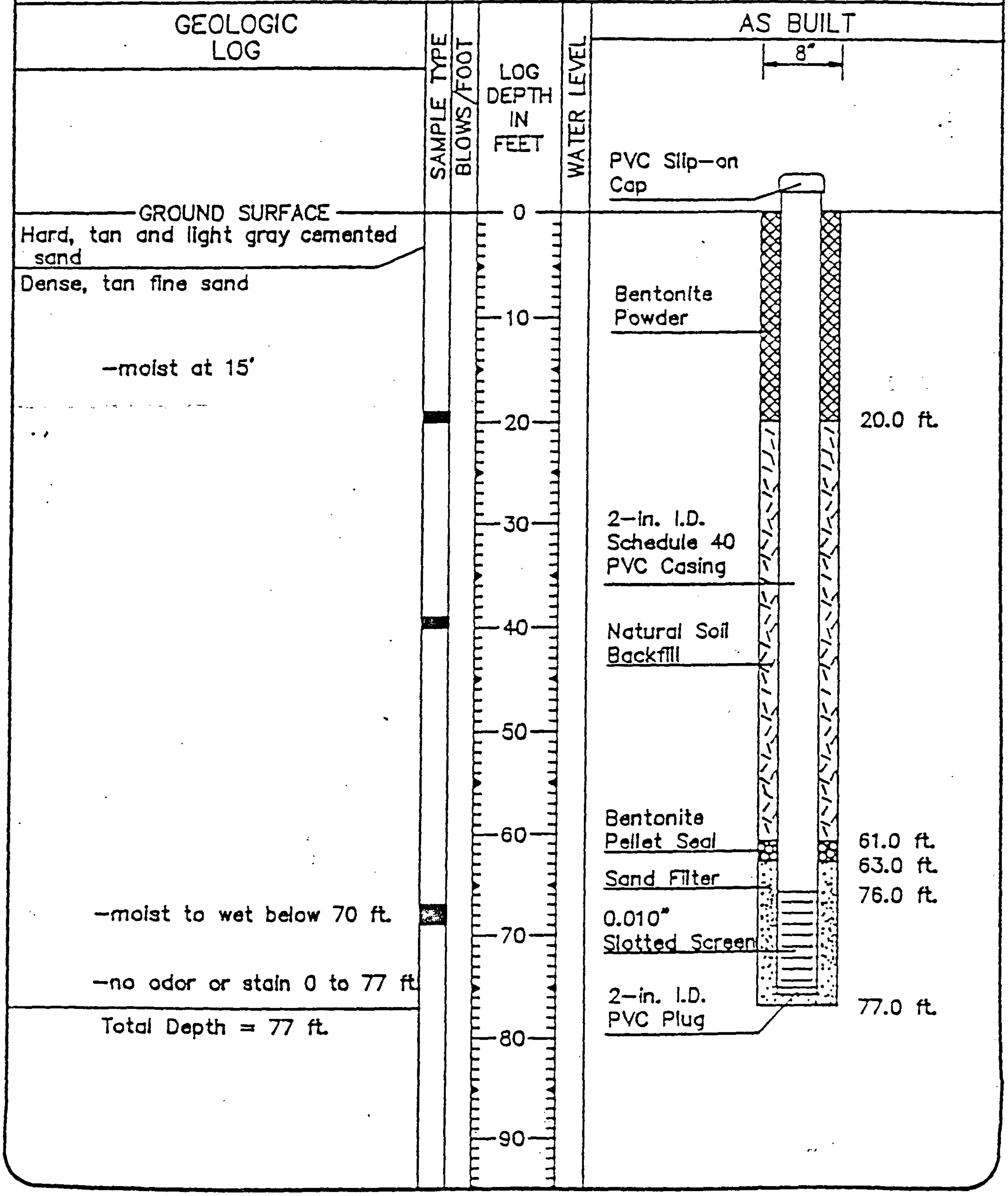
7599-10

LOG & AS-BUILT DIAGRAM

GEOLOGIST: John Buchanan
DRILLER: Southwest Engineering
DRILLING METHOD: Hollowstem Auger

COMPLETION DATE: 1-17-89
TOP OF CASING ELEV.: 99.30'
GROUND SURFACE ELEV.: Not Determined



PILKO & ASSOCIATES, INC.

TW-13
Southern Union Refinery

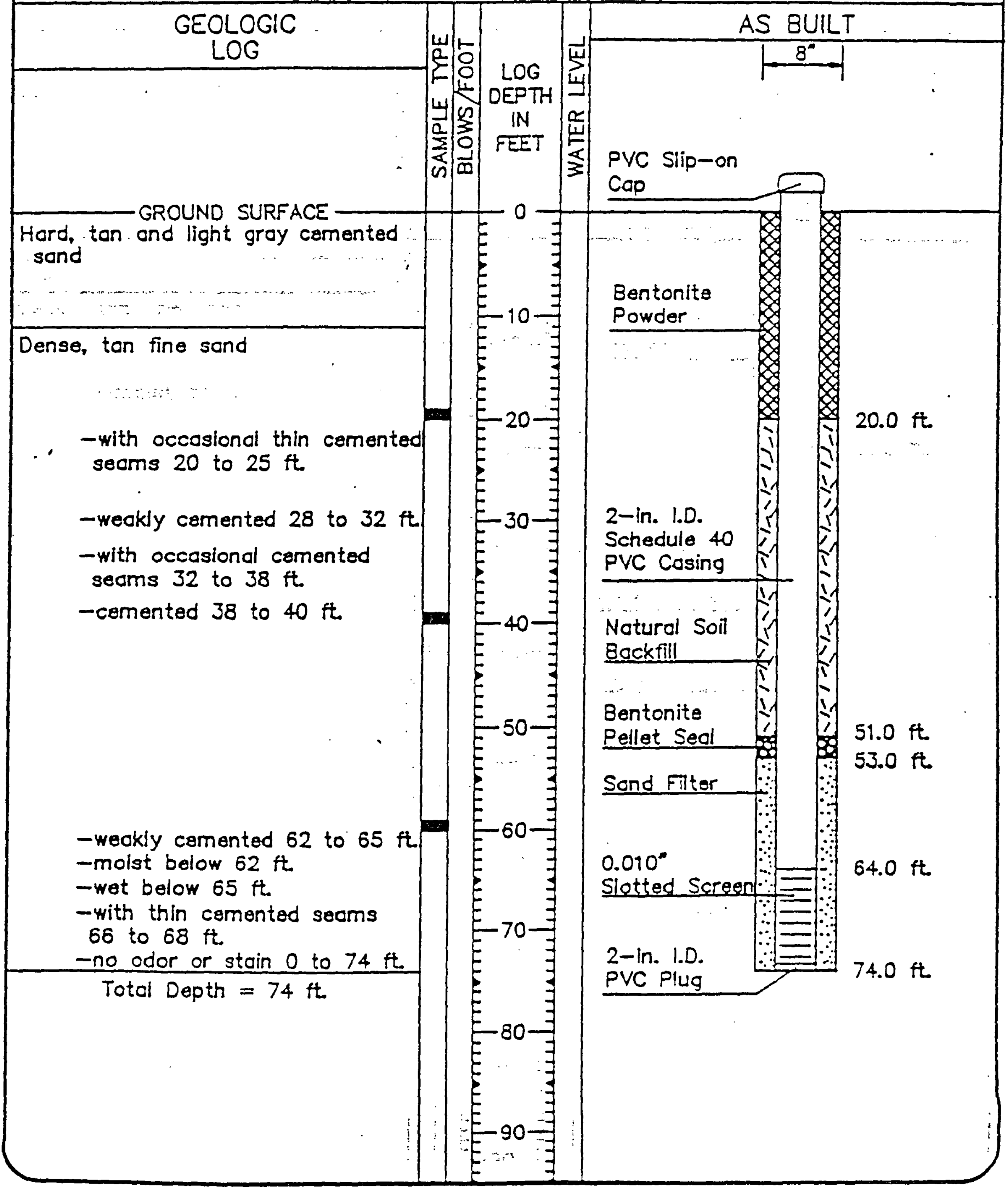
Job No.: 7599
Jan., 1989

7599-11

LOG & AS-BUILT DIAGRAM

GEOLOGIST: Darryl Carlson
DRILLER: Southwest Engineering
DRILLING METHOD: Hollowstem Auger

COMPLETION DATE: 1-16-89
TOP OF CASING ELEV.: 96.00'
GROUND SURFACE ELEV.: Not Determined



Hard, tan and light gray cemented sand

Dense, tan fine sand

-with occasional thin cemented seams 20 to 25 ft.

-weakly cemented 28 to 32 ft.

-with occasional cemented seams 32 to 38 ft.

-cemented 38 to 40 ft.

-weakly cemented 62 to 65 ft.
-moist below 62 ft.
-wet below 65 ft.
-with thin cemented seams 66 to 68 ft.
-no odor or stain 0 to 74 ft.

Total Depth = 74 ft.

PILKO & ASSOCIATES, INC.

TW-14
Southern Union Refinery
New Mexico

Job No.: 7599
Jan., 1989
Page 1 of 1

APPENDIX B

UNICHEM
INTERNATIONAL

MATERIAL SAFETY DATA SHEET

Date Prepared 05/22/86
Supersedes Previous Sheet Dated 10/31/85

I. PRODUCT IDENTIFICATION

Unichem International 707 N. Leech/P. O. Box 1499/Hobbs, New Mexico 88240
EMERGENCY TELEPHONE NUMBER (505) 393-7751

Trade Name UNICHEM 1300

Chemical Description
Proprietary Scale and Corrosion Inhibitor Blend

II. HAZARDOUS INGREDIENTS

Material	TLV (Units)
Potassium Hydroxide CAS# 1310-58-3	2 mg/m³
Proprietary Corrosion Inhibitor	10 mg/m³
Proprietary Corrosion/Scale Inhibitors	Not Established

Neither this product nor its ingredients are listed in any of OSHA Standard, Section 1910.1200 sources as carcinogenic.

III. PHYSICAL DATA

Boiling Point, 760 mm Hg	212°F	Freezing Point	0°F
Specific Gravity (H_2O=1)	1.3 g/ml	Solubility in Water	Complete

Appearance and Odor Amber, Clear Liquid; Slight Sweet Odor

IV. FIRE AND EXPLOSION HAZARD DATA

Flash Point (Test Method) None

Extinguishing Media Carbon Dioxide, Dry Chemical, Water Spray or Fog, Foam. Use a water spray to cool fire-exposed containers.

Special Fire Fighting Procedures Firefighters should wear self-contained breathing apparatus and full protective clothing. Firefighters should be made aware of the corrosive nature of this chemical.

Unusual Fire and Explosion Hazards None

V. HEALTH HAZARD DATA

Threshold Limit Value Not Determined

Effects of Overexposure Contact will cause burns to the skin and severe damage to the eyes. Inhalation of vapors or mists will irritate the entire respiratory tract. Ingestion will cause irritation and burning of the digestive tract.

Emergency and First Aid Procedures **Eyes:** Flush promptly with copious quantities of water for at least fifteen minutes. Seek medical attention. **Skin:** Flush area with water. Wash with soap and remove contaminated clothing. **Inhalation:** Remove to fresh air. Apply artifical respiration if necessary. **Ingestion:** Call a physician. Do not induce vomiting. Dilute with water or milk.

VI. REACTIVITY DATA

Stability	**Stable** X	**Conditions to Avoid**	None
	Unstable		

Incompatibility (Materials to Avoid) Strongly acidic materials, oxidizers.

Hazardous Decomposition of Products Oxides of Carbon and Nitrogen

Hazardous Polymerization	**May Occur**	**Conditions to Avoid**
	Will Not Occur X	None

VII. SPILL OR LEAK PROCEDURES

Steps to be Taken if Material is Released or Spilled Provide adequate ventilation. Remove sources of ignition. Contain and absorb spill.

Waste Disposal Method Dispose via a licensed waste disposal company. Follow local, state, and federal regulations.

VIII. SPECIAL PROTECTION INFORMATION

Respiratory Protection (Specify Type) Use air-supplied or self-contained breathing apparatus if exposure levels exceed TLV for this product or its ingredients.

Ventilation	**Local Exhaust**	As needed to prevent accumulation of	**Special**	None
	Mechanical (General)	vapors above TLV	**Other**	None

Protective Gloves Rubber Eye Protection Safety Glasses, Goggles, and/or Face Shield

Other Protective Equipment Overalls, Rubber Boots, Eyewash Stations, Safety Showers

IX. SPECIAL PRECAUTIONS

Precautions to be Taken in Handling and Storing Store in cool, well-ventilated, low fire-risk area away from ignition sources and incompatible materials. Keep containers closed when not in use. Do not transfer or store in improperly marked containers.

Other Precautions Avoid prolonged or repeated breathing of vapors or contact with skin. Do not ingest.

UNICHEM
INTERNATIONAL

MATERIAL SAFETY DATA SHEET

Date Prepared 05/15/87
Supersedes Previous Sheet Dated Not Dated

I. PRODUCT IDENTIFICATION

Unichem International 707 N. Leech/P. O. Box 1499/Hobbs, New Mexico 88240
EMERGENCY TELEPHONE NUMBER (505) 393-7751

Trade Name ALPHA 512

Chemical Description Proprietary Microbiocide Blend

II. HAZARDOUS INGREDIENTS

Material	TLV (Units)
Potassium Dimethyldithiocarbamate CAS# 128-03-0	None Established
Methanol CAS# 000-067-561	200 ppm (Skin) 8 Hour TWA or 260 mg/m^3

Neither this product nor its ingredients are listed in any of OSHA Standard, Section 1910.1200 sources as carcinogenic.

III. PHYSICAL DATA

Boiling Point, 760 mm Hg	150°F (Initial)	Freezing Point	-35°F
Specific Gravity (H_2O=1)	1.0 g/ml	Solubility in Water	Complete

Appearance and Odor Brown Clear Liquid; Alcoholic - Sulfur Odor

IV. FIRE AND EXPLOSION HAZARD DATA

Flash Point (Test Method) 69°F TCC

Extinguishing Media Carbon Dioxide, Dry Chemical, Water Spray, or Fog, Foam. Use a water spray to cool fire-exposed containers.

Special Fire Fighting Procedures Firefighters should wear self-contained breathing apparatus and full protective clothing. Firefighters should be made aware of the corrosive nature of this chemical.

Unusual Fire and Explosion Hazards Methanol is a moderate explosion hazard and a dangerous fire hazard when exposed to heat, sparks, or flames and can react vigorously with oxidizing agents.

Precautions to be taken in Handling and Storing Store in cool, well-ventilated, Product ALPHA 512

V. HEALTH HAZARD DATA

Threshold Limit Value Not Determined

Effects of Overexposure Contact will cause burns to the skin and severe damage to the eyes. Inhalation of vapors or mists will irritate the entire respiratory tract. Ingestion will cause irritation and burning of the digestive tract. Harmful or fatal if swallowed. Symptoms of overexposure to liquid or vapor include dizzines visual impairment, nausea, and narcosis.

Emergency and First Aid Procedures Eyes: Flush promptly with copious quantities of water for at least fifteen minutes. Seek medical attention. Skin: Flush area with water. Wash with soap and remove contaminated clothing. Inhalation: Remove to fresh air. Apply artifical respiration if ncessary. Ingestion: Call a physician. Induce vomiting, if conscious. Give patient water or milk.

VI. REACTIVITY DATA

Stability	Stable X	Conditions to Avoid	None
	Unstable		

Incompatibility (Materials to Avoid) Stongly Acidic Materials, Oxidizers

Hazardous Decomposition of Products Oxides of Carbon, Nitrogen, and Sulfur Carbon Disulfide, Dimethylamine

Hazardous Polymerization	May Occur	Conditions to Avoid
	Will Not Occur x	None

VII. SPILL OR LEAK PROCEDURES

Steps to be Taken if Material is Released or Spilled Provide adequate ventilation. Remove sources of ignition. Contain and absorb spill. This material is toxic to fish.

Waste Disposal Method Dispose via a licensed waste disposal company. Follow local, state, and federal regulations.

VIII. SPECIAL PROTECTION INFORMATION

Respiratory Protection (Specify Type) Use air-supplied or self-contained breathing apparatus if exposure levels exceeds TLV for this product or its ingredients.

Ventilation	Local Exhaust	As needed to prevent accumulation of	Special	None
	Mechanical (General)	vapors above TLV	Other	None

Protective Gloves Rubber **Eye Protection** Safety Glasses, Goggles, and/or Face Shield

Other Protective Equipment Overalls, Rubber Boots, Eyewash Stations, Safety Showers

IX. SPECIAL PRECAUTIONS

Precautions to be Taken in Handling and Storing Store in cool, well-ventilated, l fire-risk area away from ignition sources and incompatable materials. Keep containers c when not in use.

Other Precautions Avoid prolonged or repeated breathing of vapors or contact with skin. Do not ingest.

UNICHEM
INTERNATIONAL

MATERIAL SAFETY DATA SHEET

Date Prepared 05/22/86
Supersedes Previous Sheet Dated Not Dated

I. PRODUCT IDENTIFICATION

Unichem International 707 N. Leech/P. O. Box 1499/Hobbs, New Mexico 88240
EMERGENCY TELEPHONE NUMBER (505) 393-7751

Trade Name ALPHA 570

Chemical Description
Proprietary Biocide Blend

II. HAZARDOUS INGREDIENTS

Material	TLV (Units)
Alkyl Dimethyl Benzylammonium Chloride	Not Established
Alkyl Dimethyl Ethylammonium Bromide	Not Established
Tributyltin Neodecanoate	Not Established

Neither this product nor its ingredients are listed in any of OSHA Standard, Section 1910.1200 sources as carcinogenic.

III. PHYSICAL DATA

Boiling Point, 760 mm Hg	208°F	Freezing Point	32°F
Specific Gravity (H_2O=1)	0.998 g/ml	Solubility in Water	Complete

Appearance and Odor Light Straw Color, Slight Musty Odor; Liquid

IV. FIRE AND EXPLOSION HAZARD DATA

Flash Point (Test Method) None

Extinguishing Media Carbon Dioxide, Dry Chemical, Water Spray or Fog, Foam. Use a water spray to cool fire-exposed containers.

Special Fire Fighting Procedures Firefighters should wear self-contained breathing apparatus and full protective clothing. Firefighters should be made aware of the corrosive nature of this chemical.

Unusual Fire and Explosion Hazards None

Precautions to be Taken in Handling and Storing store in cool, well-ventilated,

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V. HEALTH HAZARD DATA

Threshold Limit Value Not Determined

Acute Oral LD_{50}: 0.88 g/kg (Male rats) 1.08 g/kg (Femal
Acute Dermal LD_{50}: Greater than 2 g/Kg for male and female

Effects of Overexposure Contact will cause burns to the skin and severe damage to the eyes. Inhalation of vapors or mists will irritate the entire respiratory tract. Ingestion will cause irritation and burning of the digestive tract.

Emergency and First Aid Procedures **Eyes:** Flush promptly with copious quantities of water for at least fifteen minutes. Seek medical attention. **Skin:** Flush area with water. Wash with soap and remove contaminated clothing. **Inhalation:** Remove to fresh air. Apply artifical respiration if necessary. **Ingestion:** Call a physician. Do not induce vomiting. Dilute with water or milk. See note to physician below. (Section IX - Other Precautions)

VI. REACTIVITY DATA

Stability	**Stable**	X	**Conditions to Avoid** None
	Unstable		

Incompatibility (Materials to Avoid) Highly Alkaline Materials, Oxidizers

Hazardous Decomposition of Products Oxides of Carbon and Nitrogen

Hazardous Polymerization	**May Occur**		**Conditions to Avoid** None
	Will Not Occur	X	

VII. SPILL OR LEAK PROCEDURES

Steps to be Taken if Material is Released or Spilled Provide adequate ventilation Remove sources of ignition. Contain and absorb spill. This product is toxic to fish. Keep out of lakes, streams, and ponds.

Waste Disposal Method Dispose via a licensed waste disposal company. Follow local, state, and federal regulations.

VIII. SPECIAL PROTECTION INFORMATION

Respiratory Protection (Specify Type) Use air-supplied or self-contained breathing apparatus if exposure levels exceed TLV for this product or its ingredients.

Ventilation	**Local Exhaust**	As needed to prevent accumulation of	**Special**	None
	Mechanical (General)	vapors above TLV	**Other**	None

Protective Gloves Rubber **Eye Protection** Safety Glasses, Goggles, and/or Face Shield

Other Protective Equipment Overalls, Rubber Boots, Eyewash Stations, Safety Showers

IX. SPECIAL PRECAUTIONS

Precautions to be Taken in Handling and Storing Store in cool, well-ventilated, low fire-risk area away from ignition sources and incompatible materials. Keep containers closed when not in use. Do not transfer or store in improperly marked containers.

Other Precautions Avoid prolonged or repeated breathing of vapors or contact with skin. Do not ingest. **TO PHYSICIAN:** Probably mucosul damage may contraindictable the use of gastric lavage. Measures against circulation shock, respiratory depression, and convulsion may be needed.

UNICHEM
INTERNATIONAL

MATERIAL SAFETY DATA SHEET

Date Prepared 05/22/86
Supersedes Previous Sheet Dated Not Dated

I. PRODUCT IDENTIFICATION

Unichem International 707 N. Leech/P. O. Box 1499/Hobbs, New Mexico 88240
EMERGENCY TELEPHONE NUMBER (505) 393-7751

Trade Name UNICHEM 3030

Chemical Description Proprietary Boiler Water Scale and Corrosion Inhibitor

II. HAZARDOUS INGREDIENTS

Material	TLV (Units)
Proprietary Chelant	5 mg/m³
Potassium Hydroxide CAS# 1310-58-3 (Corrosive)	2 mg/m³

Neither this product nor its ingredients are listed in any of OSHA Standard, Section 1910.1200 sources as carcinogenic.

III. PHYSICAL DATA

Boiling Point, 760 mm Hg	212°F	Freezing Point	10°F
Specific Gravity (H_2O=1)	1.3 g/ml	Solubility in Water	Complete

Appearance and Odor Light Brown Liquid; No Significant Odor

IV. FIRE AND EXPLOSION HAZARD DATA

Flash Point (Test Method) None

Extinguishing Media Carbon Dioxide, Dry Chemical, Water Spray or Fog, Foam. Use a water spray to cool fire-exposed containers.

Special Fire Fighting Procedures Firefighers should wear self-contained breathing apparatus and full protective clothing. Firefighters should be made aware of the corrosive nature of this chemical.

Unusual Fire and Explosion Hazards None

Precautions to be Taken in Handling and Storing Store in cool, well-ventilated,

Liability is expressly disclaimed for any loss or injury arising out of the use of this information or the use of any materials designated.

V. HEALTH HAZARD DATA

Threshold Limit Value Not Determined

Effects of Overexposure Contact will cause burns to the skin and severe damage to the eyes. Inhalation of vapors or mists will irritate the entire respiratory tract. Ingestion will cause irritation and burning of the digestive tract.

Emergency and First Aid Procedures **Eyes:** Flush promptly with copious quantities of water for at least fifteen minutes. Seek medical attention. **Skin:** Flush area with water. Wash with soap and remove contaminated clothing. **Inhalation:** Remove to fresh air. Apply artifical respiration if necessary. **Ingestion:** Call a physician. Do not induce vomiting. Dilute with water or milk.

VI. REACTIVITY DATA

Stability	**Stable**	X	**Conditions to Avoid**	None
	Unstable			

Incompatibility (Materials to Avoid) Strongly acidic materials, oxidizers.

Hazardous Decomposition of Products Oxides of Carbon and Nitrogen

Hazardous Polymerization	**May Occur**		**Conditions to Avoid**
	Will Not Occur	X	None

VII. SPILL OR LEAK PROCEDURES

Steps to be Taken if Material is Released or Spilled Provide adequate ventilation. Remove sources of ignition. Contain and absorb spill.

Waste Disposal Method Dispose via a licensed waste disposal company. Follow local state, and federal regulations.

VIII. SPECIAL PROTECTION INFORMATION

Respiratory Protection (Specify Type) Use air-supplied or self-contained breathing apparatus if exposure levels exceed TLV for this product or its ingredients.

Ventilation	**Local Exhaust**	As needed to prevent accumulation of	**Special**	None
	Mechanical (General)	vapors above TLV	**Other**	None

Protective Gloves Rubber **Eye Protection** Safety Glasses, Goggles, and/or Face Shield

Other Protective Equipment Overalls, Rubber Boots, Eyewash Stations, Safety Showers

IX. SPECIAL PRECAUTIONS

Precautions to be Taken in Handling and Storing Store in cool, well-ventilated, low fire-risk area away from ignition sources and incompatible materials. Keep containers closed when not in use. Do not transfer or store in improperly marked containers.

Other Precautions Avoid prolonged or repeated breathing of vapors or contact with skin. Do not ingest.

UNICHEM
INTERNATIONAL

MATERIAL SAFETY DATA SHEET

Date Prepared 05/22/86
Supersedes Previous Sheet Dated Not Dated

I. PRODUCT IDENTIFICATION

Unichem International 707 N. Leech/P. O. Box 1499/Hobbs, New Mexico 88240
EMERGENCY TELEPHONE NUMBER (505) 393-7751

Trade Name UNICHEM 3140

Chemical Description Proprietary Boiler Water Oxygen Scavenger

II. HAZARDOUS INGREDIENTS

Material	TLV (Units)
Proprietary Oxygen Scavenger	1 ppm (ACGIH)

Neither this product nor its ingredients are listed in any of OSHA Standard, Section 1910.1200 sources as carcinogenic.

III. PHYSICAL DATA

Boiling Point, 760 mm Hg	212°F	Freezing Point	13°F
Specific Gravity (H_2O=1)	1.2 g/ml	Solubility in Water	Complete

Appearance and Odor Water White Clear Liquid; Slight Musty Odor

IV. FIRE AND EXPLOSION HAZARD DATA

Flash Point (Test Method) None

Extinguishing Media Carbon Dioxide, Dry Chemical, Water Spray or Fog, Foam. Use a water spray to cool fire-exposed containers.

Special Fire Fighting Procedures Firefighters should wear self-contained breathing apparatus and full protective clothing. Firefighters should be made aware of the corrosive nature of this chemical.

Unusual Fire and Explosion Hazards None

V. HEALTH HAZARD DATA

Threshold Limit Value Not Determined

Effects of Overexposure Contact will cause burns to the skin and severe damage to the eyes. Inhalation of vapors or mists will irritate the entire respiratory tract. Ingestion will cause irritation and burning of the digestive tract.

Emergency and First Aid Procedures Eyes: Flush promptly with copious quantities of water for at least fifteen minutes. Seek medical attention. Skin: Flush area with water. Wash with soap and remove contaminated clothing. Inhalation: Remove to fresh air. Apply artifical respiration if necessary. Ingestion: Call a physician. Do not induce vomiting. Dilute with water or milk.

VI. REACTIVITY DATA

Stability	Stable	X	Conditions to Avoid None
	Unstable		

Incompatibility (Materials to Avoid) Highly Alkaline Materials, Oxidizers

Hazardous Decomposition of Products Oxides of Carbon and Sulfur

Hazardous Polymerization	May Occur		Conditions to Avoid None
	Will Not Occur	X	

VII. SPILL OR LEAK PROCEDURES

Steps to be Taken if Material is Released or Spilled Provide adequate ventila
Remove sources of ignition. Contain and absorb spill.

Waste Disposal Method Dispose via a licensed waste disposal company. Follow local state, and federal regulations.

VIII. SPECIAL PROTECTION INFORMATION

Respiratory Protection (Specify Type) Use air-supplied or self-contained breathing apparatus if exposure levels exceed TLV for this product or its ingredients.

Ventilation	Local Exhaust	As needed to prevent accumulation of	Special	None
	Mechanical (General)	vapors above TLV	Other	None

Protective Gloves Rubber **Eye Protection** Safety Glasses, Goggles, and/or Face Shield

Other Protective Equipment Overalls, Rubber Boots, Eyewash Stations, Safety Showers

IX. SPECIAL PRECAUTIONS

Precautions to be Taken in Handling and Storing Store in cool, well-ventilated, low fire-risk area away from ignition sources and incompatible materials. Keep containers closed when not in use. Do not transfer or store in improperly marked containers.

Other Precautions Avoid prolonged or repeated breathing of vapors or contact with skin. Do not ingest.

UNICHEM INTERNATIONAL

MATERIAL SAFETY DATA SHEET

Date Prepared 5-22-86

Supersedes Previous Sheet Dated Undated

I. PRODUCT IDENTIFICATION

Unichem International 707 N. Leech/P. O. Box 1499/Hobbs, New Mexico 88240

EMERGENCY TELEPHONE NUMBER (505) 393-7751

Trade Name UNICHEM 3235

Chemical Description Proprietary Neutralizing Amine

II. HAZARDOUS INGREDIENTS

Material	TLV (Units)
Proprietary Neutralizing Amine	10 ppm

Neither this product nor its ingredients are listed in any of OSHA Standard, Section 1910.1200 sources as carcinogenic.

III. PHYSICAL DATA

Boiling Point, 760 mm Hg	212°F	Freezing Point	-38°F
Specific Gravity (H_2O=1)	0.960	Solubility in Water	Soluble

Appearance and Odor Brown Liquid, Ammonia Odor

IV. FIRE AND EXPLOSION HAZARD DATA

Flash Point (Test Method) >200°F TCC

Extinguishing Media Carbon Dioxide, Dry Chemical, Water Spray or Fog, Foam. Use a water spray to cool fire-exposed containers.

Special Fire Fighting Procedures Firefighers should wear self-contained breathing apparatus and full protective clothing. Firefighters should be made aware of the corrosive nature of this chemical.

Unusual Fire and Explosion Hazards None

[illegible] store in improperly marked containers.

Product UNICHEM 3235

V. HEALTH HAZARD DATA

Threshold Limit Value Not Determined

Effects of Overexposure Contact will cause burns to the skin and severe damage to the eyes. Inhalation of vapors or mists will irritate the entire respiratory tract. Ingestion will cause irritation and burning of the digestive tract.

Emergency and First Aid Procedures **Eyes:** Flush promptly with copious quantities of water for at least fifteen minutes. Seek medical attention. **Skin:** Flush area with water. Wash with soap and remove contaminated clothing. **Inhalation:** Remove to fresh air. Apply artifical respiration if necessary. **Ingestion:** Call a physician. Do not induce vomiting. Dilute with water or milk.

VI. REACTIVITY DATA

Stability	**Stable** X	**Conditions to Avoid**	None
	Unstable		

Incompatibility (Materials to Avoid) Strongly acidic materials, oxidizers.

Hazardous Decomposition of Products Oxides of Carbon and Nitrogen

Hazardous Polymerization	**May Occur**	**Conditions to Avoid**
	Will Not Occur X	None

VII. SPILL OR LEAK PROCEDURES

Steps to be Taken if Material is Released or Spilled Provide adequate ventilation. Remove sources of ignition. Contain and absorb spill.

Waste Disposal Method Dispose via a licensed waste disposal company. Follow local, state, and federal regulations.

VIII. SPECIAL PROTECTION INFORMATION

Respiratory Protection (Specify Type) Use air-supplied or self-contained breathing apparatus if exposure levels exceed TLV for this product or its ingredients.

Ventilation	**Local Exhaust**	As needed to prevent accumulation of	**Special**	None
	Mechanical (General)	vapors above TLV	**Other**	None

Protective Gloves Rubber **Eye Protection** Safety Glasses, Goggles, and/or Face Shield

Other Protective Equipment Overalls, Rubber Boots, Eyewash Stations, Safety Showers

IX. SPECIAL PRECAUTIONS

Precautions to be Taken in Handling and Storing Store in cool, well-ventilated, low fire-risk area away from ignition sources and incompatible materials. Keep containers closed when not in use. Do not transfer or store in improperly marked containers.

Other Precautions Avoid prolonged or repeated breathing of vapors or contact with skin. Do not ingest.

UNICHEM
INTERNATIONAL

MATERIAL SAFETY DATA SHEET

Date Prepared 05/22/86
Supersedes Previous Sheet Dated 01/02/86

I. PRODUCT IDENTIFICATION

Unichem International 707 N. Leech/P. O. Box 1499/Hobbs, New Mexico 88240
EMERGENCY TELEPHONE NUMBER (505) 393-7751

Trade Name UNICHEM 3510

Chemical Description Proprietary Boiler Water Condensate Corrosion Inhibitor Blend

II. HAZARDOUS INGREDIENTS

Material	TLV (Units)
Proprietary Amine	10 ppm TWA, 8-Hour Workday
Isopropanol CAS# 63-67-0	400 ppm

Neither this product nor its ingredients are listed in any of OSHA Standard, Section 1910.1200 sources as carcinogenic.

III. PHYSICAL DATA

Boiling Point, 760 mm Hg	179°F Initial	Freezing Point	-10°F
Specific Gravity (H_2O=1)	0.96 g/ml	Solubility in Water	Complete

Appearance and Odor Yellow Clear Liquid; Sharp Amine Odor

IV. FIRE AND EXPLOSION HAZARD DATA

Flash Point (Test Method) 95°F TCC

Extinguishing Media Carbon Dioxide, Dry Chemical, Water Spray or Fog, Foam. Use a water spray to cool fire-exposed containers.

Special Fire Fighting Procedures Firefighers should wear self-contained breathing apparatus and full protective clothing. Firefighters should be made aware of the corrosive nature of this chemical.

Unusual Fire and Explosion Hazards None

Liability is expressly disclaimed for any loss or injury arising out of the use of this information or the use of any materials designated.

V. HEALTH HAZARD DATA

Threshold Limit Value Not Determined

Effects of Overexposure Contact will cause burns to the skin and severe damage to the eyes. Inhalation of vapors or mists will irritate the entire respiratory tract. Ingestion will cause irritation and burning of the digestive tract. May cause an allergic skin or respiratory reaction.

Emergency and First Aid Procedures **Eyes:** Flush promptly with copious quantities of water for at least fifteen minutes. Seek medical attention. **Skin:** Flush area with water. Wash with soap and remove contaminated clothing. **Inhalation:** Remove to fresh air. Apply artifical respiration if necessary. **Ingestion:** Call a physician. Do not induce vomiting. Dilute with water or milk.

VI. REACTIVITY DATA

Stability	Stable X	Conditions to Avoid	None
	Unstable		

Incompatibility (Materials to Avoid) Strongly Acidic Materials, Oxidizers.

Hazardous Decomposition of Products Oxides of Carbon and Nitrogen

Hazardous Polymerization	May Occur	Conditions to Avoid
	Will Not Occur X	None

VII. SPILL OR LEAK PROCEDURES

Steps to be Taken if Material is Released or Spilled Provide adequate ventilation. Remove sources of ignition. Contain and absorb spill.

Waste Disposal Method Dispose via a licensed waste disposal company. Follow local state, and federal regulations.

VIII. SPECIAL PROTECTION INFORMATION

Respiratory Protection (Specify Type) Use air-supplied or self-contained breathing apparatus if exposure levels exceed TLV for this product or its ingredients.

Ventilation	Local Exhaust	As needed to prevent accumulation of	Special	None
	Mechanical (General)	vapors above TLV	Other	None

Protective Gloves Rubber **Eye Protection** Safety Glasses, Goggles, and/or Face Shield

Other Protective Equipment Overalls, Rubber Boots, Eyewash Stations, Safety Showers

IX. SPECIAL PRECAUTIONS

Precautions to be Taken in Handling and Storing Store in cool, well-ventilated, low fire-risk area away from ignition sources and incompatible materials. Keep containers closed when not in use. Do not transfer or store in improperly marked containers.

Other Precautions Avoid prolonged or repeated breathing of vapors or contact with skin. Do not ingest.

UNICHEM
INTERNATIONAL

MATERIAL SAFETY DATA SHEET

Date Prepared 05-22-86

Supersedes Previous Sheet Dated 11-12-85

I. PRODUCT IDENTIFICATION

Unichem International 707 N. Leech/P. O. Box 1499/Hobbs, New Mexico 88240

EMERGENCY TELEPHONE NUMBER (505) 393-7751

Trade Name UNICHEM 3310

Chemical Description Proprietary Corrosion Inhibitor

II. HAZARDOUS INGREDIENTS

Material	TLV (Units)
Isopropanol (CAS#67-63-0)	400 ppm

Neither this product nor its ingredients are listed in any of OSHA Standard, Section 1910.1200 sources as carcinogenic.

III. PHYSICAL DATA

Boiling Point, 760 mm Hg	212°F initial	Freezing Point	9°F
Specific Gravity (H_2O=1)	0.95 g/ml	Solubility in Water	Soluble

Appearance and Odor Amber to Brown liquid; No Odor

IV. FIRE AND EXPLOSION HAZARD DATA

Flash Point (Test Method) 81°F TCC

Extinguishing Media Carbon Dioxide, Dry Chemical, Water Spray or Fog, Foam. Use a water spray to cool fire-exposed containers.

Special Fire Fighting Procedures Firefighters should wear self-contained breathing apparatus and full protective clothing.

Unusual Fire and Explosion Hazards Vapors may flow along surfaces to distant ignition sources and flashback. Dangerous fire hazard when exposed to heat, sparks, flames, or oxidizing agents.

rials. Keep containers closed when not in use. Do not transfer or store in improperly marked containers.

Liability is expressly disclaimed for any loss or injury arising out of the use of this information or the use of any materials designated.

V. HEALTH HAZARD DATA

Threshold Limit Value Not Determined

Effects of Overexposure prolonged skin contact will cause dryness and irritation. Ingestion may cause catharsis. Inhalation of mist may cause respiratory irritation. Eye contact will cause irritation.

Emergency and First Aid Procedures EYES: Flush promptly with copious quantities of water for at least fifteen minutes. Seek medical attention. SKIN: Flush area with water. Wash with soap and remove contaminated clothing. INHALATION: Remove to fresh air. Apply artifical respiration if necessary. INGESTION: Call a physician. Do not induce vomiting. Dilute wit water or milk.

VI. REACTIVITY DATA

Stability	**Stable** X	**Conditions to Avoid** None
	Unstable	

Incompatibility (Materials to Avoid) Oxidizers

Hazardous Decomposition of Products Oxides of Carbon and Nitrogen

Hazardous Polymerization	**May Occur**	**Conditions to Avoid** None
	Will Not Occur X	

VII. SPILL OR LEAK PROCEDURES

Steps to be Taken if Material is Released or Spilled Provide adequate ventilation. Remove sources of ignition. Contain and absorb spill.

Waste Disposal Method Dispose via a licensed waste disposal company. Follow local, state and federal regulations.

VIII. SPECIAL PROTECTION INFORMATION

Respiratory Protection (Specify Type) Use air-supplied or self-contained breathing apparatus if exposure levels exceed TLV for this product or its ingredients.

Ventilation	**Local Exhaust** As needed to prevent accumulation of	**Special** None
	Mechanical (General) vapors above TLV	**Other** None

Protective Gloves Rubber

Eye Protection Safety glasses, goggles, and/or face shield

Other Protective Equipment Overalls, rubber boots, eyewash stations, safety showers

IX. SPECIAL PRECAUTIONS

Precautions to be Taken in Handling and Storing Store in cool, well-ventilated, low fire-risk area away from ignition sources and incompatible materials. Keep containers closed when not in use. Do not transfer or store in improperly marked containers.

Other Precautions Avoid prolonged or repeated breathing of vapors or contact with skin. Do not ingest.

UNICHEM
INTERNATIONAL

MATERIAL SAFETY DATA SHEET

Date Prepared 05/20/86

Supersedes Previous Sheet Dated Undated

I. PRODUCT IDENTIFICATION

Unichem International 707 N. Leech/P. O. Box 1499/Hobbs, New Mexico 88240

EMERGENCY TELEPHONE NUMBER (505) 393-7751

Trade Name UNICHEM 4500

Chemical Description Proprietary Resin Cleaner

II. HAZARDOUS INGREDIENTS

Material	TLV (Units)
Sodium Hydroxide	2 mg/m³

Neither this product nor its ingredients are listed in any of OSHA Standard, Section 1910.1200 sources as carcinogenic.

III. PHYSICAL DATA

Boiling Point, 760 mm Hg	212°F	Freezing Point	26°F
Specific Gravity (H_2O=1)	1.104	Solubility in Water	Soluble

Appearance and Odor Water White Clear Liquid; No Odor

IV. FIRE AND EXPLOSION HAZARD DATA

Flash Point (Test Method) None

Extinguishing Media Carbon Dioxide, Dry Chemical, Water Spray or Fog, Foam. Use a water spray to cool fire-exposed containers.

Special Fire Fighting Procedures Firefighers should wear self-contained breathing apparatus and full protective clothing. Firefighters should be made aware of the corrosive nature of this chemical.

Unusual Fire and Explosion Hazards None

Liability is expressly disclaimed for any loss or injury arising out of the use of this information or the use of any materials designated.

V. HEALTH HAZARD DATA

Threshold Limit Value Not Determined

Effects of Overexposure Contact will cause burns to the skin and sever eyes. Inhalation of vapors or mists will irritate the entire respiratory t will cause irritation and burning of the digestive tract.

Emergency and First Aid Procedures **Eyes:** Flush promptly with copious water for at least fifteen minutes. Seek medical attention. **Skin:** Flush a Wash with soap and remove contaminated clothing. **Inhalation:** Remove to fre artifical respiration if necessary. **Ingestion:** Call a physician. Do not i Dilute with water or milk.

VI. REACTIVITY DATA

Stability	**Stable** X	**Conditions to Avoid**	None
	Unstable		

Incompatibility (Materials to Avoid) Strongly acidic materials, oxidiz

Hazardous Decomposition of Products Oxides of Carbon and Nitrogen

Hazardous Polymerization	**May Occur**	**Conditions to Avoid**
	Will Not Occur X	None

VII. SPILL OR LEAK PROCEDURES

Steps to be Taken if Material is Released or Spilled Provide adequa Remove sources of ignition. Contain and absorb spill.

Waste Disposal Method Dispose via a licensed waste disposal company state, and federal regulations.

VIII. SPECIAL PROTECTION INFORMATION

Respiratory Protection (Specify Type) Use air-supplied or self-containec apparatus if exposure levels exceed TLV for this product or its ingredients.

Ventilation	**Local Exhaust**	As needed to prevent accumulation of	**Special**	None
	Mechanical (General)	vapors above TLV	**Other**	None

Protective Gloves Rubber Eye Protection Safety Glasses, Gogg Face Shield

Other Protective Equipment Overalls, Rubber Boots, Eyewash Stations, Safe

IX. SPECIAL PRECAUTIONS

Precautions to be Taken in Handling and Storing Store in cool, we v low fire-risk area away from ignition sources and incompatible materials. Keep closed when not in use. Do not transfer or store in improperly marked containe

Other Precautions Avoid prolonged or repeated breathing of vapors or contac Do not ingest.

PETROLITE

MATERIAL SAFETY DATA SHEET

PETROLITE CORPORATION
369 MARSHALL AVE.
ST.LOUIS MO 63119 U.S.A

REVISION DATE: 11/25/88
EMERGENCY PHONE: 1-314-961-3500
CHEMTREC EMER NO: 1-800-424-9300

****

SECTION 1 PRODUCT IDENTIFICATION

PRODUCT: PET7140 TRADE NAME: PETROTEC LABEL: 014
000
000

(IF HAZARDOUS PER D.O.T. CFR TITLE 49)
SHIPPING NAME: Combustible Liquid, N.O.S. (In Bulk D.O.T.)

HAZARD CLASS: Combustible Liquid ID#: NA1993

CHEMICAL DESCRIPTION
OXYALKYLATED ALKYLPHENOLIC RESINS IN AROMATIC HYDROCARBONS

****

SECTION 2 HAZARDOUS INGREDIENTS

CAS NUMBER	MATERIAL	%	EXPOSURE LIMITS
64742-94-5	Heavy aromatic naphtha	30-60	RECOMMENDED: 25 ppm

Specific chemical identity of unlisted ingredients is being withheld for confidential business purposes.

****

SECTION 3 PHYSICAL DATA

SPECIFIC GRAVITY(H20 = 1.0@60 F): 0.987
VAPOR PRESSURE: Not Established
VOLATILITY: Appreciable
SOL. IN WATER: Insoluble

APPEARANCE AND ODOR: Amber liquid. Aromatic odor.

****

SECTION 4 FIRE AND EXPLOSION HAZARD DATA

FLASH POINT: 118 F
FLAMMABLE LIMITS: Not Established

FLASH METHOD:
SFCC ASTM D-3828

EXTINGUISHING MEDIA:
Use water spray or fog, alcohol-type foam, dry chemical or CO2.

FIRE FIGHTING PROCEDURES:
Use a self-contained breathing apparatus with full facepiece operated in pressure-demand or other positive pressure mode.

CONTINUED ON PAGE: 2

[illegible] Do not transfer [illegible] store in [illegible] materials. Ke
Other Precautions

Combustible. Keep fire exposed containers cool using water spray.

UNUSUAL FIRE AND EXPLOSION HAZARDS:
At elevated temperatures, vapors can form an ignitable mixture with air. Vapors can flow along surfaces to distant ignition sources and flash back.

****

SECTION 5 HEALTH HAZARD DATA

EFFECTS OF OVEREXPOSURE:

INHALATION:
Exposure may result in eye, nose and respiratory irritation, and may produce nausea, headache and dizziness. Prolonged exposures to elevated concentrations may cause weakness and CNS depression. In extreme cases, drowsiness and even loss of consciousness may occur.

SKIN AND EYE CONTACT:
Intermittant, brief skin contact may result in mild irritation. Prolonged contact with skin may cause moderate to severe irritation resulting in rashes and dermatitis. Contact with eyes will cause moderate to severe irritation, and may produce moderate but reversible eye injury.

INGESTION:
May cause severe gastrointestinal distress with nausea, vomiting and diarrhea. Aspiration into lungs may cause pulmonary edema and chemical pneumonitis. May be readily absorbed through the gastrointestinal tract.

EMERGENCY AND FIRST AID PROCEDURES:
Wash skin thoroughly with soap and water. If rash or irritation develops, consult a physician. Launder clothing before reuse. If in eyes, irrigate with flowing water immediately and continuously for fifteen minutes. Consult a physician promptly.
If inhaled, remove to fresh air. Administer oxygen if necessary. Consult a physician if symptoms persist or exposure was severe.
Due to possible aspiration into the lungs, DO NOT induce vomiting if ingested. Consult a physician immediately.
NOTE TO PHYSICIAN: Administer activated carbon if indicated.

****

SECTION 6 REACTIVITY DATA

STABILITY:
Stable under normal conditions of storage and use.

CONTINUED ON PAGE: 3

***CONTINUATION OF PET7140 ***

INCOMPATIBILITY:
Keep away from strong oxidizing agents.

HAZARDOUS DECOMPOSITION PRODUCTS:
None known.

HAZARDOUS POLYMERIZATION:
Will not occur.

****

SECTION 7 SPILL AND LEAK PROCEDURES

IF MATERIAL IS SPILLED OR RELEASED:
Small spill - Absorb on paper, cloth or other material. Large spill - Dike to prevent entering any sewer or waterway. Transfer liquid to a holding container. Cover residue with dirt, or suitable chemical adsorbent. Use personal protective equipment as necessary.

DISPOSAL METHOD:
Place chemical residues and contaminated adsorbent materials into a suitable waste container and take to an approved waste disposal site. Dispose of all residues in accordance with applicable waste management regulations.

DECONTAMINATION PROCEDURES:
Not appropriate.

****

SECTION 8 SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION:
When concentrations exceed the exposure limits specified, use of a NIOSH-approved organic vapor cartridge respirator is recommended. Where the protection factor of the respirator may be exceeded, use of a self-contained breathing unit may be necessary.

VENTILATION:
General ventilation should be provided to maintain ambient concentrations below nuisance levels. Local ventilation of emission sources may be necessary to maintain ambient concentrations below recommended exposure limits.

PROTECTIVE CLOTHING:
Chemical-resistant gloves and chemical goggles should be used to prevent skin and eye contact.

CONTINUED ON PAGE: 4

***CONTINUATION OF PET7140 ***

****

SECTION 9 SPECIAL PRECAUTIONS

Avoid heat, sparks and open flames. Avoid breathing of vapors and contact with eyes, skin or clothing. Keep container closed when not in use. Hazardous product residue may remain in emptied container. Do not reuse empty container without commercial cleaning or reconditioning.

****

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MATERIAL SAFETY DATA SHEET

PETROLITE CORPORATION
369 MARSHALL AVE.
ST.LOUIS MO 63119 U.S.A

REVISION DATE: 03/18/88
EMERGENCY PHONE: 1-314-961-3500
CHEMTREC EMER NO: 1-800-424-9300

****

SECTION 1 PRODUCT IDENTIFICATION

PRODUCT: PET7210 TRADE NAME: PETROTEC LABEL: 002
000
000

(IF HAZARDOUS PER D.O.T. CFR TITLE 49)

SHIPPING NAME: Flammable Liquid, N.O.S.

HAZARD CLASS: Flammable Liquid ID#: UN1993

CHEMICAL DESCRIPTION

OXYALKYLATED ALKANOLAMINES AND ALKYLARYL SULFONATES IN WATER, METHANOL AND ISOPROPANOL.

****

SECTION 2 HAZARDOUS INGREDIENTS

CAS NUMBER	MATERIAL	%	EXPOSURE LIMITS
00067-56-1	Methanol	10-30	ACGIH TLV: 200ppm TWA OSHA PEL: 200ppm TWA ACGIH STEL: 250 ppm
00067-63-0	Isopropanol	10-30	ACGIH TLV: 400ppm TWA OSHA PEL: 400ppm TWA ACGIH STEL:500 ppm
25155-30-0	Sodium arylsulfonate	1-5	Not Established

****

SECTION 3 PHYSICAL DATA

SPECIFIC GRAVITY(H20 = 1.0@60 F): 0.989
VOLATILITY: Significant
VAPOR PRESSURE: Not Established
SOL. IN WATER: Soluble

APPEARANCE AND ODOR: Amber liquid. Alcohol odor.

****

SECTION 4 FIRE AND EXPLOSION HAZARD DATA

FLASH POINT: 84 F
FLAMMABLE LIMITS: Not Established

FLASH METHOD:

SFCC ASTM D-3828

EXTINGUISHING MEDIA:

Use water spray or fog, alcohol-type foam, dry chemical or CO2.

CONTINUED ON PAGE: 2

***CONTINUATION OF PET7210 ***

FIRE FIGHTING PROCEDURES:

Use a self-contained breathing apparatus with full facepiece operated in pressure-demand or other positive pressure mode. Flammable. Cool fire-exposed containers using water spray.

UNUSUAL FIRE AND EXPLOSION HAZARDS:

Flammable liquid, vapors of which can form an ignitable mixture with air. Vapors can flow along surfaces to distant ignition sources and flash back.

****

SECTION 5 HEALTH HAZARD DATA

EFFECTS OF OVEREXPOSURE:

INHALATION:

Prolonged exposure may cause mild irritation of mucous membranes, headache and tiredness. At elevated concentrations, symptoms may include nausea, shortness of breath and a sense of drunkeness. In extreme cases, visual disturbances and occular damage may occur.

SKIN AND EYE CONTACT:

Repeated and prolonged contact may cause dermatitis, drying or cracking of skin due to defatting solvent properties. Contact with eyes will cause moderate irritation.

INGESTION:

May be harmful if swallowed. May cause gastrointestinal disturbances.
Ingestion of methanol may result in a feeling of intoxication and can cause visual disturbances and, in extreme cases, occular damage.

EMERGENCY AND FIRST AID PROCEDURES:

Wash skin thoroughly with soap and water. If rash or irritation develops, consult a physician. Launder clothing before reuse. If in eyes, irrigate with flowing water immediately and continuously for fifteen minutes. Consult a physician promptly.
If inhaled, remove to fresh air. Administer oxygen if necessary. Consult a physician if symptoms persist or exposure was severe.
If ingested, induce vomiting. Never give anything by mouth to an unconscious person. Consult a physician immediately.

****

SECTION 6 REACTIVITY DATA

STABILITY:

Stable under normal conditions of storage and use.

CONTINUED ON PAGE: 3

***CONTINUATION OF PET7210 ***

INCOMPATIBILITY:

Keep away from strong oxidizing agents, heat and open flames.

HAZARDOUS DECOMPOSITION PRODUCTS:

Oxides of nitrogen.

HAZARDOUS POLYMERIZATION:

Will not occur.

****

SECTION 7 SPILL AND LEAK PROCEDURES

IF MATERIAL IS SPILLED OR RELEASED:

Small spill - Absorb on paper, cloth or other material. Large spill - Dike to prevent entering any sewer or waterway. Transfer liquid to a holding container. Cover residue with dirt, or suitable chemical adsorbent. Use personal protective equipment as necessary.

DISPOSAL METHOD:

Place chemical residues and contaminated adsorbent materials into a suitable waste container and take to an approved hazardous waste disposal site. Dispose of all residues in accordance with applicable waste management regulations.

DECONTAMINATION PROCEDURES:

Not appropriate.

****

SECTION 8 SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION:

When concentrations exceed the exposure limits specified, use of a NIOSH-approved supplied air respirator is recommended. Where the protection factor of the respirator may be exceeded, use of a self-contained breathing unit may be necessary.

VENTILATION:

General ventilation should be provided to maintain ambient concentrations below nuisance levels. Local ventilation of emission sources may be necessary to maintain ambient concentrations below recommended exposure limits.

PROTECTIVE CLOTHING:

Chemical-resistant gloves and chemical goggles should be used to prevent skin and eye contact.

CONTINUED ON PAGE: 4

Stable under normal conditions of storage and use.

CONTINUED ON PAGE: 3

***CONTINUATION OF PET7210 ***

****

SECTION 9 SPECIAL PRECAUTIONS

Flammable liquid. Avoid heat, sparks and open flames. Avoid breathing of vapors and contact with eyes, skin or clothing. Keep container closed when not in use. Hazardous product residue may remain in emptied container. Do not reuse empty containers without commercial cleaning or reconditioning.

****

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PETROLITE

ENVIRONMENTAL DATA SHEET

PETROLITE CORPORATION
369 MARSHALL AVE.
ST. LOUIS MO 63119 U.S.A.

REVISION DATE: 03/01/90
EMERGENCY PHONE: 1-314-961-3500
CHEMTREC EMER NO: 1-800-424-9300

****

PET7210

SARA TITLE III, SECTION 313

This notification is incorporated into the Material Safety Data Sheet (MSDS) for the Petrolite product named above. When physically attached to the MSDS, this notification must not be detached from the MSDS. Any copying and redistribution of the MSDS to which this notification is attached must include copying and redistribution of this notification.

This Petrolite product contains a toxic chemical or chemicals subject to the reporting requirements of section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR 372, as follows:

CHEMICAL	CAS NUMBER	WEIGHT PERCENT
METHANOL	000067-56-1	11.3%

****

PETROLITE

MATERIAL SAFETY DATA SHEET

PETROLITE CORPORATION
369 MARSHALL AVE.
ST.LOUIS MO 63119 U.S.A

REVISION DATE: 09/28/88
EMERGENCY PHONE: 1-314-961-3500
CHEMTREC EMER NO: 1-800-424-9300

SECTION 1 PRODUCT IDENTIFICATION

PRODUCT: PET4030   TRADE NAME: PETROTEC   LABEL: 014

(IF HAZARDOUS PER D.O.T. CFR TITLE 49)
SHIPPING NAME: Combustible Liquid, N.O.S. (In Bulk D.O.T.)

HAZARD CLASS: Combustible Liquid   ID#: NA1993

CHEMICAL DESCRIPTION
A PROCESS ANTIFOULANT IN AROMATIC AND ALIPHATIC HYDROCARBONS.

SECTION 2 HAZARDOUS INGREDIENTS

CAS NUMBER	MATERIAL	%	EXPOSURE LIMITS
**	Magnesium sulfonates	20-30	Not Established
64742-94-5	Heavy aromatic naphtha	50-60	RECOMMENDED: 25 ppm
**	Magnesium carboxylates	10-20	Not Established
64742-46-7	Petroleum hydrocarbons	5-10	Not Established

**Specific chemical identity is being withheld for confidential business purposes.

SECTION 3 PHYSICAL DATA

SPECIFIC GRAVITY(H20 = 1.0@60 F): 1.016   VOLATILITY: Moderate
VAPOR PRESSURE: Not Established   SOL. IN WATER: Insoluble

APPEARANCE AND ODOR: Black liquid. Aromatic odor.

SECTION 4 FIRE AND EXPLOSION HAZARD DATA

FLASH POINT: 112 F   FLAMMABLE LIMITS: Not Established

FLASH METHOD:
SFCC ASTM D-3828

EXTINGUISHING MEDIA:
Use water spray or fog, alcohol-type foam, dry chemical or CO2.

CONTINUED ON PAGE: 2

***CONTINUATION OF PET4030 ***

FIRE FIGHTING PROCEDURES:

Use a self-contained breathing apparatus with full facepiece operated in pressure-demand or other positive pressure mode. Combustible. Keep fire exposed containers cool using water spray.

UNUSUAL FIRE AND EXPLOSION HAZARDS:

At elevated temperatures, vapors can form an ignitable mixture with air. Vapors can flow along surfaces to distant ignition sources and flash back.

****

SECTION 5 HEALTH HAZARD DATA

EFFECTS OF OVEREXPOSURE:

INHALATION:

Vapors are highly irritating to eyes, nose and respiratory system, and may produce nausea, headache and dizziness. Prolonged exposure to elevated concentrations may cause drowsiness, weakness and CNS depression. In extreme cases narcosis and even loss of consciousness may occur.
Chronic effects of repeated exposures to high concentrations may include damage to kidneys and liver.

SKIN AND EYE CONTACT:

Causes mild to moderate irritation on brief skin contact. Prolonged contact with skin will cause moderate to severe irritation or possibly burns where clothing is confined. Repeated or prolonged contact may result in dermatitis due to defatting solvent properties.
Contact with eyes will result in moderate to severe irritation, and in extreme cases may result in severe but transient eye injury.

INGESTION:

May cause severe gastrointestinal distress with nausea, vomiting and diarrhea. Aspiration into lungs may cause pulmonary edema and chemical pneumonitis. May be readily absorbed through the gastrointestinal tract.

EMERGENCY AND FIRST AID PROCEDURES:

Wash skin thoroughly with soap and water. If rash or irritation develops, consult a physician. Launder clothing before reuse. If in eyes, irrigate with flowing water immediately and continuously for fifteen minutes. Consult a physician promptly.
If inhaled, remove to fresh air. Administer oxygen if necessary. Consult a physician if symptoms persist or exposure was severe.

CONTINUED ON PAGE: 3

***CONTINUATION OF PET4030 ***

Due to possible aspiration into the lungs, DO NOT induce vomiting if ingested. Consult a physician immediately. NOTE TO PHYSICIAN: Administer activated carbon if indicated.

****

SECTION 6 REACTIVITY DATA

STABILITY:
Stable under normal conditions of storage and use.

INCOMPATIBILITY:
Keep away from strong oxidizing agents.

HAZARDOUS DECOMPOSITION PRODUCTS:
Oxides of nitrogen, sulphur.

HAZARDOUS POLYMERIZATION:
Will not occur.

****

SECTION 7 SPILL AND LEAK PROCEDURES

IF MATERIAL IS SPILLED OR RELEASED:
Small spill - Absorb on paper, cloth or other material. Large spill - Dike to prevent entering any sewer or waterway. Transfer liquid to a holding container. Cover residue with dirt, or suitable chemical adsorbent. Use personal protective equipment as necessary.

DISPOSAL METHOD:
Place chemical residues and contaminated adsorbent materials into a suitable waste container and take to an approved waste disposal site. Dispose of all residues in accordance with applicable waste management regulations.

DECONTAMINATION PROCEDURES:
Not appropriate.

****

SECTION 8 SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION:
When concentrations exceed the exposure limits specified, use of a NIOSH-approved organic vapor cartridge respirator is recommended. Where the protection factor of the respirator may be exceeded, use of a self-contained breathing unit may be necessary.

CONTINUED ON PAGE: 4

***CONTINUATION OF PET4030 ***

VENTILATION:

General ventilation should be provided to maintain ambient concentrations below nuisance levels. Local ventilation of emission sources may be necessary to maintain ambient concentrations below recommended exposure limits.

PROTECTIVE CLOTHING:

Chemical-resistant gloves and chemical goggles should be used to prevent skin and eye contact.

****

SECTION 9 SPECIAL PRECAUTIONS

Avoid heat, sparks and open flames. Avoid breathing of vapors and contact with eyes, skin or clothing. Keep container closed when not in use. Hazardous product residue may remain in emptied container. Do not reuse empty container without commercial cleaning or reconditioning.

****

Although the information and recommendations set forth herein are believed to be correct as of the date hereof, Petrolite makes no representations to the accuracy of such information and recommendations. It is the user's responsibility to determine the suitability and completeness of such information and recommendation for its own particular use.Petrolite shall not be responsible for any direct,indirect,incidental or consequential damages of whatsoever nature resulting from the publication,use of or reliance upon such information and recommendations.

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PETROLITE

MATERIAL SAFETY DATA SHEET

PETROLITE CORPORATION
369 MARSHALL AVE.
ST.LOUIS MO 63119 U.S.A

REVISION DATE: 08/02/90
EMERGENCY PHONE: 1-314-961-3500
CHEMTREC EMER NO: 1-800-424-9300

* * *

SECTION 1 PRODUCT IDENTIFICATION

PRODUCT: PET1202
TRADE NAME: PETROTEC
LABEL: 014
000
000

(IF HAZARDOUS PER D.O.T. CFR TITLE 49)
SHIPPING NAME: Combustible Liquid, N.O.S. (In Bulk D.O.T.)

HAZARD CLASS: Combustible Liquid
ID#: NA1993

CHEMICAL DESCRIPTION
CARBOXYLIC ACID/POLYAMINE REACTION PRODUCTS IN ALIPHATIC AND AROMATIC HYDROCARBONS.

* * *

SECTION 2 HAZARDOUS INGREDIENTS

CAS NUMBER	MATERIAL	%	EXPOSURE LIMITS
**	Carboxylic acid/polyamine reaction products	30-60	Not Established
64742-96-7	Heavy aliphatic naphtha	30-60	RECOMMENDED: 15 ppm
64742-94-5	Heavy aromatic naphtha	5-10	RECOMMENDED: 25 ppm

**Specific chemical identity is being withheld for confidential business purposes.

* * *

SECTION 3 PHYSICAL DATA

SPECIFIC GRAVITY(H20 = 1.0@60 F): 0.888
VOLATILITY: Moderate
VAPOR PRESSURE: Not Established
SOL. IN WATER: Insoluble

APPEARANCE AND ODOR: Amber liquid. Aliphatic odor.

* * *

SECTION 4 FIRE AND EXPLOSION HAZARD DATA

FLASH POINT: 140 F
FLAMMABLE LIMITS: Not Established

FLASH METHOD:
SFCC ASTM D-3828

EXTINGUISHING MEDIA:
Use water spray or fog, alcohol-type foam, dry chemical or CO2.

CONTINUED ON PAGE: 2

***CONTINUATION OF PET1202 ***

FIRE FIGHTING PROCEDURES:

Use a self-contained breathing apparatus with full facepiece operated in pressure-demand or other positive pressure mode. Combustible. Keep fire exposed containers cool using water spray.

UNUSUAL FIRE AND EXPLOSION HAZARDS:

At elevated temperatures, vapors can form an ignitable mixture with air. Vapors can flow along surfaces to distant ignition sources and flash back.

****

SECTION 5 HEALTH HAZARD DATA

EFFECTS OF OVEREXPOSURE:

INHALATION:

Exposure may result in eye, nose and respiratory irritation, and may produce nausea, headache and dizziness. Prolonged exposures to elevated concentrations may cause weakness and CNS depression. In extreme cases, drowsiness and even loss of consciousness may occur.

SKIN AND EYE CONTACT:

Intermittant, brief skin contact may result in mild irritation. Prolonged contact with skin may cause moderate to severe irritation resulting in rashes and dermatitis. Contact with eyes will cause moderate to severe irritation, and may produce moderate but reversible eye injury.

INGESTION:

May cause severe gastrointestinal distress with nausea, vomiting and diarrhea. Aspiration into lungs may cause pulmonary edema and chemical pneumonitis. May be readily absorbed through the gastrointestinal tract.

EMERGENCY AND FIRST AID PROCEDURES:

Wash skin thoroughly with soap and water. If rash or irritation develops, consult a physician. Launder clothing before reuse. If in eyes, irrigate with flowing water immediately and continuously for fifteen minutes. Consult a physician promptly.
If inhaled, remove to fresh air. Administer oxygen if necessary. Consult a physician if symptoms persist or exposure was severe.
Due to possible aspiration into the lungs, DO NOT induce vomiting if ingested. Consult a physician immediately.
NOTE TO PHYSICIAN: Administer activated carbon if indicated.

CONTINUED ON PAGE: 3

****

SECTION 6 REACTIVITY DATA

STABILITY:
Stable under normal conditions of storage and use.

INCOMPATIBILITY:
Keep away from strong oxidizing agents.

HAZARDOUS DECOMPOSITION PRODUCTS:
Oxides of nitrogen.

HAZARDOUS POLYMERIZATION:
Will not occur.

****

SECTION 7 SPILL AND LEAK PROCEDURES

IF MATERIAL IS SPILLED OR RELEASED:
Small spill - Absorb on paper, cloth or other material. Large spill - Dike to prevent entering any sewer or waterway. Transfer liquid to a holding container. Cover residue with dirt, or suitable chemical adsorbent. Use personal protective equipment as necessary.

DISPOSAL METHOD:
Place chemical residues and contaminated adsorbent materials into a suitable waste container and take to an approved waste disposal site. Dispose of all residues in accordance with applicable waste management regulations.

DECONTAMINATION PROCEDURES:
Not appropriate.

****

SECTION 8 SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION:
When concentrations exceed the exposure limits specified, use of a NIOSH-approved organic vapor cartridge respirator is recommended. Where the protection factor of the respirator may be exceeded, use of a self-contained breathing unit may be necessary.

VENTILATION:
General ventilation should be provided to maintain ambient concentrations below nuisance levels. Local ventilation of emission sources may be necessary.

CONTINUED ON PAGE: 4

***CONTINUATION OF PET1202 ***

PROTECTIVE CLOTHING:
Chemical-resistant gloves and chemical goggles should be used to prevent skin and eye contact.

****

SECTION 9 SPECIAL PRECAUTIONS

Avoid heat, sparks and open flames. Avoid breathing of vapors and contact with eyes, skin or clothing. Keep container closed when not in use. Hazardous product residue may remain in emptied container. Do not reuse empty container without commercial cleaning or reconditioning. From skin-painting studies of petroleum distillates of similar composition and distillate range, it has been shown that these types of materials often possess weak carcinogenic activity in laboratory animals. In these tests, the material is painted on the shaved backs of mice twice a week for their lifetime. The material is not washed off between applications. Therefore, there may be a potential risk of skin cancer from prolonged or repeated skin contact with this product in the absence of good personal hygiene.

****

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PETROLITE

ENVIRONMENTAL DATA SHEET

PETROLITE CORPORATION
369 MARSHALL AVE.
ST. LOUIS MO 63119 U.S.A.

REVISION DATE: 08/27/90
EMERGENCY PHONE: 1-314-961-3500
CHEMTREC EMER NO: 1-800-424-9300

****

PET1202

SARA TITLE III, SECTION 313

This notification is incorporated into the Material Safety Data Sheet (MSDS) for the Petrolite product named above. When physically attached to the MSDS, this notification must not be detached from the MSDS. Any copying and redistribution of the MSDS to which this notification is attached must include copying and redistribution of this notification.

This Petrolite product contains a toxic chemical or chemicals subject to the reporting requirements of section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR 372, as follows:

CHEMICAL	CAS NUMBER	WEIGHT PERCENT
1,2,4-Trimethylbenzene *	000095-63-6	1.7 %
Xylene (mixed isomers) *	001330-20-7	1.3 %

* solvent component

****

MATERIAL SAFETY DATA SHEET

PETROLITE CORPORATION
369 MARSHALL AVE.
ST.LOUIS MO 63119 U.S.A

REVISION DATE: 06/15/90
EMERGENCY PHONE: 1-314-961-3500
CHEMTREC EMER NO: 1-800-424-9300

****

SECTION 1 PRODUCT IDENTIFICATION

PRODUCT: PET1100
TRADE NAME: PETROTEC
LABEL: 008
084
096

(IF HAZARDOUS PER D.O.T. CFR TITLE 49)

SHIPPING NAME: Ethylenediamine Solution

HAZARD CLASS: Corrosive Material
ID#: UN1604

CHEMICAL DESCRIPTION

ETHYLENEDIAMINE AND ACYLATED POLYAMINES IN WATER.

****

SECTION 2 HAZARDOUS INGREDIENTS

CAS NUMBER	MATERIAL	%	EXPOSURE LIMITS
00107-15-3	Ethylenediamine	30-60	ACGIH TLV: 10 ppm TWA
			OSHA PEL: 10 ppm TWA

****

SECTION 3 PHYSICAL DATA

SPECIFIC GRAVITY(H2O = 1.0@60 F): 1.004
VOLATILITY: N/A
VAPOR PRESSURE: Not Established
SOL. IN WATER: Soluble

APPEARANCE AND ODOR: Light amber liquid. Amine odor.

****

SECTION 4 FIRE AND EXPLOSION HAZARD DATA

FLASH POINT: >200 F
FLAMMABLE LIMITS: Not Established

FLASH METHOD:

SFCC ASTM D-3828

EXTINGUISHING MEDIA:

Use water spray or fog, alcohol-type foam, dry chemical or CO2.

FIRE FIGHTING PROCEDURES:

Use a self-contained breathing apparatus with full facepiece operated in pressure-demand or other positive pressure mode. Non-flammable. Keep fire-exposed containers cool using water spray.

CONTINUED ON PAGE: 2

***CONTINUATION OF PET1100 ***

UNUSUAL FIRE AND EXPLOSION HAZARDS:

The product is toxic upon skin contact. When heated it emits highly irritating and noxious vapors.

****

SECTION 5 HEALTH HAZARD DATA

EFFECTS OF OVEREXPOSURE:

INHALATION:

Vapors are moderately to highly irritating to eyes, nose and respiratory system. Prolonged exposure to excessive concentrations may result in delayed lung injury as well as kidney and liver damage.

Repeated overexposures may produce an allergic sensitization resulting in skin rashes or possibly asthmatic-type response with moderate to severe breathing difficulty in extreme cases.

SKIN AND EYE CONTACT:

Corrosive! Contact with skin will produce severe irritation or burns with possible in-depth injury. Contact with eyes will result in severe eye irritation or burns and, if not immediately removed, may lead to permanent eye damage. Repeated skin contact may produce allergic sensitization. In such cases, incedental (minor) contact may cause allergic rashes, and in rare cases may result in an asthmatic response with associated breathing difficulties.

EYE IRR. SCORE: 4 (0=None, 4=Severe)

SKIN IRR SCORE: 4 (0=None, 4=Severe)

INGESTION:

Corrosive! Causes severe irritation or burns to the mouth and gastrointestinal tract. In extreme cases may cause kidney and liver damage.

EMERGENCY AND FIRST AID PROCEDURES:

If contacted, wash skin immediately with soap and water. Remove contaminated clothing and wash before reuse. If irritation or burns develop, consult a physician. If in eyes, irrigate with flowing water immediately and continuously for fifteen minutes. Consult a physician.

If inhaled, remove to fresh air. Administer oxygen if necessary. Consult a physician if symptoms persist or exposure was severe.

If ingested, DO NOT induce vomiting. If conscious, drink promptly large quantities of water. Call a physician immediately. NOTE TO PHYSICIAN: Probable mucosal damage may contraindicate the use of gastric lavage. Measures against circulatory shock and convulsion may be necessary.

CONTINUED ON PAGE: 3

***CONTINUATION OF PET1100 ***

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SECTION 6 REACTIVITY DATA

STABILITY:

Stable under normal conditions of storage and use.

INCOMPATIBILITY:

Keep away from acids and strong oxidizing agents. Avoid contact with zinc, aluminium, copper and their alloys.

HAZARDOUS DECOMPOSITION PRODUCTS:

Oxides of nitrogen.

HAZARDOUS POLYMERIZATION:

Will not occur.

****

SECTION 7 SPILL AND LEAK PROCEDURES

IF MATERIAL IS SPILLED OR RELEASED:

Small spill - Dilute with water and adsorb on sand, dirt or other non-combustible adsorbent. Neutralize residues with dilute acid such as hydrochloric or acetic acid.
Large spill - Dike to prevent entering any sewer or waterway. Transfer liquid to a holding container. Neutralize residues with dilute hydrochloric or acetic acid.

DISPOSAL METHOD:

Secure container and take to an approved waste disposal site. Flush neutralized residues to chemical process sewer or sanitary sewer.
If not diluted or neutralized, this material may be classified as hazardous waste by the EPA under authority of RCRA. Federal, state and local regulations should be followed in disposing of this material.

DECONTAMINATION PROCEDURES:

Neutralize product residues with dilute acids such as hydrochloric or acetic acid.
Do not attempt to neutralize large quantities of material unless measures to control reactivity and heat generation have been taken.

****

SECTION 8 SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION:

When concentrations exceed the exposure limits specified, use of a NIOSH-approved supplied air respirator with full facepiece is recommended. Where the protection factor of the respirator may be exceeded, use of a self-contained breathing unit may be necessary.

CONTINUED ON PAGE: 4

***CONTINUATION OF PET1100 ***

VENTILATION:

General ventilation should be provided to maintain ambient concentrations below nuisance levels. Local ventilation of

emission sources may be necessary to maintain ambient concentrations below recommended exposure limits.

PROTECTIVE CLOTHING:

Chemical-resistant gloves and chemical goggles, face shield and synthetic apron or coveralls should be used to prevent contact with eyes, skin or clothing.

****

SECTION 9 SPECIAL PRECAUTIONS

Avoid heat, sparks and open flames. Avoid breathing of vapors and contact with eyes, skin or clothing. Keep container closed when not in use. Hazardous product residue may remain in emptied container. Do not reuse empty container without commercial cleaning or reconditioning. Triple-rinse drum prior to offering for recycle, reconditioning or disposal. Dispose of rinsate in an environmentally acceptable manner consistant with applicable waste management regulations.

****

Although the information and recommendations set forth herein are believed to be correct as of the date hereof, Petrolite makes no representations to the accuracy of such information and recommendations. It is the user's responsibility to determine the suitability and completeness of such information and recommendation for its own particular use.Petrolite shall not be responsible for any direct,indirect,incidental or consequential damages of whatsoever nature resulting from the publication,use of or reliance upon such information and recommendations.

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PETROLITE

ENVIRONMENTAL DATA SHEET

PETROLITE CORPORATION
369 MARSHALL AVE.
ST. LOUIS MO 63119 U.S.A.

REVISION DATE: 03/05/91
EMERGENCY PHONE: 1-314-961-3500
CHEMTREC EMER NO: 1-800-424-9300

****

PET1100

SARA TITLE III, SECTION 313

This notification is incorporated into the Material Safety Data Sheet (MSDS) for the Petrolite product named above. When physically attached to the MSDS, this notification must not be detached from the MSDS. Any copying and redistribution of the MSDS to which this notification is attached must include copying and redistribution of this notification.

This Petrolite product contains no toxic chemicals subject to the reporting requirements of section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR 372.

****

UOP

Material Safety Data Sheet

UOP
25 East Algonquin Road
Des Plaines, Illinois 60017-5017
Telephone: 708-391-2000
FAX: 708-391-2953
Telex: 211-442

Emergency Assistance
24 Hour Emergency Telephone Numbers:

USA:	UOP	708/391-2123
	Chemtrec	800/424-9300
Canada:	Canatec	613/996-6666
Outside USA:	Chemtrec	202/483-7616

PRODUCT NAME

MEROX FB®
REAGENT

INGREDIENTS

MATERIAL	(CAS NO.)	WT(%)	1988-89 ACGIH TLV-TWA (OSHA PEL)
Cobalt phthalocyanine sulfonate (cobalt compound)*		28	0.05 mg/m^3 (0.05 mg/m^3) [Cobalt metal, dust and fume (as CO)]
Water	(7732-18-5)	72	None established

Governmental Inventory Status: All components registered in accordance with TSCA.
*This chemical is subject to the reporting requirements of Section 313 of the Emergency Planning and Community-Right-To-Know Act of 1986 and of 40 CFR 372. This information must be included in all MSDSs that are copied and distributed for this material.

TRANSPORTATION CLASSIFICATION

DOT Hazard Class: Not regulated
IMO Hazard Class: Not regulated

PHYSICAL DATA

Boiling Point, °F (°C): 212 (100)
Specific Gravity, g/ml @ 60°F: 1.15
Appearance: Dark blue gelatinous dispersion

% Volatiles, by Weight: 72
Solubility in Water: Not complete
Odor: Odorless

FIRE AND EXPLOSION DATA

Flash Point, °F (°C):	Not applicable
Special Fire Fighting Equipment:	Area may be entered freely with self-contained breathing apparatus that provides eye protection
Extinguishing Media:	Water fog, foam, CO_2, dry chemical
Fire and Explosion Hazards:	Fire may produce poisonous gases (i.e., HCN, SO_x, NO_x, CO)

REACTIVITY DATA

Stability:	Stable to 300°C
Conditions to Avoid:	Temperatures above 300°C
Hazardous Decomposition Products:	HCN, SO_x, NO_x, CO
Hazardous Polymerization:	Will not occur
Incompatible Materials:	Active chlorine; strong oxidizers

SPILL OR LEAK PROCEDURE

Large Spills:Immediately isolate the affected area and keep out all unauthorized personnel. Confine entry to those persons who are properly protected.

Stop leak at the source. If possible, reposition, plug, or encapsulate the container to stop further leakage. Cut off and redirect surface runoff by trenching or diking.

Spills should be contained through the use of a commercial aqueous absorbent, but other materials such as earth, sand, or sawdust may be more expedient to limit the extent of contamination.

Clean contaminated surface with a generous amount of aqueous absorbent, soaking up as much liquid as possible. Contaminated material should be disposed in accordance with waste disposal regulations. Refer to WASTE DISPOSAL section.

Small Spills: Wear proper protective equipment. Absorb spilled material using a commercial aqueous absorbent soaking up as much material as possible. Contaminated material should be disposed in accordance with waste disposal regulations. See WASTE DISPOSAL section.

WASTE DISPOSAL

Merox FB waste, including concentrated solutions, contaminated absorbent, and materials from spill clean-up procedures, must be handled in accordance with federal, state and local regulations. Although Merox FB and its components are not listed either by generic name or by trademark name in the U.S. EPA's Hazardous Waste Regulations, UOP recommends that Merox FB reagent be disposed as hazardous waste, because the reagent has been shown to have a mutagenic potential. Recommended disposal practices include incineration or waste treatment at permitted facilities.

HEALTH HAZARD DATA

Primary Routes Of Exposure:	Contact with skin or eyes. Product ingestion is unlikely but may occur if proper safety/hygiene procedures are not followed. Exposure may also occur via inhalation or ingestion if the product

Ingestion: If the patient is conscious, induction of vomiting or gastric lavage to empty the stomach contents is advised. Administer 2-4 tablespoons of U.S.P. activated charcoal mixed with 6 ounces of water, followed by a hypertonic laxative.

PROTECTIVE EQUIPMENT

Skin: Impervious protective clothing such as pants, jacket, apron, rubber gloves, rubber footwear.

Eye: Splash-proof goggles or face shield as necessary to prevent eye contact.

Other: Do not eat, drink or smoke in areas where the product is handled. It is recommended that if physical contact with product occurs: 1) personal protective clothing should then be decontaminated by washing with detergent and chlorinated bleach; 2) other personal protective clothing should also be cleaned, according to manufacturer's instructions; 3) persons should shower before putting on clean work or street clothing.

SPECIAL PRECAUTIONS

Do not reuse empty containers. Rinse the container with water, adding the rinsings to the Merox unit to recover all active ingredients.

NOTE: If further details are required, please address inquiries to:

Product Stewardship Coordinator
Health, Safety and Environmental Department
UOP, 25 East Algonquin Road, Des Plaines, Il 60017-5017
(708) 391-3189

24 HOUR EMERGENCY TELEPHONE NUMBER (708) 391-2123

The data and recommendations presented in this data sheet concerning the use of our product are believed to be accurate and are based on information which is considered reliable as of the date hereof. However, the customer should determine the suitability of such materials for his purpose before adopting them on a commercial scale. Since the use of our products by others is beyond our control, no guarantee, express or implied, is made and no responsibility assumed for the use of this material or the results to be obtained therefrom. Information on this form is furnished for the purpose of compliance with Government Health and Safety Regulations and shall not be used for any other purposes. Moreover, the recommendations contained in this data sheet are not to be construed as a license to operate under, or a recommendation to infringe, any existing patents, nor should they be confused with state, municipal or insurance requirements, or with national safety codes.

UOP 3049

Date: January 1989

Revision: 2

Supercedes: May 1986

is heated or if the product is misted or sprayed during handling and/or processing. In order to minimize exposure to product, proper equipment should be used and proper safety/hygiene procedures should be followed.

Acute Oral LD_{50}:	3.6 g/kg (rat)
Acute Inhalation LC_{50}:	The Acute Inhalation LC_{50} is undetermined. Testing was conducted on the powdered active ingredient. The highest dosage level achieved (due to the physical nature of the powder) was 1.05 mg/l; at this dosage level, two test animals (rats) out of ten died.
Acute Dermal LD_{50}:	≥ 2 g/kg (rabbit)
Primary Eye Irritation:	Draize eye score: Nonrinsed = 98 max/110 possible extending through 13 days; rinsed = 9 max/110 possible (rabbit).
Primary Dermal Irritation:	Index = 0.4 (rabbit)
Genetic Toxicology:	Weakly mutagenic in the L5178YTK+/-mouse lymphoma cell in vitro assay.
Summary:	Slight acute toxicity. Slight to moderate irritant to skin and pulmonary system. Primary eye irritant. Mutagenic in the test system used.

FIRST AID

Skin:	Wash contaminated skin with soap and water. Merox reagent intensely stains skin and is very difficult to remove. A soft hand brush may aid in the removal of Merox reagent from skin. A mechanics waterless skin cleaner may also be used to decontaminate skin. Residual color will eventually wear off. DO NOT use bleach to decolorize skin.
Eyes:	Flush with large amounts of water for a minimum of 15 minutes. Obtain prompt medical attention.
Inhalation:	Remove from contaminated area. Obtain professional medical attention.
Ingestion:	INDUCE VOMITING. Obtain immediate medical attention.

Note To Physician:

Eyes:	Rinse eye for 15 minutes. Stain to check for corneal damage in severe cases.
Skin:	Treat minor cases as contact dermatitis.

LEGEND

-·—·—·— FENCE LINE
— — — — PROPERTY LINE
——— UNDERGROUND SEWER LINE (4' LATERALS, 10' MAIN)
-·—·—·— ABOVE GROUND SEWER LINE
○ STORAGE TANK

UTILITY LOCATION PLAN

NOT OT SCALE

NOTES

REFERENCE DRAWINGS

NO.	REVISIONS	BY	CHK.	DATE	APPR.	APPR.

NO.	REVISIONS	BY	CHK.	DATE	APPR.	APPR.

DRAWING TITLE

PLATE 1
LEA REFINING COMPANY
WASTEWATER COLLECTION
AND TREATMENT SYSTEM

LEA REFINING CO.
ENGINEERING DEPARTMENT
P.O. DRAWER 159
ARTESIA, NEW MEXICO

DRAWN BY	CHK'D BY	SCALE	
DATE	APPR BY	DRAWING NUMBER	REV.

SITE INVESTIGATION AND REMEDIATION PLAN
SOUTHERN UNION COMPANY
LEA REFINERY, NEW MEXICO
TRUCK RACK AREA

RECEIVED

SEP 19 1989

OIL CONSERVATION DIV.
SANTA FE

Prepared for

SOUTHERN UNION COMPANY

SEPTEMBER, 1989

REED & ASSOCIATES, INC.
Hydrologists & Environmental Consultants

A Geraghty & Miller Company

SITE INVESTIGATION AND REMEDIATION PLAN
SOUTHERN UNION COMPANY
LEA REFINERY, NEW MEXICO
TRUCK RACK AREA

PREPARED FOR
SOUTHERN UNION COMPANY

BY
REED & ASSOCIATES, INC.
HYDROLOGISTS AND ENVIRONMENTAL CONSULTANTS
MIDLAND -- CORPUS CHRISTI -- AUSTIN
SEPTEMBER, 1989

REED & ASSOCIATES, INC.
A Geraghty & Miller Company

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SOUTHERN UNION COMPANY
LEA REFINERY, NEW MEXICO
TRUCK RACK AREA

INTRODUCTION

Southern Union Company of Dallas, Texas, employed Reed and Associates, Inc. (RAI) to conduct an environmental investigation of the truck rack area at the Lea Refinery located on State Highway 18 south of Lovington, Lea County, New Mexico (Figure 1). The refinery was recently sold by the Southern Union Company to the Holly Corporation, also of Dallas. The refinery is not operating at present.

The truck rack area is situated in the southeastern part of the refinery property (Figure 2). It contains concrete paved wash bays, drain lines, a concrete holding pit for wash water, pumps, and a separator tank. Available information on the operation of the truck rack indicates that a kerosene-based solution was utilized in the truck wash process.

A previous environmental assessment of the truck rack area was conducted by Pilko and Associates, Inc. in February, 1989. This investigation consisted of the installation of two monitor wells at the site which have since been plugged (Figure 2). Hydrocarbon odors in the soils were noted during the drilling of well TW-2 on the northern corner of the concrete drain pit. These odors, described as fuel or kerosene-like, persisted to a depth of 32 feet. No soil analyses were performed. Analyses of water from TW-2 showed trace concentrations of eleven volatile organic compounds. The downgradient well, TW-5, showed no evidence of volatile compounds. Analyses for total petroleum hydrocarbons or fuels were not conducted.

RAI was retained by the Southern Union Company to further define the extent of the soil contamination in the truck rack area. This report summarizes the results of the RAI investigation and presents recommendations for site remediation.

Background surface soil sampling was conducted at the Lea Refinery by Western Technologies, Inc. in June, 1989, at the request of the Southern Union Company. The results of these analyses have been utilized in the RAI study.

SITE DESCRIPTION

SETTING

The Lea Refinery is located about 4 miles southeast of Lovington, New Mexico on the Llano Estacado of eastern New Mexico and western Texas. The Llano Estacado is a depositional surface of low relief sloping uniformly to the southeast. There is no integrated drainage in the area and runoff flows to shallow depressions where it remains until it evaporates or seeps into the ground.

Elevations at the refinery range from about 3,845 feet on the northwest to 3,815 feet on the southeast. The topographic slope is approximately 25 feet per mile to the southeast.

The climate of this portion of New Mexico is characterized by low annual precipitation (12 to 15 inches per year), low humidity and high average annual temperature. The climate has been classified as marginal between semiarid and arid.

GEOLOGY

The area of interest is located in a large subsurface structural province known as the Permian basin. Oil and gas exploration has revealed a complex subsurface geology which involves rocks from Precambrian to Permian in age. This structure is overlain by gently southeasterly dipping Triassic redbeds separated from the older rocks by an erosional unconformity.

Above the Triassic redbeds are the Pliocene age sediments of the Ogallala formation. These sediments form the Llano Estacado surface and were deposited by easterly flowing braided streams following the Laramide revolution and the uplifting of the Rocky Mountains to the west.

The Ogallala is composed of sands, silts, clays and gravels with no persistent marker beds in the formation. Basal gravel is present in many places, usually in buried stream valleys in the pre-Ogallala erosional surface. The upper portion of the Ogallala contains a dense caliche cap up to 13 feet thick at the refinery site.

HYDROLOGY

The Ogallala formation is the major source of ground water in the region. Recharge to this aquifer occurs from rainfall on the outcrop. Only a small percentage of precipitation actually reaches the aquifer due to a combination of low rainfall, high evaporation rate, and a generally low infiltration rate. Water in the Ogallala is unconfined and contained in pore spaces of the clastic sediments.

The quality of water from the Ogallala in Lea County is generally fair with total dissolved solids usually less than 1,100 milligrams per liter (mg/l). The water is typically high in silica, contains moderate amounts of calcium and magnesium, and is low in sulfate, sodium and chloride. Brine contamination of the Ogallala, mostly the result of the past practice of placing produced brine from oil wells into shallow unlined surface pits for evaporation, is known to occur in parts of Lea County.

The ground water gradient at the Lea Refinery is to the southeast at about 10 feet per mile. Depth to ground water in the truck rack area of the Lea Refinery is about 70 feet.

FIELD PROGRAM METHODOLOGY

BACKGROUND SOIL SAMPLING

Background surface soil sampling was conducted prior to the RAI truck rack investigation by Western Technologies, Inc. at the request of the Southern Union Company. This sampling was completed in June, 1989.

Four background soil samples (BG-1, BG-2, BG-3, & BG-4) were collected at random from widely separated areas of the Lea Refinery (Figure 2). These samples were collected from the approximate depth of 1 to 2 feet using a clean stainless steel trowel. Samples to be analyzed for volatile organic compounds (VOC) and total metals were placed into 500 milliliter (ml) glass jars, sealed, and preserved by cooling in an ice chest. Samples for total petroleum hydrocarbons (TPH) were placed in 40 ml vials and similarly handled. Quality control and chain-of-custody procedures were employed.

Samples were sent to a laboratory chosen by Western Technologies, Inc. and analyzed for VOC by EPA Method 8240, TPH by Method 3050/418.1 and total metals by Method 3050/6010. The analytical results were used to establish background or baseline levels for VOC, TPH and total metals on the refinery site.

SOIL VAPOR SURVEY

A reconnaissance soil vapor survey was conducted in the truck rack area as an aid in identifying the presence and relative concentrations of volatile hydrocarbons in the soil. An HNU-101 photo-ionization detector with a 10.2 electron-volt source calibrated for benzene was used for all field measurements.

The survey was performed by augering 4-inch diameter holes to a maximum depth of 5 feet. The initial holes were placed in areas of stained soil. Each auger hole was covered for a period of 45 minutes to one hour to allow soil gases to collect within the hole. The hydrocarbon gas concentration within the auger hole was then measured with the HNU. Additional holes were augered on a grid pattern outward from areas of elevated soil vapor concentrations to determine the horizontal limits of soil contamination. The locations of soil vapor holes are shown on Figure 3.

SOIL BORINGS

Two deep soil borings, B-1 and B-2 (Figure 3) were constructed in the truck rack area. These borings were advanced with an air rotary drilling rig. Soil samples were obtained at regular intervals with a split spoon sampler or a core barrel, depending on the hardness of the formation being sampled. Split spoon samples were collected in 6-inch long brass liners and sealed immediately with plastic caps. Core samples were removed from the core barrel and placed in glass jars.

B-1 was drilled to a depth of 61 feet. B-2 was drilled to a depth of 13 feet. All soil samples were screened with the HNU-101 photo-ionization detector to determine the relative concentrations of volatile hydrocarbons. The sample from boring B-1 at the depth of the highest HNU reading (18.5 to 19.5 feet) was preserved on ice for laboratory analysis. The bottom sample from B-1 (60-61 feet) was also preserved for later analysis. B-2 was advanced to a total depth of 13 feet. No organic vapors were detected by the HNU on samples collected from B-2 below a depth of 3 feet. Therefore, no samples from this hole were submitted to the laboratory.

Soil samples were sent to National Environmental Testing, Inc. in Austin, Texas for analyses. Standard chain of custody procedures were followed. Samples were analyzed for VOC by EPA Method 8240, TPH by Method 3050/418.1, and base neutral/acid extractable compounds by Method 8270. In addition, total arsenic, chromium, lead and zinc were determined by Method 3050/6010.

RESULTS

BACKGROUND SOIL SAMPLING

The results of background soil analyses may be found in Appendix A and a summary in Table 1. None of the samples contained detectable volatile organic compounds except for trace levels of methylene chloride in BG-4. Western Technologies, Inc. has indicated that the presence of methylene chloride is due to laboratory contamination.

All background samples contained detectable total petroleum hydrocarbons in levels ranging from 3.9 to 28.3 milligrams per kilogram (mg/kg). Surface soils at the refinery may contain small amounts of non-volatile hydrocarbon residue built up over time due to general airborne emissions in the environs of the refinery.

The total metals analyses of the background soils for arsenic, chromium, lead, and zinc showed the presence of these metals at detectable levels in all samples. Arsenic ranged from 2.1 to 2.8 mg/kg, chromium from 5.1 to 25.6 mg/kg, lead from 5.1 to 8.5 mg/kg, and zinc from 13.3 to 55.8 mg/kg.

SOIL VAPOR SURVEY

The HNU survey in the vicinity of the truck rack indicated two areas with elevated hydrocarbon vapor levels (Figure 3). One area, with a high reading of 250 parts per million (ppm), is centered on an area of black-stained soil some 45 feet south of the truck rack

TABLE 1

Summary - Background Soil Analyses in MG/KG (ppm)

	Sample No.			
	BG-1	BG-2	BG-3	BG-4
Total Petroleum Hydrocarbons	3.9	28.3	17.4	6.2
Arsenic, Total	2.2	2.1	2.8	2.4
Chromium, Total	10.8	6.3	5.1	25.6
Lead, Total	6.9	6.3	5.1	8.5
Zinc, Total	28.4	17.4	13.3	55.8

separator. A second stained region was investigated on the northwest, north and northeast sides of the concrete pit. The maximum soil vapor reading at the second site was 193 ppm.

The staining south of the truck rack separator is related to a pipeline spill. This is apparent from the position and orientation of the stain with respect to the above ground pipeline corridor. The stained area around the concrete pit may be the result of cleaning transport trucks directly over the pit.

Several asphalt spill areas were noted on the southeast side of the pipeline corridor which lies between the truck rack and the concrete drain pit. These are surficial spills associated with asphalt product release valves and are not a contributing factor to subsurface contamination.

SOIL BORINGS

The two soil borings were constructed in the vicinity of the highest soil vapor readings. Broken caliche and fill were encountered from the surface to a depth of 2 feet. Sandy, relatively soft caliche was found from approximately 2 feet to a depth of 9 feet. Hard, crystalline caliche occurs from 9 feet to about 13 feet, interbedded caliche and sand from 13 to 20 feet, and fine sand from 20 to 61 feet. Logs of the borings may be found in Appendix B.

HNU readings in B-1 were up to 86 parts per million (ppm) in the upper 8 feet, decreased to about 16 ppm in the hard caliche from 9 to 13 feet, and increased to over 100 ppm in the sand below the caliche. HNU values as high as 150 ppm were noted in the 18 to 20 foot sample interval. Readings began to decrease significantly at 45 feet, dropping to the 20 to 50 ppm range, and decreased to 10 to 15 ppm at 61 feet. B-1 was not taken to ground water, estimated to be at a depth of about 70 feet, but it is probable that low levels of hydrocarbons extend to this depth as evidenced by the existence of trace amounts of volatile hydrocarbons in the plugged monitor well, TW-2.

Low vapor readings in the caliche overlying the sand reflect the lack of primary permeability in this material. However, there is secondary permeability in the form of solution cavities or vugs (see Appendix C photos). This secondary permeability allowed the movement of contaminants through the caliche without significant retention of hydrocarbons. The fine sand below the caliche absorbed the downward migrating hydrocarbons.

Detectable compounds found in the analyses of deep boring samples are summarized in Table 2. Laboratory sheets are in Appendix A. The bulk of the contaminants present in the cores from B-1 are kerosene and diesel fuel. The 18.5 to 19.5 foot sample contained 1,014 micrograms per gram (ug/g) kerosene and 1,220 ug/g diesel fuel. Total petroleum

TABLE 2

Summary - Deep Boring Analyses in UG/G (ppm)

	Sample No.	
	B-1 (18.5-19.5')	B-1 (60-61')
Ethylbenzene	1.5	ND
Xylenes	8.0	ND
Bis(2-ethylhexyl)phthalate	3.0	----
Kerosene	1,014	----
Diesel Fuel	1,220	----
Total Petroleum Hydrocarbons	1,550	131
Arsenic, Total	1.6	----
Chromium, Total	1.5	----
Lead, Total	<5.0	----
Zinc, Total	227	----

hydrocarbons were 1,550 ug/g. The 60 to 61 foot sample contained total petroleum hydrocarbons of 131 ug/g. All volatiles analyzed were below detection limits for this sample. These results conform with the known usage of fuel-based cleaning solutions at the truck wash rack.

The analyses for total arsenic, chromium, lead and zinc for the 18.5 to 19.5 foot sample in B-1 may also be found in Table 2. All metals were below background soil levels except for zinc at 227 ug/g. This level of zinc is over four times higher than the highest background sample. The elevated level of zinc, in the absence of other heavy metals, may reflect the differences in geologic materials between the B-1 sample and the surface background samples.

Boring B-2 was advanced to a total depth of 13 feet. Staining and HNU readings dropped off rapidly with depth. No staining or odor was noted in the bottom sample at 11 to 13 feet. HNU readings for this sample were at background level.

REMEDIATION RECOMMENDATIONS

GENERAL

The concrete pit has recently received two applications of a spray-on coating to aid in the reduction of fluid leakage from the pit. In addition, a soil berm will be constructed around the concrete pit to eliminate surface drainage to the pit during periods of heavy rainfall. Concrete barriers will also be installed around the pit to prevent the cleaning of transport vehicles directly into the pit. This will help to eliminate spills on the soils around the pit and confine truck washing to the concrete paved and drain equipped wash rack.

The fluid level in the concrete pit will be kept to a minimum to reduce the potential for leakage. A higher capacity separator may be installed onsite to reduce the holding time of fluids in the pit. In addition, the pit walls and lining will be visually inspected for cracks or other deterioration on a semi-annual basis.

SOIL REMOVAL

The stained soil on the north and east sides of the concrete pit will be removed. Care will be taken not to damage the concrete pit walls. Only near surface soils will be removed. The native caliche will not be disturbed. The depth of excavation is estimated to be about 2 feet. The volume of soil to be removed is estimated at 45 cubic yards.

Stained soil will also be removed from the area of the pipeline break. Subsurface caliche can be removed in this area to the depth necessary to bring HNU readings down to background levels. Excavation to a depth of 3 to 4 feet is anticipated. The volume of soil to be removed is estimated at about 40 cubic yards.

All excavations will be filled with clean dirt and compacted in 6-inch lifts. Excavated soil will be stockpiled and removed at a later date. It is anticipated that the soils to be disposed will be combined with soils to be removed from the overflow pond area. This disposal has been addressed in the RAI Overflow Pond Closure Plan of August, 1989.

VAPOR EXTRACTION SYSTEM

The installation of a vapor extraction system (VES) is proposed to remediate the subsurface soils around and beneath the truck rack concrete pit. The VES will employ wells constructed in the unsaturated zone to vent volatile hydrocarbons to the atmosphere. A blower, gathering lines, and a vent stack will complete the VES installation (Figure 4). All permits or exemptions for atmospheric release of the hydrocarbon vapors will be obtained prior to system installation.

The VES 2-inch wells will be constructed to a total depth of 63 feet. Two-inch PVC pipe will be used to case the holes. The wells will be screened with mill slot (.040-inch or larger) screen and packed with coarse gravel. A 2-inch gathering line will connect the wellheads. A typical VES well is shown in Figure 5.

The VES pipeline will be separately valved to enable individual wells to be taken off-line for sampling purposes. The 2-inch gathering line will be connected through an air filter to a specialized blower. This blower, with a capacity of up to 150 cubic feet per minute, is designed to accelerate inlet air on a regenerative principle to provide higher pressure and vacuum than a standard centrifugal-type blower. Exhaust air from the blower will be vented through a stack designed to release vapors well above ground level. Figure 6 details the VES design.

Baseline air samples will be collected from each individual VES well when the system is installed. Monitoring of the VES system will be on a quarterly basis for the first year, then semi-annually. All air sampling will be for total petroleum hydrocarbons. When hydrocarbon levels are reduced to background, the VES will be shut down for one month. The system will then be restarted and sampled to ensure that remediation of the hydrocarbon soil vapors is complete. VES wells will be plugged upon system abandonment from bottom to top with a cement-bentonite grount.

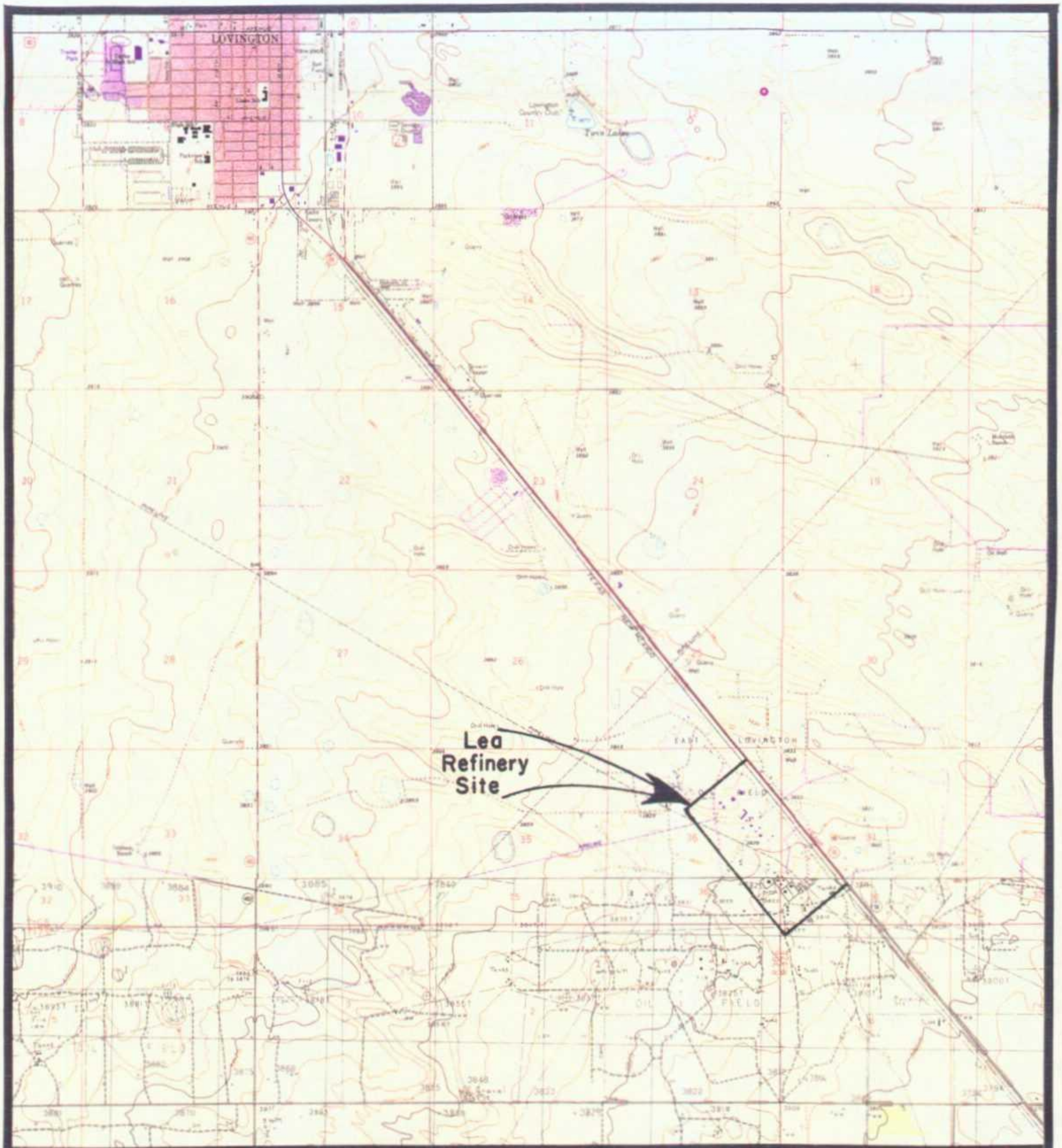
REGISTERED GEOLOGIST
CERTIFICATE NO.
22748
ALLAN T.
SCHMIDT
Date Signed 9-15-89
ARIZONA U.S.A.

Respectfully submitted,

REED & ASSOCIATES, INC.
Allan T. Schmidt
Allan T. Schmidt
Senior Geologist

ATS/bjm

FIGURES



LEA COUNTY, NEW MEXICO

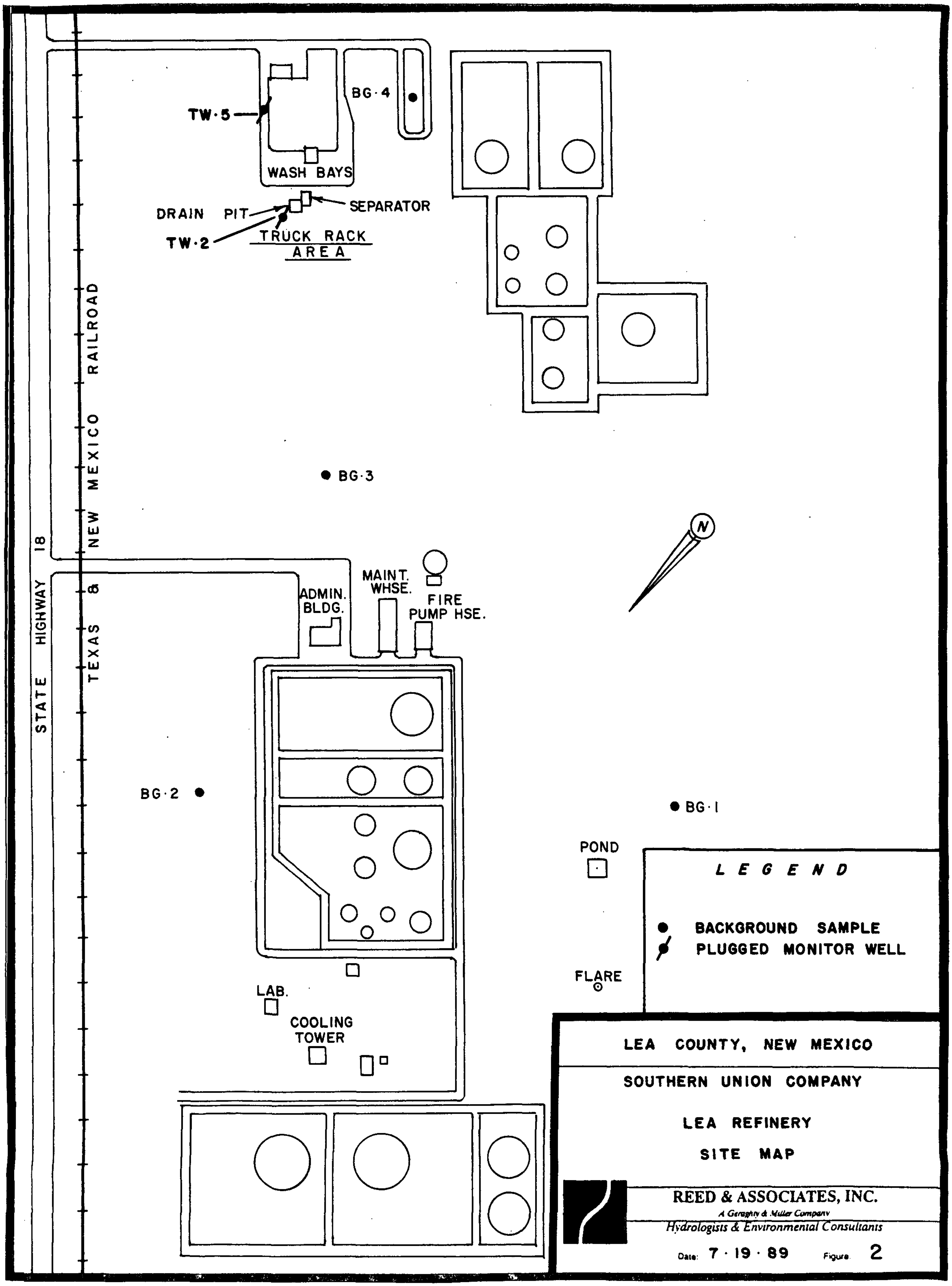
SOUTHERN UNION COMPANY

LEA REFINERY

LOCATION MAP

REED & ASSOCIATES, INC.
A Geraghty & Miller Company
Hydrologists & Environmental Consultants

Date: 7 · 19 · 89 Figure 1



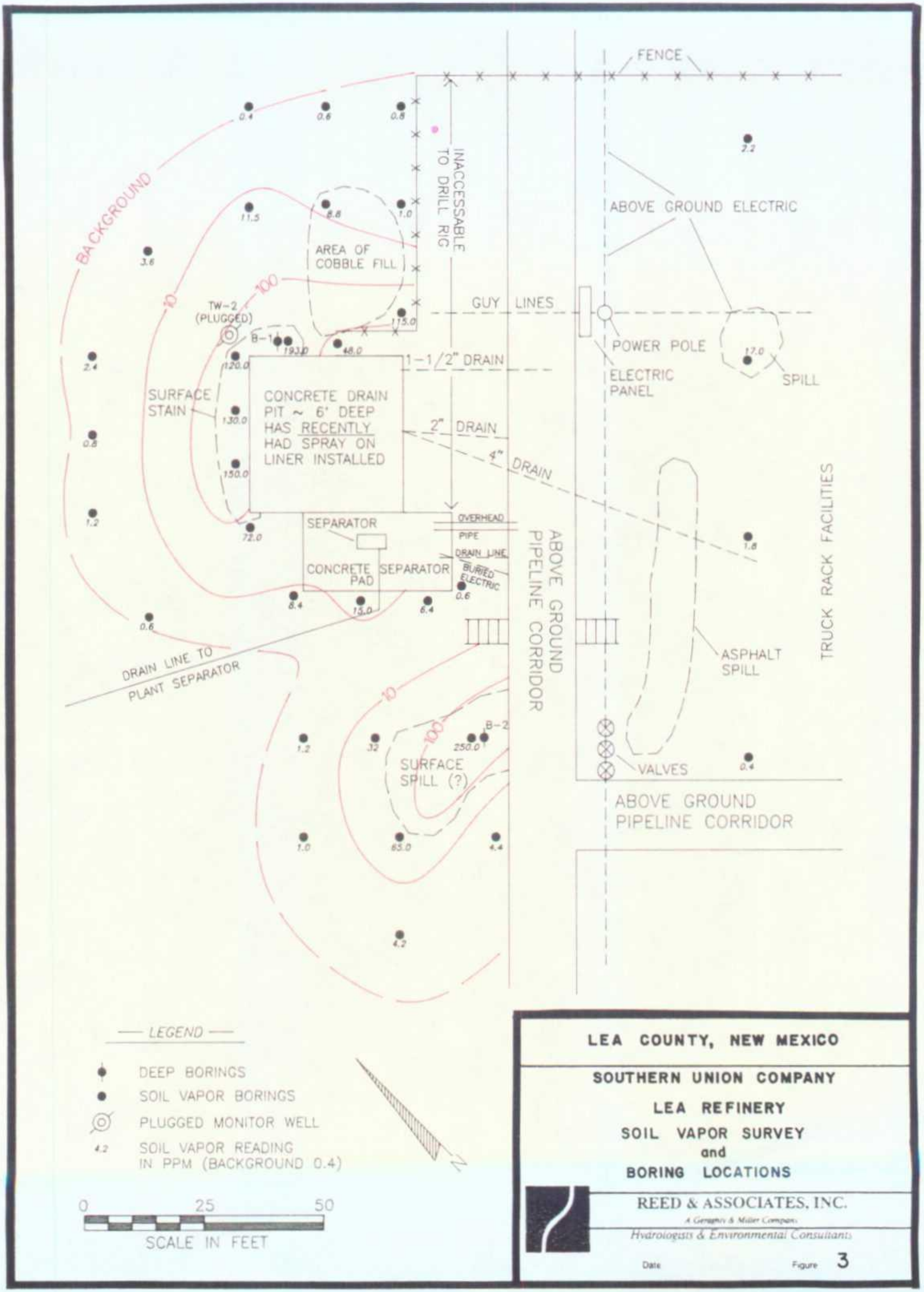
LEA COUNTY, NEW MEXICO

SOUTHERN UNION COMPANY

LEA REFINERY
SITE MAP

REED & ASSOCIATES, INC.
A Geraghty & Miller Company
Hydrologists & Environmental Consultants

Date: 7 · 19 · 89 Figure 2



LEA COUNTY, NEW MEXICO

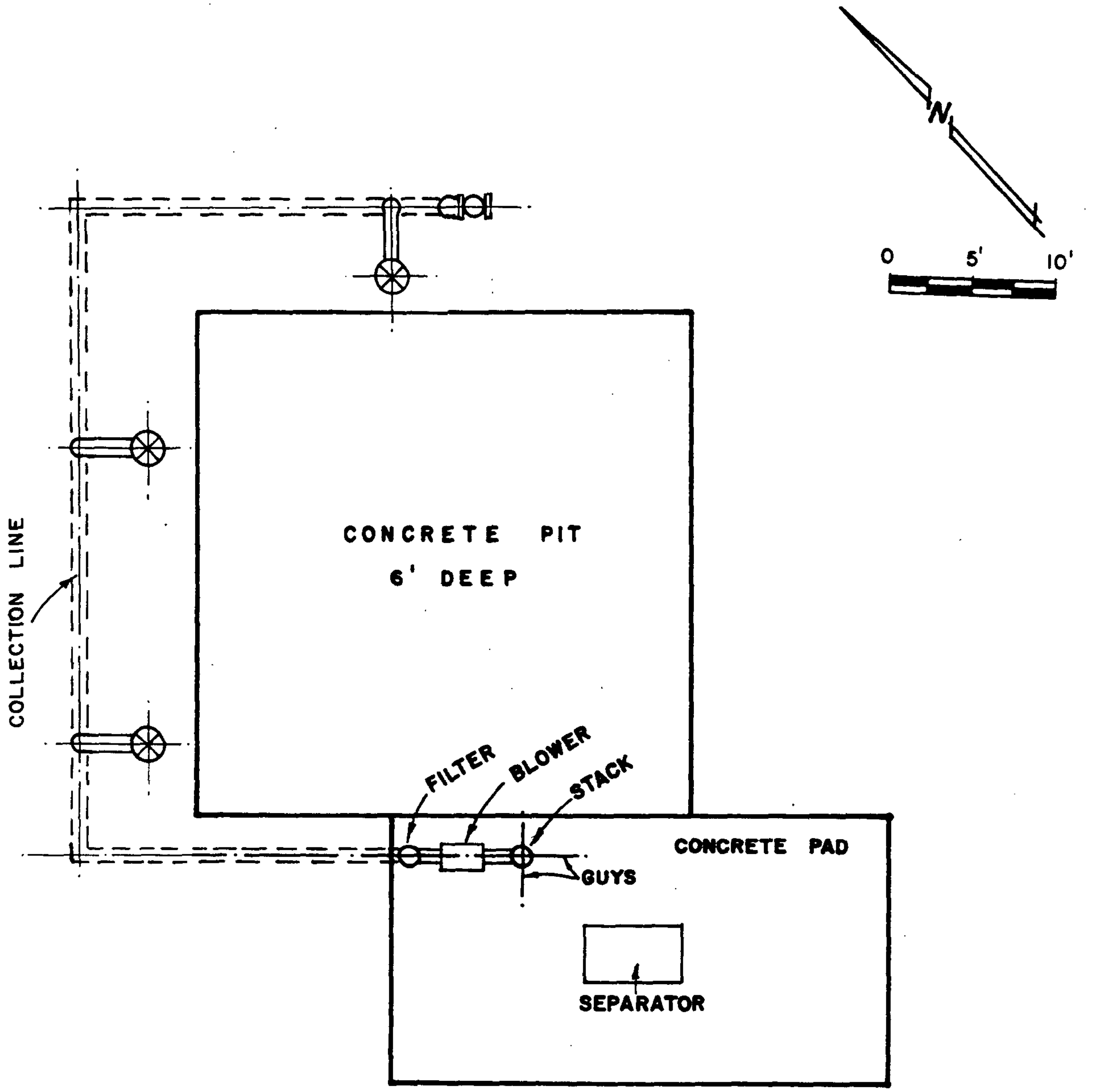
SOUTHERN UNION COMPANY

LEA REFINERY
SOIL VAPOR SURVEY
and
BORING LOCATIONS

REED & ASSOCIATES, INC.
A Geraghty & Miller Company
Hydrologists & Environmental Consultants

Date

Figure 3



LEGEND

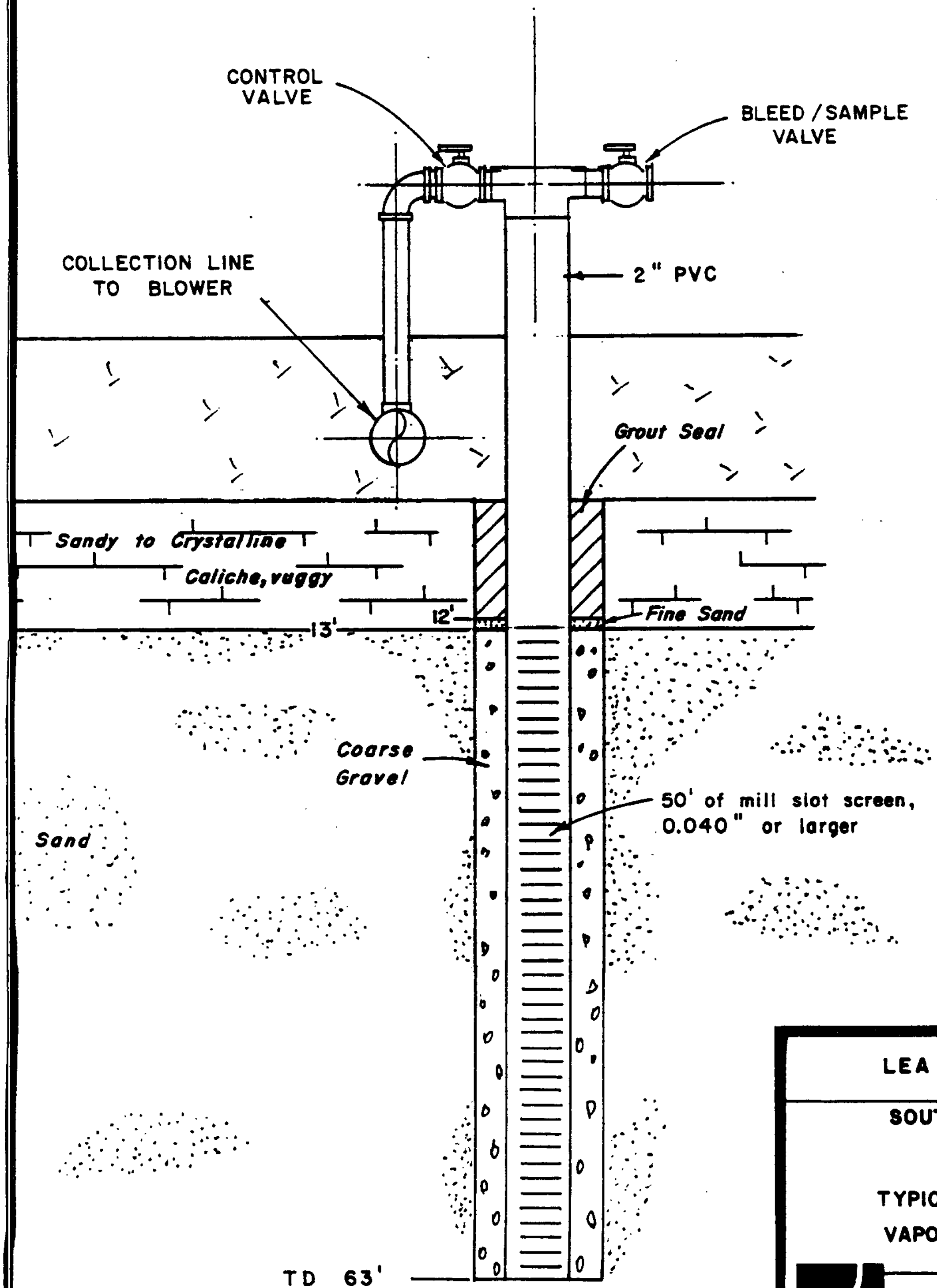
⊗ Vapor extraction well

LEA COUNTY, NEW MEXICO

SOUTHERN UNION COMPANY
LEA REFINERY
PROPOSED LOCATION
VAPOR EXTRACTION SYSTEM

REED & ASSOCIATES, INC.
A Geraghty & Miller Company
Hydrologists & Environmental Consultants

Date 9·11·89 Figure 4



LEA COUNTY, NEW MEXICO

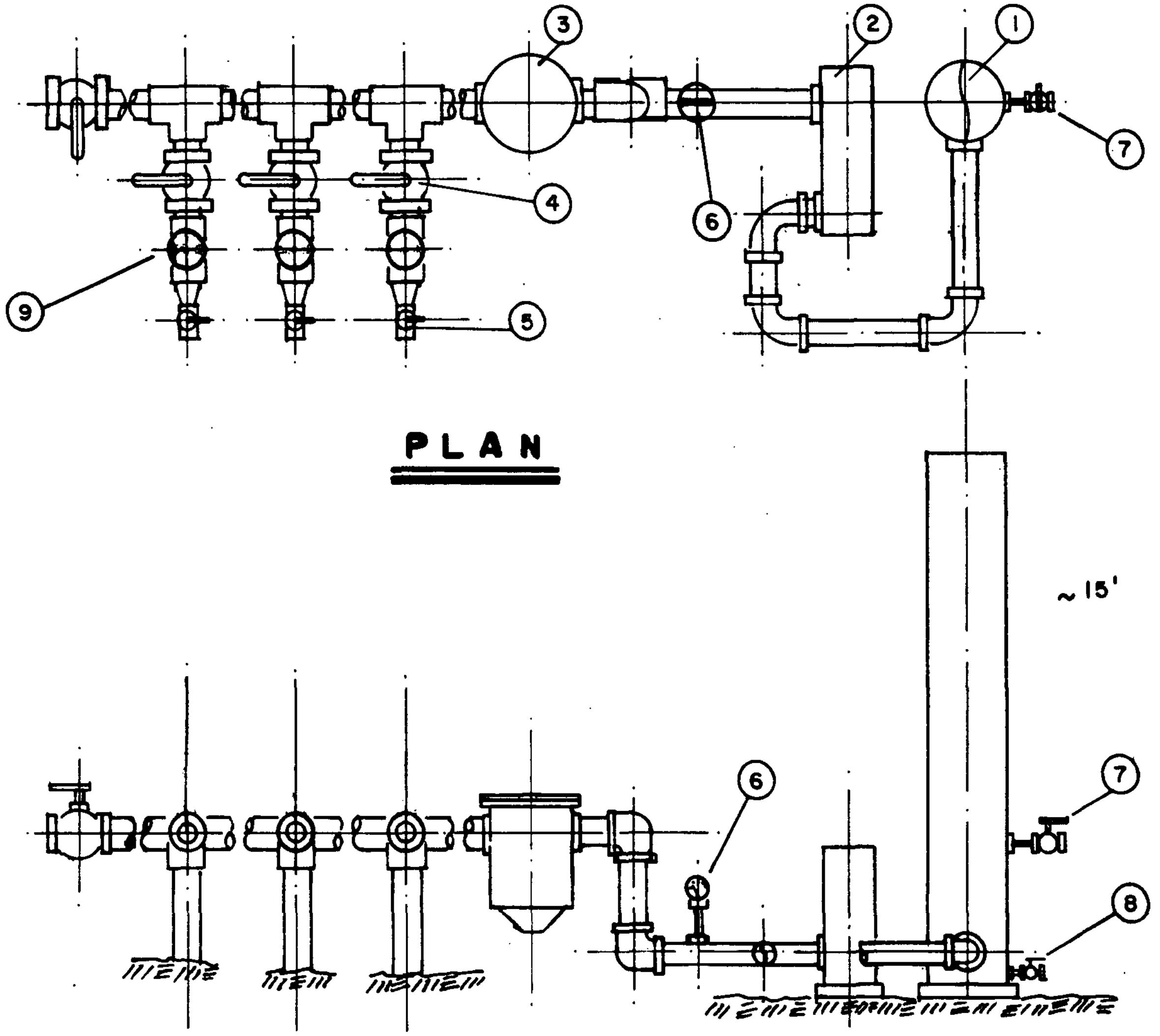
SOUTHERN UNION COMPANY

LEA REFINERY

TYPICAL WELL CONSTRUCTION
VAPOR EXTRACTION SYSTEM

REED & ASSOCIATES, INC.
A Geraghty & Miller Company
Hydrologists & Environmental Consultants

Date **9-12-89** Figure **5**



PLAN

ELEVATION

LEGEND

1	VAPOR EXHAUST STACK
2	BLOWER
3	AIR FILTER
4	CONTROL VALVE (TYP.)
5	BLEED / SAMPLE VALVE (TYP.)
6	VACUUM GAUGE
7	STACK SAMPLE VALVE
8	STACK DRAIN VALVE
9	WELLHEAD

LEA COUNTY, NEW MEXICO

SOUTHERN UNION COMPANY

LEA REFINERY

SURFACE FACILITIES
VAPOR EXTRACTION SYSTEM

REED & ASSOCIATES, INC.
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Date: 9 · 14 · 89 Figure: 6

APPENDIX A

BACKGROUND SOIL ANALYSES
AND B-1 LABORATORY SHEETS

BACKGROUND SOIL ANALYSES

VOLATILE ORGANIC COMPOUNDS IN UG/KG (ppb)

	BG-1	BG-2	BG-3	BG-4
Detection Level	Low	Low	Low	Low
Chloromethane	<10	<10	<10	<10
Bromomethane	<10	<10	<10	<10
Vinyl Chloride	<10	<10	<10	<10
Chloroethane	<10	<10	<10	<10
Methylene Chloride	<5	<5	<5	5.98*
Acetone	<10	<10	<10	<10
Carbon Disulfide	<5	<5	<5	<5
1.1-Dichloroethene	<5	<5	<5	<5
1.1-Dichlorethane	<5	<5	<5	<5
1.2-Dichlorethane (total)	<5	<5	<5	<5
Chloroform	<5	<5	<5	<5
1.2-Dichloroethane	<5	<5	<5	<5
2-Butanone	<10	<10	<10	<10
1.1.1-Trichloroethane	<5	<5	<5	<5
Carbon Tetrachloride	<5	<5	<5	<5
Vinyl Acetate	<10	<10	<10	<10
Bromodichloromethane	<5	<5	<5	<5
1.2-Dichloropropane	<5	<5	<5	<5
cis-1.3-Dichloropropene	<5	<5	<5	<5
Trichloroethene	<5	<5	<5	<5
Dibromochloromethane	<5	<5	<5	<5
1.1.2-Trichloroethane	<5	<5	<5	<5
Benzene	<5	<5	<5	<5
trans-1.3-Dichloropropene	<5	<5	<5	<5
Bromoform	<5	<5	<5	<5
4-Methyl-2-Pentanone	<10	<10	<10	<10
2-Hexanone	<10	<10	<10	<10
Tetrachloroethene	<5	<5	<5	<5
1.1.2.2-Tetrachloroethane	<5	<5	<5	<5
Toluene	<5	<5	<5	<5
Chlorobenzene	<5	<5	<5	<5
Ethylbenzene	<5	<5	<5	<5
Styrene	<5	<5	<5	<5
Xylene (total)	<5	<5	<5	<5
Acrolein	<10	<10	<10	<10
Acrylonitrile	<10	<10	<10	<10

TOTAL PETROLEUM HYDROCARBONS MG/KG (ppm)

	BG-1	BG-2	BG-3	BG-4
	3.9	28.3	17.4	6.2

TOTAL METALS IN MG/KG (ppm)

	BG-1	BG-2	BG-3	BG-4
Background				
As	2.2	2.1	2.8	2.4
Cr	10.8	6.3	5.1	25.6
Pb	6.9	6.3	5.1	8.5
Zn	28.4	17.4	13.3	55.8

*Laboratory Contaminant

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ANALYTICAL REPORT

Formerly: Aqualab, Inc.

Allen Schmidt
REED & ASSOCIATES INC.
1030 Andrews Hwy-Suite 120
Midland, Texas 79701

09-05-89

SAMPLE NO: 43620

Southern Union/Lea Refinery

SAMPLE DESCRIPTION: B-1 (18.5-19.5)

Date Taken: 08-04-89

Date Received: 08-08-89

Total Rec Pet Hydrocarbons	1,550.	ug/g
Arsenic	1.6	ug/g
Chromium, Total	1.5	ug/g
Lead	<5.0	ug/g
Zinc	227.	ug/g

for

Pam Jupe, Manager
Austin Division

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09-05-89

SAMPLE NO: 43620

Southern Union/Lea Refinery

SAMPLE DESCRIPTION: B-1 (18.5-19.5)

Date Taken: 08-04-89

Date Received: 08-08-89

METHOD 8240 VOLATILES

Acrolein	<10.0	ug/g
Acrylonitrile	<10.0	ug/g
Benzene	<1.0	ug/g
Bromodichloromethane	<1.0	ug/g
Bromoform	<1.0	ug/g
Bromomethane	<20.0	ug/g
Carbon tetrachloride	<1.0	ug/g
Chlorobenzene	<1.0	ug/g
Chloroethane	<20.0	ug/g
2-Chloroethylvinyl ether	<1.0	ug/g
Chloroform	<1.0	ug/g
Chloromethane	<20.0	ug/g
Dibromochloromethane	<1.0	ug/g
1,2-Dichlorobenzene	<1.0	ug/g
1,3-Dichlorobenzene	<1.0	ug/g
1,4-Dichlorobenzene	<1.0	ug/g
1,1-Dichloroethane	<1.0	ug/g
1,2-Dichloroethane	<1.0	ug/g
1,1-Dichloroethene	<1.0	ug/g
trans-1,2-Dichloroethene	<1.0	ug/g
1,2-Dichloropropane	<1.0	ug/g
cis-1,3-Dichloropropene	<1.0	ug/g
trans-1,3-Dichloropropene	<1.0	ug/g
Ethyl benzene	1.5	ug/g
Methylene chloride	<5.0	ug/g
1,1,1,2-Tetrachloroethane	<1.0	ug/g
Tetrachloroethene	<1.0	ug/g
Toluene	<1.0	ug/g
1,1,1-Trichloroethane	<1.0	ug/g

Pam Jupe, Manager
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Midland, Texas 79701

09-05-89

SAMPLE NO: 43620

Southern Union/Lea Refinery

SAMPLE DESCRIPTION: B-1 (18.5-19.5)

Date Taken: 08-04-89

Date Received: 08-08-89

METHOD 8240 VOLATILES		
1,1,2-Trichloroethane	<1.0	ug/g
Trichloroethene	<1.0	ug/g
Trichlorofluoromethane	<1.0	ug/g
Vinyl chloride	<20.0	ug/g

Pam Jupe, Manager
Austin Division

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Midland, Texas 79701

09-05-89

SAMPLE NO: 43620

Southern Union/Lea Refinery

SAMPLE DESCRIPTION: B-1 (18.5-19.5)

Date Taken: 08-04-89 Date Received: 08-08-89

BASE/NEUTRAL COMP.-SOLID

Acenaphthene	<1.	ug/g
Acenaphthylene	<1.	ug/g
Anthracene	<1.	ug/g
Benzidine	<5.	ug/g
Benzo(a)anthracene	<1.	ug/g
Benzo(b)fluoranthene	<1.	ug/g
Benzo(k)fluoranthene	<1.	ug/g
Benzo(a)pyrene	<1.	ug/g
Benzo(ghi)perylene	<1.	ug/g
Benzyl butyl phthalate	<1.	ug/g
Bis(2-chloroethyl)ether	<1.	ug/g
Bis(2-chloroethoxy)methane	<1.	ug/g
Bis(2-ethylhexyl)phthalate	3.	ug/g
Bis(2chloroisopropyl)ether	<1.	ug/g
4-Bromophenyl phenyl ether	<1.	ug/g
2-Chloronaphthalene	<1.	ug/g
4-Chlorophynylphenyl ether	<1.	ug/g
Chrysene	<1.	ug/g
Dibenzo(a,h)anthracene	<1.	ug/g
Di-n-butylphthalate	<1.	ug/g
1,3-Dichlorobenzene	<1.	ug/g
1,2-Dichlorobenzene	<1.	ug/g
1,4-Dichlorobenzene	<1.	ug/g
3,3-Dichlorobenzidine	<2.	ug/g
Diethyl phthalate	<1.	ug/g
Dimethyl phthalate	<1.	ug/g
2,4-Dinitrotoluene	<1.	ug/g
2,6-Dinitrotoluene	<1.	ug/g
Di-n-octylphthalate	<1.	ug/g

for
Pam Jupe, Manager
Austin Division

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Midland, Texas 79701

09-05-89

SAMPLE NO: 43620

Southern Union/Lea Refinery

SAMPLE DESCRIPTION: B-1 (18.5-19.5)

Date Taken: 08-04-89

Date Received: 08-08-89

BASE/NEUTRAL COMP.-SOLID

Fluoranthene	<1.	ug/g
Fluorene	<1.	ug/g
Hexachlorobenzene	<1.	ug/g
Hexachlorobutadiene	<1.	ug/g
Hexachlorocyclopentadiene	<1.	ug/g
Hexachloroethane	<1.	ug/g
Indeno(1,2,3-cd)pyrene	<1.	ug/g
Isophorone	<1.	ug/g
Naphthalene	<1.	ug/g
Nitrobenzene	<1.	ug/g
N-Nitrosodimethylamine	<1.	ug/g
N-Nitrosodiphenylamine	<1.	ug/g
N-Nitrosodi-n-propylamine	<1.	ug/g
Phenanthrene	<1.	ug/g
Pyrene	<1.	ug/g
1,2,4-Trichlorobenzene	<1.	ug/g

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09-05-89

SAMPLE NO: 43620

Southern Union/Lea Refinery

SAMPLE DESCRIPTION: B-1 (18.5-19.5)

Date Taken: 08-04-89

Date Received: 08-08-89

ACID EXT. COMPOUNDS-SOLID		
4-Chloro-3-methylphenol	<1.	ug/g
2-Chlorophenol	<1.	ug/g
2,4-Dichlorophenol	<1.	ug/g
2,4-Dimethylphenol	<1.	ug/g
2,4-Dinitrophenol	<5.	ug/g
2-Methyl-4,6-dinitrophenol	<5.	ug/g
2-Nitrophenol	<1.	ug/g
4-Nitrophenol	<5.	ug/g
Pentachlorophenol	<5.	ug/g
Phenol	<1.	ug/g
2,4,6-Trichlorophenol	<1.	ug/g

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Midland, Texas 79701

09-05-89

SAMPLE NO: 43620

Southern Union/Lea Refinery

SAMPLE DESCRIPTION: B-1 (18.5-19.5)

Date Taken: 08-04-89 Date Received: 08-08-89

MISCELLANEOUS ORGANICS

Acetone	<10.0	ug/g
Carbon disulfide	<5.0	ug/g
Gasoline	<195.	ug/g
Kerosene	1,014.	ug/g
2-Methylphenol	<5.	ug/g
4-Methylphenol	<5.	ug/g
Benzoic Acid	<5.	ug/g
4-Chloroaniline	<5.	ug/g
Methyl ethyl ketone	<10.0	ug/g
Methyl isobutyl ketone	<5.0	ug/g
Xylenes	8.0	ug/g
cis-1,2-Dichloroethene	<5.0	ug/g
2-Methyl Napthalene	<5.	ug/g
2-Hexanone	<10.0	ug/g
Benzyl alcohol	ND	
Dibenzofuran	ND	
4-Methyl-2-pentanone	<5.0	ug/g
o-Nitroaniline	ND	
m-Nitroaniline	ND	
p-Nitroaniline	ND	
Styrene	<5.0	ug/g
2,4,5-Trichlorophenol	<5.	ug/g
Vinyl acetate	<10.0	ug/g
Diesel Fuel	1,220.	ug/g

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Formerly: Aqualab, Inc.

ANALYTICAL REPORT

Allen Schmidt
REED & ASSOCIATES INC.
1030 Andrews Hwy-Suite 120
Midland, Texas 79701

08-15-89

SAMPLE NO: 43621

Southern Union/Lea Refinery

SAMPLE DESCRIPTION: B-1 (60-61)

Date Taken: 08-04-89

Date Received: 08-08-89

Total Rec Pet Hydrocarbons	131.	ug/g
	VOLATILES	
Benzene	<1.0	ug/g
Toluene	<1.0	ug/g
Ethyl Benzene	<1.0	ug/g
Xylenes	<5.0	ug/g

Pam Jupe

Pam Jupe, Manager
Austin Division

APPENDIX B

BORING LOGS

BORING LOG

Elevation
Start
Finish
WL

Boring No. B-1 at V-9
Date 8-4-89
Client / Proj. Southern Union
Location Truck Rack

Sketch

DEPTH - FT.	SAMPLED	ANALYZE	TYPE/NO.	LITHOLOGY	DESCRIPTION	REMARKS HNU Background 0.4
					100% white, hard caliche - stained gray	3-3.5' HNU 62
5	■		SS		60% gray-black, stained sand; 40% broken caliche; noticeable hydrocarbon odor	
	■		SS		40% pink-tan-gray, slightly sandy caliche; 60% gray-tan, medium sand; odor	7.5-8' HNU 86
10	■		CR		100% hard, gray-pink caliche, vuggy, odor	10-12' HNU 15.4
15	■		CR		60% tan sand; 40% hard, gray caliche (thin layers); very aromatic odor	14-16' HNU 130
20	■	■	SS		80% tan sand; 20% gray caliche (thin layers); odor	18.5-19.5' HNU 150
25	■		SS		100% fine, brown-tan sand (spoon will only push approximately 1')	22-23' HNU 80-140
	■		SS		100% tan silt layer at apprxomately 27' at bottom of SS	26-27' HNU 50-80
30					80% tan-gray fine sand; 20% silt and siltstone; odor	

S - Shelby
SS - Split spoon
CR - Core

A - Auger
CT - Cuttings
TD - Total Depth

▽ - Water level
░ - Sand
▥ - Silt

▤ - Clay
⁘ - Gravel
▨ - Fill/Concrete

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Hydrologists and Environmental Consultants
AUSTIN · CORPUS CHRISTI · MIDLAND

BORING LOG

Elevation ________
Start ________
Finish ________
WL ________

Boring No. B-1 at V-9
Date 8-4-89
Client / Proj. Southern Union
Location Truck Rack

Sketch

DEPTH - FT.	SAMPLED	ANALYZE	TYPE/NO.	LITHOLOGY	DESCRIPTION	REMARKS
						HNU Background 0.4
30	■		SS		100% fine to medium tan sand, semi-cemented, odor	30-31' HNU 100-120
	■		SS			34-35' HNU 35-75
35					100% fine, tan-brown sand and silt; some cemented thin layers; odor	
40	■		SS			40-41' HNU 30-100
45	■		SS			45-46' HNU 20-50
50	■		SS		100% fine tan sand; odor	50-51' HNU 20-50
55						
60						60-61' HNU 10-15

S - Shelby
SS - Split spoon
CR - Core

A - Auger
CT - Cuttings
TD - Total Depth

▽ - Water level
▨ - Sand
▨ - Silt

▨ - Clay
▨ - Gravel
▨ - Fill/Concrete

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Hydrologists and Environmental Consultants
AUSTIN · CORPUS CHRISTI · MIDLAND

BORING LOG

Elevation
Start
Finish
WL

Boring No. B-1 at V-9
Date 8-4-89
Client / Proj. Southern Union
Location Truck Rack

Sketch

DEPTH-FT.	SAMPLED	ANALYZE	TYPE/NO.	LITHOLOGY	DESCRIPTION	REMARKS
						HNU Background 0.4
61	■	■	SS	░	Slight odor	

S - Shelby
SS - Split spoon
CR - Core

A - Auger
CT - Cuttings
TD - Total Depth

▽ - Water level
░ - Sand
▦ - Silt

▤ - Clay
⁘ - Gravel
▨ - Fill/Concrete

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Hydrologists and Environmental Consultants
AUSTIN · CORPUS CHRISTI · MIDLAND

BORING LOG

Elevation ________
Start ________
Finish ________
WL ________

Boring No. B-2 at V-19
Date 8-4-89
Client / Proj. Southern Union
Location Truck Rack

Sketch

DEPTH-FT.	SAMPLED	ANALYZE	TYPE/NO.	LITHOLOGY	DESCRIPTION	REMARKS
						HNU Background 4.0
					Caliche rock	
	■		SS			2-3' HNU 20
5						
	■		SS			6-7' No Recovery
					100% sandy, white caliche	
10						
13	■		SS			11-13' HNU 0.4

S - Shelby
SS - Split spoon
CR - Core

A - Auger
CT - Cuttings
TD - Total Depth

▽ - Water level
⁙ - Sand
▦ - Silt

☷ - Clay
● - Gravel
▨ - Fill/Concrete

REED & ASSOCIATES, INC.
Hydrologists and Environmental Consultants
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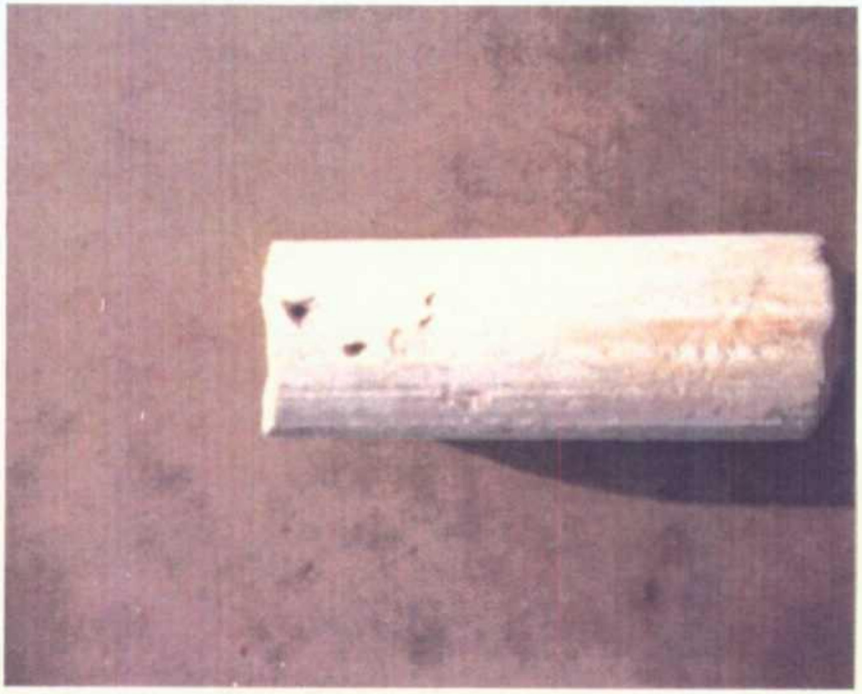
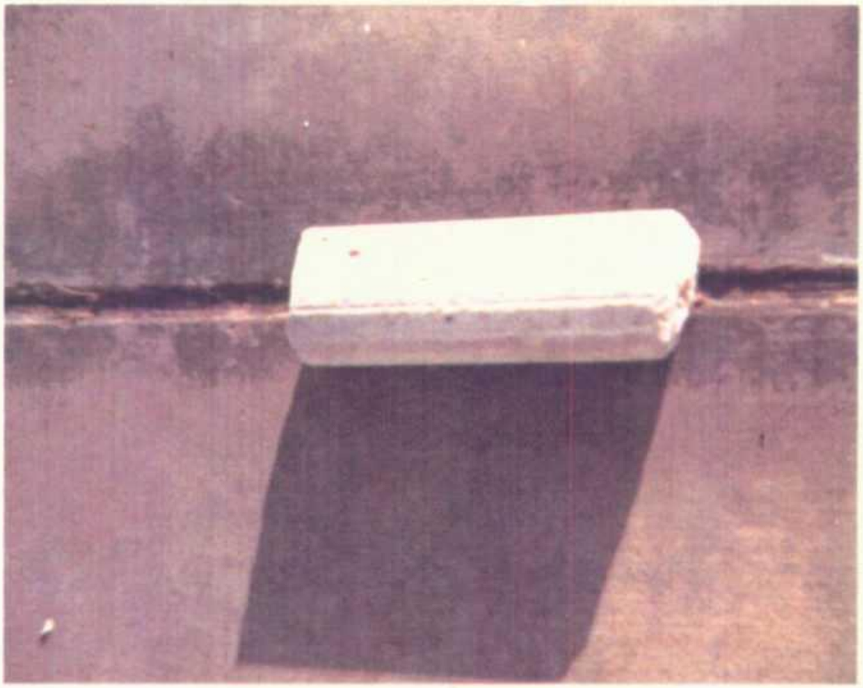
APPENDIX C

PHOTOS



CORE OF CALICHE FROM 10-12 FOOT INTERVAL IN B-1, NOTE SOLUTION CAVITIES.



VIEW OF OPPOSITE SIDE OF ABOVE CORE.

G. A. Baca and Associates, Ltd.
University Plaza, Suite 210
330 Garfield St.
Santa Fe, New Mexico 87501
Telephone (505) 983-2594

SOUTHERN UNION REFINING COMPANY
LOVINGTON REFINERY
WASTE WATER DISCHARGE PLAN

Submitted to:
New Mexico Oil Conservation Division
Santa Fe, New Mexico

Submitted by:
Southern Union Refining Company
P.O. Box 980
Hobbs, New Mexico
October 26, 1981

For Information Contact:
Mr. Don Ham
505/396-3658

CONTENTS

1.0 INTRODUCTION

The following data for the Southern Union Refining Company's Lovington refinery is submitted as a waste water discharge plan under the requirements of Section 3-106 of the New Mexico State Water Quality Control Commission Regulations, WQCC81-2, as requested by the New Mexico State Oil Conservation Division.

The Lovington refinery is a crude oil processing facility which uses 230 gpm of water produced from two wells located on the refinery property. The waste water, produced at 130 gpm, is processed through two stages of oil-water separation, then pipelined to two contract waste injection wells. Contaminated surface drainage is contained, processed to recover oil, and pumped to the injection wells.

Solid wastes are handled by outside disposal contractors.

2.0 PLANT DESCRIPTION

The Southern Union Lovington Refinery is a crude oil refining facility with a normal design capacity of 31,500 barrels per stream day (BPSD) and a U.S. Department of Energy Capacity test rating of 37,500 BPSD. This report section provides a description of the refinery location, a brief history of the refinery, and a description of the current refinery facilities.

2.1 Refinery Location

The Lovington Refinery is located in Lea County, just west of State Highway 18, approximately 5 miles southeast of Lovington, New Mexico and 12 miles northwest of Hobbs, New Mexico. The region within 30 miles of the refinery is characterized by generally flat topography.

2.2 Refinery and Corporate History

The Lovington Refinery was constructed at its current capacity in 1973 and 1974 and was originally owned by the corporate interests of Mr. Walter Famariss. As part of the original project, Southern Union constructed an adjacent products storage and shipping terminal on the south side of the Famariss Refinery.

In 1975, the Southern Union Oil Products Company purchased the Lovington Refinery, and the older Monument Refinery, from Famariss Oil Corporation and operated it as a subsidiary called Famariss Oil and Refining Company.

In December, 1976, Southern Union Oil Products Company was merged into Southern Union Refining Company, a firm whose operational plants include both the Lovington and Momument Refineries as well as the two gas liquid extraction plants in northern New Mexico at Kutz (near Bloomfield) and Lybrook.

In May of 1977, Famariss Oil Corporation and Famariss Oil & Refining Company were merged into Southern Union Refining Company. The parent of Southern Union Refining Company is the Southern Union Company, headquartered in Dallas, Texas.

In September of 1980, the Monument Refinery was shut down and the process equipment mothballed.

2.3 Current Refinery Facilities

A block flow diagram of the current refinery operations is shown in Figure 2.3.1. The existing process facilities at Lovington consist of the following:

Unit	Capacity
. Crude Unit-Atmospheric Fractionation Section	37,500 BPSD
. Crude Unit-Naphtha Stabilization Section	
. Naphtha Treating Unit-Merox	8,000 BPSD
. Kerosene Treating Unit-Merox	6,000 BPSD
. Vacuum Distillation Unit	10,000 BPSD

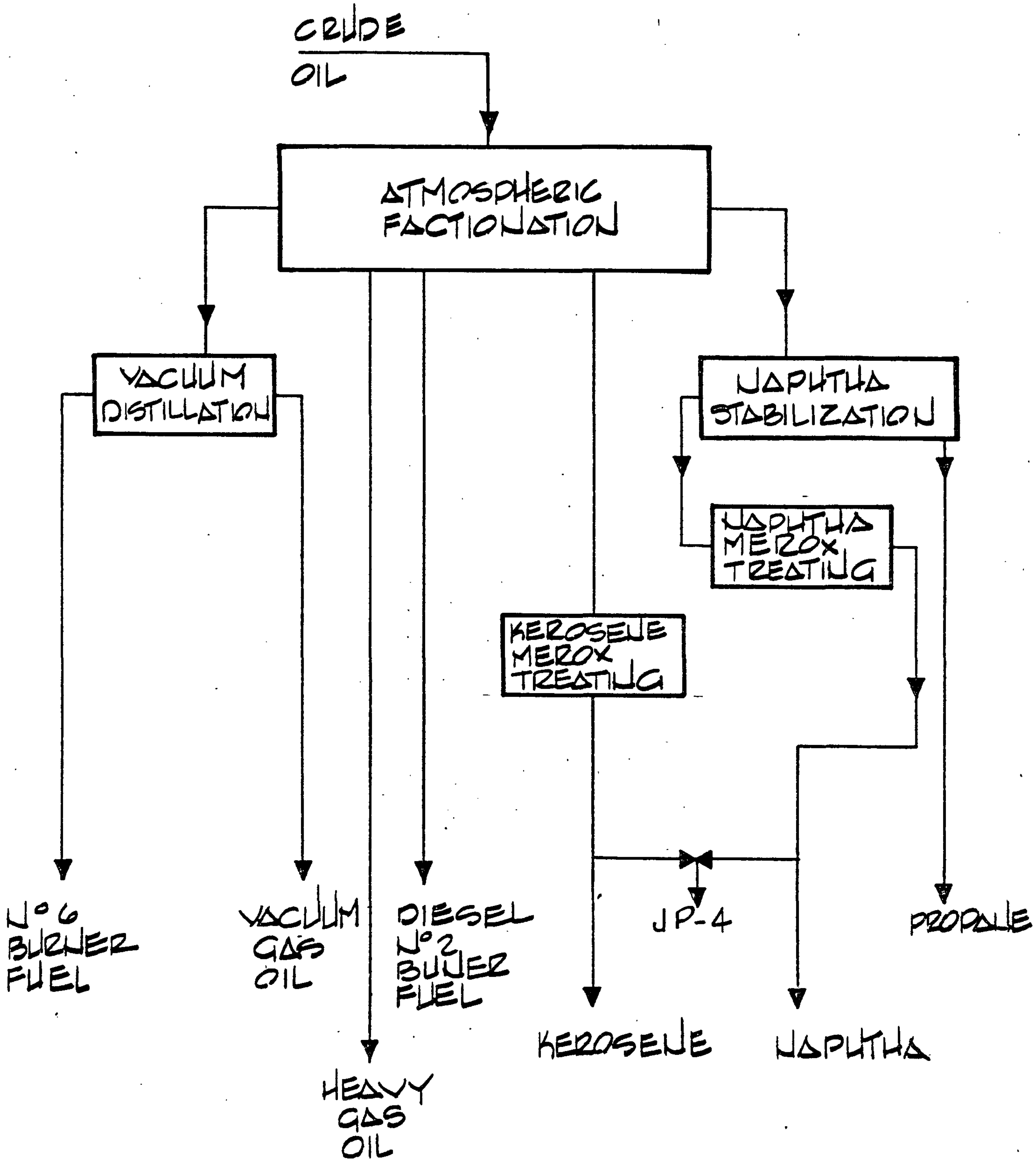
Support facilities for the process facilities include the following:

- Cooling water tower
- Steam generation
- Multiple transformers for incoming power
- Instrument air system
- Relief flare system
- Oil-water separator system
- Crude oil and products storage tanks
- Products shipping terminal
- Associated offices, maintenance shop, and parts warehouse.

REFINERY BLOCK FLOW DIAGRAM

FIGURE 2.3.1

SOUTHERN UNION REFINING COMPANY
LOVINGTON REFINERY



The refinery processes a mixture of local crudes to produce propane, naphtha, jet fuel (JP4), kerosene, diesel fuel, No. 2 burner fuel, heavy gas oil, vacuum gas oil, and No. 6 burner fuel.

3.0 WATER USAGE

The Lovington Refinery uses 121 million gallons of water per year (230 gpm) produced from two wells located on the refinery property. The water is used for cooling tower make up, steam generation, oil processing, and sanitary use. The well water usage rate is based on well water meters. The refinery produced 68 million gallons per year (130 gpm) of waste water which is deep well injected under contract with Araho, Inc. Waste water production is based on water meter data provided by the injection company.

3.1 Water Wells

The refinery water is supplied by two wells located on the refinery property. The well designated as the "north well" is located approximately 50' west of the refinery warehouse. The well designated as the "south well" is located approximately 175' south of the north well. The location of the wells is shown on the refinery drawing "Overall Plot Plan", Drawing No. 001-AP-1 Rev 1 found in Appendix A. The directions indicated above are based on the designated plant north which is 39°37' north by northwest of true north.

The wells currently in use were drilled by the City of Lovington in 1973 to replace the original wells drilled in 1965. The original wells were located in the same general area and were abandoned after the wells collapsed.

The north well was drilled to a depth of 235', the south well to 248'. Both wells are cased, being perforated from a depth of 78' down to 228'. The well pumps are set at a depth of 175'. The well depths indicate the top of the red clay strata which is the base of the aquifer.

3.2 Refinery Water Flow

Well water at an average rate of 230 gpm is pumped into the water storage tank, TK-1210, located near the south well. From this tank, water is provided for sanitary use, fire protection, cooling tower make up, and water softener feed. The water from the softener goes to the soft water storage tank, TK-1108. Water from the water storage tank provides boiler feed water, desalter water, and Merox water wash make up. Steam generated in the boilers is used for general heating, atmospheric distillation tower stripping steam, and vacuum tower eductor motive stream. The water flow through the refinery is shown in Figure 3.2.

3.2.1 Sanitary Water

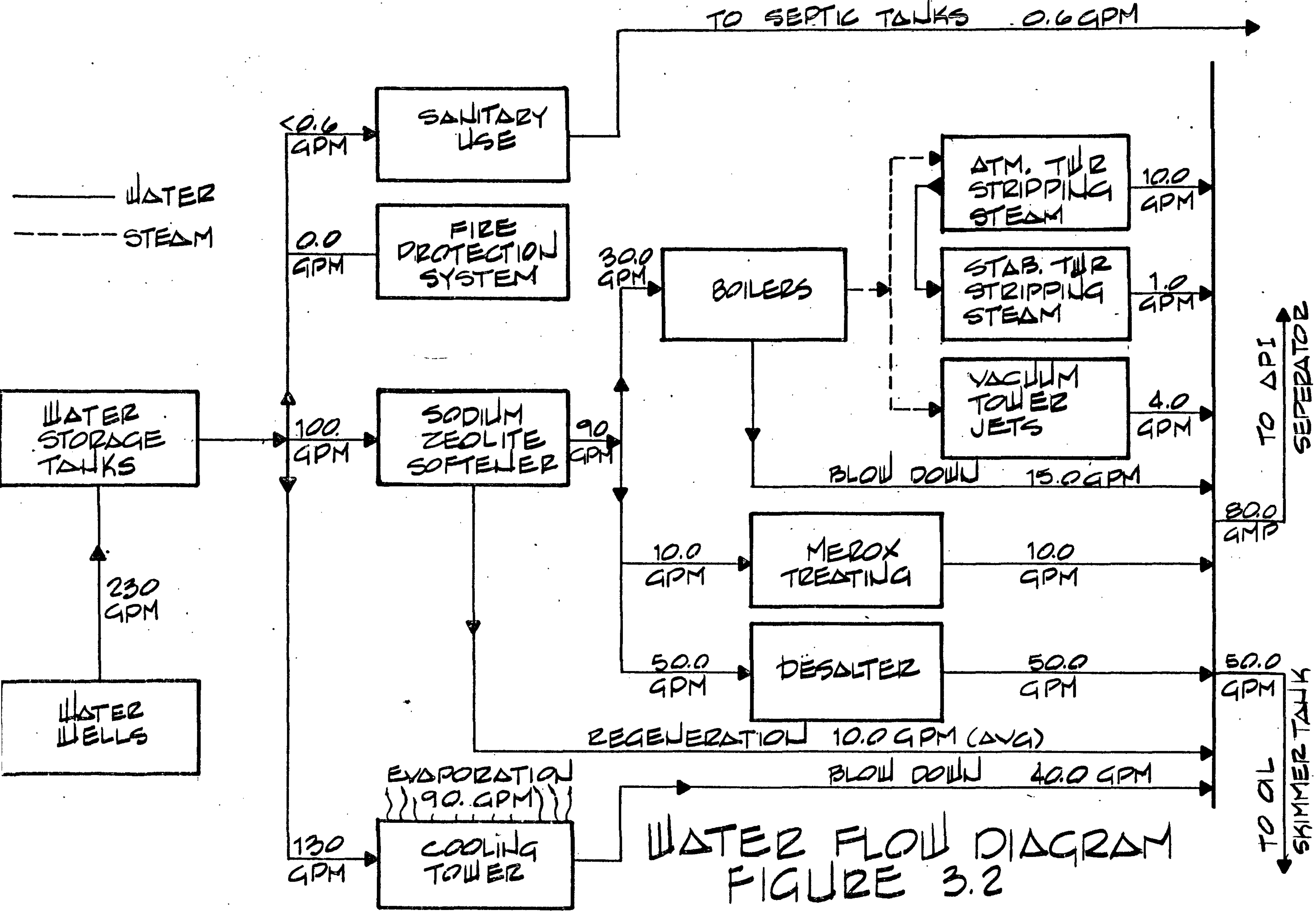
Refinery staffing is 65 people during the day shift and 6 people during the evening and night shifts. Based on water usage data found in "Design Manual - Onsite Wastewater Treatment and Disposal Systems", USEPA, EPA 625/1-80-012, October, 1980, Table 4-2, P. 54, sanitary water usage is 32 gal/person/day. With one-third day occupancy per person, the total usage is estimated at 825 gallons per day (gpd), or an average consumption rate of 0.57 gpm. Waste water from sanitary use is handled by septic tanks discussed later.

3.2.2 Fire Protection

There is normally no flow to the fire protection system.

3.2.3 Cooling Tower

An open recirculating cooling tower is used to provide process cooling requirements. The water recirculation rate through the tower is 10,000 gpm. The cycles of concentration, the ratio of the concentration of impurities in



WATER FLOW DIAGRAM
FIGURE 3.2

SOUTHERN UNION REFINING COMPANY
LOVINGTON REFINERY

the curculating water to that in the make-up water, is limited to 4.0 to prevent scaling. Cooling tower make-up averages 130 gpm. The average blowdown rate is 40 gpm. The difference, 90 gpm, is lost to the atmosphere through evaporation.

Chemicals are added to the circulating water to prevent corrosion, biological growth and scale formation. Material Safety Data Sheets for the chemicals can be found in Appendix B. Their use is as follows:

- Sulfuric acid is added to maintain the pH of the circulating water between 6.8 and 7.2. This pH range optimizes the performance of scale and corrosion prevention chemicals.
- The trade name chemical, Betz 2040, is added as a corrosion inhibitor. The chemical is an aqueous solution of organic and inorganic phosphates, a triazole derivative, and caustic potash. The chemical is continuously added to maintain 15 to 20 ppm phosphate in the cooling tower water.
- The trade name chemical, Betz 2020, is added as a calcium and iron dispersant. The chemical is a wetting agent which keeps calcium and iron particulates in suspension so they are removed from the cooling tower with the blowdown. The chemical is an aqueous solution of low molecular weight hydroxylated polymer and is added continuously to maintain 70 ppm in the cooling tower water.
- Chlorine gas is injected into the water to control biological growth. The gas is added once per week in the quantity required to maintain a residual chlorine level of 3 ppm in the circulating water for three hours.

. The trade name chemicals, Betz Slimicide 508 and Betz Slimicide C-30 are used to control slime growth in the water. The chemicals are alternated on a weekly basis to prevent the slime from building chemical resistance due to the continued use of only one chemical. One gallon of slimicide is shot fed into the circulating water each week.

Betz Slimicide 508 is an organic bromine. The formulation is roughly 20% volume 2,2-Dibromo-3-nitrilopropionamide, 50% volume polyethylene glycol, the remainder being water.

Betz Slimicide C-30 is roughly 20% volume bis (trichloromethyl) sulfone, 5% volume methylene bisthiocyanate, the remainder being an intert diluent hydrocarbon.

3.2.4 Sodium Zeolite Softening

The well water not used for sanitary use, fire protection or cooling tower make up, is softened using sodium zeolite softening. This softening method uses an insoluble zeolite to exchange the calcium and magnesium ions for sodium ions. The unit consists of two softeners, one on line, the second being regenerated. In the on line unit, sodium ions which have been fixed on the zeolite are replaced on the zeolite by calcium or magnesium ions. In the regenerating unit, the zeolite is exposed to saturated sodium chloride brine. The high concentration of sodium ions in the salt solution reverses the above reaction. The calcium and magnesium ions are rejected into the brine and their position on the zeolite is replaced with sodium ions.

One softener is regenerated for every 12 hr of operation. The cycle consists of soaking the softener in sodium chloride brine followed by rinsing to remove excess salt. The regeneration brine and the rinse water are both rejected to the waste water system. Based on current operating practice and the softener vendor's operating manual, the water rejected during regeneration is estimated to average 10 gpm over the 12-hr cycle.

3.2.5 Boiler Feed Water

The refinery produces 28,000 LB/HR of steam at 165 PSIG using both fired boilers and waste heat recovery. The steam is used for process heating, for stripping steam in fractionators, and for vacuum jet motive steam. The condensate from process heating is recovered and recycled to the boilers. The stripping steam and vacuum jet motive streams are condensed in contact with hydrocarbons and are discharged to the waste water disposal system.

Steam generation requires 35 gpm of softened water for make up rejecting 15 gpm of blowdown water. Chemical treatment is used to prevent corrosion and scaling. Material Safety Data Sheets for the chemicals can be found in Appendix B. Their use is as follows:

- Sodium hydroxide is added to maintain the boiler water pH at 11.0.
- The trade name chemical, Betz Balanced Polymer 6000 series is added for scale and corrosion control. The chemical is an aqueous mixture containing any or all of the following: tetrasodium ethylene diamine tetra acedic acid (EDTA), sodium silicate, sodium sulfite, neutralizing amine, acrylate polymer, sulonate polymer, sodium hydroxide, and sodium nitrate.

EDTA is a chelating agent which undergoes reactions with metal ions to hold them in suspension. The chemical is added to the boiler feed make up water to maintain an EDTA redisual in the boiler water of 5 to 15 ppm.

In the event the zeolite softeners are inoperative, and the boiler feed water has not been softened, the above treatment is replaced with Betz chelant CL-2, a mixture of sodium EDTA and a water-soluble lignin derivative.

. The trade name chemical, Betz Corrogen is added to reduce the oxygen content of the water to reduce oxidation corrosion. The chemical is sodium sulfite with a cobalt catalyst. Sodium sulfite scavenges oxygen from the boiler feed water by reacting to form sodium sulfate. The presence of cobalt increases the reaction rate. Sodium sulfite is added to the boiler feed water to maintain an excess of 30 to 50 ppm sulfite in the boiler water.

. In addition to chemical treatment of the boiler water, a filming amine is added to the steam line to prevent CO_2 and O_2 corrosion in areas of the steam system where condensate is trapped. The CO_2 is formed by breakdown of alkalinity in the boiler. The trade name chemical, Betz Neutrafilm 463, is added to the steam system to the equivalent of 10 ppm based on steam production. The chemical is a water dispersion of heterocyclic and high molecular weight straight chain primary filming amines.

3.2.6 Steam Usage

The steam uses which form waste water are atmospheric fractionator stripping steam and motive steam for the vacuum jets. In these uses the steam is condensed in the presence of oil and is therefore contaminated. Water carryover from the atmospheric fractionator to the naphtha stabilizer results in the accumulation of waste water in the stabilizer. This steam use results in 10 gpm waste water from the atmospheric fractionator, 1 gpm from the stabilizer, and 4 gpm from the vacuum jets.

The atmospheric distillation tower overhead is treated with chemicals to prevent corrosion. Material Safety Data Sheets for these chemicals can be found in Appendix B. Their use is as follows:

- The trade name chemical, Unichem TECHNI-HIB 7350 is a neutralizing amine added to the tower overhead to maintain the pH of the condensed water between 8 and 9. The chemical is a mixture of straight chain and ringed hydrocarbon amines.
- The trade name chemical, Unichem TECHNI-HIB 7060 is a filming amine which coats metal internals to prevent corrosion. The material consists of cyclic amines and is added to give a concentration of 6 ppm in the total tower overhead flow.
- The trade name chemical, Unichem TECHNI-HIB 7182 is a dispersant added to give a concentration of 6 ppm in the tower overhead. The chemical is a mixture of xylene and a proprietary sulfide dispersant.
- The trade name chemical, Unichem TECHNI-HIB 7061 is added to the tower top reflex stream at a concentration of 12 ppm based on the reflux flow. The material is the same as TECHNI-HIB 7182 except the diluent is naphtha instead of xylene.

3.2.7 Desalting

The desalter requires 50 gpm softened water and rejects the same volume of water to the waste water system. The water is mixed with the raw crude then separated back out by settling enhanced by an electric field and the addition of oil-water emulsion breakers and surfactants. The sodium, magnesium, and calcium chloride salts as well as some of the solids found in the incoming crude oil are removed with the water. Material Safety Data Sheets for the emulsion breaker and surfactant can be found in Appendix B. Their use is as follows:

- The trade name chemical, Unichem TECHNI-HIB 7201, an amine-based deemulsifier is added to give 6 ppm based on crude throughput. The chemical acts to break down oil-water emulsions.
- The trade name chemical, Unichem Deoiling Surfactant, a sulfonated organic material is added at a rate of 6 ppm based on the crude throughput. The chemical allows wetting of the surface of solids to facilitate their settling into and removal with the water from the desalter.

3.2.8 Merox Treating

Merox treating is a process used to convert mercaptans found in light product streams into disulfides. Mercaptans are sulfur compounds which cause corrosion and odor problems. They are converted by first extracting them from the hydrocarbon product with sodium hydroxide, then oxidating to disulfides by injection of air in contact with a catalyst. The disulfides which are neither corrosive nor odiferous are then returned to the product. The product stream is washed with water to remove caustic carryover.

The Lovington Refinery Merox treats both naphtha and kerosene. Treating requires 10 gpm softened water as wash water and rejects the same volume of waste water to the waste water disposal system.

The Merox catalyst, cobalt phthalocyanine sulfonate, is fixed to activated carbon which makes up the Merox reactor bed. Safe handling information for the catalyst and caustic can be found in Appendix B.

4.0 WASTE WATER DISPOSAL SYSTEM

Waste water from sanitary use is disposed of through septic tanks. Process waste water and surface runoff from the cement pads in the process area are collected in a sewer system which carries the waste water to the refinery oil-water separator (API separator). Water from storage tanks is periodically drained into stock tanks located at each tank. The stock tanks are emptied with a vacuum truck which hauls the water to the API separator. The oil recovered from the API separator is pumped to slop oil recovery and the water is pumped to the oil skimmer tanks for a second stage of oil-water separation. The oil recovered at the skimmer tank is pumped to slop oil recovery and the water is pumped to contract waste disposal wells.

Oil spills and surface runoff from the product loading terminal are collected in a sewer system and flows to a second API separator. The recovered oil is pumped to slop oil recovery and the water is pumped into the line to the injection wells.

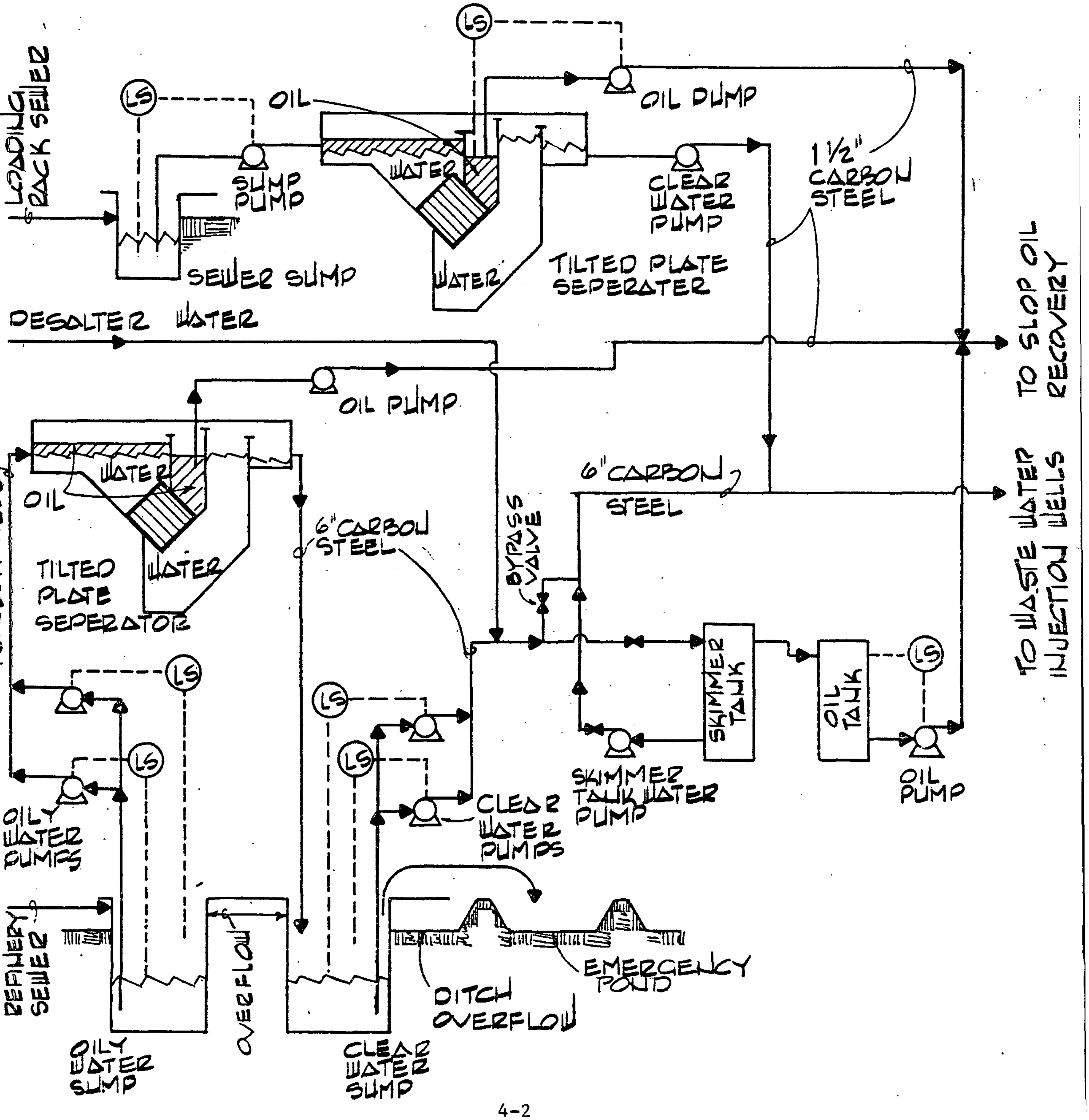
The contract water disposal company takes custody of the water in the refinery. The contractor is responsible for maintenance of the 6" waste water line in the refinery boundary and of the line to the wells. The water is skimmed a third time at the well sites and metered before injection.

A flow sheet showing the waste water disposal system can be found in Figure 4.0

4.1 Sanitary Waste Water

Sanitary waste water is handled by six septic tanks. The locations of the septic tanks are indicated on the refinery drawing "Overall Plot Plan",

WASTE WATER FLOW DIAGRAM
FIGURE 4.0
SOUTHERN UNION REFINING COMPANY
LOVINGTON REFINERY



Drawing No. 001-AP-1 Rev 1 found in Appendix A. The sanitary waste water volume is the same as the sanitary water usage, 825 gal/day. The sanitary waste discharge is therefore exempt from the discharge plan review under Section 3-105 Part B of the Water Quality Control Commission Regulations WQCC 81-2.

4.2 Process Waste Water

The sources of waste water were defined in Section 3.2, the refinery water flow discussion. The sources are summarized in the following discussion.

4.2.1 Cooling Tower Blowdown

The cooling tower blowdown rate is 40 gpm. The blowdown will have salt and hardness concentrations four times higher than the incoming make up water as well as residuals of the water treating chemicals.

4.2.2 Sodium Zeolite Softener Regeneration

The average waste water rate from softener regeneration is 10 gpm. The water will have high concentrations of sodium chloride which will vary through the regeneration cycle.

4.2.3 Boiler Blowdown

The boiler blowdown is 15 gpm. The pH of the water is nominally 11.0 Residuals of the boiler treating chemicals will be found in the blowdown.

4.2.4 Merox Treating Wash Water

The waste water rate from the Merox water wash averages 10 gpm. The water will contain small quantities of caustic and hydrocarbons.

4.2.5 Atmospheric Stripping Steam Condensate

Stripping steam in the atmospheric distillation tower is carried overhead and condensed with the overhead hydrocarbons. The hydrocarbons and water are separated by settling. The water is drawn off to the sewer at an average rate of 10 gpm. The water will contain small concentrations of hydrocarbons, chloride salts, sulfide salts, and ammonia salts. Iron salts may be present as corrosion products. Corrosion treating chemicals and their salts will be found in the water.

4.2.6 Stabilizer Condensate

The overhead of the atmospheric distillation tower is feed to the stabilizer. The hydrocarbon feed will carry a small quantity of water which is drawn off the stabilizer overhead accumulator. The waste water at 1 gpm will contain the same contaminates as the atmospheric stripping steam condensate.

4.2.7 Vacuum Jet Steam Condensate

The motive steam from the vacuum jet eductors becomes mixed with hydrocarbon vapors which come overhead of the vacuum tower. Both the steam and hydrocarbon vapors are condensed and separated by settling. The water, at an average rate of 4 gpm, is drawn off to the sewer. The water will contain hydrocarbons and chloride and sulfide salts. No chemical corrosion treatment is currently being used in the vacuum tower overhead.

4.2.8 Desalting Waste Water

Water is mixed with the incoming crude which has been heated to 240° F. The oil and water are then separated by settling enhanced by an electrical field and emulsion breaking chemicals. The water is drawn off to the line to the oil skimmer. Desalter waste water will contain hydrocarbons, calcium chloride, sodium chloride, magnesium chloride, desalter chemicals, and small amounts of solids. The desalter waste water rate averages 50 gpm.

4.3 Surface Runoff

The paved processing area covers slightly less than one acre of area. Surface runoff from this area is handled by the sewer system which drains to the API separator. Based on an annual rainfall of 14", the annual average flow to the sewers is 0.72 gpm. Assuming 100-year flooding criteria rainfall of 6"/24 hr period, the rate to the sewer is 94 gpm.

Improvements to process runoff containment consisting of the installation of cememt curbs around the process area will be made.

Crude and product tanks are impounded in earth dikes of sufficient volumes to contain the contents of the tank should the tank rupture. Water accumulated in the tank is drained into stock tanks. The stock tanks are periodically emptied with vacuum trucks and the water hauled to the API separator. The water will contain hydrocarbon and water drained from crude tanks will contain chloride salts.

The volume of water drained from tanks is relatively small. Historically, the incoming crude contains less tha 0.1 percent water. If the same amount is assumed to be present in the product and all the water could be drawn from the tanks, the waste water rate would only be 0.75 gpm. Part of the water remains in equilibrium with the hydrocarbon so the actual rate is lower and insignificant compared to the other sources.

Precipitation accumulation in the tank dike areas will be removed by vacuum trucks if it contains appreciable quantities of oil. Natural drainage is used for areas outside the process area and the tank farm. In these areas, precipitation does not come in contact with hydrocarbons or chemicals. Accidental hydrocarbon or chemical spills are picked up with a vacuum truck and the area cleaned to prevent migration of the material into the ground or off the refinery site.

4.4 Refinery API Separator

The refinery API separator consists of an oily water sump, a tilted plate separator, and a clear water sump.

4.4.1 Oily Water Sump

The oily water sump is constructed with 10" reinforced concrete walls and floor. The sump is 7'3½" wide by 11'7" long by 10'1" deep and is set 9' below grade. The oily water sump shares a wall with the clear water sump and the sumps are interconnected by a 12" overflow line.

Capacity of the oily water sump is 6370 gallons. The water level is normally maintained 8' from the top allowing 5052 gallons of surge capacity.

4.4.2 Tilted Plate Separator

The separation is a Pielkerrod corrugated plated separator with a nominal capacity of 300 gpm. Capacities higher than 300 gpm can be handled with some loss of oil recovery efficiency. The separator is constructed of steel and mounted above grade.

4.4.3 Clear Water Sump

The clear water sump is the same construction as the oily water sump. The clear water sump is 4'2" wide by 11'7" long by 10'1" deep. The capacity is 3640 gal. The water level is normally 5' below overflow allowing 1800 gal of surge capacity.

4.4.4 Refinery API Operation

Waste water collected by the sewer system flows by gravity into the oily water sump. The water is pumped from the oily water sump through the tilted plate separator into the clear water sump. There are two oily water sump pumps, each with a 500 gpm capacity. The pumps are activated by level switches with staggered set levels. If one pump is incapable of handling the flow to the sump, the rising level will start the second pump.

The oil and water are separated in the tilted plate separator. The oil accumulated in the separator is pumped to slop oil recovery. The pump is activated by level control. The water flows by gravity to the clear water sump. The clear water sump has two pumps activated by level control which pump into a 6" carbon steel line which goes to the oil skimmer tank. The main clear water pump has a capacity of 600 gpm. The auxiliary clear water pump, which is activated at a higher sump level than the main pump, has a capacity of 230 gpm.

Should both oily water sump pumps fail, the sump will fill and overflow to the clear water sump and be pumped to the oil skimmer tank. Should both clear water pumps fail, or should the flow be greater than can be handled by the auxiliary pump should the main pump fail, the sumps have a total surge capacity of 6852 gal. If this is exceeded, the sumps overflow through a ditch to an emergency pond.

4.5 Emergency Pond

The emergency pond is located 300' southwest of the API separator. The location is shown on the refinery drawing "Overall Plot Plan", Drawing No. 001-AP-1 Rev 1 found in Appendix A. The pond is of earth construction with a 1' high dike wall. The pond is 270' long by 120' wide for a 240,000 gal capacity. Water accumulated in the pond during an emergency is transferred back to the API separator. The improvements will be completed prior to the end of the 1982 calendar year.

The emergency pond is used only in periods of prolonged power failure or clear water pump failures.

4.6 Skimmer Tank

From the clear water sump, the water is pumped through a 6" carbon steel pipe into the skimmer tank. The pipe rests on stanchions above ground to allow visual inspection for leaks.

A second stage of oil separation takes place in the skimmer tank. The oil overflows the skimmer tank into the slop oil tank and is pumped to slop oil recovery. The pump is activated by level control.

The water in the skimmer tank is pumped through a 6" carbon steel line to the waste disposal wells. The water pump is activated by a level control which reacts to the oil-water interface level. The line rests on stanchions above ground.

Should the skimmer tank water pump fail, the water lines to and from the skimmer tank have a 6" bypass. Waste water can be pumped directly from the clear water sump through the bypass to the waste injection wells.

4.7 Product Loading Terminal API Separator

The product loading terminal API separator consists of an oily water sump and a tilted plate separator

4.7.1 Terminal Oily Water Sump

The terminal oily water sump is constructed with 10" reinforced concrete walls and floors. The sump is 30' wide by 30' long by 6' deep. The level is maintained 5' from the top allowing 33,600 gal of surge capacity.

4.7.2 Terminal Tilted Plate Separator

The separator is a corrugated plate separator which is fabricated from carbon steel and mounted above grade.

4.7.3 Terminal API Operation

Surface drainage from approximately 0.75 acre around the loading area is accumulated in a sewer system and flows by gravity to the terminal oily water sump. The water is pumped from the sump through the tilted-plate separator. The oily water pump has a capacity of 50 gpm and is activated by a level control in the pit.

Oil accumulated in the tilted plate separator is pumped to slop oil recovery. The oil pump has a capacity of 20 gpm and is activated by level control.

Water accumulated in the tilted plate separator is pumped through a 1½" carbon steel line and intersects the 6" line to the injection wells downstream of the skimmer tank. The water pump has a capacity of 30 gpm and is activated by the water level in the tilted plate separator. Should the clear water pump fail, the tilted plate separator overflows back to the oily water sump.

Based on 14" of rain per year, the average water flow from the terminal drain area is 0.54 gpm. Based on 100-year flood criteria, the flow would equal 70 gpm.

4.8 Injection Wells

The two injection wells are operated by Araho Inc., P.O. Box 5456, Midland, Texas 79704. The wells are located one mile south of the refinery.

Araho takes custody of the water within the refinery boundary and is responsible for maintenance of the 6" line from the clear water sump to the skimmer tank and from the skimmer tank to the injection wells. A third stage of oil-water separation is performed at the injection wells.

Injected water volumes are measured at each of the two well sites. The use of two wells assures the stream time reliability of the injection system. Operation of the injection wells has not backed up waste water in the refinery.

5.0 WATER SAMPLES

Samples of well water and waste water were taken for analysis for concentrations of elements and chemicals listed in WQCC 82-1, Sections 3-304 A, B, and C. The results of the analysis can be found summarized in Table 5.0. Samples were taken and preserved in accordance with "Methods for Chemical Analysis of Water and Waste Water", EPA-600/4-79-020, March, 1979. The samples were delivered to the laboratory in a timely fashion to allow for analysis of cyanides, nitrates, and phenols within 24 hr of sampling. The analytical tests were performed by Controls for Environmental Pollution (CEP), 1925 Rosina, Santa Fe, New Mexico 87501. The reports from CEP can be found in Appendix C.

5.1 Well Water

Well water was sampled at the suction side of the process water pumps. The pumps are located north of and take suction from the fresh water tank, TK-1210. This location is indicated on the refinery plot plan drawing in Appendix A. Both wells were pumping during the sampling of the fresh water tank and the process water pump was operating taking suction from the tank. The capacity of the fresh water tank provided mixing of the well water to give a representative sample.

The analysis represents the current quality of the aquifer under the refinery. The location of the wells relative to the refinery API separator, emergency pond and skimmer tank, make the wells reasonable selections as test wells to detect any infiltration of contaminants into the aquifer.

5.2 Waste Water

Waste water was sampled at a drain point on the 6" line to the injection wells downstream of the skimmer tank water pump. The skimmer tank water pump was operating when the sample was taken. The capacity of the API separator and the skimmer tank provided mixing and retention of the waste streams to give a representative sample.

The sample point is upstream of the intersection of the waste water line from the terminal API separator. At the time of sampling, the terminal API was inactive. Waste water from the terminal will have only oil contamination.

The sample was analyzed for benzene and ethylbenzene, defined as toxic pollutants in Section 1-100 of WQCC 81-2. These chemicals naturally occur in crude oil. They are not soluble in water and were determined by analysis not to be present in the samples. The remaining chemicals listed as toxic pollutants in the regulations do not occur naturally in crude oil and are not used in the refinery as chemical treatments.

TABLE 5.0

WATER ANALYSIS

Samples taken: Date 9/17/81

Time 10:30 a.m.

		WELL WATER	WASTE WATER
Part A			
Arsenic	mg/l	0.01	0.1
Barium	mg/l	0.3	0.5
Cadmium	mg/l	<0.001	<0.001
Chromium	mg/l	0.001	0.053
Cyanide	mg/l	<0.1	260
Fluoride	mg/l	1.0	1.7
Lead	mg/l	<0.001	0.005
Total Mercury	mg/l	<0.0004	0.0009
Nitrate (NO_3 as N)		3.5	0.8
Selenium	mg/l	<0.01	<0.01
Silver	mg/l	<0.01	<0.01
Uranium	mg/l	< 5	14
Radioactivity p^{C}i/l			
Radium-226		<0.6	<0.6
Radium-228		4.2 + 3.0	3.1 + 2.3
Part B			
Chloride	mg/l	79	505
Copper	mg/l	0.002	0.005
Iron	mg/l	0.02	4.6
Manganese	mg/l	0.002	0.11
Phenols	mg/l	<0.001	0.327
Sulfate	mg/l	74.5	292
TDS	mg/l	453	1300
Zinc	mg/l	<0.1	0.1
pH*	--	7.1	9.8

Part C			
Aluminum	mg/l	<0.1	<0.1
Boron	mg/l	0.2	2.0
Cobalt	mg/l	<0.01	<0.01
Molybdenum	mg/l	0.001	<0.001
Nickel	mg/l	<0.01	<0.01
Toxic Pollutants			
Benzene			<1.0
Ethybenzene			<1.0

Notes:

* pH determined at the site

< less than symbol: presence of the chemical not detected at the lowest sensitivity of the test

6.0 SOLID WASTES

The solid wastes consisting mainly of paper products are removed from the refinery under contract with the City of Lovington.

Empty chemical barrels are either stored, returned to the chemical vendor or cleaned and used in the refinery.

Oily sludges from the API separators and tank bottoms are hauled away by a contractor who recovers the oil from the sludge. The sludge volume generated is low. The API has been cleaned once in two years yielding approximately 10 ft^3 of sludge. The tanks have not required cleaning. This is consistent with the low water and solids content (BS&W) of the incoming crude which is below 0.2 percent volume.

The refinery does not produce leaded gasoline which would increase the toxicity of API and gasoline tank sludge. The refinery has not, and does not presently use asbestos insulation. It is, therefore, not present in the refinery wastes.

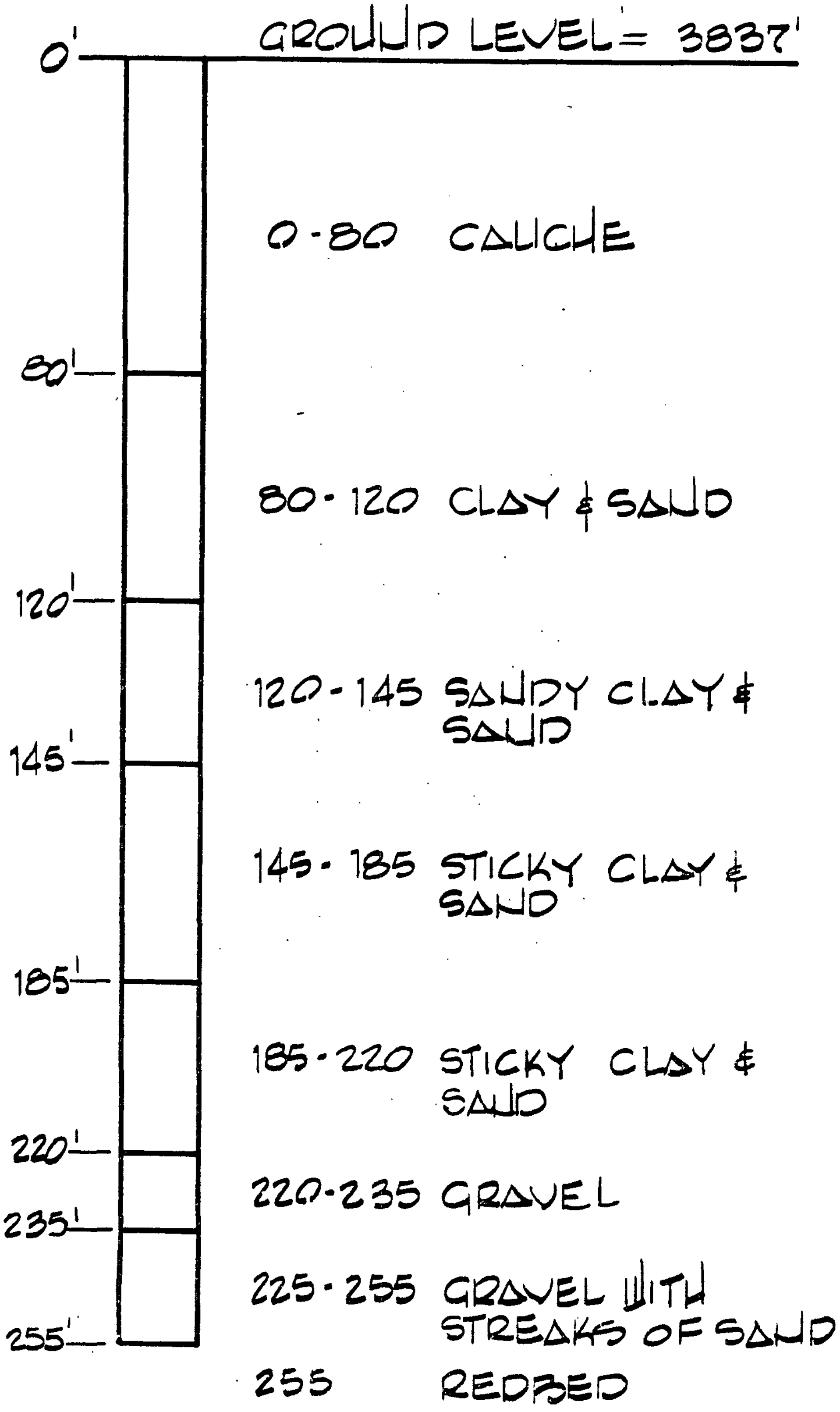
7.0 SITE GEOLOGY

The soil strata under the refinery site is shown in Figure 7.0. The figure is based on data taken during the drilling of the original refinery water well. The red bed, a clay layer, which starts at a depth of 255' is the base of the aquifer from which well water is produced for the refinery.

The wells currently in use were drilled in 1973. The static water levels at that time were 60' below the surface at the south well and 66' below the surface at the north well.

SOIL STRATA
FIGURE 7.0

SOUTHERN UNION REFINING COMPANY
LOVINGTON REFINERY



8.0 SITE TOPOGRAPHY

The site topography can be seen in Figure 8.0. Predominate surface drainage is to the southeast. There are no major surface bodies of water within one mile of the refinery. Major failures of containment of oil or waste water from the refinery could be contained by erection of temporary dikes and recovery with vacuum trucks. The topography in the vicinity is generally flat and the flooding potential is negligible.

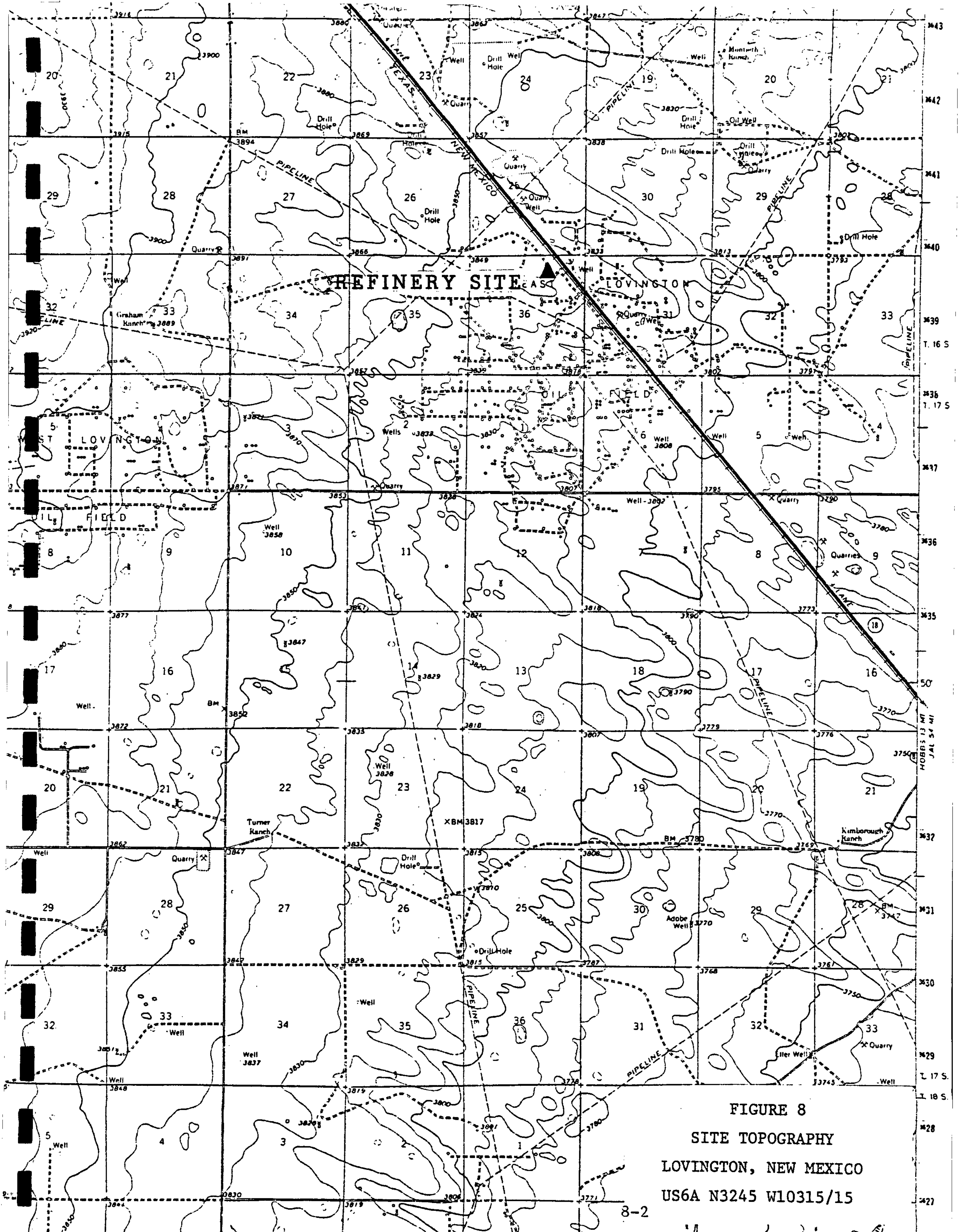


FIGURE 8

SITE TOPOGRAPHY

LOVINGTON, NEW MEXICO

US6A N3245 W10315/15

9.0 CONTINGENCY

The normal flow to the refinery API separator is 80 gpm. Assuming 100-year flood criteria, surface drainage would add 94 gpm to the flow for a total flow of 174 gpm. The capacity of each of the two oily water pumps is 500 gpm. The capacity of the clear water pumps is 600 gpm for the main pump and 230 gpm for the auxiliary pump. The pumps are adequate to move the water through the API separator to the skimmer tank. The surge capacity of the API separator provides containment assuming failure of both clear water pumps for 85 min with normal flow and 40 min assuming surface drainage during flooding conditions. Should this period be exceeded the API overflows to the emergency pond with a 240,000 gallon capacity, providing two days of containment for normal flow and 23 hr assuming the 100-year flooding conditions. This period would allow adequate time to install a temporary portable pump or use vacuum trucks to move water to the injection wells. Vacuum trucks carry 8400 gal per load. One truck would be adequate to maintain the water level in the emergency pond assuming normal flow conditions and 1½ hr turnaround time. Two trucks would be needed assuming flooding conditions.

Failure of both clear water pumps would occur during a power interruption or simultaneous mechanical failure. A power interruption of 40 min is an infrequent occurrence and results in a shutdown of the refinery processes. Simultaneous pump failures are possible, but repairs are normally possible within the two-day time frame allowed by the capacity of the emergency pond. Overflow of the API to the emergency pond will be an infrequent occurrence. The emergency pond is adequate to contain the water should both clear water pumps fail.

The desalter water flows directly from the desalter into the line to the skimmer tank. Total normal flow to the skimmer tank is 130 gpm and 224 gpm assuming the flood criteria. The skimmer water pump is adequate to handle this flow. Should the pump fail, the skimmer tank is bypassed. The clear water pumps have sufficient head to pump directly to the injection wells. The pressure of the desalter is also sufficient to move the desalter waste water to the injection wells. Loss of desalter pressure would be indicative of loss of crude flow through the desalter in which case there is no need of continued water flow through the desalter.

Assuming the 100-year flood criteria, the flow to the terminal oily sump would be 70 gpm. The pump to the injection line is capable of 30 gpm, leaving a net of 40 gpm. The surge capacity of the sump would handle the flow for 14 hr at which time the sewers would back up accumulating water in the terminal loading area. In this event, the water will be contained by using vacuum trucks to move water to the refinery API separator.

10.0 INSPECTION

The API separator and skimmer tank operation are observed as part of regular rounds of plant personnel. With the exception of sewers, piping is above ground and is visually inspected as part of the rounds. Pumps are maintained as part of the normal refinery maintenance program.

11.0 REPORTING

The Lovington Refinery will report on a yearly basis the following data:

- .Total waste water volume injected
- .The occurrence of waste water pipeline leaks and
- .The incidence of API overflow to the emergency pond.

12.0 CONCLUSIONS

The existing waste water system at the Lovington Refinery has adequate capacity to contain waste water during normal operation. Assuming 100-year flooding criteria, vacuum trucks will have to be used to contain surface water at the loading terminal.

Planned improvements to the waste water system consist of the installation of curbs around process areas to better contain surface runoff and revisions to the emergency pond to facilitate return of water from the pond to the refinery API separator.

APPENDIX A

REFINERY PLOT PLAN DRAWING

General Notes:

1. ☒ DENOTES EXISTING OIL WELLS
2. ▽ DENOTES SURVEY MONUMENTS
3. — - — DENOTES REFINERY PROPERTY LINES
4. DENOTES ACCESS ROAD, CONSISTING OF GRADED & SHAPED SUBGRADE MATERIAL COMPACTED BY ORDINARY METHODS.
5. DENOTES REFINERY ROAD CONSISTING OF GRADED & SHAPED SUBGRADE & SURFACE COURSE OF CONTROLLED DENSITY.

LEGEND

☐ EXISTING EQUIPMENT
☐ NEW EQUIPMENT
▨ MODIFIED EQUIPMENT
PROPOSED EQUIPMENT

NO	REVISIONS	BY	CHK	DATE	APPR.
0	ISSUE FOR CONSTRUCTION	W.H.	JAB	5-15-80	[illegible]
1	[illegible]	J.B.	RH	6-12-80	WH
	ADDED NEW WAREHOUSE				
2	REV. PER. JOB E-12303				
	ISSUE FOR REVIEW	RRH	WH	8-31-81	WH
3	ISSUE FOR BID	RM	RRH	9-30-81	[illegible]

PCI ENGINEERS, INC.
HOUSTON, TEXAS

DRAWN	CHECKED	APPROVED
KUBACAK	BENAVIDEZ	
DATE 11-27-79	DATE 1-14-80	SCALE 1"=50'-0

OVERALL
PLOT PLAN

SOUTHERN UNION OIL CO.
LOVINGTON, NEW MEXICO

JOB NO.	DRAWING NO.			REV.
E-10503	001	AP	1	3

7530

APPENDIX B

MATERIAL SAFETY DATA SHEETS

Chemical Safety Data Sheet SD-20

PROPERTIES AND ESSENTIAL INFORMATION

FOR

HANDLING AND USE

OF

SULFURIC ACID

●

REVISED 1963

MCA MANUFACTURING CHEMISTS ASSOCIATION
1825 CONNECTICUT AVENUE, N. W. WASHINGTON, D. C. 20009

Safety Data Sheets are published as an activity of the Association's ***Safety and Fire Protection Committee.*** Other MCA committees which cooperate in their preparation include:

Air Quality Committee
Chemical Packaging Committee
Labels and Precautionary Information Committee
Occupational Health Committee
Transportation Equipment Committee
Water Resources Committee

Address correspondence to Manager, Technical Publications, Manufacturing Chemists Association, 1825 Connecticut Avenue, N.W., Washington, D. C. 20009.

Published 1948
Revised 1952
Revised 1963

The information and recommendations contained in this Chemical Safety Data Sheet were prepared for the guidance of plant engineering, operations and management, and for persons working with or handling sulfuric acid. The information was compiled from experience and information provided by various manufacturers of sulfuric acid, and from material on sulfuric acid appearing in scientific publications. While the Manufacturing Chemists Association believes these sources are reliable and represent the best opinions available on this subject as of 1963, the Association makes no warranty, guaranty or representation as to the correctness or sufficiency of any information or recommendation herein, and the Association assumes no responsibility in connection therewith; nor can it be assumed that all necessary warnings and precautionary measures are contained in this Chemical Safety Data Sheet, or that other or additional information measures may not be required or desirable because of particular exceptional conditions or circumstances, or because of applicable federal, state or local law.

TABLE OF CONTENTS

Chemical Safety Data Sheet

SULFURIC ACID

PREFACE

This chemical safety data sheet contains material previously published in Manual TC-1 "Tank Cars—Unloading when filled with sulfuric acid, etc."

Sulfuric acid is a colorless to cloudy liquid used widely in the manufacture of chemicals, textiles, leather, pigments, steel and other metal products, dyes, petroleum, explosives, etc.

It is highly corrosive to most metals particularly in strengths below 60°Be. with evolution of hydrogen, a highly flammable and explosive gas. Sulfuric acid itself is not flammable but may cause ignition by contact with combustible liquids and solids.

On contact with the skin or eyes sulfuric acid produces severe burns. Swallowing may cause severe injury or death. Inhalation of concentrated vapor or mist from hot acid may be injurious to the lungs.

The full text of this chemical safety data sheet should be consulted for details of the hazards of sulfuric acid and suggestions for their control.

FIRST AID — PAGE 25

For assistance in the event of any emergency involving this chemical in transportation, call MCA's **Chemical Transportation Emergency Center.**

CHEMTREC

(800) 424-9300 * *(Use 483-7616 in District of Columbia)*

Toll-free, day or night

*** Use long distance access number if required.**

In CANADA, call Canadian Chemical Producers Association's TEAP (Transportation Emergency Assistance Plan)

Manual
Sheet
SD-20

Chemical Safety Data Sheet

SULFURIC ACID

ADOPTED FEBRUARY, 1948
FIRST REVISION 1952
SECOND REVISION 1963

1. NAME

Chemical Names:	Sulfuric Acid, Fuming Sulfuric Acid
Common Names:	Sulfuric Acid, Oleum
Formula:	H_2SO_4 Oleum: H_2SO_4 with dissolved SO_3

2. PROPERTIES

2.1 GRADES AND STRENGTHS

2.1.1 **Grades:** Technical (Commercial), CP, USP, Battery Acid, Fuming (Oleum).

2.1.2 **Strengths:** Strengths and other data on representative commercial grades follow (see MCA Manual Sheets T-7, T-7A, and T-8 for complete details):

Sulfuric Acid

Bé	*% H_2SO_4*	*Sp. Gr. at 60°F. Compared to H_2O/60°F.*	*Freezing Point °C.*	*Freezing Point °F.*
52°	65.13	1.5591	—40.0	—40°
58°	74.36	1.6667	—44.0	—47°
60°	77.67	1.7059	— 8.0	18°
66°	93.19	1.8354	—32.0	—26°
—	98.00	1.8438	3.0	37°
—	100.00	1.8392	10.0	50°

Oleums

% Free SO_3	*% Equivalent H_2SO_4*	*Sp. Gr. at 100°F. Compared to H_2O/60°F.*	*Freezing Point °C.*	*Freezing Point °F.*
20.0	104.50	1.8820	— 9.0	15°
30.0	106.75	1.9156	15.5	60°
40.0	109.00	1.9473	33.0	94°
65.0	114.63	1.9820	3.6	34°
100.0 (Liquid SO_3)	122.50	1.8342	17.2	63°

2.2 PROPERTIES AND CHARACTERISTICS

Physical state	Liquid
Color	Clear, colorless to cloudy
Odor	Oleum has a sharp, penetrating odor
Flash point	None
Corrosivity	Highly corrosive to most metals; particularly at concentrations below 60° Bé with evolution of hydrogen gas (See 3.2).
Reactivity	In addition to attacking many metals, the acid in its concentrated form is a strong oxidizing agent and may cause ignition on contact with organic materials and such products as nitrates, carbides, chlorates, etc. It also reacts exothermically with water.
Hygroscopicity	Yes

3. HAZARDS

3.1 HEALTH HAZARDS (See also Section 10)

Due to its corrosive, oxidizing and sulfonating properties, sulfuric acid produces rapid destruction of tissues and severe burns on contact with bodily tissues of any kind.

3.1.1 Warning Properties

Sulfuric acid is odorless but fuming sulfuric or oleum has a sharp, penetrating effect on the nose due to release of dissolved SO_3. Sulfuric acid mists in concentrations in excess of 1 mg/m^3 are easily recognized by most observers, while a concentration of 5 mg/m^3 is distinctly objectionable. A sensation of "breathing dusty air" is experienced.

3.1.2 Threshold Limit

A threshold limit of 1 mg/m^3 has been recommended as a safe concentration for an eight-hour exposure.

3.2 FIRE HAZARDS (See Section 6, Fire and Explosion Hazards)

The acid itself is not flammable, but in its higher concentrations may cause ignition by contact with combustible liquids and solids.

A highly flammable and explosive gas, hydrogen, is generated by the action of the acid on most metals.

4. ENGINEERING CONTROL OF HAZARDS

4.1 BUILDING DESIGN

Buildings may be constructed of wood, concrete or steel. Open steel work should be protected by an acid resistant paint. Provision should be made for drainage and washing down spills with large quantities of water.

Stairs, platforms and walkways should be provided to give access to tank tops.

4.2 EQUIPMENT DESIGN

Since sulfuric acid is highly corrosive to many metals and alloys, the proper design and selection of handling, storage and processing equipment is imperative.

Storage tank manholes, and those on other large vessels containing sulfuric acid, should be designed so that men wearing rescue harness, life line and breathing apparatus can enter readily.

4.2.1 System Types

Sulfuric acid should be handled in a closed system throughout whenever possible. Storage tanks and similar equipment should always be protected by breather vents so located that accidental overflow will be safely discharged into a sump or other safe location.

4.2.2 Filling Operations

A common system used to feed carboy and drum locations consists of an acid tank, with two valves in the line, feeding the packaging line by gravity.

If the two valves are closed and the system allowed to remain idle for any length of time, pressure may build up between the two valves, particularly during hot weather. Then, when the lower valve is opened, acid may blow out the open line.

This hazard can be controlled by either of the following methods:

(a) When ending filling operations, close only one valve.

(b) If both valves are found to be closed when resuming filling operations, open the valve nearest to the tank. This will permit any pressure in the line to vent into the tank itself.

4.3 VENTILATION

The vapor from hot sulfuric acid or oleum, sometimes referred to as fumes, while not seriously toxic, is extremely irritating to the upper respiratory tract. (See Section 10.1, Health Hazards.) It is also highly corrosive to metal and other materials of construction. It is therefore important to maintain adequate ventilation at all locations where such acid is handled.

Storage should be located in the open, or in well-ventilated buildings or sheds.

Individual sensitivity to vapors is variable; 0.125 to 0.50 parts per million may be mildly annoying; 1.5 to 2.5 ppm definitely unpleasant, and 10 to 20 ppm unbearable. Workers exposed to low concentrations of vapor gradually become less sensitive to their irritant action.

4.4 ELECTRICAL EQUIPMENT

Electrical fixtures should be of the liquid-tight type. All wiring should be in liquid-tight, rigid metal conduit. (See article 500 of National Electrical Code.)

5. EMPLOYEE SAFETY

5.1 EMPLOYEE EDUCATION AND TRAINING

Safety in handling sulfuric acid depends, to a great extent, upon the effectiveness of employee education, proper training in safe practices and the use of safe equipment, and intelligent supervision.

The education and training of employees to work safely and to use the personal protective equipment provided for them is the responsibility of supervision. Training classes for both new and old employees should be conducted periodically to maintain a high degree of safety in handling procedures. Employees should be thoroughly informed of the hazards that may result from improper handling of sulfuric acid, oleum or liquid SO_3. They should be cautioned to prevent spills, and thoroughly instructed regarding proper action to take in case they occur. (See 7.10.) Each employee should know what to do in an emergency and should be fully informed as to first aid measures. (See Section 11, FIRST AID.)

In addition to the above, employee education and training should include the following:

(a) Instruction and periodic drill or quiz regarding the locations, purpose, and use of emergency fire fighting equipment, fire alarms and emergency shutdown equipment such as valves and switches.

(b) Instructions and periodic drill or quiz regarding the locations, purpose, and use of personal protective equipment.

(c) Instruction and periodic drill or quiz regarding the locations of safety showers, eye-baths, bubbler drinking fountains, or the closest source of water for use in emergencies.

(d) Instructions to avoid all unnecessary inhalation of vapors of sulfuric acid and all direct contact with liquid.

(e) Instructions to report to the proper authority all cases of equipment failure.

5.2 SAFETY SHOWERS AND EYE WASH FOUNTAINS

Readily accessible, well marked, rapid action safety showers and eye wash fountains (preferably with warm water supply) must be available in the areas where sulfuric acid is being handled. Showers should have deluge type heads, easily accessible, plainly marked and controlled by quick-opening valves of the type that stay open. They should be capable of supplying large quantities of water under moderately high pressure. Blankets should be located near the safety showers. Eye wash fountains, or a ready source of running tap water, such as a drinking fountain or hose with a gentle flow of water should be immediately available for eye irrigation. All safety equipment should be inspected and tested at regular intervals, preferably daily and especially during freezing weather, to make sure it is in good working condition at all times.

5.3 PERSONAL PROTECTIVE EQUIPMENT

5.3.1 Availability and Use

While personal protective equipment is not an adequate substitute for good, safe working conditions, adequate ventilation, and intelligent conduct on the part of employees working with sulfuric acid, it is, in many instances, the only practical means of protecting the worker, particularly in emergency situations. One should keep firmly in mind that personal protective equipment protects only the worker wearing it, and other unprotected workers in the area may be exposed to danger.

The correct usage of personal protective equipment requires the education of the worker in proper employment of the equipment available to him. Under conditions which are sufficiently hazardous to require personal protective equipment, its use should be supervised and the type of protective equipment selected should be capable of control over any potential hazard.

The following personal protective equipment should be used when indicated.

5.3.2 Eye Protection

5.3.2.1 *Chemical Safety Goggles*

Cup-type or rubber framed goggles, equipped with the approved impact resistant glass or plastic lenses, should be worn whenever there is danger of sulfuric acid coming in contact with the eyes. Goggles should be carefully fitted to ensure maximum protection and comfort.

5.3.2.2 *Spectacle-Type Safety Goggles*

Metal or plastic rim safety spectacles with unperforated side shields which can be obtained with prescription safety lenses or suitable all plastic safety goggles may be used where continuous eye protection is desirable, as in laboratories. These types, however, should not be used where complete eye protection against sulfuric acid is needed.

5.3.2.3 *Face Shields*

Plastic shields (full length, eight inch minimum) with forehead protection may be worn in addition to chemical safety goggles where complete face protection is desirable. Chemical safety goggles should always be worn as added protection where there is danger of material striking the eyes from underneath or around the sides of the face shield.

5.3.3 Respiratory Protection

Severe exposure to sulfuric acid may occur in tanks during equipment cleaning and repairs, when decontaminating areas following spills, or in case of failure of piping or equipment.

Employees who may be subject to such exposures should be provided with proper respiratory protection and trained in its use and care. Available types are described below.

NOTE: Respiratory protective equipment should bear U. S. Bureau of Mines approval and must be carefully maintained, inspected, cleaned and sterilized at regular intervals, and always before and after use by another person.

(a) *Self-contained Breathing Apparatus which permits the wearer to carry a supply of oxygen or air compressed in the cylinder, and the self-generating type which produces oxygen chemically.* These allow considerable mobility. The length of time a self-contained breathing apparatus provides protection varies according to the amount of air, oxygen or regenerating material carried. Compressed oxygen should not be used where there is danger of contact with flammable liquids, vapors, or sources of ignition, especially in confined spaces such as tanks or pits.

(b) *Positive Pressure Hose Masks supplied by blowers requiring no internal lubrication.* The wearer must be able to use the same route for exit as for entrance and must take precautions to keep the hose line free of entanglement. The air blower must be placed in an area free of contaminants.

(c) *Air-line Masks supplied with clean compressed air.* These are suitable for use only where conditions will permit safe escape in case of failure of the compressed air supply. These masks are usually supplied with air piped to the area from a compressor. It is extremely important that the air supply is taken from a safe source, and that it is not contaminated by oil decomposition from inadequate cooling at the compressor. The safer method is to use a separate compressor of the type not requiring internal lubrication.

Pressure reducing and relief valves, as well as suitable traps and filters, must be installed at all mask stations. An alternative arrangement frequently used is high pressure breathing air from standard (200 cu. ft.) cylinders, with a demand-type valve and face piece. This arrangement may also be used with 50-100 lb. clean piped plant air, and, as an additional precaution with the demand mask, a small cylinder of compressed air may be worn for use as an emergency escape from the area. Consult a safety equipment dealer for details on the proper use of Bureau of Mines approved equipment.

(d) *Industrial Canister Type Gas Masks, equipped with full face pieces and approved by the U. S. Bureau of Mines, fitted with the proper canister for absorbing sulfuric acid.* These will afford protection against concentrations not exceeding 2 per cent by volume when used in accordance with the manufacturer's instructions. The oxygen content of the air must not be less than 16 per cent by volume. The masks should be used for relatively short exposure periods only. They may not be suitable for use in an emergency since, at that time, the actual vapor concentration is unknown and an oxygen deficiency may exist. The wearer must be warned to leave the contaminated area immediately on detecting the odor of a harmful vapor. This may indicate that the mask is not functioning properly, the vapor concentration is too high, the canister is exhausted or the mask is not properly fitted.

NOTE: Where carbon monoxide or other gas having little or no odor may be encountered in addition to sulfuric acid, the mask should be equipped with an "all purpose canister" and a "timing device" or a colorimetric window indicator as approved by the U. S. Bureau of Mines.

5.3.4 Head Protection

"Hard" hats should be worn where there is danger from falling objects. If hard hats are not considered necessary, soft-brimmed hats or caps may be worn to give protection against liquid leaks and splashes.

5.3.5 Foot Protection

Rubber safety shoes with built-in steel toe caps are recommended for workers handling drums and carboys of sulfuric acid. Rubbers worn over leather safety shoes should be thoroughly cleaned after contamination.

5.3.6 Body, Skin and Hand Protection

Sustained or intermittent skin contact with liquid sulfuric acid will produce burns at the site of contact. Creams and ointments do not afford adequate protection. Rubber gloves and aprons should be worn when there is a possibility of body contact. Protective clothing contaminated by sulfuric acid should be flushed with flowing water promptly and cleaned inside and out each time it is used. Affected areas of the body should be flushed thoroughly with water. As a general hygienic measure, facilities for personal cleanliness should be provided, and washing before lunch and at the end of the work day should be encouraged.

6. FIRE AND EXPLOSION HAZARD CONTROL

The acid itself is not flammable, but in its higher concentrations may cause ignition by contact with combustible materials. It should, therefore, be isolated from organic materials, and such products as nitrates, carbides, chlorates and metallic powders. Safeguard against mechanical injury of containers. *When diluting, always add the acid to water. Never add water to the acid.*

Hydrogen, a highly flammable gas, can be generated inside a drum, tank car, tank truck or metal storage tank containing sulfuric acid. As hydrogen will form explosive mixtures with air under certain conditions, smoking should not be permitted near open drums, tank cars or tank trucks, nor should open lights be permitted.

When welding or performing other hot work in storage areas, precautions should be taken so that hydrogen vapors will not be flashed or exploded by a spark. This precaution is particularly applicable to partially filled drums or tanks.

Explosions have occurred when welding in atmospheres where hydrogen has accumulated over a weekend. Weak acid can attack systems during such idle time, permitting accumulation of hydrogen in coolers, towers, and other equipment.

To prevent hydrogen explosions when burning or welding, valves on lines leading to the equipment being worked on should be closed or blanked off. Sampling ports should be provided at the top of towers and elsewhere in the system, to test for hydrogen before work is started. Meters for hydrogen measurement are available commercially. Special care should be taken when welding or burning on acid lines which have been emptied but not washed. The accelerated generation of hydrogen by localized heat often causes minor explosions, spraying acid and destroying welds. Such lines should be washed and purged if at all practicable.

On all closed systems which are opened for hot work, the section involved must be isolated as far as possible in both directions. Sweeping out entrained or accumulated gases should be practiced to the maximum extent feasible.

Hydrogen can be exploded when alarm probes on automatic pump controls come in contact with acid. An induction type relay with a high probe voltage can produce a spark. If this type relay is used, the low volt tap should be used. Other types of level alarms, where there is no spark hazard, are preferable.

Adequate ventilation is the best precaution against hydrogen fires.

7. HANDLING AND STORAGE

7.1 USUAL SHIPPING CONTAINERS

Sulfuric acid is classified by the Interstate Commerce Commission as a corrosive liquid. As such, it must be packed in ICC specification containers when shipped by rail, water, or highway, and all of the ICC Regulations regarding loading, handling, and marking must be followed.

7.1.1 Type and Size

(a) For all strengths, glass bottles in wooden boxes, ICC Spec. 15A, 15B, 15C, 16A, or 19A, in corrugated cartons, ICC Spec. 12A, in expanded polystyrene cases, ICC Spec. 33A.

(b) For strengths not less than 100% nor more than 115% (approx.), steel drum, ICC 5C.

(c) For strengths not to exceed 100.5%, glass carboys up to 13 gallon capacity, ICC Spec. 1A, 1C, 1D, 1E, or 1K.

(d) For strengths not to exceed 95%, metal drums, ICC Spec. 5H; polyethylene carboys, ICC Spec. 2T or 2TL, overpacked in ICC Spec. 1H, 15P, 22C, 37A, 21C, or 16D, outer containers. Inside polyethylene containers, ICC Spec. 2S or 2Sh overpacked in steel drums, ICC 5B, 6V, or 37A, in wirebound wooden overwrap, ICC Spec. 16D. Inside polyethylene container, ICC Spec. 2U, over-packed in fibreboard boxes, ICC Spec. 12B, or wirebound wooden box 16A.

(e) For strengths 77.5% or greater, provided the acid has a corrosive effect on steel, measured at 100°F., no greater than 66° Bé commercial sulfuric acid. Metal drums, ICC Spec. 5A or 5C for acid of 93% or greater strength. ICC Spec 17F (single trip only), drums must be equipped with vented closures.

(f) For strengths 65.25% or greater provided that corrosive effect on steel, measured at 100°F. is no greater than 52° Bé commercial acid; portable tank, ICC Spec. 60; tank motor vehicle, MC310 and MC311; tank cars, ICC Spec. 103A, 103A-W, or 111A100-W-2.

(g) For strengths not to exceed 51%; rubber lined metal drums, ICC Spec. 5D; portable tanks (rubber lined); tank motor vehicles (rubber lined) ICC Spec. MC310, or MC311; tank cars, ICC Spec. 103B, 103B-W, or 111A100-W-5. Numerous small containers are authorized, and new ones are constantly being added; ICC Regulations should be consulted for approved containers.

(h) Tank cars, ICC Spec. 103A or 103A-W, for acid of 1.5591 specific gravity (52° Bé) or greater strength.

(i) Rubber-lined tank cars, ICC Spec. 103B or 103B-W, for acid of not over 1.4 specific gravity (42° Bé).

(j) Tank motor vehicles, ICC Spec. MC-310 and MC-311, rubber-lined, for sulfuric acid not exceeding 1.408 specific gravity (42° Bé).

(k) Tank motor vehicles, ICC Spec. MC-310 and MC-311, for sulfuric acid of 1.5591 specific gravity (52° Bé) or greater strength.

Note:

See ICC Regulations, Section 74.538 and 77.848 specifying the dangerous articles which may not be loaded with sulfuric acid.

In certain instances nitric acid is added as an anti-freeze agent to sulfuric acid, particularly oleum. ICC specification containers must be used for these mixtures (see ICC Regulations).

The long term effects of strong acid (90-95% H_2SO_4) on polyethylene are not definitely established. Color changes do occur in the resin, however, and returnable containers of such material should be examined regularly for embrittlement of the plastic, especially at lower temperatures, before refilling for shipment.

7.2 LABELING AND IDENTIFICATION

7.2.1 ICC Requirements

7.2.1.1 Each container should carry an identifying label or stencil.

7.2.1.2 Each drum and each box containing inside containers, must bear the ICC white ACID label.

Tank cars, and railroad cars carrying one or more containers of sulfuric acid must bear the ICC DANGEROUS placard. Motor vehicles (including tank motor vehicles) transporting sulfuric acid must be marked in accordance with Section 77.823 of ICC Regulations.

7.2.1.3 *Disposal and Return Precautions*

Before returning shipping containers to suppliers, observe usual precautions regarding complete drainage of contents and tightly close all openings.

Follow ICC Regulations regarding the condition of empty containers and labeling; and the condition of empty cars and placard requirements before returning to the shipper.

Before returning glass containers to the shipper they must be stoppered and the ICC white ACID labels on the outside cases must be removed. It is recommended that the prescribed white "EMPTY" label not be used to cover an ACID label, as it can be washed off, exposing the label underneath.

7.2.2 Precautionary Labeling

The following label text is from page 89 of Manual L-1, *Guide to Precautionary Labeling of Hazardous Chemicals*, Sixth Edition, 1961, and is designed for the product as shipped for industrial use. Before adopting a label the latest edition of this Manual should always be consulted. The text should be used in addition to or in combination with any specific wording required by law. Since individual statutes, regulations or ordinances may require that particular information be included in a label, that certain information be displayed in a particular manner or that a specific label be affixed to a container, the use of this label text will not necessarily ensure compliance with such laws. Such laws include the Federal Hazardous Substances Labeling Act; Federal Insecticide, Fungicide & Rodenticide Act and similar state and municipal legislation.

SULFURIC ACID

DANGER! CAUSES SEVERE BURNS

Do not get in eyes, on skin, on clothing.

In case of contact, immediately flush skin or eyes with plenty of water for at least 15 minutes; for eyes, get medical attention.

Do not add water to contents while in a container because of violent reaction.

OLEUM

(FUMING SULFURIC ACID)

DANGER! CAUSES SEVERE BURNS

Do not get in eyes, on skin, on clothing.

Avoid breathing vapor.

In case of contact, immediately flush skin or eyes with plenty of water for at least 15 minutes; for eyes, get medical attention.

Do not add water to contents while in a container because of violent reaction.

7.3 CARBOYS

(a) The instructions for handling carboys in MCA Manual Sheets C-1 (for shippers) and C-2 (for consignees) should be followed.

(b) Protective clothing should consist of a felt, treated fiber or safety hard hat with brim, rubber gloves, face shield or chemical type goggles, rubber apron and rubber safety-toe boots or shoes. A supply of water should be close at hand.

(c) Carefully inspect all carboys on receipt and set aside any damaged ones for special handling.

(d) Be sure closures are securely fastened before moving either filled or empty carboys.

(e) Place a cap or boot over the neck of the carboy before moving it.

(f) Use specially designed hand-trucks for transporting individually boxed carboys about the plant. Do not use hooks.

(g) Never handle carboys by the closure or neck of the bottle.

(h) Never walk a carboy on the edge of the box.

(i) When removing full or empty boxed carboys from storage tiers, trucks or cars, and when stacking full or empty carboys, the neck of the bottle should never be tilted toward the workman.

(j) Carboys should never be stored more than three tiers high, preferably two tiers. Empty boxed carboys should be stored on their flat side, not over four tiers high, in such a manner that the necks will not protrude into aisles or passageways.

(k) When opening carboys, keep the hands and face to the side of the neck, never over it. A wire cutter should be used to remove the wire which holds the stopper in place. No attempt should be made to loosen the wire by twisting or prying.

(l) NEVER USE AIR PRESSURE TO EMPTY CARBOYS. Use a tilter especially designed for the purpose, or a safety siphon fabricated of material resistant to sulfuric acid.

(m) It is mandatory that empty boxed carboys be completely drained before presentation to the transportation company. Failure to do so is in violations of ICC Regulations.

7.4 DRUMS

7.4.1 Emptying

(a) The instructions for handling drums given in MCA Manual Sheets D-30 (for shippers) and D-31 (for consignees) should be followed.

(b) Protective clothing should consist of a felt, treated fiber or safety hard hat with brim, rubber gloves, face shield or chemical-type goggles, rubber apron and rubber safety-toe shoes. A supply of water should be close at hand.

(c) Inspect drums for loose plugs and signs of leakage or damage before moving. Set aside for special handling if damage is found. Tighten loose plugs.

(d) Avoid rough handling of drums. Do not drop. Drums should be handled carefully to and from their place of storage. Before emptying contents, substantially support drums and block them to prevent movement.

(e) To remove the body plug, place plug up and use a pipe wrench or preferably a plug wrench with a long handle. Stand to one side and face away during the operation. After the plug starts, turn slowly, and open not more than one full turn. If accumulated internal pressure vents, allow it to reduce to atmospheric pressure. Only then should the plug be slowly loosened further or removed.

(f) Drums should be stored with plugs up. Storage period should be kept to a minimum.

(g) VENT DRUMS WEEKLY, MORE FREQUENTLY IN HOT WEATHER, TO RELEASE PRESSURE THAT MAY BUILD UP. (Liquid SO_3 drums should not be vented during storage as excessive moisture pick-up may destroy stabilizer action.) An alternative method to the above is to cover the drum with a rubber blanket, loosen the plug, then proceed as in (e) above, using the wrench under the blanket to afford maximum protection against a pressure spray of acid.

(h) Drums should be emptied by gravity only, using a faucet or safety siphon fabricated of material resistant to sulfuric acid. APPLICATION OF PRESSURE TO THE DRUM IS EXTREMELY DANGEROUS AND SHOULD NEVER BE ATTEMPTED.

(i) Smoking should be strictly forbidden while handling, working on, or emptying drums because of the hydrogen hazard. (See Section 6)

(j) Since drums may contain hydrogen gas they should never be struck with a spark-producing tool.

7.4.2 Defective or Leaking Drums

(a) Employees handling leaking drums should wear full protective equipment—rubber safety-toe boots, gloves and suit, safety glasses covered by a face shield and a brimmed hat. If extreme conditions exist, an acid hood should be worn.

(b) Move the defective drum to a well-ventilated or outdoor area. Clear the immediate area of non-essential personnel and material.

(c) If the leak cannot be stopped, tie rubber sheeting around the drum to minimize splashing while it is being used. Check that the cross-threaded plug will not become dislodged.

NOTE: KEEP WATER AWAY FROM LEAKING LIQUID SO_3 DRUMS. Tie rubber sheeting around the drum. Contact the supplier for advice.

(d) Neutralize spills with soda ash. Wash the area thoroughly with water. If necessary, sand or a mixture of soda ash and sand can be used to soak up the acid. This should be shoveled up for disposal.

(e) Protect or remove material in the area which may be affected by fumes. The effect of fumes on neighboring property should also be taken into account.

(f) When transferring acid make sure that the serviceable container is clean and that when filled it is adequately labeled.

(g) Pumps which can pressurize drums should not be used when transferring acid. Pumps must be cleaned after use. A self-starting (bulb-activated) siphon may be used. The siphon hose should be firmly anchored before starting transfer operations.

(h) Defective drums should be thoroughly washed (except where a violent reaction with water due to heat of dilution will result), then destroyed by punching holes in the bottom with non-sparking hammer and chisel. Take care to avoid jagged edges. If the contents of drum cannot be transferred, the drum should be taken to an open ground area. A hole should be dug for the drum, and the hole filled with soda ash. If it is not possible to dig a hole, surround the drum with a dike of soda ash and let it leak.

7.5 TANK TRUCKS

7.5.1 General

(a) The use of tank trucks is authorized by ICC Regulations. Local rules, regulations and ordinances must also be observed.

(b) ICC Regulations (Section 77.834) require that tank motor vehicles be attended during loading and unloading. If it becomes necessary for the attendant to leave the operation, transfer of the acid must be stopped.

(c) Protective equipment consisting of an acid hood, acid-resistant apron and gloves and a long-sleeved shirt and trousers (preferably of wool or other acid-resistant fiber) should be worn while venting or connecting and disconnecting pipelines. Acid goggles and a brimmed hat should be worn under all conditions except when an acid hood is being used. If necessary to work on connections beneath the tank, a full acid suit should be worn. Respiratory protection should be worn when necessary to work in an atmosphere containing sulfuric acid fumes. If caught in an emergency without respiratory protection, the breath should be held and escape made, if possible, without breathing. If this is not possible, short shallow breaths should be taken so as not to fill lungs. Any exposure to fumes should be reported so the individual can receive immediate medical attention.

(d) An emergency shower and preferably an eye bath should be easily accessible and within 25 feet of the loading or unloading spot and other sources of water should be available for washdowns.

7.5.2 Fittings, Etc.

(a) The packing and lubricant for pumps, glands, etc. must be of a material recommended for sulfuric acid handling.

(b) The pump glands, flanged fittings, and valve stems should be provided with splash shields or collars in cases where personnel would be exposed to acid leaks or sprays if acid should escape. The use of transparent shields may assist personnel in detecting incipient leaks before they become serious.

(c) Where access to the top of the tank truck is needed, the spot should be provided with stairs and platform. Non-combustible construction is preferred. Overhead loading lines should be counterweighted with a pulley and weight system, or equivalent.

7.5.3 Damage en Route

In case a tank truck becomes damaged en route so that it cannot proceed safely to destination, every effort should be made to park it where it will not endanger traffic or property. The police and fire departments should be notified and public warned to stay away. The truck should be parked, if possible, in a vacant lot and away from an area in which there is a concentration of people. If leaking, the acid should be trapped in a depression or pit and if possible, neutralized with soda ash or lime and the neutralized material subsequently thoroughly washed away. Litmus paper should be used to determine that the spill has been adequately neutralized. If available, another authorized tank truck should be brought to the disabled vehicle to "pump off" the leaking acid.

7.5.4 Unloading

(a) Tank trucks should be visually inspected for leaks before they are allowed to enter the plant.

(b) Unloading should preferably be performed only during daylight hours. When it is necessary to unload at night, proper and adequate lighting should be provided around the tank truck and the working areas involved in the operation.

(c) It is preferable that the truck pad be arranged so liquid spillage will drain away from the truck and exposed structures. The pad should be of sufficient length to allow the truck and trailer a minimum of a 4-foot clearance at each end and 2-foot clearance on each side. Because of the hazard of backing equipment into roadways and the possible need to move a truck quickly from the unloading spot, it should be so arranged that the truck can be driven away in a forward direction. Where a drive-through arrangement is used, a chain, gravity-swing guard gate, or equivalent, should be provided across the truck entrance to the driveway when same is not in use.

(d) Only qualified and properly instructed employees should operate the truck and make the hook-up of the hose from the tank truck to the receiving tank.

(e) Contents of the tank truck should be checked before they are transferred. If a sample is required for testing purposes, the truck driver should open the manhole or filling opening. The person taking the sample should wear the prescribed protective equipment.

(f) An authorized and qualified consignee representative should give approval to unload into the storage tank. This consignee representative should designate the specific unloading connection to be used. He should trace the line to make sure that all valves are properly set and that the overflow line on the storage tank will discharge to a safe location. He should also make sure there is room in it for the amount of acid to be transferred.

(g) Before connecting for unloading, the truck engine should be stopped and not started again during the entire unloading operation unless it is necessary to operate the pump by power take-off or to use the truck engine to operate compressors as a source of air for air pressure unloading.

(h) Truck parking brakes should be set and, where necessary, the wheels blocked.

(i) A sign should be placed near truck stating in effect "Danger—Unloading Acid" to caution others to stay away from the operation.

(j) Whether unloading by pump or air, the piping should, if possible, be arranged so the acid will drain toward the storage tank when the pump is shut down or when the discharge valve is closed.

(k) When unloading line must be run across a walkway, suitable warning signs should be provided to denote the hazard.

(l) Before starting to vent or connect, a water hose should be connected and ready for emergency use and the emergency shower should be tested.

(m) The acid flow should not be started until the truck driver is so instructed by the consignee's authorized representative.

(n) Wherever practicable, unloading should be accomplished by pumping. Whether pumping or unloading by air pressure, observe the following procedure. Operate relief valve to vent the tank. Remove blind flange from air inlet line. Leave this line open during pumping. After making certain there is no air pressure, remove blind flange from standpipe and connect unloading line to standpipe.

(o) If transfer is by means of air pressure, connect air line and apply air slowly until there is a normal flow of acid into the storage tank. The air pressure must not exceed the safe working pressure of the tank or the start-to-discharge pressure of the relief valve. When the tank truck is empty, shut off the air and operate the relief valve to vent off the pressure. After pressure has been vented, disconnect the air line. Do not disconnect the acid unloading line until the tank truck is at atmospheric pressure and the tank truck standpipe drained. After disconnecting the acid unloading line replace blind flanges on standpipe and air line.

(p) If a spill or overflow should occur during a transferring operation, the pump or supply of air should be stopped, valves shut off and spill cleaned up before other actions are taken.

7.6 TANK CARS—UNLOADING

7.6.1. General

(a) Acids may be safely unloaded either by pump or air pressure, if proper safeguards are taken. While it is difficult to unload oleum by means of a pump due to the difficulty of maintaining suction at the pump, this method can be used if desired. It has the advantage of eliminating the venting of the large volume of SO_3 laden air which results from blowing a tank empty with air.

(b) Car number should be compared with that on shipping papers or invoice to verify contents and avoid mixing of products.

(c) Shipper's instructions for unloading should always be followed. Observe all precautions. The sequence of handling the pipe caps is particularly important—the air inlet should be opened first, and the acid connection last.

(d) Protective clothing should consist of a felt or treated fiber hat with brim, face shield, rubber gloves, high-top rubber safety-toe shoes and outer clothing. A rubber suit should be worn when connecting or disconnecting the car, but the wearing should be limited to short periods to avoid excessive fatigue. Water in ample quantity should be immediately available at the unloading station (See Section 5.2 Safety Showers and Eye Wash Fountains).

7.6.2 Explosion Hazards

(a) NO NAKED FLAME OF ANY KIND SHOULD EVER BE PERMITTED NEAR AN OPENING OF THE TANK FOR ANY PURPOSE. Explosion proof lights or flashlights may be used with safety.

(b) Smoking is strictly forbidden in the vicinity of the dome.

(c) All tools used in connection with unloading must be kept free from oil, dirt, and grit.

(d) Never strike tank fittings with tools or other hard objects. Do not use hammer and chisel at any time. FAILURE TO OBSERVE THESE PRECAUTIONS MAY RESULT IN THE IGNITION OF HYDROGEN GAS FROM THE DOME AND CREATE AN EXPLOSION.

(e) Tank must not be used for a product other than that which it last contained, as injury to the tank or an explosion may result. Consignee should never take this risk.

(f) Under no circumstances should air pressure in excess of 30 psi be used for unloading car tank. Use of air beyond this pressure may produce tank damage or bursting.

(g) Discharge connections must be detached immediately after tank is unloaded. Unloader must stay with car throughout the unloading operation and until all discharge fittings are disconnected and car fittings replaced and closed.

(h) Should any hazardous conditions arise, immediately close air supply, and do not reopen until repairs have been completed.

NOTE: Tanks are hydrostatically tested to 60 or 100 psi depending on the class and so certified by stencilled markings on both sides of the tank as required by ICC Regulations. THESE STENCILLED MARKINGS HAVE NO RELATION WHATEVER TO THE PRESSURE USED FOR UNLOADING. The shipper, with full knowledge of the product transported, restricts unloading pressure to not over 30 psi to insure safety.

7.6.3 Placement of Car for Unloading

(a) Unloading dock should be in the open and located so as to dissipate vapors to fresh air.

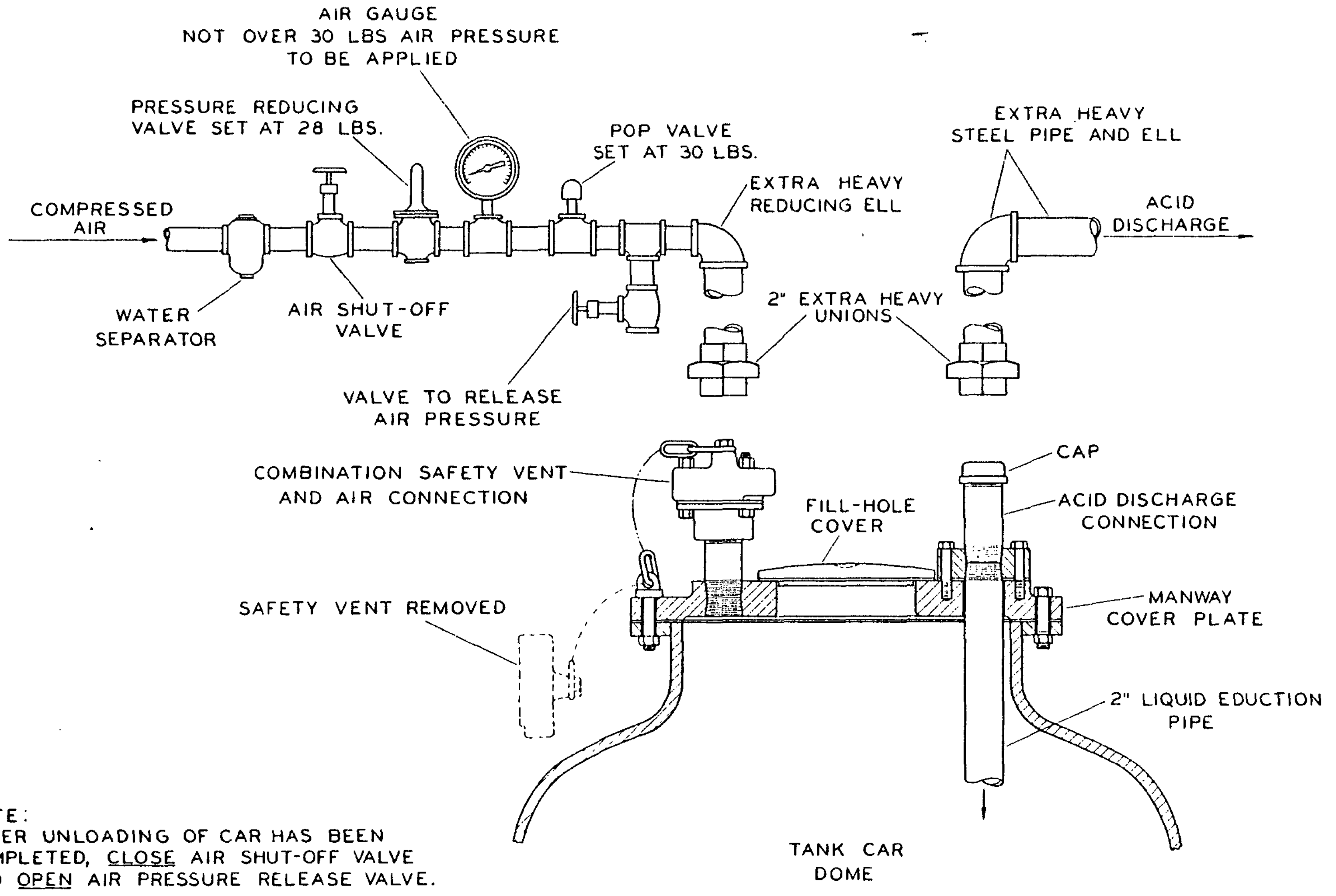
(b) See that train or engine crew accurately spot the car at the unloading line. Tracks can be marked for proper location to simplify proper spotting. Unloading track should be level.

(c) Brakes should be set and wheels blocked on all cars being unloaded.

(d) Standard derails and blue warning flags and lights should be placed. In addition, caution signs can be so placed as to give necessary warning to persons approaching from open track or siding end, and should be left in place until after car is unloaded and disconnected. Sign should be at least 12 x 15 inches in size, and bear words, "STOP—TANK CAR CONNECTED", the word "STOP" being in letters at least 4″ high, and the other letters at least 2″ high. Lettering should be white on blue background. Signs and derails are standard equipment available from safety equipment dealers.

(e) If it is necessary to move a partly unloaded tank car, all openings should be closed and the car moved carefully as considerable force can be exerted by the movement of the acid in the tank.

FIGURE 1 — AIR PIPING ARRANGEMENT FOR UNLOADING ACID TANK CARS



NOTE:
AFTER UNLOADING OF CAR HAS BEEN COMPLETED, CLOSE AIR SHUT-OFF VALVE AND OPEN AIR PRESSURE RELEASE VALVE. THEN, DISCONNECT AIR LINE BEFORE DISCONNECTING ACID DISCHARGE LINE.

FIGURE 2 — TANK CAR DOME WITH AIR INLET AND LIQUID EDUCTION VALVES

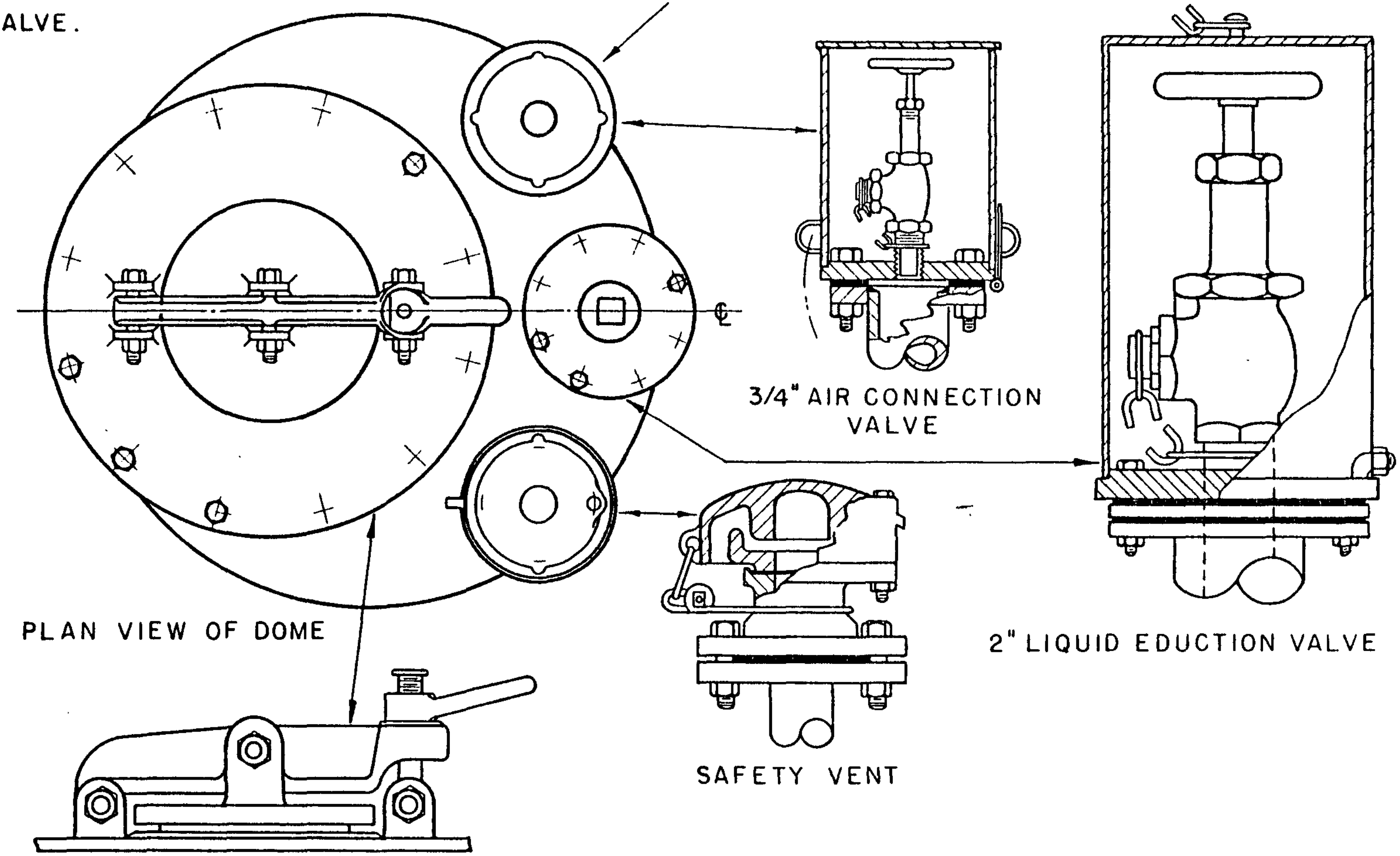
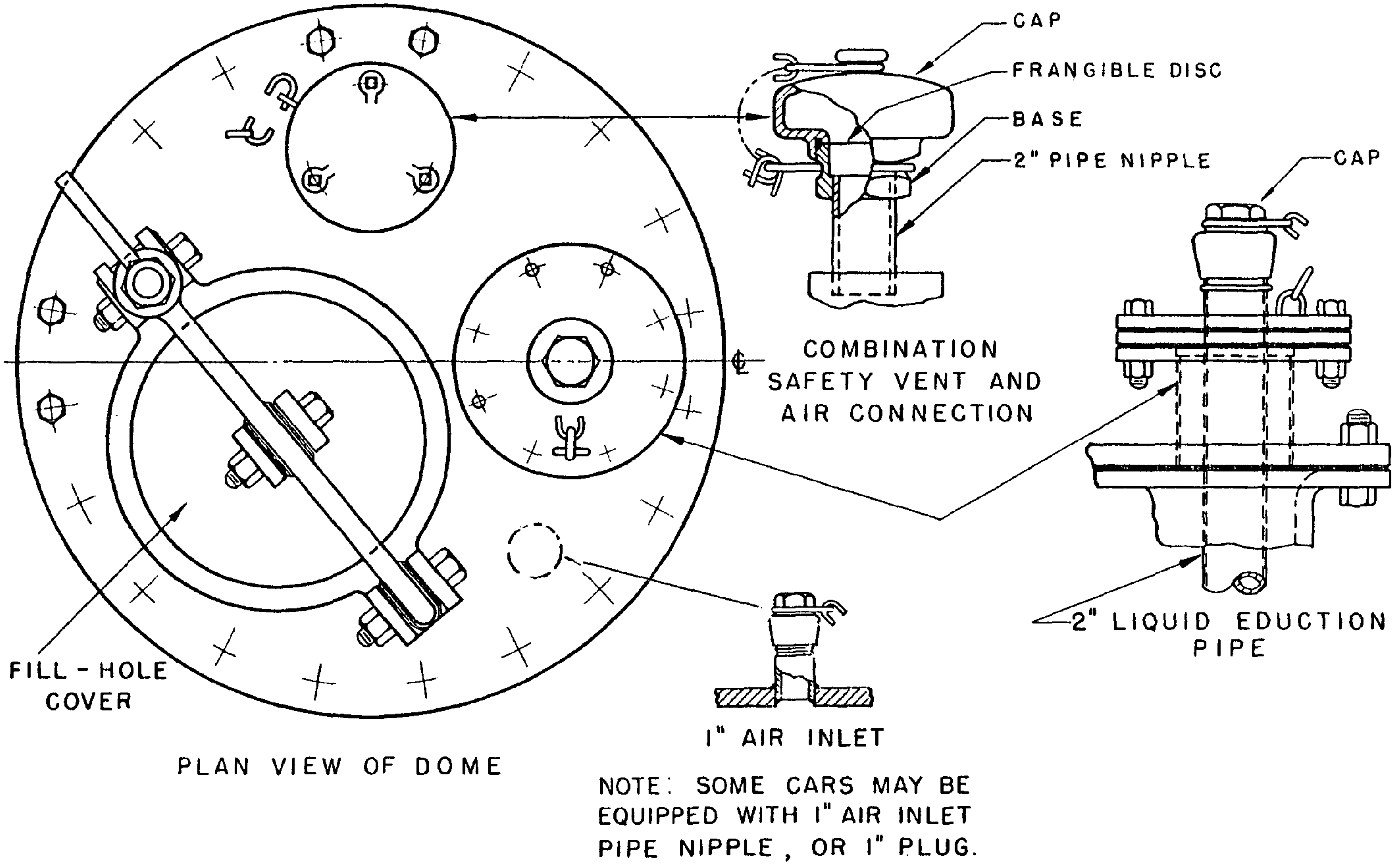

NOTE: SOME CARS MAY BE EQUIPPED WITH A SECOND SAFETY VENT INSTEAD OF THE AIR VALVE.

FIGURE 3 — TANK CAR DOME WITH AIR INLET AND LIQUID EDUCTION CONNECTIONS



NOTE: SOME CARS MAY BE EQUIPPED WITH 1" AIR INLET PIPE NIPPLE, OR 1" PLUG.

7.6.4 Dome Fittings (see Figures 1, 2, and 3)

(a) Dome fittings of tank cars may be of different types. All are designed to require unloading through the dome acid connections by means of compressed air or pump. The following fittings and connections are usually identified by name and stencilled for identification:

1. Fill-hole Cover (hinged or secured by center screw).
2. Discharge (or eduction) Pipe (closed with cap, plug, or valve).
3. Air Connection: (a) A pipe nipple closed with a safety vent; or, (b) a separate air connection closed with a cap, valve, or plug cock. (c) When car is equipped with two vents, one is sealed and must not be removed.
4. Safety Vent. A safety device equipped with a frangible disc, designed to relieve abnormal pressure, which may be built up in the tank during transit. All cars are equipped with a safety vent device. Some cars require removal of the safety vent assembly to make the air connection for unloading. Other cars are equipped with two safety vents, one of which is a sealed vent, not to be removed.

(b) Removal and replacement of connections should be made with a wrench.

(c) If leakage at any of the tank car dome fittings occurs and cannot be stopped by tightening the bolts or fittings, shut off the air supply. When pressure in the car has been reduced to atmospheric, remove such fitting and apply a new rubber asbestos or approved plastic gasket. Special gaskets are used. If the wrong type is used as a replacement, contents of the tank may be contaminated.

(d) DO NOT USE A RUBBER HOSE FOR THE ACID DISCHARGE CONNECTION

7.6.5 Bottom Openings

(a) Bottom openings must be blanked as per ICC Regulations except on sludge acid cars.

(b) Discharge of contents through the bottom of the tank should never be attempted. The bottom flanged plate is used only as a washout connection.

7.6.6 Unloading Procedures

UNDER NO CIRCUMSTANCES SHOULD THE DISCHARGE PIPE BE OPENED UNTIL ALL PRESSURE IN THE TANK HAS BEEN RELEASED.

Carefully read all caution markings on tank and dome before discharge.

7.6.7 Unloading by Air Pressure

Compressed air used for unloading must be as free as possible from oil, excess moisture and foreign matter. To insure this, the air supply should be taken from the TOP of the air receiver (reservoir). This receiver should be drained at regular intervals. The air line leading to tank car—(usually a dead and idle line between receipts)—should be thoroughly blown clear before making connection to the tank car. Any moisture so admitted may readily generate heat depending on the acid being unloaded and accelerate corrosion of the tank. It is recommended that consignee install an air dryer or water separator in the air line, adjacent to and preceding the air shut-off valve.

Air unloading operations should be carried out strictly in the following sequence:

(a) First vent the car by loosening, very slowly, the ENTIRE air vent device or air inlet cap to relieve internal pressure. Then remove this device from the top of the pipe nipple. Care is necessary, for the tank car may be under pressure, particularly during hot weather. If this pressure is not released gradually, there is danger from acid spray being carried out with the escaping air.

(b) The fill-hole cover on the dome may now be safely opened for the purpose of securing a sample of the product, after which it must be tightly secured in place—be sure the gasket is properly seated.

(c) Remove pipe cap from top of acid discharge pipe and make STEEL PIPE connection from pipe on car (or from valve on car) to the acid storage tank.

(d) Make STEEL PIPE connection from plant air line to the air connection on tank car dome. (Compressed air connection can be a properly sized and pressure rated hose as far as water separator. It should be steel pipe from separator to car.) The air line must have a pressure reducing or safety valve set at not over 28 psi, also an air gauge and valve to release car tank pressure when emptied.

(e) APPLY AIR PRESSURE SLOWLY until there is normal flow into storage tank; then adjust air pressure and maintain until the tank car is completely empty. Storage tank must be vented to atmosphere while acid is entering. A drop in pressure and the sound of air rushing through the discharge pipe indicates that the tank is empty. Continue the flow of air until the discharge line is completely empty, then shut off the air, open the relief valve, and allow the acid pipe to drain.

(f) Disconnect plant air fittings from the safety vent or air inlet on car and replace safety vent, or close air inlet.

(g) Do not disconnect the acid line from the car until the tank is at atmospheric pressure and sufficient time is given to permit complete drainage of line. (Close valve on acid line at car, if so equipped.)

(h) Always assuming line still has acid in it, and taking precautions accordingly, carefully disconnect plant acid line from the discharge pipe fitting (or valve) and tightly replace pipe cap or plug with wrench. (Wear protective clothing as outlined in 7.6.1 (d).) Any drippings from the acid line should be caught in a lead or other suitable receptacle. Do not permit drainage to spill on tank car. Wash any spillage with water.

7.6.8 Unloading By Pump

The pump should be constructed of materials not readily affected by the product. A self-priming centrifugal pump is preferred over the positive displacement type. If the latter is used, it should be provided with an un-valved by-pass from outlet to inlet with properly rated rupture disc of suitable material. Also, car must be vented to prevent a vacuum and to permit air to displace the acid as car is unloaded. All connections to the pump should be made in such a manner as to avoid excessive stresses at the pump. The pump packing should be checked prior to unloading to avoid the danger of acid leakage. The relief valve should be connected to discharge to a safe location or may be connected so as to discharge to the pump suction. In all cases, the relief valve should be large enough to handle the full pump capacity to avoid pressure building up beyond the safe limits for the pump or piping system.

Pump unloading operations should be carried out strictly in the following sequence:

(a) First vent the car by loosening, very slowly, the entire air vent device or air inlet cap to relieve internal pressure. Then remove this device from the top of the pipe nipple. Care is necessary, for the tank car may be under pressure, particularly during hot weather. If this pressure is not relieved gradually, there is danger from acid spray being carried out with the escaping air.

(b) The fill-hole cover on the dome may now be safely opened for the purpose of securing a sample of the product.

(c) Remove pipe cap from top of acid discharge pipe and make STEEL PIPE connection from pipe on car (or, from valve on car) to the pump inlet. Make STEEL PIPE connection from pump outlet to acid storage tank.

(d) Start pump, with car vented to atmosphere. If priming is required, follow procedure for unloading by air and apply only sufficient pressure to start flow of acid to pump. Do not use more than 30 psi pressure.

(e) Storage tank must be vented to the atmosphere while acid is being transferred.

(f) When the tank car is empty, the pump, operating under less of a burden, may signal the end of the transfer by operating faster at a different sound pitch and the sound of acid entering the storage tank will cease.

(g) Shut off the pump and open drain line valves.

(h) After lines have completely drained (close valve on acid line at car, if so equipped), disconnect plant acid line from car discharge pipe fitting (or valve), and tightly replace car pipe cap or plug with wrench. (Place a lead or other suitable receptacle under the connection while dismantling to catch drippings. Wear rubber gloves and goggles. Do not permit drainage to spill on tank car. Wash any spillage with water.)

(i) Close fill-hole cover on dome. Be sure gasket is properly seated.

7.6.9 Defective Discharge Pipe

The acid discharge pipe is subject to corrosion. If the pipe has broken or defective threads or holes or cracks, or the bottom is worn away, complete discharge of the tank will be difficult. In such case, replacement should be made with extra-heavy steel pipe.

7.6.10 Obstructed Discharge Pipe

Other than from frozen or congealed product, obstruction in the discharge pipe may be caused by an accumulation of sediment at the lower end of pipe. To remedy this, use an iron or steel rod, not over ⅜ inch in diameter, in the following sequence:

(a) Insert rod in top of discharge pipe, and push it through to the bottom, ramming until the pipe is clear.

(b) Then loosen sediment around base outside of the discharge pipe by prodding area with the rod.

(c) Withdraw the rod and wash it off with water.

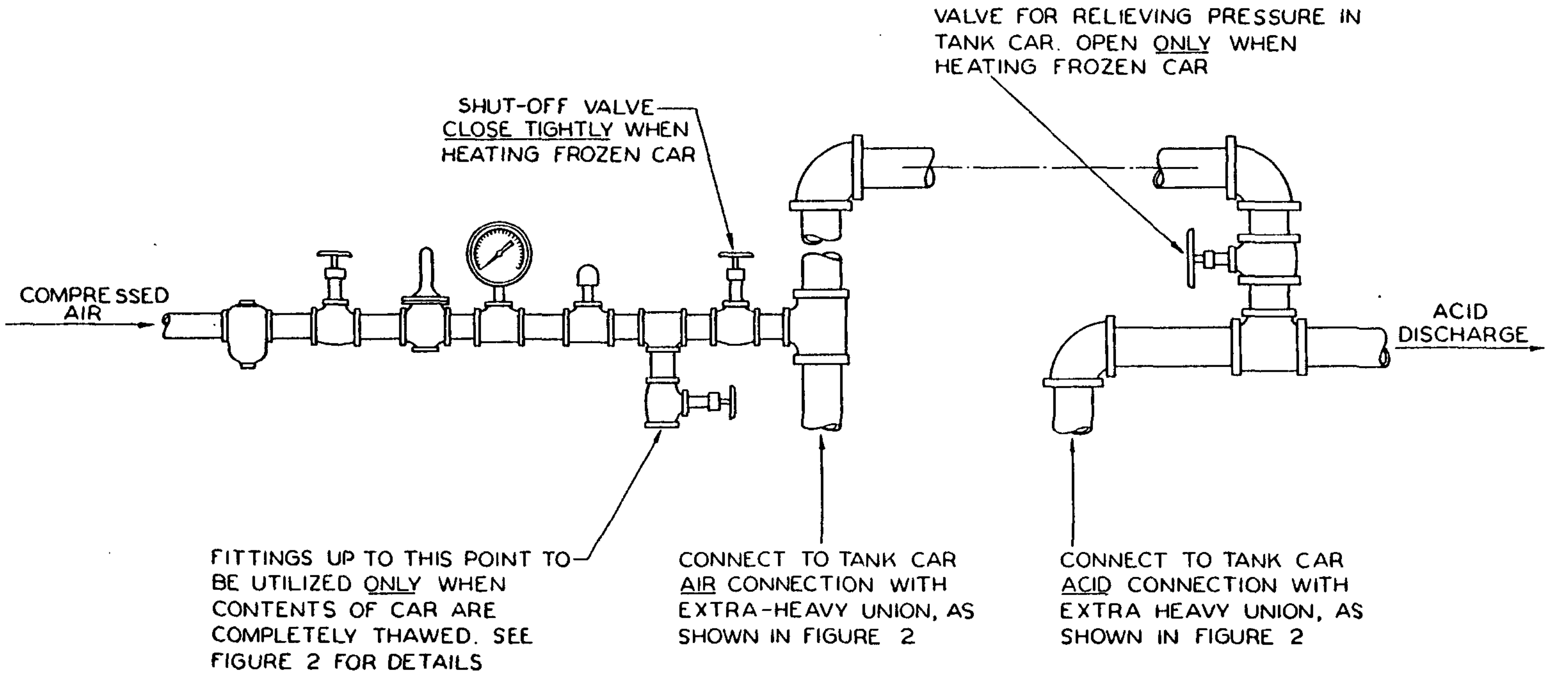
(d) If unloading by air, replace and secure the dome fill-hole cover. See that gasket is properly placed and that all necessary connections are made before proceeding with unloading. (If pump unloading is being used this step can be eliminated.)

7.6.11 Frozen (Congealed) Sulfuric Acid and Oleum (See Figure 4)

In very cold weather, the higher strengths of Sulfuric Acid and Oleum congeal or crystallize. Before thawing is attempted, the consignee should test for this by working an iron or steel rod down through the discharge pipe as a frozen or otherwise plugged discharge pipe may be responsible for any difficulty encountered. If the product is crystallized, the rod will not reach the bottom of the tank.

FIGURE 4 — UNLOADING FROZEN ACID AND OLEUM

RECOMMENDED PIPING ARRANGEMENT WHEN TANK CAR IS HANDLED IN HEATED BUILDING IN ACCORDANCE WITH PARAGRAPH 10



One method of liquefying the product is to cover the tank car with a tarpaulin and place a perforated steam pipe between the rails under the car tank.

Another method of liquefying the product is by placing the tank car in a heated building and thawing the contents. If the building is heated by steam, piping should be laid preferably between the two railroad rails the entire length of the car tank. The Consignee should use the piping arrangement shown in Figure 1 throughout the heating operation to avoid possible tank damage from pressure and overflow of acid through dome fitting. If any of the above methods fail, consult your supplier for additional assistance.

If car is equipped with insulation and external coils, liquefying the product can be accomplished by making pipe connection for low pressure steam at the heater coil inlet pipes.

NEVER ATTEMPT TO THAW CONTENTS BY BUILDING A FIRE OR USING AN OPEN FLAME UNDER THE TANK CAR OR AROUND THE TANK:

(1) Because of the danger of explosion, and

(2) The Consignee will be responsible for all such fire damage.

7.6.12 Removal or Reversal of Placards

The four 10¾ x 10¾ inch ICC caution placards on sides and ends of the tank or car must be removed, or reversed (if in metal placard holders), by the party discharging the tank car.

The empty tank car must be offered to the receiving carrier either without placards, or preferably with four "Dangerous—Empty" placards. (See Sections 74.562 and 74.563 of Interstate Commerce Commission Regulations.)

7.6.13 Return of Empty Cars

Return empty tank cars as promptly as possible, in accordance with the shipping instructions received from the shipper. Shipper's routing instructions should always be strictly followed.

7.6.14 Internal Washing

Under no circumstances should water or other liquid be introduced into car tanks by consignee, nor should any employee be permitted to enter an empty tank car for any purpose whatsoever.

7.6.15 Discharge Line Between Tank Car and Storage

All pipe and fittings forming the delivery line between the tank car and storage tank should be of iron, steel, or other suitable material.

The minimum air pressure necessary for emptying a car tank depends upon the following:

(a) Specific gravity of the product

(b) Design of the delivery line

(c) Length of delivery line to the storage

(d) Height from a point on a plane with the bottom of the car tank to top of storage tank.

Corrosive liquids are usually of high specific gravity, and it is important that the delivery line be properly designed and maintained to insure against undue hazards. Exceptions involving the use of smaller than two-inch diameter pipe, or abnormal length or height of line, should be avoided. Careful consideration should be given to all new and existing delivery lines and storage tanks. Alterations should be made to insure unloading of tank cars with air pressure not exceeding 30 psi. This may involve:

(a) Utilizing an existing railway track

(b) Extending the present track

(c) Installing a new track, to permit moving the tank car closer to the storage tank.

If more than 30 psi air pressure is necessary to discharge contents to storage, an acid pump should be provided.

7.6.16 Damage to Exterior of Tank Car During Unloading

Damage to the paint, stencilled markings and tank metal by the product, in the form of a liquid or spray, is evidence to the shipper and consignee that unloading was permitted under conditions hazardous to employees and property.

Damage of this nature can usually be attributed to the following:

(a) Careless operation

(b) Defective fittings in consignee's delivery line

(c) Defective connection fittings on tank car

(d) Disconnecting delivery line from tank car before it has completely drained.

Any spillage on the exterior of the tank car should be promptly washed off with water to avoid damage and possible injury to persons handling car during course of return.

The Consignee is responsible for damage.

7.6.17 Service

Every effort is made by the shipper to insure loaded tank cars being in proper condition at time of shipment. This often includes application of a tank air test, after loading, to determine the tightness of tank, dome fittings, and gaskets. In the event a tank car is received with evidence of a leak or splashing through one of the dome fittings, the consignee should make repairs sufficient to unload the contents. In each such case, the shipper should be notified, given full particulars, describing the defect. This procedure will insure proper inspection and further repairs, as required, upon receipt of the tank car by the shipper.

7.7 SAMPLING OF PRODUCT

(a) A sample may be taken by filling a bottle of acid resistant material. This can be lowered into the acid by use of an iron rod with a slip-hold attachment.

NOTE: Do not use polyethylene sample bottles on acids of strengths 99% or greater, or on mixed acid. Glass is preferable.

(b) Alternatively, the introduction of a tee and sampling valve at any desired point in the unloading line to the storage tank will permit easy withdrawal of samples. The sample valve on unloading line should be flushed, as it may well contain contamination not representative of the tank truck or tank car's contents.

7.8 STORAGE TANKS

Sulfuric acid, which attacks most metals, can be stored satisfactorily in tanks of material similar to that permitted for shipping containers. Steel is not satisfactory for all strengths.

7.9 SPENT ACIDS

Many of the spent acids, especially sludge acids, emit fumes when agitated by being dumped into a tank car or tank truck. These fumes, depending on the origin of the acid, can either be hydrocarbons or sulfur dioxide. Conditions have been encountered where personnel were apparently severely affected by inhalation of the fumes. Employee training should include these factors and efforts to minimize such exposures may include:

(a) Loading through a drop pipe to the bottom of the tank to minimize agitation and aeration, and/or

(b) Use of a fume hood attached to a suitable exhauster. Some spent acids will foam when agitated. This can result in overflow of an otherwise only partially filled tank. Foaming problems can be handled by providing surge tanks, or overflow lines.

In process, separation of spent acids from oil or hydrocarbon may be incomplete. This is especially true of alkylation acid, and can result in creation of an explosive atmosphere in and around a vessel.

These factors should be considered both in loading and unloading tank cars and tank trucks. Frequent tests with a combustible gas indicator should be made, and tank cars and trucks should be grounded before loading or unloading. The possible deleterious effect of an acid vapor atmosphere on the combustible gas indicator should be considered.

Pumping is preferred by many as the safest method of handling spent acids though bottom or gravity unloading of tank motor vehicles is authorized by the ICC. Air blowing is not recommended because agitation of spent acids containing hydrocarbons may create, or add to possibilities of explosive mixtures. Also, the use of air may cause emission of fumes, creating a breathing hazard. In addition to frequent tests with a combustible gas indicator, equipment to protect against breathing fumes or vapors may be required.

Safety showers supplying warmed water are preferred for the removal of sludge acid from the skin. (See 5.2, Safety Showers and Eye Wash Fountains.)

7.10 LEAKS AND SPILLS

In manufacturing or handling sulfuric acid, any leak occurring in pipe lines or equipment should be considered as an acid leak and treated accordingly with extreme caution until proven to be otherwise. A contaminated area should be immediately zoned off to avoid anyone being exposed to the acid spray or stream, and applicable valves adjusted to isolate the system and stop further leakage. The contaminated area should be thoroughly flushed down with copious quantities of water and soda ash or lime spread around to neutralize any remaining acidity on the surface of the ground or concrete pad as the case may be.

If water is not available, the contaminated area should be covered with sand, ashes or gravel and acidity neutralized with soda ash or lime.

If the acid leak or spill is of sufficient quantity to contaminate the sewer system, soda ash or other alkaline material should be added to neutralize the acidity.

A water hose should be readily available when repairs to pipe lines or equipment are being made.

Employees should wear personal protective equipment (see 5.4) as required by the circumstances.

Sulfuric acid leaks, spills, or drainings must not come in contact with any sulfide wastes, such as in sewers, because of the danger of evolving hydrogen sulfide gas.

8. TANK AND EQUIPMENT CLEANING AND REPAIRS

(See MCA Safety Guide, SG-10)

8.1 PREPARATION OF TANKS AND EQUIPMENT

(a) The hazardous nature of tank inspection, cleaning or repairs, requires that the supervisor and crew be selected, trained and drilled carefully. They should be thoroughly familiar with the hazards, and the safeguards necessary for the safe performance of the work. All tank work should be done under the direct supervision of a foreman.

(b) Wherever possible enclosures should be cleaned from the outside, using clean-out doors.

(c) Pipelines, including vent lines, into or out of the tank or other apparatus should be shut off, disconnected, preferably by removing a complete small section and installing a blind flange on the open end to protect against human error and unsuspected leaks. Valves, cocks and blind flanges IN the pipeline should not be relied on.

(d) Warning signs should be displayed to indicate when employees are in the tank or other apparatus.

(e) Be sure the tank can be left by the original entrance.

(f) All fuses or safety jacks must be pulled, switches tagged off and locked out with multiple locks on agitators, pumps or any other power driven equipment. Belts must be removed on multiple line shaft driven equipment.

(g) Drain the tank as completely as possible.

(h) Wash thoroughly with large quantities of running water any sludge and residues that cannot be drained; add soda ash or lime in sufficient quantity to neutralize any residual acid; fill the tank COMPLETELY with water and drain out.

(i) A constant source of fresh air, introduced in such a manner as to insure a complete air change, must be provided.

(j) Use proper protective equipment. (See 5.3)

8.2 ENTERING TANK

(a) Before entering a tank and during the course of the work, tests should be made by a qualified person to determine that no further washing is necessary, that no oxygen deficiency exists, and that no harmful gas or vapor is present.

(b) Before directing men to enter a tank, an inspection of the interior should be made by the supervisor, who should be equipped with a supplied-air respirator or self-contained breathing apparatus, together with rescue harness and life line.

(c) One man on the outside of the tank should keep the men in the tank under constant observation during inspection and performance of work. At least two other men should be available to aid in rescue if any of those in the tank are overcome.

(d) Only authorized persons should be permitted to enter a tank or vessel.

(e) A supplied-air respirator or self-contained breathing apparatus, together with rescue harness and life line, should be located outside the tank entrance. This equipment should be used for rescue, regardless of the type of respiratory protection or air supply which is provided for employees inside the tank.

(f) In addition to protecting the employees actually engaged in cleaning and repairing the tank, attention should be paid to the protection of workers in nearby areas. Where there is a hazard of objects falling from overhead, barricades should be erected, with appropriate warning signs.

(g) The portable electric lights and power tools should be of the three-wire grounded, explosion-proof type approved for use in hazardous locations. They should be maintained in excellent condition.

8.3 EMERGENCY RESCUE

Under no circumstances should a rescuer enter a tank to remove a victim of over-exposure without proper respiratory protection, a safety harness and an attached life line. The end of the life line should be manned by an attendant located outside the tank. This end of the life line should be secured so that it cannot be pulled into the tank inadvertently.

Another attendant should be immediately available to assist in the rescue if needed. The rescuer should be in view of the outside attendant at all times or in constant communication with him.

Emergency procedures should be established for summoning ambulance, physician, or other agency promptly, so that such assistance will be en route to the location before the rescue is accomplished.

8.4 EXTERIOR REPAIR WORK

All outside welding or burning on tanks or equipment which have contained sulfuric acid should be done only after such containers have been thoroughly purged, due to the possible hazard of hydrogen being present. Steam or inert gas may be used for purging when outside welding or burning work is scheduled.

In all cases, if repair work is interrupted, the tank atmosphere should be checked thoroughly and a new work permit issued before resumption of work.

9. WASTE DISPOSAL

9.1 All local and state regulations concerning waste disposal to streams, municipal treatment plants or impounding basins should be determined and followed.

9.2 Sulfuric Acid is corrosive to most sewer construction materials. When neutralized and in dilute solution, there is no evidence of corrosivity, toxicity, or taste and odor problems in disposal to a municipal treatment plant or a stream. The preferred neutralizing agents are lime and soda ash. Limestone may be used but when acid strength is high an insoluble coating will form on the surface of the stone reducing its activity. The reaction with limestone and soda ash releases carbon dioxide and ventilation is required in certain cases. For continuous waste neutralization an effluent holding basin may be required to settle out suspended calcium sulfate and other insoluble salts. For more details on neutralization, see MCA Manual Sheet W-3 on Neutralization of Acidic and Alkaline Plant Effluents.

9.3 In neutralized, diluted form (such as sodium sulfate or calcium sulfate), it may be safely sewered to a municipal sewage treatment plant. Restrictions on quantities that may be sewered are matters of agreement with the treatment plant. Presence of high concentrations of sulfates in total influent to sewage plants employing anaerobic treatment could result in somewhat more H_2S production than normal due to partial degradation of some of the sulfate ion in the anaerobic process. Calcium sulfate contributes to permanent hardness in water which would be unaffected by the treatment process.

9.4 Disposal of neutralized solutions of sulfuric acid to a watercourse is dependent upon the assimilative capacity of the stream. The only effects upon the stream would be those of adding dissolved solids and hardness (if calcium sulfate) to the river water provided existing concentrations in the river water are below those of the discharge. Degree of increase would depend upon dilution ratio of river flow to discharge rate which is usually sufficiently high to make any effects insignificant. In cases where river water is quite alkaline and highly buffered, direct discharge of dilute solutions of sulfuric acid without neutralization could prove beneficial in neutralizing excess alkalinity in the stream. Method of disposal and quantity of discharges are subject to the approval of the applicable control authority.

9.5 Impounding of unneutralized sulfuric acid wastes in lagoons may be allowable in certain areas where soils are sufficiently alkaline and where no contamination of a drinking water supply might result. Such disposal would depend upon quantity of acid wastes involved. Area and state pollution control laws and regulations would dictate whether approval of control authority was required. Generally speaking, however, such disposal comes under the jurisdiction of control authorities in most states.

10. MEDICAL MANAGEMENT

10.1 HEALTH HAZARDS

10.1.1 **General**

On contact with the skin or eyes, sulfuric acid produces severe burns. Inhalation of concentrated vapor or mist from hot acid or oleum may be injurious to the lung. Swallowing may cause severe injury or death.

10.1.2 **Acute Toxicity**

10.1.2.1 *Systemic Effects*

No systemic effects are noted except those due to the irritating or corrosive character of the material.

10.1.2.2 *Local Effects*

Sulfuric acid is dangerous when improperly handled. Concentrated solutions are rapidly destructive to any body tissues with which they come in contact. Repeated contact with diluted solutions may cause a dermatitis.

Contact with the eyes very rapidly causes severe damage which may be followed by total loss of sight.

Inhalation of concentrated vapor or mist from hot acid or oleum will cause damage to the upper respiratory tract and even to the lung tissue proper.

10.1.3 **Chronic Toxicity**

10.1.3.1 *Systemic Effects*

No systemic effects are noted, except those secondary to tissue damage. These can be prevented by proper handling and use of the material, and minimized by prompt first-aid measures.

10.1.3.2 *Local Effects*

Repeated contact with dilute solutions may cause skin irritation. Repeated inhalation of mist may cause an inflammation of the upper and lower respiratory tract.

10.2 PREVENTIVE HEALTH MEASURES

Sulfuric acid is not a serious industrial hazard if workers are adequately instructed and supervised in the proper means of handling the chemical. Contact with the skin and eyes as well as the inhalation of vapors or mists should be avoided. A threshold limit value of 1 mg/m^3 has been suggested as the safe concentration for an eight-hour exposure.

10.2.1 Personal Hygiene

Properly designed emergency showers and eye baths should be placed in convenient locations wherever sulfuric acid is used. All employees should know the location and operation of such equipment. It must be frequently inspected to make sure it is in proper working condition.

Personal protective equipment for workers who are exposed to contact with sulfuric acid is described in 5.3.

10.2.2 Physical Examination

10.2.2.1 *Preplacement Examinations*

It may be desirable to exclude from potential exposure to sulfuric acid, prospective employees with the following conditions:

(a) Those with only one functioning eye.

(b) Those with uncorrected, severe faulty vision.

(c) Those who have chronic diseases of the upper respiratory tract or lung.

(d) Those with severe pre-existing skin lesions.

10.2.2.2 *Periodic Health Examinations*

No specific type of periodic health examination is needed.

10.3 SUGGESTIONS TO PHYSICIANS

10.3.1 General

Treatment is symptomatic and no specific antidotes are known. Because there is no specific known antidote for sulfuric acid, effective and immediate relief of symptoms is the primary goal of medical management.

10.3.2 Oxygen Administration

Oxygen has been found useful in the treatment of sulfuric acid inhalation exposures. In most exposures, administration of 100 per cent oxygen at atmospheric pressures has been found to be adequate. This is best accomplished by use of a face mask having a reservoir bag of the non-rebreathing type. Inhalation of 100 per cent oxygen should not exceed one hour of continuous treatment. After each hour therapy should be interrupted. It may be reinstituted as the clinical condition indicates.

Some believe that superior results are obtained when exposures are treated with oxygen under an exhalation pressure not exceeding 4 cm water. Masks providing for such exhalation pressures are obtainable. A single treatment may suffice for minor exposures. It is believed by some observers that oxygen under pressure is useful as an aid in the prevention of pulmonary edema after breathing irritants.

In the event of an exposure causing symptoms or in the case of a history of severe exposure, the patient may be treated with oxygen under 4 cm exhalation pressure for one-half hour periods out of every hour. Treatment may be continued in this way until symptoms subside or other clinical indications for interruption appear.

11. FIRST AID

11.1 GENERAL PRINCIPLES

Speed in removing sulfuric acid is of primary importance. It is important to remove the patient from a contaminated area as soon as possible.

11.2 CONTACT WITH SKIN AND MUCOUS MEMBRANE

Immediate removal by the use of large amounts of water is urgent. If the skin contact is extensive and an emergency shower is available, the employee should get under the show immediately. Clothes can be removed while under the shower. In other instances, flushing with large amounts of running water together with soap and water washing should be continued for at least fifteen minutes. It is important to remove all clothing including shoes, socks, etc., which may be contaminated. Subsequent medical treatment is the same as for thermal burns.

11.3 CONTACT WITH EYES

If even small amounts of sulfuric acid enter the eyes, they should be irrigated immediately with large amounts of water for a minimum of fifteen minutes. This can be done with an eye bath, if available, a gentle stream of water from a hose, or by pouring water from any clean container. The eyelids should be held apart during the irrigation to insure contact of water with all of the tissues of the surface of the eyes and lids. If pain is still present after the first fifteen-minute period of irrigation, the irrigation should be continued for fifteen minutes longer. It is permissible as a first-aid measure to instill two or three drops of an effective aqueous local eye anesthetic for relief of pain. If this is done, cover the eye with a patch. No oils or oily ointments should be instilled. The employee should be sent to a physician, preferably an eye specialist, as promptly as possible after the irrigation has been completed.

11.4 TAKEN INTERNALLY

If a person has swallowed any sulfuric acid, he should drink large amounts of water immediately in order to reduce the concentration of chemical. Medical attention should, of course, be obtained immediately.

11.5 INHALATION

11.5.1 General

If a worker has been exposed to sulfuric acid mist or to the vapors arising from oleum or hot sulfuric acid, he should be at once removed to an uncontaminated area and a physician called. He should be kept under observation until the possibility of developing a delayed pulmonary reaction is no longer present. If oxygen inhalation apparatus is available, oxygen may be administered but only by a person authorized by a physician.

11.5.2 Artificial Respiration

If breathing has apparently ceased, artificial respiration should be started immediately. Have someone call a physician immediately.

OTHER CHEMICAL SAFETY DATA SHEETS AVAILABLE

(Date of latest available edition, as of December 1976, given in parentheses)

Acetaldehyde	(1952)	SD-43
Acetic Acid	(1973)	SD-41
Acetic Anhydride	(1962)	SD-15
Acetone	(1962)	SD-87
Acetylene	(1957)	SD-7
Acrolein	(1961)	SD-85
Acrylonitrile	(1974)	SD-31
Allyl Chloride	(1973)	SD-99
Aluminum Chloride	(1956)	SD-62
Ammonia Anhydrous	(1960)	SD-8
Ammonia Aqua	(1947)	SD-13
Ammonium Dichromate	(1952)	SD-45
Aniline	(1963)	SD-17
Antimony Trichloride (Anhydrous)	(1957)	SD-66
Arsenic Trioxide	(1956)	SD-60
Benzene	(1960)	SD-2
Benzoyl Peroxide	(1960)	SD-81
Benzyl Chloride	(1974)	SD-69
Bromine	(1968)	SD-49
Butadiene	(1974)	SD-55
n-Butyllithium in Hydrocarbon Solvents	(1966)	SD-91
Butyraldehydes	(1960)	SD-78
Calcium Carbide	(1967)	SD-23
Carbon Disulfide	(1967)	SD-12
Carbon Tetrachloride	(1963)	SD-3
Caustic Potash	(1968)	SD-10
Caustic Soda	(1974)	SD-9
Chloroform	(1974)	SD-89
Chlorosulfonic Acid	(1968)	SD-33
Chromic Acid	(1952)	SD-44
Cresol	(1952)	SD-48
Cyclohexane	(1957)	SD-68
o-Dichlorobenzene	(1974)	SD-54
Diethylamine	(1971)	SD-97
Diethylenetriamine	(1959)	SD-76
Dimethyl Sulfate	(1966)	SD-19
Dinitrotoluenes	(1966)	SD-93
Ethyl Acetate	(1972)	SD-51
Ethyl Chloride	(1953)	SD-50
Ethyl Ether	(1965)	SD-29
Ethylene	(1973)	SD-100
Ethylene Dichloride	(1971)	SD-18
Ethylene Oxide	(1971)	SD-38
Formaldehyde	(1960)	SD-1
Hydrochloric Acid	(1970)	SD-39
Hydrocyanic Acid	(1961)	SD-67
Hydrofluoric Acid	(1970)	SD-25
Hydrogen Peroxide	(1969)	SD-53
Hydrogen Sulfide	(1968)	SD-36
Isopropyl Alcohol	(1972)	SD-98
Isopropylamine	(1959)	SD-72
Lead Oxides	(1956)	SD-64
Maleic Anhydride	(1974)	SD-88
Methanol	(1970)	SD-22
Methyl Acrylate and Ethyl Acrylate	(1960)	SD-79
Methylamines	(1955)	SD-57
Methyl Bromide	(1968)	SD-35
Methyl Chloride	(1970)	SD-40
Methylene Chloride	(1962)	SD-86
Methyl Ethyl Ketone	(1961)	SD-83
Mixed Acid	(1974)	SD-65
Naphthalene	(1956)	SD-58
Nitric Acid	(1961)	SD-5
Nitric-Sulfuric Acid Mixtures	(1974)	SD-65
paraNitroaniline	(1966)	SD-94
Nitrobenzene	(1967)	SD-21
Nitrocellulose (Wet Types)	(1970)	SD-96
Ortho-Dichlorobenzene	(1974)	SD-54
Paraformaldehyde	(1974)	SD-6
Perchloroethylene	(1971)	SD-24
Perchloric Acid Solution	(1965)	SD-11
Phenol	(1964)	SD-4
Phosgene	(1967)	SD-95
Phosphoric Acid	(1958)	SD-70
Phosphoric Anhydride	(1974)	SD-28
Phosphorus, Elemental	(1976)	SD-16
Phosphorus Oxychloride	(1968)	SD-26
Phosphorus Pentasulfide	(1958)	SD-71
Phosphorus Trichloride	(1972)	SD-27
Phthalic Anhydride	(1956)	SD-61
Propylene	(1974)	SD-59
Sodium Chlorate	(1952)	SD-42
Sodium Cyanide	(1967)	SD-30
Sodium, Metallic	(1974)	SD-47
Sodium and Potassium Dichromates	(1952)	SD-46
Styrene Monomer	(1971)	SD-37
Sulfur	(1959)	SD-74
Sulfur Chlorides	(1960)	SD-77
Sulfur Dioxide	(1953)	SD-52
Sulfur Trioxide	(1976)	SD-101
Sulfuric Acid	(1963)	SD-20
Tetrachloroethane	(1949)	SD-34
Toluene	(1956)	SD-63
Toluene Diisocyanate	(1971)	SD-73
Toluidine	(1961)	SD-82
1, 1, 1-Trichloroethane	(1965)	SD-90
Trichloroethylene	(1956)	SD-14
Vinyl Acetate	(1970)	SD-75

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BETZ
TREVOSE, PENNSYLVANIA 19047

MATERIAL SAFETY DATA SHEET

DATE: Revised November, 1979

Information on this form is furnished solely for the purpose of compliance with the Occupational Safety and Health Act of 1970 and shall not be used for any other purpose. Use or dissemination of all or any part of this information for any other purpose may result in a violation of law or constitute grounds for legal action.

1.

MANUFACTURER'S NAME Betz Laboratories, Inc.	EMERGENCY TELEPHONE NO. 215: 355-3300
ADDRESS (Number, Street, City, State and ZIP Code) 4636 Somerton Road, Trevose, PA 19047	
CHEMICAL NAME AND SYNONYMS	TRADE NAME AND SYNONYMS Betz 2040
CHEMICAL FAMILY	FORMULA A blended product

2. HAZARDOUS INGREDIENTS

PAINTS, PRESERVATIVES, & SOLVENTS	%	TLV (Units)	ALLOYS AND METALLIC COATINGS	%	TLV (Units)
PIGMENTS			BASE METAL		
CATALYST			ALLOYS		
VEHICLE			METALLIC COATINGS		
SOLVENTS			FILLER METAL PLUS COATING OR CORE FLUX		
ADDITIVES			OTHERS		
OTHERS					

GENERIC DESCRIPTION	%	TLV (Units)
An aqueous solution of organic and inorganic phosphates,		
a triazole derivative and caustic potash.		

3. PHYSICAL DATA

		Viscosity 70 F	14 cps
BOILING POINT (F.)	N.D.	SPECIFIC GRAVITY (H_2O=1) 70 F	1.457
VAPOR PRESSURE (mm Hg.)	N.D.	PERCENT, VOLATILE BY VOLUME (%)	N.D.
VAPOR DENSITY (AIR=1)	N.D.	EVAPORATION RATE (ether =1)	1
SOLUBILITY IN WATER	Complete	pH (Undiluted)	12.5
APPEARANCE AND ODOR	Clear, amber liquid- mild odor		

4. FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method used)	FLAMMABLE LIMITS	Lel	Uel
Open and Closed cup > 200 F	never determined		

EXTINGUISHING MEDIA
Water, water spray, dry chemical or carbon dioxide.

SPECIAL FIRE FIGHTING PROCEDURES
Keep drums cooled with water if in the area of a fire

UNUSUAL FIRE AND EXPLOSION HAZARDS
None

5. HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE
Never established for the product.

EFFECTS OF OVEREXPOSURE
May cause eye irritations and skin burns.

EMERGENCY AND FIRST AID PROCEDURES
Skin contact - Wash well with soap and water. Eye contact - Flush thoroughly and promptly with clear water. In case of ingestion or eye contact, immediately contact physician.

6. REACTIVITY DATA

STABILITY	UNSTABLE		CONDITIONS TO AVOID
	STABLE	X	

INCOMPATABILITY (Materials to avoid)
Do not mix directly with acidic materials. Use only steel or PVC in feed system.

HAZARDOUS DECOMPOSITION PRODUCTS
On complete decomposition primarily oxides of phosphorous would be emitted.

HAZARDOUS POLYMERIZATION	MAY OCCUR		CONDITIONS TO AVOID
	WILL NOT OCCUR	X	

7. SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED
Wash down with copious amounts of water for disposal in sanitary sewer or waste treatment facility.

WASTE DISPOSAL METHOD
Small quantities may be diluted with copious amounts of water for disposal in sanitary sewer or waste treatment facility. Large quantities may best be handled through an approved chemical disposal service.

8. SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (Specify type)
None required, but avoid inhalation of any fumes.

VENTILATION Normal	LOCAL EXHAUST	SPECIAL
	MECHANICAL (General)	OTHER

PROTECTIVE GLOVES Rubber gloves	EYE PROTECTION Goggles or face shield

OTHER PROTECTIVE EQUIPMENT
Use any equipment necessary to protect against the hazards stated on the label.

9. SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING Remove contaminated clothing and wash before reuse. Store in dry place. Keep container covered. Protect from freezing. If frozen, thaw completely and mix prior to use.

OTHER PRECAUTIONS
Product is for industrial use only and use only as directed for a specific application Do not take internally.

While the information and recommendations set forth herein are believed to be accurate as of the date hereof, BETZ LABORATORIES, INC. MAKES NO WARRANTY WITH RESPECT THERETO AND DISCLAIMS ALL LIABILITY FROM RELIANCE THEREON.

BETZ
TREVOSE, PENNSYLVANIA 19047

MATERIAL SAFETY DATA SHEET

Revised
DATE: March, 1980

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1.

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EMERGENCY TELEPHONE NO.: 215: 355-3300
ADDRESS (Number, Street, City, State and ZIP Code): 4636 Somerton Rd., Trevose, PA 19047
CHEMICAL NAME AND SYNONYMS:
TRADE NAME AND SYNONYMS: Betz 2020
CHEMICAL FAMILY:
FORMULA: A blended product

2. HAZARDOUS INGREDIENTS

PAINTS, PRESERVATIVES, & SOLVENTS	%	TLV (Units)	ALLOYS AND METALLIC COATINGS	%	TLV (Units)
PIGMENTS			BASE METAL		
CATALYST			ALLOYS		
VEHICLE			METALLIC COATINGS		
SOLVENTS			FILLER METAL PLUS COATING OR CORE FLUX		
ADDITIVES			OTHERS		
OTHERS					

GENERIC DESCRIPTION	%	TLV (Units)
An aqueous solution of low molecular weight hydroxylated polymer.		

3. PHYSICAL DATA

Viscosity 70F 7.1 cps

BOILING POINT (F.)	*N. D.	SPECIFIC GRAVITY (H_2O=1)	70F	1.114
VAPOR PRESSURE (mm Hg.) 22° C	19.4-19.7	PERCENT, VOLATILE BY VOLUME (%)		N. D.
VAPOR DENSITY (AIR=1)	< 1	EVAPORATION RATE (ether =1)		< 1
SOLUBILITY IN WATER	Complete	pH (Undiluted)		5.3

APPEARANCE AND ODOR: Clear; may vary from water white through amber
Mild to pungent odor

4. FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method used): Open and Closed cup > 200F
FLAMMABLE LIMITS: Never determined Lel: Uel:
EXTINGUISHING MEDIA: Water, water spray, dry chemical or carbon dioxide.
SPECIAL FIRE FIGHTING PROCEDURES: Keep drums cooled with water if in the area of a fire.
UNUSUAL FIRE AND EXPLOSION HAZARDS: None

* Never determined

ENG 207A 7509

5. HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE
Never established for the product.

EFFECTS OF OVEREXPOSURE
May cause skin and eye irritation.

EMERGENCY AND FIRST AID PROCEDURES
Skin contact - Wash well with soap and water. Eye contact - Flush thoroughly and promptly with clear water. In case of ingestion or eye contact, immediately contact physician.

6. REACTIVITY DATA

STABILITY	UNSTABLE		CONDITIONS TO AVOID
	STABLE	X	

INCOMPATABILITY (Materials to avoid)
Avoid use of mild steel tanks, pumps and piping in the feed system.

HAZARDOUS DECOMPOSITION PRODUCTS
On complete decomposition oxides of carbon would be emitted.

HAZARDOUS POLYMERIZATION	MAY OCCUR		CONDITIONS TO AVOID
	WILL NOT OCCUR	X	

7. SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED
Wash down with copious amounts of water for disposal in sanitary sewer or waste treatment facility. Large spills may be absorbed on inert material for disposal by approved incineration.

WASTE DISPOSAL METHOD
Small quantities may be diluted with copious amounts of water for discharge to sanitary sewer or waste treatment facility. Large quantities may be absorbed on inert material for approved incineration or may be sent to an approved chemical waste disposal operator.

8. SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (Specify type)
None required, but avoid inhalation of any fumes.

VENTILATION	LOCAL EXHAUST	SPECIAL
Adequate	MECHANICAL (General)	OTHER

PROTECTIVE GLOVES Rubber gloves recommended	EYE PROTECTION Goggles or face shield recommended

OTHER PROTECTIVE EQUIPMENT
Use any equipment necessary to protect against any hazards stated on the label.

9. SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING Remove contaminated clothing and wash before reuse. Store in dry place. Keep container covered. Protect from freezing although material becomes homogeneous even after several freeze/thaw cycles.

OTHER PRECAUTIONS
Product may darken in storage but retains effectiveness. Product is for industrial use only and should be used only as directed. Do not take internally.

While the information and recommendations set forth herein are believed to be accurate as of the date hereof, BETZ LABORATORIES, INC. MAKES NO WARRANTY WITH RESPECT THERETO AND DISCLAIMS ALL LIABILITY FROM RELIANCE THEREON.

U.S. DEPARTMENT OF LABOR
Occupational Safety and Health Administration

Form Approved
OMB No. 44-R1387

MATERIAL SAFETY DATA SHEET

Required under USDL Safety and Health Regulations for Ship Repairing,
Shipbuilding, and Shipbreaking (29 CFR 1915, 1916, 1917)

SECTION I

MANUFACTURER'S NAME Unichem International, Inc.	**EMERGENCY TELEPHONE NO.** 505/393-7751
ADDRESS *(Number, Street, City, State, and ZIP Code)* P.O. Box 1499, Hobbs, NM 88240	
CHEMICAL NAME AND SYNONYMS Chlorine	**TRADE NAME AND SYNONYMS**
CHEMICAL FAMILY Halogen Gas	**FORMULA** Cl_2

SECTION II - HAZARDOUS INGREDIENTS

PAINTS, PRESERVATIVES, & SOLVENTS	%	TLV (Units)	ALLOYS AND METALLIC COATINGS	%	TLV (Units)
PIGMENTS			BASE METAL		
CATALYST			ALLOYS		
VEHICLE			METALLIC COATINGS		
SOLVENTS			FILLER METAL PLUS COATING OR CORE FLUX		
ADDITIVES			OTHERS		
OTHERS					

HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES	%	TLV (Units)
Chlorine	100	1ppm

SECTION III - PHYSICAL DATA

BOILING POINT (°F.)	-29.29°F	SPECIFIC GRAVITY (H_2O=1) at 32°F	1.47
VAPOR PRESSURE (mm Hg.) at 68°F	4800	PERCENT, VOLATILE BY VOLUME (%)	gas
VAPOR DENSITY (AIR=1) at 32°F	2.48	EVAPORATION RATE (________ =1)	gas
SOLUBILITY IN WATER slightly			
APPEARANCE AND ODOR Greenish-yellow gas or liquid - suffocating odor			

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method used) non-flammable	FLAMMABLE LIMITS N/A	Lel	Uel

EXTINGUISHING MEDIA

SPECIAL FIRE FIGHTING PROCEDURES In case of fire, remove all chlorine containers away from fire zone. If they cannot be moved, keep containers cool by applying water.

UNUSUAL FIRE AND EXPLOSION HAZARDS Chlorine is a powerful oxidizing agent. Wear SCBA.

(Continued on reverse side)

SECTION V - HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE 1 ppm/3 mg/m^3

EFFECTS OF OVEREXPOSURE
Chlorine vapor strongly irritates the mucous membranes, the respiratory system and the skin. Strong concentrations irritate the eyes and causes coughing and labored breathing.

EMERGENCY AND FIRST AID PROCEDURES
Liquid chlorine may cause skin and eye burns on contact. Remove victim to fresh air at once. Administer artificial respiration if necessary. Wash affected skin or eyes with water for at least 15 minutes. See a physician immediately.

SECTION VI - REACTIVITY DATA

STABILITY	UNSTABLE		CONDITIONS TO AVOID
	STABLE	X	

INCOMPATABILITY *(Materials to avoid)*
Hydrogen, finely divided metals, oxides, (combines readily with all materials except rare ga[illegible]e and nitrogen

HAZARDOUS DECOMPOSITION PRODUCTS

HAZARDOUS POLYMERIZATION	MAY OCCUR		CONDITIONS TO AVOID
	WILL NOT OCCUR	X	

SECTION VII - SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED
Clear contaminated area of personnel. Stay up wind. Only specially trained and equipped men should be allowed in area. Close and tighten all valves. If container wall is leaking turn container on side so that gas and not liquid will escape. Do not use water on leak.

WASTE DISPOSAL METHOD Follow all applicable federal, state and local regulations regarding health and safety and natural resource pollution.

SECTION VIII - SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION *(Specify type)*
Supplied air, SCBA or canister gas mask depending upon concentration of vapors.

VENTILATION	LOCAL EXHAUST	SPECIAL
	MECHANICAL *(General)* In case of leak only - 1-4 minute rate of change.	OTHER

PROTECTIVE GLOVES Protection from extreme cold from liquid	EYE PROTECTION Chemical splash goggles

OTHER PROTECTIVE EQUIPMENT

SECTION IX - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING
Store containers in cool, dry, relatively isolated areas, protected from weather and extreme temperature changes. Store containers off floor or ground.

OTHER PRECAUTIONS

BETZ
TREVOSE, PENNSYLVANIA 19047

MATERIAL SAFETY DATA SHEET

DATE: Revised November, 1980

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1.

MANUFACTURER'S NAME Betz Laboratories, Inc.	EMERGENCY TELEPHONE NO. 215: 355-3300
ADDRESS (Number, Street, City, State and ZIP Code) 4636 Somerton Rd., Trevose, PA 19047	
CHEMICAL NAME AND SYNONYMS DBNPA	TRADE NAME AND SYNONYMS Slimicide 508
CHEMICAL FAMILY Organic Bromine	FORMULA A blended product

2. HAZARDOUS INGREDIENTS

PAINTS, PRESERVATIVES, & SOLVENTS	%	TLV (Units)	ALLOYS AND METALLIC COATINGS	%	TLV (Units)
PIGMENTS			BASE METAL		
CATALYST			ALLOYS		
VEHICLE			METALLIC COATINGS		
SOLVENTS			FILLER METAL PLUS COATING OR CORE FLUX		
ADDITIVES			OTHERS		
OTHERS					

HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES	%	TLV (Units)
2,2 -Dibromo-3-nitrilopropionamide	20	
Polyethylene glycol approx.	50	
Water approx.	30	

3. PHYSICAL DATA

BOILING POINT (F.) decomposes	> 120°C	SPECIFIC GRAVITY (H_2O=1) 60F	1.265
VAPOR PRESSURE (mm Hg.)	N. D.	PERCENT, VOLATILE BY VOLUME (%)	N. D.
VAPOR DENSITY (AIR=1)	N. D.	EVAPORATION RATE (ether =1)	< 1
SOLUBILITY IN WATER	completely miscible	pH (5%)	3.7
APPEARANCE AND ODOR Clear yellow liquid			

4. FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method used) TAG open cup >200F TAG cc >200F	FLAMMABLE LIMITS never determined	Lel	Uel

EXTINGUISHING MEDIA
Water fog, alcohol foam or dry chemical

SPECIAL FIRE FIGHTING PROCEDURES

Wear self-contained breathing apparatus and goggles.

UNUSUAL FIRE AND EXPLOSION HAZARDS

None to our knowledge in drum quantities and containers.

5. HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE
Moderate to high single dose oral toxicity; LD50 (Rat) 126 mg/kg

EFFECTS OF OVEREXPOSURE
Causes severe eye irritation and damage. Causes skin irritation and may cause chemic burn with prolonged or repeated exposure.

EMERGENCY AND FIRST AID PROCEDURES
Eyes: Immediately flush with flowing water for 15 min. & obtain medical aid. Skin: Immediately flush with flowing water for 15 min. while removing contaminated clothing & shoes. Ingestion: If swallowed, immediately give large amounts of water (or milk), then induce vomiting and call physician.

6. REACTIVITY DATA

STABILITY	UNSTABLE		CONDITIONS TO AVOID Temperatures above 60°C.
	STABLE	X	

INCOMPATABILITY (Materials to avoid)
For storage stability avoid water and bases.

HAZARDOUS DECOMPOSITION PRODUCTS
Gases formed above 120°C: Methyl bromide, ethyl bromide, hydrogen cyanide, nitric oxide.
Cyanogen bromide in vapor space of drums.

HAZARDOUS POLYMERIZATION	MAY OCCUR		CONDITIONS TO AVOID
	WILL NOT OCCUR	X	

7. SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED
Use proper protective equipment. Contain spill; soak up with absorbant material; to hasten degradation of solution add an excess of soda ash or other alkaline material and maintain solution pH at 8.1 or higher for at least 18 hrs. before disposing of it.

WASTE DISPOSAL METHOD
Pesticide or rinsate that cannot be used or chemical reprocessed should be disposed of in a landfill approved for pesticides or buried in a safe place away from water supplies.

8. SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (Specify type) Organic vapor - acid respirator (American Optical Shurgard R-5053-Cartridge R-53)

VENTILATION	LOCAL EXHAUST	SPECIAL
Adequate	MECHANICAL (General)	OTHER Adequate ventilation required when opening drums.

PROTECTIVE GLOVES Rubber gloves	EYE PROTECTION Goggles or face shield

OTHER PROTECTIVE EQUIPMENT
Use any covering clothing necessary to protect against hazards recited on label.

9. SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING
Avoid breathing mists if generated. Prevent eye contact. Avoid all skin contact. Keep container tightly closed when not in use. Protect from freezing.

OTHER PRECAUTIONS
Do not reuse empty drums; empties should be disposed of properly. Use material only as directed for the specific application.

BETZ®
TREVOSE, PENNSYLVANIA 19047

MATERIAL SAFETY DATA SHEET

Revised
DATE: April, 1981

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1.

MANUFACTURER'S NAME Betz Laboratories, Inc.	EMERGENCY TELEPHONE NO. 215: 355:3300
ADDRESS (Number, Street, City, State and ZIP Code) 4636 Somerton Rd., Trevose, PA 19047	
CHEMICAL NAME AND SYNONYMS	TRADE NAME AND SYNONYMS Slimicide C-30
CHEMICAL FAMILY	FORMULA A proprietary material

2. HAZARDOUS INGREDIENTS

PAINTS, PRESERVATIVES, & SOLVENTS	%	TLV (Units)	ALLOYS AND METALLIC COATINGS	%	TLV (Units)
PIGMENTS			BASE METAL		
CATALYST			ALLOYS		
VEHICLE			METALLIC COATINGS		
SOLVENTS			FILLER METAL PLUS COATING OR CORE FLUX		
ADDITIVES			OTHERS		
OTHERS					

HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES	%	TLV (Units)
Bis(trichloromethyl) sulfone	20.0	
Methylene bisthiocyanate	5.0	
Inert ingredients	75.0	
EPA Reg. No. 3876-61		

3. PHYSICAL DATA

BOILING POINT (F.)	> 212	SPECIFIC GRAVITY (H_2O=1) 62F	1.074
VAPOR PRESSURE (mm Hg.) @ 72F	8.2	PERCENT, VOLATILE BY VOLUME (%)	never determined
VAPOR DENSITY (AIR=1)	> 1	EVAPORATION RATE (ether =1)	< 1
SOLUBILITY IN WATER	Moderate	pH (5% solution)	4.1
APPEARANCE AND ODOR	Straw colored liquid-hydrocarbon odor (Lachrymator)		

4. FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method used) 169F open cup Tag cc 139F	FLAMMABLE LIMITS	Lel	Uel

EXTINGUISHING MEDIA
Dry chemicals, carbon dioxide, foam or water.

SPECIAL FIRE FIGHTING PROCEDURES
If foam or water are used extremely slippery surfaces can result. Spread sand or grit.

UNUSUAL FIRE AND EXPLOSION HAZARDS
None

5. HEALTH HAZARD DATA

ACGIH TLV-TWA -30 mg/m^3 (SKIN)

THRESHOLD LIMIT VALUE

Ingredient:Dimethyl Formamide-OSHA STEL -60mg/m^3 (SKIN)
PEL -30mg/m^3 (SKIN)

EFFECTS OF OVEREXPOSURE

May cause irritation on prolonged contact. Corrosive to the eyes. Prolonged exposure may cause dizziness and headaches.

EMERGENCY AND FIRST AID PROCEDURES

Remove contaminated clothing. Wash skin area with soap solution or water for 15 min. Promptly flush eyes with water for 15 min., immed. contact physician. Remove victim to fresh air area. Feed nothing by mouth to an unconscious or convulsive victim. Don't induce vomiting. Dilute stomach contents with milk, water or burnt toast (charcoal) and milk of magnesia in strong tea. Immed contact physician.

6. REACTIVITY DATA

STABILITY			CONDITIONS TO AVOID
	UNSTABLE		
	STABLE	X	Heat and open flame

INCOMPATABILITY (Materials to avoid)

Avoid mixing with strong oxidizers and acids .

HAZARDOUS DECOMPOSITION PRODUCTS

Heating to decomposition or in an acid environment may produce cyanides.

HAZARDOUS POLYMERIZATION			CONDITIONS TO AVOID
	MAY OCCUR		
	WILL NOT OCCUR	X	

7. SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

Sweep up if dry and place in waste disposal container. Contain and absorb with inert materials. Sweep up and place in waste disposal container. Flush area with water. Wet area may be slippery; spread sand or grit. Product is a lachymator. Flush cleansed area cautiously with water.

WASTE DISPOSAL METHOD

Incinerate or bury in an approved landfill.

8. SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (Specify type)

Air line respirator or self-contained breathing apparatus (positive-pressure full face-piece type).

VENTILATION	LOCAL EXHAUST	SPECIAL
Adequate to keep contaminants below exposure limits.	MECHANICAL (General)	OTHER

PROTECTIVE GLOVES	EYE PROTECTION
Solvent-resistant gloves;replace as necessary	Face shield-air tight chemical goggles.

OTHER PROTECTIVE EQUIPMENT

Use any equipment necessary to protect against the hazards stated on the label.

9. SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING

Protect from freezing. Keep away from flames or sparks, do not use, pour or store near heat or open flames. Material is combustible.

OTHER PRECAUTIONS

Do not use empty container. Triple rinse container or equivalent method before sending to drum reconditioner or destroying be preforation or crushing and burying in a safe place.

While the information and recommendations set forth herein are believed to be accurate as of the date hereof, BETZ LABORATORIES, INC. MAKES NO WARRANTY WITH RESPECT THERETO AND DISCLAIMS ALL LIABILITY FROM RELIANCE THEREON.

BETZ®
TREVOSE, PENNSYLVANIA 19047

PRODUCT DATA

BETZ SLIMICIDE C-30

DESCRIPTION AND USE

BETZ Slimicide C-30 aids in the control of objectionable slimes formed by bacteria and fungi in industrial cooling tower water equipment.

BETZ Slimicide C-30 and its use as a slime-control composition are covered by United States Patent 3,426,134.

GENERAL SPECIFICATIONS

Bis (trichloromethyl) sulfone	20.0%
Methylene bisthiocyanate	5.0%
Inert Ingredients (including solubilizing and dispersing agents)	75.0%
Environmental Protection Agency Registration Number	3876-61

Appearance	straw colored liquid
Density (62F)	8.9 pounds per gallon
Flash Point (open cup)	169F
Flash Point (closed cup)	139F
pH (5 percent solution)	4.1
Pour Point (ASTM)	≤-50F
Specific Gravity (62F)	1.074
Viscosity (60F)	6.2 cps

TREATMENT AND FEEDING REQUIREMENTS

BETZ Slimicide C-30 should be added neat (undiluted) and directly to the cooling water at a rate of 0.1 to 0.3 pound per thousand gallons of cooling water in the system. The frequency of feeding and the duration of treatment depend on the severity of slime deposits.

Consult BETZ for technical advice on specific applications.

SAFETY PRECAUTIONS

WARNING - TOXIC. HARMFUL OR FATAL IF SWALLOWED OR ABSORBED THROUGH SKIN. Causes eye burns and skin irritations. Avoid breathing vapor or mist. Use with adequate ventilation.

Do not get into eyes, on skin or clothing. Wear rubber gloves, and goggles or face shield, when handling.

Wash thoroughly after handling. Remove and wash contaminated clothing before reuse.

In case of contact with skin, wash well with soap and water. In case of contact with eyes, flush promptly and thoroughly with clear water. In case of ingestion or contact with eyes, secure immediate medical attention.

PACKAGING INFORMATION

BETZ Slimicide C-30 is blended as a liquid, and is supplied in 55-gallon, bung-type, nonreturnable steel drums. Approximate net weight - 460 pounds per drum. This product is available also in five-gallon, nonreturnable steel pails with pour spout. Approximate net weight - 40 pounds per pail.

SHIPPING POINTS

Addison, Illinois; Compton, California; Garland, Texas; Macon, Georgia and Philadelphia, Pennsylvania.

PRICES

Prices are FOB the BETZ plant from which shipment is made, and apply to single shipments of this product to one place at one time. However, when a single shipment consists of 20,000 pounds or more of BETZ products, all BETZ products in that shipment will be billed at the 20,000-pound price applicable to the individual products.

All sales are subject to Seller's terms and conditions of sale as shown on the reverse side.

FREIGHT CLASS

Compounds, Industrial Water Treating, Liquid   Item 50227   LTL 60%   T/L 35%

Send all orders to BETZ, Somerton Road, Trevose, PA 19047

U.S. DEPARTMENT OF LABOR
Occupational Safety and Health Administration

Form Approved
OMB No. 44-R1387

MATERIAL SAFETY DATA SHEET

Required under USDL Safety and Health Regulations for Ship Repairing, Shipbuilding, and Shipbreaking (29 CFR 1915, 1916, 1917)

SECTION I

MANUFACTURER'S NAME Vulcan Materials Company, Chemicals Division	EMERGENCY TELEPHONE NO. 316-524-5751
ADDRESS *(Number, Street, City, State, and ZIP Code)* P. O. Box 7689, Birmingham, Alabama 35223	
CHEMICAL NAME AND SYNONYMS 50% and 73% Liquid Sodium Hydroxide	TRADE NAME AND SYNONYMS Caustic Soda
CHEMICAL FAMILY Alkali Metal Hydroxides	FORMULA NaOH in water solution

SECTION II - HAZARDOUS INGREDIENTS

PAINTS, PRESERVATIVES, & SOLVENTS	%	TLV (Units)	ALLOYS AND METALLIC COATINGS	%	TLV (Units)
PIGMENTS			BASE METAL		
CATALYST			ALLOYS		
VEHICLE			METALLIC COATINGS		
SOLVENTS			FILLER METAL PLUS COATING OR CORE FLUX		
ADDITIVES			OTHERS		
OTHERS					

HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES	%	TLV (Units)

SECTION III - PHYSICAL DATA

BOILING POINT (°F.) 50% 73%	293° 379°	SPECIFIC GRAVITY (H_2O=1) 50% @ 60° F 73% @ 142° F	1.53 1.72
VAPOR PRESSURE (mm Hg.)	N/A	PERCENT, VOLATILE BY VOLUME (%)	0
VAPOR DENSITY (AIR=1)	N/A	EVAPORATION RATE (________ =1)	N/A
SOLUBILITY IN WATER	Complete		
APPEARANCE AND ODOR Water white or gray liquid			

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method used) None	FLAMMABLE LIMITS N/A	Lel	Uel
EXTINGUISHING MEDIA N/A			
SPECIAL FIRE FIGHTING PROCEDURES N/A			
UNUSUAL FIRE AND EXPLOSION HAZARDS N/A			

(Continued on reverse side)

SECTION V - HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE
N/A

EFFECTS OF OVEREXPOSURE Concentrated solutions are destructive to tissues with which they come in contact producing severe burns to skin or eyes. Swallowing will result in severe injury and inhalation of dust or mist can cause respiratory damage.

EMERGENCY AND FIRST AID PROCEDURES
Wash affected areas with copious amounts of water. Call a physician.

SECTION VI - REACTIVITY DATA

STABILITY	UNSTABLE		CONDITIONS TO AVOID Neutralization with acids produce heat,
	STABLE	XX	sometimes violently.

INCOMPATABILITY *(Materials to avoid)*
Brass, bronze, aluminum, tin, lead, zinc, and steel above 140° F

HAZARDOUS DECOMPOSITION PRODUCTS
N/A

HAZARDOUS POLYMERIZATION	MAY OCCUR		CONDITIONS TO AVOID
	WILL NOT OCCUR	XX	

SECTION VII - SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED
Confine spill, dilute with water. Avoid contact with skin.

WASTE DISPOSAL METHOD
After dilution, neutralize with muriatic acid or sulfuric acid, dilute further for disposal. Contact local authorities. For additional information contact supplier or manufacturer.

SECTION VIII - SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION *(Specify type)*
Canister, dust filter

VENTILATION	LOCAL EXHAUST To remove mist.	SPECIAL
	MECHANICAL *(General)*	OTHER

PROTECTIVE GLOVES Rubber	EYE PROTECTION Safety glasses, goggles, face shield

OTHER PROTECTIVE EQUIPMENT
Rubber suit and shoes

SECTION IX - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING
To hold as liquid storage temperature must be above 60°F for 50% and 145°F for 73%

OTHER PRECAUTIONS
Carbon steel vessel may be used below 140°F--need nickel or epoxy lining above 140°F

BETZ
TREVOSE, PENNSYLVANIA 19047

MATERIAL SAFETY DATA SHEET

DATE: October, 1978

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1.

MANUFACTURER'S NAME Betz Laboratories, Inc.	EMERGENCY TELEPHONE NO. 215: 355-3300
ADDRESS (Number, Street, City, State and ZIP Code) 4636 Somerton Rd., Trevose, PA 19047	
CHEMICAL NAME AND SYNONYMS	TRADE NAME AND SYNONYMS Balanced Polymer 6000 Series
CHEMICAL FAMILY	FORMULA Blended Formulations

2. HAZARDOUS INGREDIENTS

PAINTS, PRESERVATIVES, & SOLVENTS	%	TLV (Units)	ALLOYS AND METALLIC COATINGS	%	TLV (Units)
PIGMENTS			BASE METAL		
CATALYST			ALLOYS		
VEHICLE			METALLIC COATINGS		
SOLVENTS			FILLER METAL PLUS COATING OR CORE FLUX		
ADDITIVES			OTHERS		
OTHERS					

GENERIC DESCRIPTION	%	TLV (Units)
An aqueous solution containing any or all of the following ingredients:		
Tetrasodium EDTA, Sodium silicate, Sodium sulfite, neutralizing amine, acrylate polymer, sulfonate polymer, sodium hydroxide and		
sodium nitrate.		

3. PHYSICAL DATA

BOILING POINT (F.)	> 200F	SPECIFIC GRAVITY (H_2O=1) Approx.	1.12
VAPOR PRESSURE (mm Hg.)	N.D.	PERCENT, VOLATILE BY VOLUME (%)	N.D.
VAPOR DENSITY (AIR=1)	N.D.	EVAPORATION RATE (____ ____ =1)	
SOLUBILITY IN WATER	Complete		
APPEARANCE AND ODOR	Brown liquid - no distinguishing odor		

4. FIRE AND EXPLOSION HAZARD DATA

		Lel	Uel
FLASH POINT (Method used) Open and Closed cup - > 200F	FLAMMABLE LIMITS Non-flammable		

EXTINGUISHING MEDIA
Water or any media suitable for the surrounding fire.

SPECIAL FIRE FIGHTING PROCEDURES

None needed.

UNUSUAL FIRE AND EXPLOSION HAZARDS

None

5. HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE
Never determined for these products.

EFFECTS OF OVEREXPOSURE
May cause skin irritation on prolonged contact.

EMERGENCY AND FIRST AID PROCEDURES
Skin contact - Wash well with soap and water. Eye contact - Flush thoroughly and promptly with clear water. In case of ingestion or eye contact, obtain immediate medical attention.

6. REACTIVITY DATA

STABILITY	UNSTABLE		CONDITIONS TO AVOID
	STABLE	X	

INCOMPATABILITY (Materials to avoid)
None to our knowledge.

HAZARDOUS DECOMPOSITION PRODUCTS
Never determined for the products.

HAZARDOUS POLYMERIZATION	MAY OCCUR		CONDITIONS TO AVOID
	WILL NOT OCCUR	X	

7. SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED
Wash down spillage with copious amounts of water.

WASTE DISPOSAL METHOD
Dilute with water and flush to sanitary sewer or waste treatment facility.

8. SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (Specify type)
Normally not needed.

VENTILATION Normal	LOCAL EXHAUST	SPECIAL
	MECHANICAL (General)	OTHER

PROTECTIVE GLOVES Rubber gloves - optional	EYE PROTECTION Goggles or face shield - optional

OTHER PROTECTIVE EQUIPMENT
Use any equipment necessary to protect against the hazards recited on the label.

9. SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING
Provision should be made to protect material from freezing. Material is for industrial use only.

OTHER PRECAUTIONS
Do not take internally. Use material only as directed. Remove contaminated clothing and wash before reuse.

BETZ
TREVOSE, PENNSYLVANIA 19047

MATERIAL SAFETY DATA SHEET

DATE: Revised November, 1980

Information on this form is furnished solely for the purpose of compliance with the Occupational Safety and Health Act of 1970 and shall not be used for any other purpose. Use or dissemination of all or any part of this information for any other purpose may result in a violation of law or constitute grounds for legal action.

1.

MANUFACTURER'S NAME Betz Laboratories, Inc.	EMERGENCY TELEPHONE NO. 215: 355-3300
ADDRESS (Number, Street, City, State and ZIP Code) 4636 Somerton Rd., Trevose, PA 19047	
CHEMICAL NAME AND SYNONYMS	TRADE NAME AND SYNONYMS Chelant CL-2
CHEMICAL FAMILY	FORMULA A blended product

2. HAZARDOUS INGREDIENTS

PAINTS, PRESERVATIVES, & SOLVENTS	%	TLV (Units)	ALLOYS AND METALLIC COATINGS	%	TLV (Units)
PIGMENTS			BASE METAL		
CATALYST			ALLOYS		
VEHICLE			METALLIC COATINGS		
SOLVENTS			FILLER METAL PLUS COATING OR CORE FLUX		
ADDITIVES			OTHERS		
OTHERS					

GENERIC DESCRIPTION	%	TLV (Units)
A water solution of sodium EDTA and a water soluble		
lignin derivative.		

3. PHYSICAL DATA

BOILING POINT (F.)	> 212F	SPECIFIC GRAVITY (H_2O=1)	75F	1.28
VAPOR PRESSURE (mm Hg.) 75.2F	18.6	PERCENT, VOLATILE BY VOLUME (%)		62
VAPOR DENSITY (AIR=1) 75.2F	< 1	EVAPORATION RATE (ether =1)		< 1
SOLUBILITY IN WATER	Complete	pH (1% soln.)		11.0-12.0
APPEARANCE AND ODOR	Brown liquid			

4. FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method used) None	FLAMMABLE LIMITS Non-flammable	Lel	Uel
EXTINGUISHING MEDIA Use water or any other suitable media if product is involved in a fire.			
SPECIAL FIRE FIGHTING PROCEDURES None needed.			
UNUSUAL FIRE AND EXPLOSION HAZARDS None Product is non-explosive.			

5. HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE
Never established.

EFFECTS OF OVEREXPOSURE
May cause skin irritations after prolonged contact.

EMERGENCY AND FIRST AID PROCEDURES
Skin contact - Wash well with soap and water. Eye contact - Flush thoroughly and promptly with clear water. In case of eye contact or ingestion, contact physician immediately.

6. REACTIVITY DATA

STABILITY	UNSTABLE		CONDITIONS TO AVOID Do not mix directly with acidic materials.
	STABLE	X	

INCOMPATABILITY (Materials to avoid)
Avoid direct contact with highly acidic materials.

HAZARDOUS DECOMPOSITION PRODUCTS
Carbon dioxide, ammonia and water

HAZARDOUS POLYMERIZATION	MAY OCCUR		CONDITIONS TO AVOID
	WILL NOT OCCUR	X	

7. SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED
Wash down with copious amounts of water to sanitary sewer or waste treatment facility.

WASTE DISPOSAL METHOD
Dilute with water and direct to sanitary sewer or waste treatment facility.

8. SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (Specify type)
Normally not needed, but avoid inhalation of fumes.

VENTILATION Normal	LOCAL EXHAUST	SPECIAL
	MECHANICAL (General)	OTHER

PROTECTIVE GLOVES Rubber gloves	EYE PROTECTION Goggles or face shield

OTHER PROTECTIVE EQUIPMENT
Use any equipment necessary to protect against any hazards stated on the label.

9. SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING
Use material only as directed for the particular application.

OTHER PRECAUTIONS
Keep container covered. Protect from freezing. Shelf life is up to one year.

BETZ
TREVOSE, PENNSYLVANIA 19047

MATERIAL SAFETY DATA SHEET

Revised
DATE: March 23, 1979

Information on this form is furnished solely for the purpose of compliance with the Occupational Safety and Health Act of 1970 and shall not be used for any other purpose. Use or dissemination of all or any part of this information for any other purpose may result in a violation of law or constitute grounds for legal action.

1.

MANUFACTURER'S NAME Betz Laboratories, Inc.	EMERGENCY TELEPHONE NO. 215: 355-3300
ADDRESS (Number, Street, City, State and ZIP Code) 4636 Somerton Rd., Trevose, PA 19047	
CHEMICAL NAME AND SYNONYMS Sodium Sulfite, Catalyzed	TRADE NAME AND SYNONYMS Corrogen (Industrial)
CHEMICAL FAMILY	FORMULA Na_2SO_3

2. HAZARDOUS INGREDIENTS

PAINTS, PRESERVATIVES, & SOLVENTS	%	TLV (Units)	ALLOYS AND METALLIC COATINGS	%	TLV (Units)
PIGMENTS			BASE METAL		
CATALYST			ALLOYS		
VEHICLE			METALLIC COATINGS		
SOLVENTS			FILLER METAL PLUS COATING OR CORE FLUX		
ADDITIVES			OTHERS		
OTHERS					

GENERIC DESCRIPTION	%	TLV (Units)
A technical grade of sodium sulfite with a cobalt catalyst		
supplied in powder form.		

3. PHYSICAL DATA

Density - approx. 85 lbs./cu. ft.

BOILING POINT (F.)	N.A.	SPECIFIC GRAVITY (H_2O=1)	
VAPOR PRESSURE (mm Hg.)	N.A.	PERCENT, VOLATILE BY VOLUME (%)	N.A.
VAPOR DENSITY (AIR=1)	N.A.	EVAPORATION RATE (________ =1)	N.A.
SOLUBILITY IN WATER	Moderate	pH (5% Solution) approx.	7 to 8
APPEARANCE AND ODOR	White powder - slight sulfur odor		

4. FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method used) Not applicable	FLAMMABLE LIMITS Non-flammable	Lel	Uel

EXTINGUISHING MEDIA
Use water or any media suitable for the surrounding fire.

SPECIAL FIRE FIGHTING PROCEDURES

None needed.

UNUSUAL FIRE AND EXPLOSION HAZARDS

None

ENG 207A 7509

5. HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE
Never determined for the product.

EFFECTS OF OVEREXPOSURE
May cause skin irritation on prolonged contact.

EMERGENCY AND FIRST AID PROCEDURES
Skin contact - Wash well with soap and water. Eye contact - Flush thoroughly and promptly with clear water. If ingested or eye contact, obtain immediate medical attention. See label statements.

6. REACTIVITY DATA

STABILITY	UNSTABLE		CONDITIONS TO AVOID
	STABLE	X	

INCOMPATABILITY (Materials to avoid)
Strong oxidizing agents.

HAZARDOUS DECOMPOSITION PRODUCTS
Fumes of the oxides of sulfur.

HAZARDOUS POLYMERIZATION	MAY OCCUR		CONDITIONS TO AVOID
	WILL NOT OCCUR	X	

7. SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED
Spilled material, if dry, may be gathered up and returned to the container.

WASTE DISPOSAL METHOD
Treated water may be sent to sanitary sewer or waste treatment facility. Disposal of surplus material should be in an approved landfill.

8. SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (Specify type)
Normally not needed.

VENTILATION Normal	LOCAL EXHAUST	SPECIAL
	MECHANICAL (General)	OTHER

PROTECTIVE GLOVES Rubber gloves - optional	EYE PROTECTION Goggles or face shield - optional

OTHER PROTECTIVE EQUIPMENT
Use any equipment necessary to protect against any hazards stated on the label.

9. SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING
Store in a dry place and keep container covered. Material has unlimited shelf life. Use material only as directed for the specific application.

OTHER PRECAUTIONS
Keep corrogen solution tank covered with a floating lid to avoid reaction with atmospheric oxygen. As with any industrial chemical, use good hygenic practices when handling.

BETZ
TREVOSE, PENNSYLVANIA 19047

MATERIAL SAFETY DATA SHEET

DATE: Revised April 4, 1979

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1.

MANUFACTURER'S NAME Betz Laboratories, Inc.	EMERGENCY TELEPHONE NO. 215:355-3300
ADDRESS (Number, Street, City, State and ZIP Code) 4636 Somerton Road, Trevose, PA 19047	
CHEMICAL NAME AND SYNONYMS	TRADE NAME AND SYNONYMS Neutrafilm 463
CHEMICAL FAMILY amines	FORMULA a blended product.

2. HAZARDOUS INGREDIENTS

PAINTS, PRESERVATIVES, & SOLVENTS	%	TLV (Units)	ALLOYS AND METALLIC COATINGS	%	TLV (Units)
PIGMENTS			BASE METAL		
CATALYST			ALLOYS		
VEHICLE			METALLIC COATINGS		
SOLVENTS			FILLER METAL PLUS COATING OR CORE FLUX		
ADDITIVES			OTHERS		
OTHERS					

GENERIC DESCRIPTION	%	TLV (Units)
A water dispersion of heterocyclic and high molecular weight straight chain primary filming amines.		

3. PHYSICAL DATA

BOILING POINT (F.)	N.D.	SPECIFIC GRAVITY (H_2O=1) 61 F	0.99
VAPOR PRESSURE (mm Hg.)	N.D.	PERCENT, VOLATILE BY VOLUME (%)	N.D.
VAPOR DENSITY (AIR=1)	N.D.	EVAPORATION RATE (ether =1)	< 1
SOLUBILITY IN WATER	dispersible	pH	10.3

APPEARANCE AND ODOR milk white liquid - amine type odor Pour Point 35F - Freeze Point 30F

4. FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method used) open cup 200F Tag cc 200F	FLAMMABLE LIMITS never determined	Lel	Uel

EXTINGUISHING MEDIA Use water or any suitable media if product is involved in a fire

SPECIAL FIRE FIGHTING PROCEDURES None needed.

UNUSUAL FIRE AND EXPLOSION HAZARDS None

ENG 207A 7509

5. HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE
Never determined for the product.

EFFECTS OF OVEREXPOSURE
Causes skin and eye irritations.

EMERGENCY AND FIRST AID PROCEDURES
Skin contact - Wash well with soap and water. Eye contact - Flush promptly and thoroughly with clear water. In case of ingestion or eye contact obtain immediate medical attention.

6. REACTIVITY DATA

STABILITY	UNSTABLE		CONDITIONS TO AVOID
	STABLE	XX	

INCOMPATABILITY (Materials to avoid)

HAZARDOUS DECOMPOSITION PRODUCTS
Oxides of nitrogen may be produced.

HAZARDOUS POLYMERIZATION	MAY OCCUR		CONDITIONS TO AVOID
	WILL NOT OCCUR	XX	

7. SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED
Wash down with copious amounts of water for disposal in sanitary sewer or waste treatment facility.

WASTE DISPOSAL METHOD
To sanitary sewer or waster treatment facility.

8. SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (Specify type)
Normally not needed. Avoid inhalation of any vapors.

VENTILATION Normal	LOCAL EXHAUST	SPECIAL
	MECHANICAL (General)	OTHER

PROTECTIVE GLOVES rubber - optional	EYE PROTECTION goggles or face mask - optional

OTHER PROTECTIVE EQUIPMENT
Use any equipment necessary to protect against the hazards recited on label.

9. SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING
Keep container covered. Protect from freezing. Do not take internally. Product should be used only as directed for a specific application.

OTHER PRECAUTIONS
Remove contaminated clothing wash before re-use.

ENG 2078 7509

U.S. DEPARTMENT OF LABOR
Occupational Safety and Health Administration

Form Approved
OMB No. 44-R1387

MATERIAL SAFETY DATA SHEET

Required under USDL Safety and Health Regulations for Ship Repairing, Shipbuilding, and Shipbreaking (29 CFR 1915, 1916, 1917)

SECTION I

MANUFACTURER'S NAME United Chemical Corporation of New Mexico	EMERGENCY TELEPHONE NO. 505-393-7751
ADDRESS (Number, Street, City, State, and ZIP Code) P. O. Box 1499, Hobbs, New Mexico, 88240 (707 North Leech Street)	
CHEMICAL NAME AND SYNONYMS Liquid Neutralizing Agent	TRADE NAME AND SYNONYMS TECHNI-HIB 7350
CHEMICAL FAMILY Neutralizing Amines	FORMULA

SECTION II - HAZARDOUS INGREDIENTS

PAINTS, PRESERVATIVES, & SOLVENTS	%	TLV (Units)	ALLOYS AND METALLIC COATINGS	%	TLV (Units)
PIGMENTS			BASE METAL		
CATALYST			ALLOYS		
VEHICLE			METALLIC COATINGS		
SOLVENTS			FILLER METAL PLUS COATING OR CORE FLUX		
ADDITIVES			OTHERS		
OTHERS					

HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES	%	TLV (Units)

SECTION III - PHYSICAL DATA

BOILING POINT (°F.)	212°	SPECIFIC GRAVITY (H_2O=1)	.960
VAPOR PRESSURE (mm Hg.)		PERCENT, VOLATILE BY VOLUME (%)	
VAPOR DENSITY (AIR=1)		EVAPORATION RATE (________ =1)	
SOLUBILITY IN WATER	Infinite		
APPEARANCE AND ODOR	Brown Liquid; ammonia odor		

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method used)	None	FLAMMABLE LIMITS	Lel	Uel
EXTINGUISHING MEDIA	Water Spray, Dry Chemical; CO_2			
SPECIAL FIRE FIGHTING PROCEDURES	None			
UNUSUAL FIRE AND EXPLOSION HAZARDS	None			

(Continued on reverse side)

SECTION V - HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE
Unknown

EFFECTS OF OVEREXPOSURE
Liquid is corrosive to eyes and skin. Harmful or fatal if ingested or absorbed through skin.

EMERGENCY AND FIRST AID PROCEDURES
Flush eyes or skin with water for fifteen minutes and call a physician. Universal antidote; induce vomiting; call a physician.

SECTION VI - REACTIVITY DATA

STABILITY	UNSTABLE		CONDITIONS TO AVOID
	STABLE	X	Highly acidic compounds

INCOMPATABILITY *(Materials to avoid)*
None

HAZARDOUS DECOMPOSITION PRODUCTS None

HAZARDOUS POLYMERIZATION	MAY OCCUR		CONDITIONS TO AVOID
	WILL NOT OCCUR	X	None

SECTION VII - SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED
Wash down with water or soak up on sand and dispose of in an approved Industrial waste landfill. Do not wash down with water where runoff will contaminate important water sources.

WASTE DISPOSAL METHOD
Contact United Chemical Corporation for assistance in disposal.

SECTION VIII - SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION *(Specify type)*
None required in normal use.

VENTILATION Control to comfort	LOCAL EXHAUST Required	SPECIAL
	MECHANICAL *(General)*	OTHER

PROTECTIVE GLOVES Rubber	EYE PROTECTION Face Shield and/or goggles

OTHER PROTECTIVE EQUIPMENT
Rubber boots, apron and coveralls

SECTION IX - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING
Avoid contact with eyes, skin and clothing. Avoid breathing mists. Keep out of reach of children. Vapor is extremely irritating in a closed area.

OTHER PRECAUTIONS
Do not transfer to improperly marked container. Keep container closed when not in use.

U.S. DEPARTMENT OF LABOR
Occupational Safety and Health Administration

Form Approved
OMB No. 44-R1387

MATERIAL SAFETY DATA SHEET

Required under USDL Safety and Health Regulations for Ship Repairing, Shipbuilding, and Shipbreaking (29 CFR 1915, 1916, 1917)

SECTION I

MANUFACTURER'S NAME Unichem International Inc.	EMERGENCY TELEPHONE NO. 505-393-7751
ADDRESS *(Number, Street, City, State, and ZIP Code)* P. O. Box 1499 707 North Leech St. Hobbs, New Mexico 88240 USA	
CHEMICAL NAME AND SYNONYMS Corrosion Inhibitor for Overhead Streams	TRADE NAME AND SYNONYMS TECHNI-HIB 7060
CHEMICAL FAMILY Proprietary Blend of Amines	FORMULA

SECTION II - HAZARDOUS INGREDIENTS

PAINTS, PRESERVATIVES, & SOLVENTS	%	TLV (Units)	ALLOYS AND METALLIC COATINGS	%	TLV (Units)
PIGMENTS			BASE METAL		
CATALYST			ALLOYS		
VEHICLE			METALLIC COATINGS		
SOLVENTS			FILLER METAL PLUS COATING OR CORE FLUX		
ADDITIVES			OTHERS		
OTHERS					

HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES	%	TLV (Units)

SECTION III - PHYSICAL DATA

BOILING POINT (°F.)	336	SPECIFIC GRAVITY (H_2O=1)	0.936
VAPOR PRESSURE (mm Hg.)		PERCENT, VOLATILE BY VOLUME (%)	
VAPOR DENSITY (AIR=1)		EVAPORATION RATE (________ =1)	
SOLUBILITY IN WATER	Dispersible		
APPEARANCE AND ODOR	Dark Brown Liquid; Slight Ammonia Odor		

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method used) (TOC) 119°F	FLAMMABLE LIMITS	Lel	Uel

EXTINGUISHING MEDIA Dry Chemical; Water Fog; or Carbon Dioxide

SPECIAL FIRE FIGHTING PROCEDURES None

UNUSUAL FIRE AND EXPLOSION HAZARDS None

(Continued on reverse side)

SECTION V - HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE Unknown

EFFECTS OF OVEREXPOSURE
Causes skin and eye irritation. Avoid prolonged or repeated skin contact. Avoid contact with eyes. Avoid breathing vapor or mist.

EMERGENCY AND FIRST AID PROCEDURES
For eye contact, wash with water for at least 15 minutes. Get prompt medical attention. For skin contact, wash with soap and water.

SECTION VI - REACTIVITY DATA

STABILITY	UNSTABLE		CONDITIONS TO AVOID
	STABLE	X	Open flames, sparks and heat

INCOMPATABILITY *(Materials to avoid)*
Avoid contact with strong oxidizing agents.

HAZARDOUS DECOMPOSITION PRODUCTS
Produces toxic oxides of nitrogen when burned.

HAZARDOUS POLYMERIZATION	MAY OCCUR		CONDITIONS TO AVOID
	WILL NOT OCCUR	X	None

SECTION VII - SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED
Extinguish all sources of ignition. Wash down with water or soak up on sand and dispose of in an approved industrial waste landfill. Do not wash down with water where runoff will contaminate important water sources.

WASTE DISPOSAL METHOD
Incinerate in an incinerator equipped with an after burner and scrubber, or bury in an approved industrial landfill.

SECTION VIII - SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION *(Specify type)* None require in normal use.

VENTILATION Control to comfort	LOCAL EXHAUST	SPECIAL
	MECHANICAL *(General)*	OTHER

PROTECTIVE GLOVES Rubber gloves	EYE PROTECTION Chemical worker's goggles

OTHER PROTECTIVE EQUIPMENT Rubber boots, overalls

SECTION IX - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING
Wear impervious clothing and gloves. If clothing is contaminated, remove and launder before reuse. Decontaminate or discard shoes.

OTHER PRECAUTIONS
Do not transfer to improperly marked container. Keep container closed when not in use.

U.S. DEPARTMENT OF LABOR
Occupational Safety and Health Administration

Form Approved
OMB No. 44-R1387

MATERIAL SAFETY DATA SHEET

Required under USDL Safety and Health Regulations for Ship Repairing, Shipbuilding, and Shipbreaking (29 CFR 1915, 1916, 1917)

SECTION I

MANUFACTURER'S NAME Unichem International Inc.	EMERGENCY TELEPHONE NO. 505-393-7751
ADDRESS *(Number, Street, City, State, and ZIP Code)* P. O. Box 1499 707 N. Leech St., Hobbs, New Mexico 88240	
CHEMICAL NAME AND SYNONYMS Corrosion Inhibitor dispersant	TRADE NAME AND SYNONYMS TECHNI-HIB 7182
CHEMICAL FAMILY Proprietary Blend	FORMULA

SECTION II - HAZARDOUS INGREDIENTS

PAINTS, PRESERVATIVES, & SOLVENTS	%	TLV (Units)	ALLOYS AND METALLIC COATINGS	%	TLV (Units)
PIGMENTS			BASE METAL		
CATALYST			ALLOYS		
VEHICLE			METALLIC COATINGS		
SOLVENTS			FILLER METAL PLUS COATING OR CORE FLUX		
ADDITIVES			OTHERS		
OTHERS					

HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES	%	TLV (Units)

SECTION III - PHYSICAL DATA

BOILING POINT (°F.)	336	SPECIFIC GRAVITY (H_2O=1)	0.876
VAPOR PRESSURE (mm Hg.)	---	PERCENT, VOLATILE BY VOLUME (%)	------
VAPOR DENSITY (AIR=1)	---	EVAPORATION RATE (________ =1)	------
SOLUBILITY IN WATER	Dispersable		
APPEARANCE AND ODOR	Dark Brown Liquid; Slight Ammonia Odor		

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method used) TCC 110° F.	FLAMMABLE LIMITS	Lel	Uel

EXTINGUISHING MEDIA
Dry Chemical, Water Fog or Carbon Dioxide

SPECIAL FIRE FIGHTING PROCEDURES
None

UNUSUAL FIRE AND EXPLOSION HAZARDS
None

(Continued on reverse side)

SECTION V - HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE
Unknown

EFFECTS OF OVEREXPOSURE
Causes skin and eye irritation. Avoid prolonged or repeated skin contact. Avoid contact with eyes. Avoid breathing vapor or mist.

EMERGENCY AND FIRST AID PROCEDURES
For eye contact, wash with water for at least 15 minutes. Get prompt medical attention. For skin contact, wash with soap and water. If irritation persists consult a physician.

SECTION VI - REACTIVITY DATA

STABILITY	UNSTABLE		CONDITIONS TO AVOID Open flames, sparks, heat
	STABLE	X	

INCOMPATABILITY *(Materials to avoid)*
Avoid contact with strong oxidizing agents.

HAZARDOUS DECOMPOSITION PRODUCTS
Produces toxic oxides of nitrogen when burned.

HAZARDOUS POLYMERIZATION	MAY OCCUR		CONDITIONS TO AVOID None
	WILL NOT OCCUR	X	

SECTION VII - SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED
Extinguish all sources of ignition. Wash down with water or soak up on sand and dispose of in an approved industrial waste landfill. Do not wash down with water where runoff will contaminate important water source.

WASTE DISPOSAL METHOD
Incinerate in an incinerator equipped with an after burner and scrubber or bury in an approved industrial landfill.

SECTION VIII - SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION *(Specify type)*
None required in normal use.

VENTILATION Control to Comfort	LOCAL EXHAUST	SPECIAL
	MECHANICAL *(General)*	OTHER

PROTECTIVE GLOVES Rubber Gloves	EYE PROTECTION Chemical Worker's Goggles

OTHER PROTECTIVE EQUIPMENT
Rubber Boots, Coveralls

SECTION IX - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING
Wear impervious clothing and gloves. If clothing is contaminated, remove and launder before reuse. Decontaminate or discard shoes.

OTHER PRECAUTIONS
Do not transfer to improperly marked container. Keep container closed when not in use. Keep out of reach of children.

U.S. DEPARTMENT OF LABOR
Occupational Safety and Health Administration

Form Approved
OMB No. 44-R1387

MATERIAL SAFETY DATA SHEET

Required under USDL Safety and Health Regulations for Ship Repairing, Shipbuilding, and Shipbreaking (29 CFR 1915, 1916, 1917)

SECTION I

MANUFACTURER'S NAME United Chemical Corporation	EMERGENCY TELEPHONE NO. 505-393-7751

DDRESS (Number, Street, City, State, and ZIP Code)
P. O. Box 1499 707 N. Leech St., Hobbs, New Mexico 88240

EMICAL NAME AND SYNONYMS Corrosion Inhibitor for Overhead Streams	TRADE NAME AND SYNONYMS TECHNI-HIB 7061
EMICAL FAMILY Proprietary Blend	FORMULA

SECTION II - HAZARDOUS INGREDIENTS

PAINTS, PRESERVATIVES, & SOLVENTS	%	TLV (Units)	ALLOYS AND METALLIC COATINGS	%	TLV (Units)
GMENTS			BASE METAL		
CATALYST			ALLOYS		
EHICLE			METALLIC COATINGS		
SOLVENTS			FILLER METAL PLUS COATING OR CORE FLUX		
DDITIVES			OTHERS		
THERS					

HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES	%	TLV (Units)
Aromatic Naphtha		

SECTION III - PHYSICAL DATA

ILING POINT (°F.)	336	SPECIFIC GRAVITY (H_2O=1)	0.936
APOR PRESSURE (mm Hg.)	---	PERCENT, VOLATILE BY VOLUME (%)	-----
VAPOR DENSITY (AIR=1)	---	EVAPORATION RATE (______ =1)	-----
LUBILITY IN WATER	Dispersable		

APPEARANCE AND ODOR Dark Brown Liquid; Slight Ammonia Odor

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method used) (TOC) 119° F.	FLAMMABLE LIMITS	Lel	Uel

TINGUISHING MEDIA Dry Chemical, Water Fog or Carbon Dioxide

SPECIAL FIRE FIGHTING PROCEDURES -----

NUSUAL FIRE AND EXPLOSION HAZARDS -----

(Continued on reverse side)

SECTION V - HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE Unknown

EFFECTS OF OVEREXPOSURE

Causes skin and eye irritation. Avoid prolonged or repeated skin contact. Avoid contact with eyes. Avoid breathing vapor or mist.

EMERGENCY AND FIRST AID PROCEDURES

For eye contact, wash with water for at least 15 minutes. Get prompt medical attention. For skin contact, wash with soap and water.

SECTION VI - REACTIVITY DATA

STABILITY	UNSTABLE		CONDITIONS TO AVOID Open flames, sparks, heat
	STABLE	X	

INCOMPATABILITY *(Materials to avoid)*

Avoid contact with strong oxidizing agents.

HAZARDOUS DECOMPOSITION PRODUCTS

Produces toxic oxides of nitrogen when burned.

HAZARDOUS POLYMERIZATION	MAY OCCUR		CONDITIONS TO AVOID None
	WILL NOT OCCUR	X	

SECTION VII - SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

Extinguish all sources of ignition. Wash down with water or soak up on sand and dispose of in an approved industrial waste landfill. Do not wash down with water where runoff will contaminate important water sources.

WASTE DISPOSAL METHOD

Incinerate in an incinerator equipped with an after burner and scrubber or bury in an approved industrial landfill.

SECTION VIII - SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION *(Specify type)* None required in normal use.

VENTILATION Control to comfort	LOCAL EXHAUST	SPECIAL
	MECHANICAL *(General)*	OTHER

PROTECTIVE GLOVES Rubber gloves	EYE PROTECTION Chemical workers' goggles

OTHER PROTECTIVE EQUIPMENT Rubber boots, Coveralls

SECTION IX - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING

Wear impervious clothing and gloves. If clothing is contaminated, remove and launder before reuse. Decontaminate or discard shoes.

OTHER PRECAUTIONS

Do not transfer to improperly marked container. Keep container closed when not in use.

U.S. DEPARTMENT OF LABOR
Occupational Safety and Health Administration

Form Approved
OMB No. 44-R1387

MATERIAL SAFETY DATA SHEET

Required under USDL Safety and Health Regulations for Ship Repairing, Shipbuilding, and Shipbreaking (29 CFR 1915, 1916, 1917)

SECTION I

MANUFACTURER'S NAME United Chemical Corporation of New Mexico	EMERGENCY TELEPHONE NO. 505-393-7751
ADDRESS *(Number, Street, City, State, and ZIP Code)* P. O. Box 1499, 601 North Leech Street, Hobbs, New Mexico 88240	
CHEMICAL NAME AND SYNONYMS Proprietary Desalting Compound Blend	TRADE NAME AND SYNONYMS TECHNI-HIB 7201
CHEMICAL FAMILY Amine Based Emulsifiers	FORMULA

SECTION II - HAZARDOUS INGREDIENTS

PAINTS, PRESERVATIVES, & SOLVENTS	%	TLV (Units)	ALLOYS AND METALLIC COATINGS	%	TLV (Units)
PIGMENTS			BASE METAL		
CATALYST			ALLOYS		
VEHICLE			METALLIC COATINGS		
SOLVENTS			FILLER METAL PLUS COATING OR CORE FLUX		
ADDITIVES			OTHERS		
OTHERS					

HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES	%	TLV (Units)

SECTION III - PHYSICAL DATA

BOILING POINT (°F.)	140°	SPECIFIC GRAVITY (H_2O=1)	0.948
VAPOR PRESSURE (mm Hg.)		PERCENT, VOLATILE BY VOLUME (%)	
VAPOR DENSITY (AIR=1)		EVAPORATION RATE (_______ =1)	
SOLUBILITY IN WATER	Insoluble		
APPEARANCE AND ODOR	Dark Brown Liquid; Slight Alcoholic Odor		

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method used) 69° F (TOC)	FLAMMABLE LIMITS	Lel	Uel

EXTINGUISHING MEDIA Water Spray; Dry Chemical; CO_2

SPECIAL FIRE FIGHTING PROCEDURES
Spray fire area with cool water to eliminate bursting of other drums in the area.

UNUSUAL FIRE AND EXPLOSION HAZARDS None

(Continued on reverse side)

SECTION V - HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE Unknown

EFFECTS OF OVEREXPOSURE
Causes skin and eye irritation. Avoid prolonged or repeated skin contact. Avoid contact with eyes. Avoid breathing vapor or mists.

EMERGENCY AND FIRST AID PROCEDURES
For eye contact, wash with water for fifteen minutes. Get prompt medical attention. For skin contact, wash with soap and water. If irritationpersists, contact a physician.

SECTION VI - REACTIVITY DATA

STABILITY	UNSTABLE		CONDITIONS TO AVOID
	STABLE	X	Open flames, sparks and heat

INCOMPATABILITY *(Materials to avoid)* Avoid contact with strong oxidizing agents

HAZARDOUS DECOMPOSITION PRODUCTS
Produces toxic oxides of nitrogen when burned.

HAZARDOUS POLYMERIZATION	MAY OCCUR		CONDITIONS TO AVOID
	WILL NOT OCCUR	X	None

SECTION VII - SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED
Extinguish all sources of ignition. Wash down with water or soak up on sand and dispose of in an approved industrial waste landfill. Do not wash down with water where runoff will contaminate important water sources.

WASTE DISPOSAL METHOD
Incinerate in an incinerator with an afterburner and scrubber; or bury in an approved industrial waste landfill.

SECTION VIII - SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION *(Specify type)* None required in normal use.

VENTILATION Control to comfort	LOCAL EXHAUST	SPECIAL
	MECHANICAL *(General)*	OTHER

PROTECTIVE GLOVES Rubber	EYE PROTECTION Chemical workers goggles and/or shield

OTHER PROTECTIVE EQUIPMENT
Rubber boots, coveralls and apron if possibility of contact exists.

SECTION IX - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING
If clothing is contaminated, remove and launder before reuse. Decontaminate or discard shoes. Do not transfer to improperly marked container.

OTHER PRECAUTIONS
Keep container closed when notin use. Keep out of reach of children. Keep away from open flames, sparks and heat.

U.S. DEPARTMENT OF LABOR
Occupational Safety and Health Administration

Form Approved
OMB No. 44-R1387

MATERIAL SAFETY DATA SHEET

Required under USDL Safety and Health Regulations for Ship Repairing,
Shipbuilding, and Shipbreaking (29 CFR 1915, 1916, 1917)

SECTION I

MANUFACTURER'S NAME *Unichem International Inc.*

EMERGENCY TELEPHONE NO. *505-393-7751*

ADDRESS *(Number, Street, City, State, and ZIP Code)* *707 N. Leech; P.O. Box 1499; Hobbs, New Mexico, 88240; USA*

CHEMICAL NAME AND SYNONYMS *Proprietary Industrial Cleaner & Wetting Agent*

TRADE NAME AND SYNONYMS *DE-OILING SURFACTANT*

CHEMICAL FAMILY *Sulfonated Organic Surfactants*

FORMULA

SECTION II - HAZARDOUS INGREDIENTS

PAINTS, PRESERVATIVES, & SOLVENTS	%	TLV (Units)	ALLOYS AND METALLIC COATINGS	%	TLV (Units)
PIGMENTS			BASE METAL		
CATALYST			ALLOYS		
VEHICLE			METALLIC COATINGS		
SOLVENTS			FILLER METAL PLUS COATING OR CORE FLUX		
ADDITIVES			OTHERS		
OTHERS					

HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES	%	TLV (Units)

SECTION III - PHYSICAL DATA

BOILING POINT (°F.)	*212*	SPECIFIC GRAVITY (H_2O=1)	*0.972*
VAPOR PRESSURE (mm Hg.)		PERCENT, VOLATILE BY VOLUME (%)	
VAPOR DENSITY (AIR=1)		EVAPORATION RATE (________ =1)	
SOLUBILITY IN WATER	*Infinite*		
APPEARANCE AND ODOR	*Yellow Appearance; Slight Alcohol Odor*		

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method used) *94°F (TCC)*	FLAMMABLE LIMITS	Lel	Uel

EXTINGUISHING MEDIA *Water Spray; CO2; Foam; Dry Chemical*

SPECIAL FIRE FIGHTING PROCEDURES *None*

UNUSUAL FIRE AND EXPLOSION HAZARDS *None*

(Continued on reverse side)

SECTION V - HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE Unknown

EFFECTS OF OVEREXPOSURE
Harmful or fatal if swallowed. May cause skin dermatitis if overexposed to skin.

EMERGENCY AND FIRST AID PROCEDURES
If ingested, consult a physician. For eye or skin contact, wash affected area for 15 minutes with water. Ir irritation or redness persist, consult a physician.

SECTION VI - REACTIVITY DATA

STABILITY	UNSTABLE		CONDITIONS TO AVOID
	STABLE	X	Keep away from heat, sparks and open flame.

INCOMPATABILITY *(Materials to avoid)* None

HAZARDOUS DECOMPOSITION PRODUCTS None

HAZARDOUS POLYMERIZATION	MAY OCCUR		CONDITIONS TO AVOID
	WILL NOT OCCUR	X	None

SECTION VII - SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED
Wash down area with water or soak up with sand or absorbent material. Do not allow water runoff to contaminate important water sources.

WASTE DISPOSAL METHOD
Dispose of in an approved waste disposal site.

SECTION VIII - SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION *(Specify type)* None required under normal use.

VENTILATION Control to comfort	LOCAL EXHAUST	SPECIAL
	MECHANICAL *(General)*	OTHER

PROTECTIVE GLOVES Rubber	EYE PROTECTION Face shield or goggles

OTHER PROTECTIVE EQUIPMENT
Rubber boots and apron is possibility of contact during use exists.

SECTION IX - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING
Keep away from heat, sparks and open flame. Keep out of the reach of children.

OTHER PRECAUTIONS
Avoid eye contact. Keep container closed when not in use. Do not transfer to improperly marked containers.

UOP
Process Division
20 UOP Plaza—Algonquin & Mt Prospect Roads • Des Plaines, Illinois 60016
Telephone 312-391-2660 • Telex 25-3285 • TWX 910-233-3501

SAFE HANDLING INFORMATION--UOP REFINING CHEMICALS

Product Name Merox Catalyst No. 1 and No. 2

Chemical Family

Composition Cobalt Phthalocyanine Sulfonate

A. TOXICOLOGICAL PROFILE

Based on Animal Testing ☒

Estimated from Test Results on Components ☐

1. Oral Toxicity

LD50-Rats 4.4 gm/kg Rating* Slightly toxic

2. Dermal Toxicity

LD50-Rabbits > 4.0 gm/kg Rating* Practically non-toxic

Primary Skin Irritation Index-Rabbits

Skin Irritant? Corrosive?

3. Eye Irritation Danger

Draize Score-Rabbits 38 max. (Total Possible Score = 110)

Eye Irritant? Yes

4. Inhalation Danger

LC50-Rats > 150 mg/liter

Rating Not hazardous

---

* Ratings as defined by Spector, Handbook of Toxicology, Vol. I, 1956, W. B. Saunders Co.

B. PHYSICAL PROPERTIES

Boiling Point ______ °F

Vapor Pressure ______ mmHg

Specific Gravity @ ______ °F Variable bulk density

Solubility in Water Dispersible in caustic

Appearance and Odor Dusty blue powder - odorless

Flash Point ______ °F by ______

Flammable Limits - Lower ______ % Upper ______ %

C. HAZARDOUS PROPERTIES AND EMERGENCY PROCEDURES

1. Exposure Hazards Toxic with respect to eyes, ingestion.

   First Aid Procedures Wash with copious quantities of water until blue color can no longer be detected.

2. Fire and Explosion Hazards ______

   Fire Extinguishing Media ______

3. Spill Cleanup Procedure Sweep up excess powder, flush with water. May be disposed with waste caustic.

4. Stability stable

5. Incompatability (Materials to Avoid) ______

6. Special Handling Precautions Avoid inhalation of dust and skin or eye contact.

   Protective Gloves ☒ Eye Protection ☒

   Other Protective Equipment Use applicable dust respirator

NOTE: If further details are required, please address inquiries to:
Refining Chemicals Department, UOP Process Division
20 UOP Plaza, Des Plaines, Illinois 60016.

Name Howard J. Schorp Signature Howard J. Schorp

Title Coordinator - Commercial Chemical Development Date May 4, 1979

APPENDIX C

LABORATORY ANALYSIS SHEETS

CUSTOMER G.A. Baca & Associates
ADDRESS 330 Gariield
CITY Santa Fe, NM 87501
ATTENTION
INVOICE NO. 110089

REPORT OF ANALYSIS

SAMPLES RECEIVED 9/18/81

CUSTOMER ORDER NUMBER

TYPE OF ANALYSIS Water Date Collected 9/17/81 @ 10:30 am

Sample Identification	Type of Analysis	mg/l
So. Union Well Water	Aluminum	< 0.1
	Arsenic	0.01
	Barium	0.3
	Cadmium	< 0.001
	Chromium	0.001
	Cobalt	< 0.01
	Copper	0.002
	Iron	0.02
	Lead	< 0.001
	Manganese	0.002
	Mercury (total)	< 0.0004
	Molybdenum	0.001
	Nickel	< 0.01
	Selenium	< 0.01
	Silver	< 0.01
	Zinc	< 0.1
So. Union Wastewater	Aluminum	< 0.1
	Arsenic	0.1
	Barium	0.5
	Cadmium	< 0.001
	Chromium	0.053
	Cobalt	< 0.01
	Copper	0.005
	Iron	4.6
	Lead	0.005
	Manganese	0.11
	Mercury (total)	0.0009
	Molybdenum	< 0.001
	Nickel	< 0.01
	Selenium	< 0.01
	Silver	< 0.01
	Zinc	0.1

10/20/81

APPROVED BY John D. Ritts, Manager Technical Services

PAGE 2 OF 2 PAGE

REPORT OF ANALYSIS

CUSTOMER G.A. Baca & Associates
ADDRESS 330 Garfield
CITY Santa Fe, NM 87501
ATTENTION
INVOICE NO. 110089

SAMPLES RECEIVED 9/18/81

CUSTOMER ORDER NUMBER

TYPE OF ANALYSIS Water

Sample Identification	Type of Analysis	mg/l
So. Union Wastewater no additives Collected 9/17/81 @ 10:30 am	Boron	2.0
	Chloride	505
	Fluoride	1.7
	Nitrogen, Nitrate (as N)	0.8
	pH Units	10.35
	Solids, Total Dissolved	1300
	Sulfate	292
	Benzene	< 1.0
	Toluene	< 1.0
	Ethylbenzene	< 1.0
	Pentachlorophenol	< 0.001
So. Union Well Water No additives Collected 9/17/81 @ 10:30 am	Boron	0.2
	Chloride	79
	Fluoride	1.0
	Nitrogen, Nitrate (as N)	3.5
	pH Units	8.0
	Solids, Total Dissolved	453
	Sulfate	74.5

10/21/81

APPROVED BY
John D. Ritts, Manager Technical Services

cep®
Controls for Environmental Pollution, Inc.
P.O. Box 5351 • 1925 Rosina • Santa Fe, New Mexico 87502
Telephone 505/982-9841

CUSTOMER G.A. Baca & Associates
ADDRESS 330 Garfield
CITY Santa Fe, NM 87501
ATTENTION
INVOICE NO. 110089

REPORT OF ANALYSIS

SAMPLES RECEIVED 9/18/81
CUSTOMER ORDER NUMBER

TYPE OF ANALYSIS Water for Phenols

Sample Identification	mg/l	Pentachlorophenol mg/l
So. Union Oil Well Water Collected 9/17/81 @ 10:30 am	< 0.001	-
So. Union Waste Water Collected 9/17/81	0.327	ND

ND - None Detected

10/21/81

APPROVED BY John D. Ritts
John D. Ritts, Manager Technical Services

Controls for Environmental Pollution, Inc.
P.O. Box 5351 • 1925 Rosina • Santa Fe, New Mexico 87502
Telephone 505/982-9841

REPORT OF ANALYSIS

CUSTOMER G.A. Baca & Associates
ADDRESS 330 Garfield
CITY Santa Fe, NM 87501
ATTENTION
INVOICE NO. 110089

SAMPLES RECEIVED 9/18/81	CUSTOMER ORDER NUMBER
TYPE OF ANALYSIS Water for Cyanide	

Sample Identification	mg/l
So. Union Well Water Collected 9/17/81 @ 10:30 am	< 0.1
So. Union Refining Co. Wastewater Collected 9/17/81 @ 10:30 am	260

APPROVED BY John D. Ritts
10/21/81 John D. Ritts, Manager Technical Services
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Telephone 505/982-9841

REPORT OF ANALYSIS

CUSTOMER G.A. Baca & Associates
ADDRESS 330 Garfield
CITY Santa Fe, NM 87501
ATTENTION
INVOICE NO. 110089

SAMPLES RECEIVED 9/18/81
CUSTOMER ORDER NUMBER

TYPE OF ANALYSIS Water

Sample Identification	Type of Analysis	pCi/l	ug/l
So. Union Wastewater Collected 9/17/81 @ 10:30 am	Radium-226	< 0.6	
	Radium-228	3.1 ± 2.3	
	Total Uranium		14
So. Union Well Water Collected 9/17/81 @ 10:30 am	Radium-226	< 0.6	
	Radium-228	4.2 ± 3.0	
	Total Uranium		< 5

10/21/81

APPROVED BY
John D. Ritts, Manager Technical Services

PAGE 1 OF 1 PAGE

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Telephone 505/982-9841

PILKO & ASSOCIATES, INC.
Business / Environmental / Real Estate Consultants

2707 NORTH LOOP WEST, SUITE 960
HOUSTON, TEXAS 77008
(713) 861-1417
FAX: (713) 861-6210

ENVIRONMENTAL SAMPLING AND TESTING OF SOILS AND GROUNDWATER AT SELECTED LOCATIONS

LOVINGTON, NEW MEXICO REFINERY

Prepared For

SOUTHERN UNION COMPANY

For PILKO & ASSOCIATES, INC.

Darryl E. Carlson

Richard F. Smullen, Jr.

Richard F. Smullen, Jr.

November, 1989
(2047.7830)

WOODLAND HILLS, CALIFORNIA • HOUSTON, TEXAS • CHICAGO, ILLINOIS • CHERRY HILL, NEW JERSEY

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A

A.

INTRODUCTION

A pre-disposition environmental assessment was completed at Southern Union's refinery, located near Lovington, New Mexico, by Pilko & Associates in October, 1988. The initial assessment recommended soils and groundwater sampling and analysis at several locations in the refinery. A preliminary soils and groundwater investigation was completed in November, 1988. A second groundwater sampling was completed in December, 1988. Additional wells were installed and groundwater was sampled in February, 1989.

Results from the preliminary investigation which included two monitoring wells, indicated a potential for groundwater contamination at the overflow pond, the truck rack separator, and the cooling tower. Subsequent work included the installation of temporary groundwater monitoring wells downgradient from the overflow pond, truck rack separator and the cooling tower, together with an upgradient well and an additional seven wells in the vicinity of the two tank farms. One monitoring well was also installed at a downgradient location on the property.

This report summarizes results of the sampling and analysis at the backfilled overflow pond, the truck rack separator and the cooling tower and presents a general overview of conditions at other locations in the refinery. Initial studies at the site were completed for the purchasing company. Subsequent studies were completed jointly for the buyer and seller in a cost sharing arrangement.

B

B.

FIELD INVESTIGATION

DRILLING

Near-surface, less than 15 feet, and subsurface soil samples from greater than 15 feet deep, were obtained during the preliminary soils and groundwater investigation. The shallow soils borings were completed using a large diameter auger rig owned by Hobbs Anchor Drilling Company. Drilling for deeper borings was performed by Northwest Engineering, Inc. with a hollow stem auger rig commonly utilized for collection of samples for environmental and geotechnical purposes. Continuous core samples were obtained from depths of approximately 15 feet to completion depths. The deeper borings were terminated at depths which were approximately 10 feet below the water table.

SOIL SAMPLING

Near-surface soil samples were obtained at locations 2, 3, and 5 at the overflow pond, truck rack separator and cooling tower respectively as shown on Figure 1. Borehole 2 was drilled through backfill and sludge in the overflow pond and Borehole 3 was drilled through stained soil at the northwest corner of the truck rack separator. The samples were collected by scraping cuttings from the large diameter auger at the selected depths directly into laboratory-supplied, pre-cleaned glass jars with plastic lids. Samples for analysis were collected generally at depths on the order of 5, 10, and 15 feet.

Subsurface soil samples from the two deeper borings at the overflow pond and truck rack separator, TW-1 and TW-2 respectively as shown on Figure 1, were selected from continuous cores. A sample was

293-3A
11-30-89

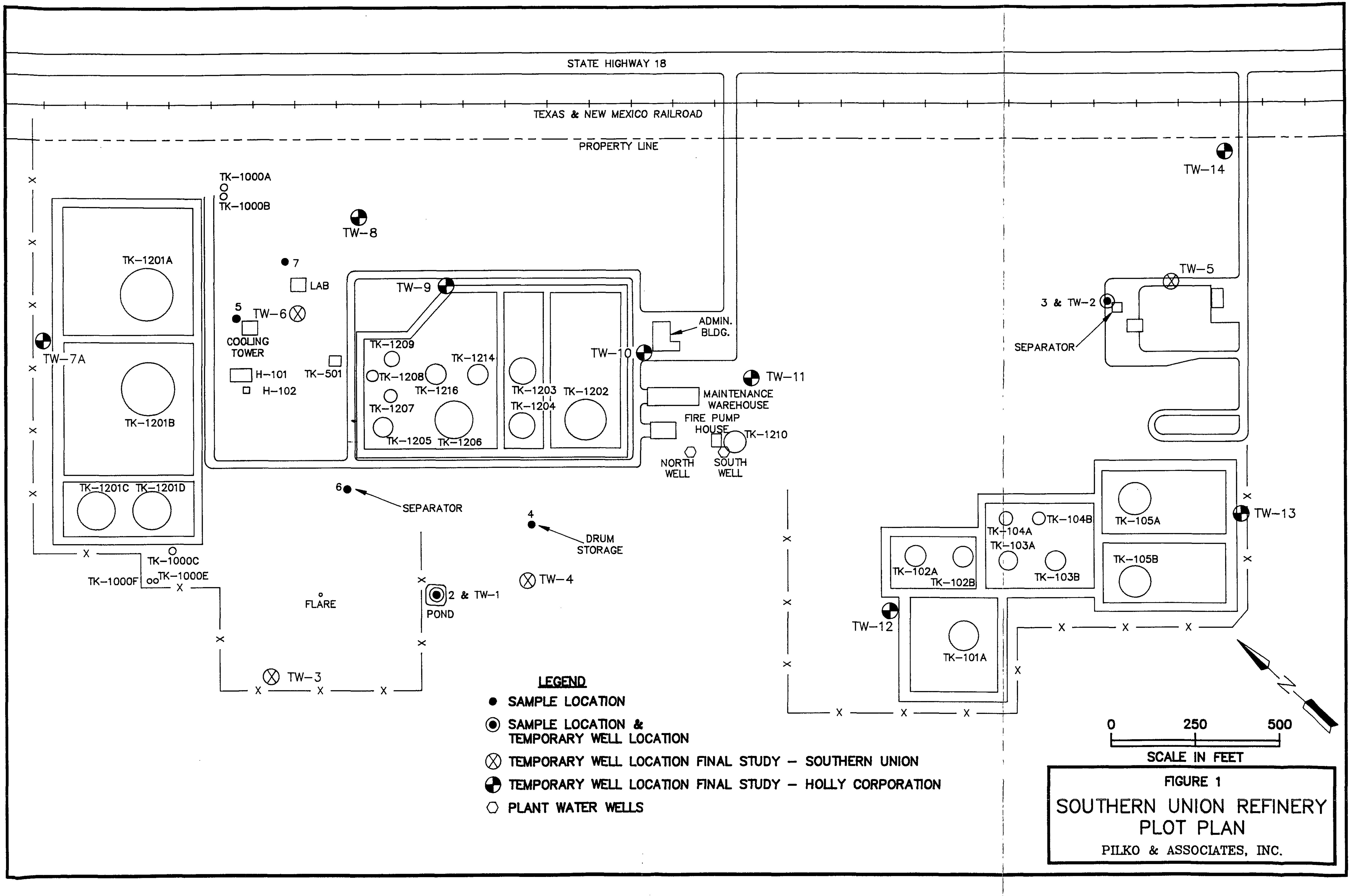

FIGURE 1

SOUTHERN UNION REFINERY PLOT PLAN

PILKO & ASSOCIATES, INC.

obtained from each five-foot core run and placed in a pre-cleaned, laboratory-supplied glass jar with a plastic lid. Prior to selecting the sample, each core was removed from the core barrel, placed on sheeting and examined for visual or olfactory indications of contamination. Descriptions of the soils encountered during drilling at these two locations were made by an onsite geologist and are included on the boring logs in Attachment 1.

Near-surface soil samples at the cooling tower, location 5, were obtained by collecting the loose materials at several locations around the cooling tower rather than from a borehole.

MONITORING WELL INSTALLATION

Temporary monitoring wells were installed at the overflow pond (TW-1), and the truck rack separator (TW-2), as indicated on Figure 1. Drilling was begun at depths of 15 feet in the previously completed near-surface sample borings. These wells were installed using the hollow stem auger rig (previously described) for subsurface soil sampling. When each borehole reached a depth of about ten feet below the water table, boring was terminated and well installation was begun.

During the preliminary soils and groundwater investigation, wells TW-1 and TW-2 were installed. Two-inch diameter schedule 40 PVC casing was inserted through the hollow stem portion of the auger to the planned screened depths. A ten-foot section of slotted screen with 0.010-inch slots was attached at the bottom end of the casing. Following insertion of the PVC casing, extraction of the augers was started by removing five-foot lengths, and then backfilling the annular space between the formation and the casing with commercial, bagged, silica filter sand. The sand backfill was continued to several feet above the slotted section and was followed by several feet above the slotted section and was followed by approximately 2-feet of bentonite pellets. The annular space above the bentonite pellet seal to within approximately 10 to 15 feet of the surface was filled with powdered bentonite. The remainder of the borehole to the surface was then filled with natural soil.

For subsequent installations, the well casings were inserted after the entire string of auger had been extracted to overcome any problems encountered on the first well. Cemented zones caused blockage of the hollow stem and prevented insertion of the PVC casing to the planned depths. The boreholes were stable and remained opened during well installations.

Backfill materials for subsequent monitoring wells TW-3 through TW-14 consisted of natural soil above the primary bentonite seal to within about 20 feet of the surface. Annular space from depths of 20 feet to the surface, above the natural soil backfill was filled with bentonite powder. Details for each of the installations are presented with the boring logs in Attachment 1.

During the last round of well installations, monitoring wells were installed at locations downgradient from the overflow pond (TW-4), truck rack separator (TW-5), and cooling tower (TW-6), along with one upgradient location (TW-3) around the two tank farms and also at a downgradient location as shown on the plan of locations, Figure 1.

MONITORING WELL DEVELOPMENT

Wells TW-1 and TW-2 were developed by bailing. Approximately ten gallons or about five well volumes, were bailed from each of the wells. These two wells were still yielding cloudy water when bailing was terminated.

Development for wells TW-3 through TW-14 was performed using a small gas-driven pump. Each well was pumped until a volume ranging from 30 to 40 gallons had been removed and at which time the effluent was relatively clear. Existing wells TW-1 and TW-2 were also pumped at the same time as TW-3 through TW-14 and approximately the same amount of water was removed from these wells.

MONITORING WELL SAMPLING

Prior to sampling, relative elevations of the well casings were determined by surveyors from John West Engineering. An assumed elevation of 100 was used for TW-2 and the other wells were surveyed relative to TW-2. These elevations are presented as Attachment 2. Water level measurements were made in each of the wells and these measurements have been converted to elevations as presented in Attachment 3.

Each well was sampled with a pre-cleaned, dedicated teflon bailer attached to a new rope. Prior to sample collection, water was removed from each well with the sampling bailer. Purged volumes and dates for each of the sampling events are listed below.

SAMPLING EVENTS AND PURGED VOLUMES

Sampling Event	Date	Well Nos.	Purged Volumes
Initial (First)	11-11-88	TW-1 and TW-2	5 gal (2-3 well volumes)
Second	12-19-88	TW-1 and TW-2	20-30 gal (10-15 well volumes)
Final	1-23-89	TW-1 to TW-14	5 gal (2-3 well volumes)

DECONTAMINATION

The augers and sampling tools were steam cleaned prior to beginning work at the site and between sample locations. The core barrel used for the subsurface sampling was washed with detergent between runs. Well casing had been cleaned and packaged at the factory. Bailers used for groundwater sampling were pre-cleaned and packaged at the laboratory. The laboratory cleaning included a soapy water scrub followed by a rinse with deionized water, followed by a nitric acid rinse, followed by a deionized water rinse. A final wash with methanol and a deionized water rinse completed the bailer cleaning. Soil sample jars were pre-cleaned in the laboratory using a non-phosphate detergent and a deionized water rinse.

SAMPLE COLLECTION

Soil samples were collected in laboratory-supplied, pre-cleaned glass jars with plastic lids. These jars had been cleaned with a non-phosphate type detergent followed by a deionized water rinse. The groundwater samples were collected with laboratory pre-cleaned teflon bailers and new rope. Containers for groundwater samples were pre-cleaned in the laboratory using the same method as for the soil sample containers. Sample containers used for analysis of total metals in groundwater contained one milliliter of concentrated nitric acid per liter that had been added by the laboratory. No preservatives were placed in containers for field filtered samples from TW-1 and TW-2 for the final round of sampling.

Types and numbers of containers used for sampling were as follows:

<u>Soil Sampling</u>

o 2, pint-sized glass jars with plastic lids

Groundwater Sampling

- 3, 40-milliliter glass vials for volatile analysis
- 2, 1-liter glass for semi-volatile analysis
- 1, 1-liter plastic for metal analysis

Samples, soils and groundwater, from the three sampling efforts were shipped to the Professional Service Industries Inc. (PSI) laboratory in Deer Park, Texas. The second round of samples from wells TW-1 and TW-2 was split and sent to PSI and CRL Environmental (CRL) in California. Ice was maintained in the sample coolers during collection and shipping.

The samples were shipped via Federal Express with guaranteed next day delivery. Chain-of-custody documentation was maintained and copies follow each set of laboratory data in Attachments 4 through 8.

FIELD TESTS

Field tests on soil samples consisted of visual and olfactory monitoring. Portions of the groundwater samples to be analyzed for metals were filtered in the field for the last study. This consisted of using a 5 1/2-inch diameter gravity filter with eight micron filter paper. The previous two sampling efforts did not include any filtering. No other field tests were performed.

QA/QC SAMPLES

For the final sampling event, additional groundwater samples were collected to verify levels of some metals and organics at locations TW-1 and TW-2. These consisted of a field blank consisting of bottled water purchased at the local grocery store. Several duplicates and several field diluted samples were also collected in order to check validity of the results. The field diluted samples were used as checks for levels/concentrations of analytes in the primary and duplicate samples at TW-1 and TW-2. These samples were prepared using 50 percent primary sample and 50 percent bottled water.

C

C.

LABORATORY TESTING

SOILS

Laboratory analyses of near-surface, as well as subsurface soil samples were performed for priority pollutant metals, volatiles, and base neutral and acid extractable compounds. Analytical methods and results for near-surface soils from the backfilled overflow pond, truck rack separator, and cooling tower are presented in Attachment 4. Results for subsurface samples at the overflow pond and truck rack separator are presented in Attachment 5.

Subsurface soil samples from the overflow pond were analyzed at depths of 20 feet, 40 feet, and 70 feet. Subsurface samples at the truck rack were analyzed at depths of 20 feet, 30 feet, and 60 feet. Subsurface samples were not obtained at the cooling tower.

Subsurface soil samples were collected during drilling and installation of monitoring wells TW-3 through TW-14, but were not analyzed. Field observation of samples at these locations did not indicate the presence of contaminants.

GROUNDWATER

Groundwater samples were analyzed from three sampling events, for priority pollutant metals, volatiles, and base neutral and acid extractable compounds. These consisted of groundwater samples obtained in November and December, 1988, for wells TW-1 and TW-2; and January, 1989, for wells TW-1 through TW-14. Results for these analyses are presented in Attachments 6 through 8.

D

D.

GEOLOGY AND GROUNDWATER CONDITIONS

GEOLOGY

The refinery is located on the Southern High Plains physiographic province. The plains surface is developed on the late Tertiary aged Ogallala Formation, and is supported by massive caliche zones within the uppermost part of the formation. The Ogallala is underlain by the Triassic aged Dockum Group.

The Ogallala Formation consists of dense tan fine sand from the surface to depths in excess of 90 feet based on observations of cores from the monitoring well locations. No clay or thick silt seams were observed. The upper 15 feet, beginning at the surface, is generally more cemented than the sands found at greater depths.

GROUNDWATER

The refinery is located on the outcrop of the regional aquifer known as the Ogallala. The aquifer extends to a depth of approximately 255 feet at one of the refinery production wells and is underlain by a relatively impermeable formation locally referred to as Red Beds of the Dockum Group. Refinery well logs indicate that between depths of 90 and 220 feet, clay and sand are present and are underlain by gravel from 220 to 255 feet.

Groundwater occurs under watertable conditions at depths ranging from 76 feet at the overflow pond, to 66 feet at the truck rack separator. A water level contour map has been prepared from measurements made at the temporary well locations and is presented in Figure 2. This map shows groundwater flow in an east/southeasterly direction at a gradient of 0.002 ft/ft.

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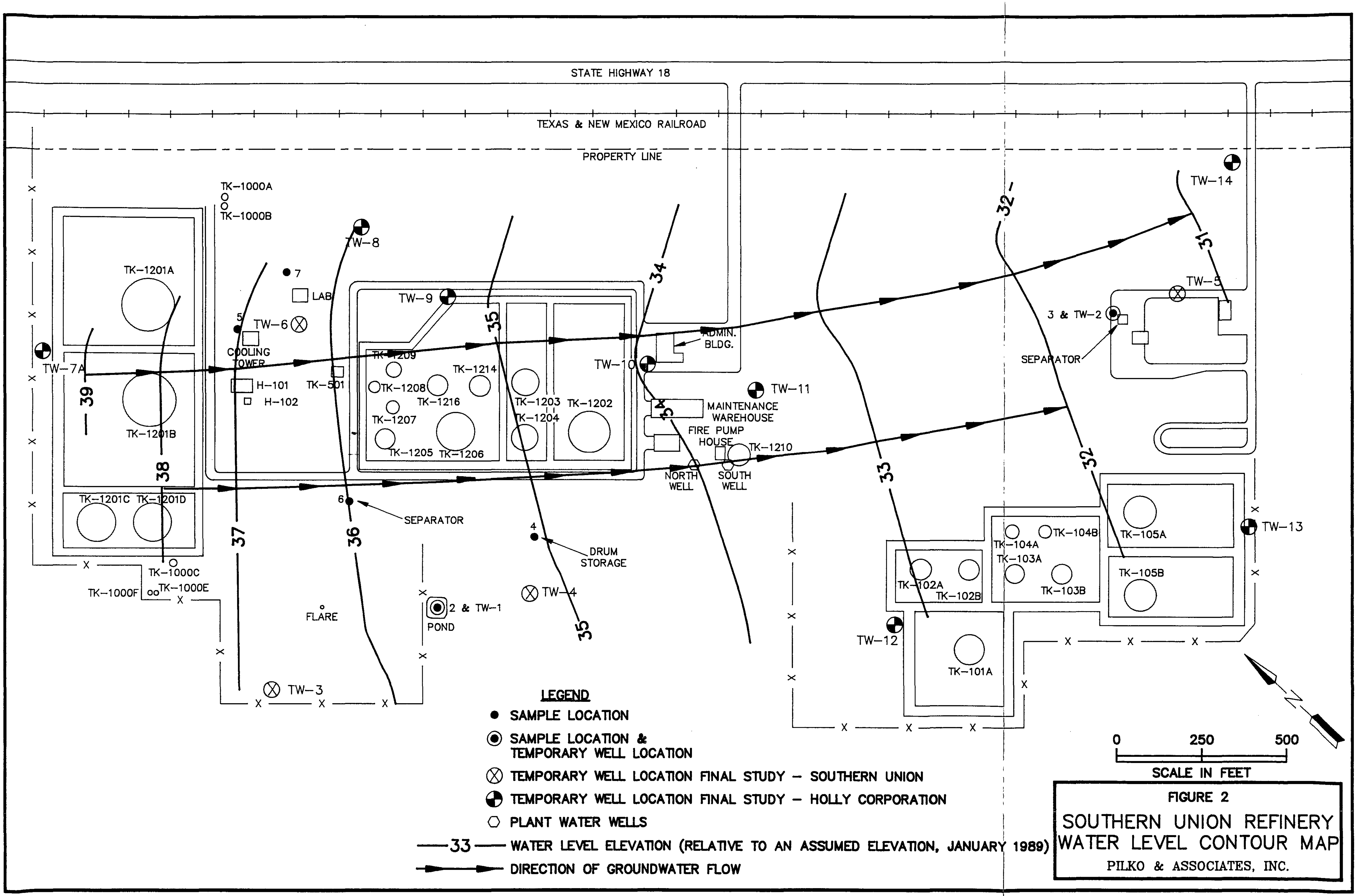

FIGURE 2
SOUTHERN UNION REFINERY
WATER LEVEL CONTOUR MAP
PILKO & ASSOCIATES, INC.

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FINDINGS

OVERFLOW POND

Soils

An auger hole was drilled through the backfilled pond for the preliminary soils and groundwater investigation. Samples were collected at depths of 5 feet 6 inches, 9 feet 11 inches, and 15 feet 4 inches. The sample taken at 5 feet 6 inches was analyzed and the other samples were temporarily retained. At a later date, the previously completed borehole was extended to a depth of 90 feet. Additional soil samples were taken and analyzed at depths of 20 feet, 40 feet, and 70 feet.

Occasional chemical odors were detected in soil cores beginning at a depth of 15 feet and continuing to approximately 40 feet. Below this depth, no odors were detected. The deeper boring was subsequently completed as monitoring well TW-1.

Results of tests for samples obtained during this preliminary study are summarized on Table 1. The shallow sample, a mixture of soil and sludge from a depth of 5 feet 6 inches, has elevated levels of chromium, copper, and zinc, together with benzene, toluene, ethylbenzene, and total xylenes (BTEX). Soil samples from depths of 20, 40, and 70 feet at this same location contain levels of arsenic indicative of the natural soils for this region, and no organics.

TABLE 1

SUMMARY OF LABORATORY ANALYSES
OVERFLOW POND
(TW-1)
1988 - INITIAL AND SECOND SAMPLING

	Soils (mg/kg)				Groundwater (mg/l)		
	Hole #2	TW-1			TW-1		
					Initial	Second	Second
DEPTH	5'6"	20'	40'	70'	11/14/88	12/19/88 PSI	12/19/88 CRL
Arsenic	<0.5	10.5	7.8	7.8	0.38	0.04	ND
Cadmium	3.83	0.6	0.71	1.0	0.12	0.81	0.92
Chromium	33.7	1.89	1.50	1.8	0.20	<0.01	0.10
Copper	11.2	0.94	<0.5	<0.5	0.07	0.75	1.0
Lead	<0.5	1.45	0.97	0.95	0.08	<0.01	ND
Nickel	7.48	5.07	11.4	2.07	0.08	0.53	0.03
Selenium	0.86	<0.5	1.3	<0.5	0.07	0.02	ND
Zinc	46.3	6.11	5.24	5.3	0.24	0.07	ND
Sulfide	8.0	4.8	4.8	4.0	4.0	*	*
Benzene	1.2	BRL	BRL	BRL	0.030	BRL	ND
Toluene	8.0	BRL	BRL	BRL	0.009	BRL	ND
Ethylbenzene	21.0	BRL	BRL	BRL	BRL	BRL	ND
Total Xylenes	43.0	BRL	BRL	BRL	**	BRL	ND

* = Not Analyzed
** = Detected but Below Reporting Limit
BRL = Below Reporting Limit
ND = Not Detected
Note: Metals results of groundwater are for unfiltered samples.

Groundwater

Results of initial groundwater sampling at this location, completed in mid-November, indicated potentially higher than background levels of arsenic, cadmium, chromium, lead, nickel, and selenium, together with low levels of benzene and toluene.

Additional groundwater sampling was performed at this well in mid-December to verify initial results. This sample was split and sent to two laboratories, Professional Service Industries, Inc. and CRL Environmental-South Coast. The results summarized in Table 1 indicate that organics were not detected in these samples. It is also noted that levels of metals were less than in the initial sample, but some such as cadmium, chromium, and nickel still appeared to be present at above background levels. These results are believed to have been influenced by metals content of the suspended sediment rather than the groundwater. It should be noted that 20 to 30 gallons of water was purged from this well prior to sampling. This resulted in a lower volume of sediment than was present in the initial sample.

Additional monitoring wells were installed at locations downgradient from the overflow pond, truck rack separator, and cooling tower, and at an upgradient location at the refinery, as shown on the plan of locations, Figure 1. Following installation of these additional wells, all were sampled. A summary of results of analyses for the final sampling of two wells at the overflow pond, TW-1 and TW-4, and the upgradient refinery well, TW-3, is presented in Table 2.

The upgradient well, TW-3, indicates groundwater with no volatile or semi-volatile organics and with metals present at background levels.

Final samples analyzed from TW-1, located in the backfilled pond, consisted of a primary, duplicate, field diluted, and field blank.

Only a primary sample was analyzed from the downgradient location TW-4.

Metals results for TW-1 primary and duplicate samples are comparable to those for the upgradient location TW-3. Analyses for the primary and duplicate samples indicate low to barely detectable levels of organics. The organics identified, however, indicate predominately halogenated compounds which were not identified in surface samples. Toluene was identified in the duplicate, but not in the primary sample. Results from the downgradient well, TW-4, showed antimony, cadmium, chromium, and lead in the unfiltered sample to be present at levels greater than at the pond and upgradient from the pond. The sample for TW-4 was filtered and the results for three of the four above listed metals were two orders of magnitude less than the unfiltered sample results. Antimony was not reanalyzed in the filtered sample, but based on results for lead and chromium, it is anticipated to be considerably lower. Analyses for volatile and semi-volatile compounds, as shown in Table 2, indicate six volatiles and no semi-volatiles present. All compounds detected were at low levels not sufficient to be quantified and most were halogenated compounds not identified in area surface soils.

Comparing of the results for the two wells in and downgradient from the overflow pond with the upgradient well, indicate that metals contents from the upgradient location to the pond and to the downgradient location are not substantially different and do not indicate a downgradient increase. Increased levels of metals in unfiltered samples are due to presence of metals in the suspended sediments rather than dissolved in groundwater as indicated by results for filtered samples.

A review of organics analyses from the backfilled pond area and downgradient compared with the upgradient location indicates the presence of several organics. Those identified by the laboratory,

TABLE 2

SUMMARY OF LABORATORY ANALYSES
OVERFLOW POND
1989 - FINAL SAMPLING

	(Up) TW-3	TW-1	TW-1 Lab Filtered	TW-1 Duplicate	TW-1 Field Dilution	TW-1 Field Blank	TW-1 Field Filtered	(Down) TW-4	TW-4 Lab Filtered
Antimony, mg/l	<0.01	0.03		0.01	<0.01	<0.01	<0.01	0.11	
Arsenic	<0.01	0.01		<0.01	<0.01	<0.01	<0.01	0.02	
Beryllium	<0.01	<0.01		<0.01	<0.01	<0.01	0.01	0.02	
Cadmium	0.02	0.02	<0.005	0.01	0.01	0.01	0.01	0.03	<0.005
Chromium	0.04	0.06		0.04	0.03	0.03	0.03	0.24	<0.005
Copper	<0.01	0.02		<0.01	<0.01	<0.01	<0.01	0.03	
Lead	0.02	0.03		0.02	<0.01	<0.01	<0.01	0.07	<0.005
Mercury	<0.001	<0.001		<0.001	<0.001	<0.001	<0.001	<0.001	
Nickel	<0.01	0.03		<0.01	<0.01	0.01	0.01	0.04	
Selenium	<0.01	<0.01		<0.01	<0.01	<0.01	<0.01	<0.01	
Silver	<0.01	0.01		<0.01	<0.01	0.01	<0.01	<0.01	
Thallium	0.01	0.01		0.01	<0.01	<0.01	<0.01	0.03	
Zinc	0.05	0.09		0.06	0.07	<0.01	0.01	0.10	
Cyanide	<0.05	<0.05		<0.05	<0.05	<0.05	<0.05	<0.05	
1,1,2-Trichloroethane, µg/l	BRL	**		**	BRL	BRL		**	
1,1,2,2-Tetrachloroethane	BRL	3		12	BRL	BRL		**	
Toluene	BRL	BRL		**	BRL	BRL		**	
1,1-Dichloroethane	BRL	**		BRL	BRL	BRL		BRL	
1,2-Dichloroethane	BRL	4		BRL	BRL	BRL		BRL	
1,2-Dichloropropane	BRL	**		BRL	BRL	BRL		BRL	
1,2-Dichlorobenzene	BRL	**		**	BRL	BRL		**	
1,3-Dichlorobenzene	BRL	BRL		**	BRL	BRL		**	
1,4-Dichlorobenzene	BRL	BRL		**	BRL	BRL		**	
Trichloroethene	BRL	3		11	BRL	BRL		BRL	
Dibromochloromethane	BRL	**		**	BRL	BRL		BRL	
Bromoform	BRL	**		**	BRL	BRL		BRL	
Chloroform	BRL	BRL		**	BRL	BRL		BRL	
Bromodichloromethane	BRL	BRL		**	BRL	BRL		BRL	
1,1,1-Trichloroethane	BRL	BRL		**	BRL	BRL		BRL	
Carbon tetrachloride	BRL	BRL		**	BRL	BRL		BRL	
1,2-Dichloropropane	BRL	BRL		**	BRL	BRL		BRL	
Chlorobenzene	BRL	BRL		**	BRL	BRL		BRL	
Ethylbenzene	BRL	BRL		80	**	BRL		BRL	
Chloromethane	BRL	BRL		BRL	BRL	BRL		BRL	

** = Detected but below reporting limit
BRL = Below Reporting Limit
Note: Metals results are for unfiltered samples except where noted.

however, are chlorinated hydrocarbons, not indicated to be present in the soils of the overflow pond, as shown in Table 1. The only organics identified in the soil samples were BTEX. Of the organics identified in near-surface soils and deeper subsurface soils at the former pond location, only toluene and ethylbenzene were identified in any of the groundwater samples for the last sampling event. In those samples, toluene was identified in the duplicate sample for TW-1 but not the primary sample, and in the downgradient sample of TW-4. Ethylbenzene was identified in the duplicate sample for TW-1 but not in the primary sample, and was not identified downgradient.

Identification of chlorinated hydrocarbons at very low levels, together with the erratic occurrence of ethylbenzene and toluene indicates a laboratory or sampling-induced source rather than the pond. Therefore, it is concluded that the pond is not influencing the groundwater at this location. Previous sampling for the first round, where several organics were identified in the groundwater, is believed to have been influenced by the drilling and well installation effort which may have introduced some contaminants from the shallow soils. Above background metal contents are probably due to metals in suspended sediments of the groundwater samples rather than dissolved metals.

TRUCK RACK SEPARATOR

Soils

A boring was drilled at the northwest corner of the separator. Soil samples were collected at depths of five feet three inches and eight feet. The sample taken at five feet three inches was analyzed and the other samples were temporarily retained. Monitoring well TW-2 was drilled through this original shallow soil boring. Samples were taken and analyzed from depths of 20, 30, and 60 feet.

Table 3 summarizes laboratory results of the soils from Borehole 3 and from TW-2, at depths of 20, 30, and 60 feet. These soil sample results indicate no elevated levels of metals, with the possible exception of nickel at the 60 foot depth in the deeper boring, and the presence of some organics in the near-surface soils at a depth of five feet three inches. At this location, acetone, benzene, 2-Butanone, toluene, naphthalene, ethylbenzene, 2-Methylnaphthalene, total xylenes, 1,1,1-Trichloroethane, and 1,1,2,2-Tetrachloroethane were identified in the shallow soils. These organics were also identified in the soils at 20 and 30 foot depths. The 60 foot deep sample did not indicate the presence of organics except for 2-Butanone, which was at a level below quantification limits.

Groundwater

Groundwater was sampled in well TW-2 in mid-November, 1988, and again in mid-December, 1988. Groundwater from the initial unfiltered sample taken in mid-November, 1988, indicated potential above background levels of arsenic, cadmium, chromium, and selenium, together with several organics. The organics identified were acetone, benzene, 2-Butanone, toluene, naphthalene, ethylbenzene, 2-Methylnaphthalene, total xylenes, 1,1,1-Trichloroethane, and 1,1,2,2-Tetrachloroethane. Subsequent groundwater samples taken in mid-December were split and sent to two laboratories, PSI and CRL. Results from these tests indicated lower concentrations of metals in unfiltered samples, together with lower levels of organics. PSI identified acetone, 2-Butanone, and total xylenes at low levels that were below quantification and CRL identified no organics. It should be noted that 20 to 30 gallons of water was purged from this well prior to the second sampling. This resulted in a lower volume of sediment than was present in the initial sample and lower metals levels.

TABLE 3

SUMMARY OF LABORATORY ANALYSES
TRUCK RACK SEPARATOR
(TW-2)
1988 - INITIAL AND SECOND SAMPLING

	Soils (mg/kg)				Groundwater (mg/l)		
	Hole #3	TW-2			TW-2		
					Initial	Second	Second
DEPTH	5'3"	20'	30'	60'	11/14/88	12/19/88 PSI	12/19/88 CRL
Arsenic	3.96	9.4	7.70	6.10	0.26	0.03	ND
Cadmium	0.61	0.94	0.74	0.75	0.09	0.35	0.28
Chromium	2.76	1.19	1.15	1.39	0.08	<0.01	0.03
Copper	<0.50	1.15	<0.50	<0.50	0.04	<0.01	0.04
Lead	<0.50	0.61	0.85	0.44	0.05	<0.01	ND
Nickel	2.18	4.61	4.11	19.8	0.07	0.55	ND
Selenium	<0.50	1.08	1.55	0.85	0.05	<0.01	ND
Zinc	7.16	5.80	4.66	4.59	0.19	0.05	0.03
Sulfide	3.20	3.2	6.4	4.80	4.0	*	*
Acetone	BRL	BRL	BRL	BRL	0.090	*	ND
Benzene	1.8	BRL	BRL	BRL	0.20	BRL	ND
2-Butanone	13.0	BRL	4.0	**	0.030	*	ND
Toluene	BRL	0.3	BRL	BRL	0.02	BRL	ND
Naphthalene	6.3	16.0	9.4	BRL	**	BRL	ND
Ethylbenzene	15.0	6.0	1.0	BRL	0.007	BRL	ND
2-Methylnaphthalene	BRL	20.9	15.0	BRL	**	BRL	ND
Total Xylenes	32.0	20.0	8.0	BRL	0.010	*	ND
1,1,1-Trichloroethane	0.48	4.0	BRL	BRL	0.007	BRL	ND
1,1,2,2-Tetrachloroethane	BRL	40.0	4.0	BRL	BRL	BRL	ND

* = Not Analyzed
** = Detected but below reporting limit
BRL = Below Reporting Limit
ND = Not Detected
Note: Metals Results of groundwater are for unfiltered samples.

wells were sampled. A summary of results for the final sampling is presented in Table 4, comparing results of the upgradient well TW-3, with well TW-2 located adjacent to the separator, and TW-5 located hydraulically downgradient. Comparing the results for the metals from TW-2 located adjacent to the truck rack, and TW-5, located downgradient, indicates no increase.

Organics were identified in some samples from well TW-2; however, at the downgradient location, no organics were identified. At location TW-2, 1,1,2-Trichloroethane, 1,1-Dichloroethane, 1,2-Dichlorobenzene, 1,3-Dichlorobenzene, 1,4-Dichlorobenzene, trichloroethene, bromoform, chloroform, bromodichloromethane, and 1,2-Dichloropropoane were identified in the primary sample at levels below the quantification limits. Only 1,2-Dichloroethane was quantified at a low level of four parts per billion. The duplicate sample only identified one organic (1,1,1-Trichloroethane), and the level was below the quantification limit.

A review of laboratory results for groundwater indicates no measurable effect from the truck rack separator. The erratic occurrence of some organics, specifically those not identified in near-surface samples would tend to indicate a laboratory or sampling source rather than the separator or refinery.

COOLING TOWER

Soils

Near-surface soil in the area around the cooling tower is yellow/green from apparent chromium staining. A sample of the thin layer of loose surface soil in the cooling tower area (No. 5) was composited and sent to the laboratory for analysis. No groundwater samples were obtained in the initial preliminary soils and groundwater investigation.

TABLE 4

SUMMARY OF LABORATORY ANALYSES
TRUCK RACK SEPARATOR
1989 - FINAL SAMPLING

	(Up) TW-3	TW-2	TW-2 Duplicate	TW-2 Field Filtered	TW-2 Field & Lab Filtered	TW-2 Field Dilution	TW-2 Field Dilution Filtered	(Down) TW-5
Antimony, mg/l	<0.01	<0.01	<0.01	<0.01		<0.01		0.03
Arsenic	<0.01	0.01	0.01	0.01		<0.01		0.01
Beryllium	<0.01	<0.01	<0.01	<0.01		<0.01		<0.01
Cadmium	0.02	0.01	0.01	0.02	0.012	0.02	0.014	<0.01
Chromium	0.04	0.02	0.03	0.03	0.021	0.03	0.016	0.04
Copper	<0.01	<0.01	<0.01	<0.01		<0.01		0.01
Lead	0.02	<0.01	<0.01	<0.01		<0.01		0.02
Mercury	<0.001	<0.001	<0.001	<0.001		<0.001		<0.001
Nickel	<0.01	0.01	<0.01	<0.01		<0.01		0.02
Selenium	<0.01	<0.01	<0.01	<0.01		<0.01		<0.01
Silver	<0.01	0.01	<0.01	<0.01		<0.01		0.01
Thallium	0.01	<0.01	<0.01	<0.01		<0.01		0.01
Zinc	0.05	<0.04	0.05	<0.01		0.01		0.07
Cyanide	<0.05	<0.05	<0.05	<0.05		<0.05		<0.05
1,1,2-Trichloroethane, µg/l	BRL	**	BRL			BRL		BRL
1,1,2,2-Tetrachloroethane	BRL	BRL	BRL			BRL		BRL
Toluene	BRL	BRL	BRL			**		BRL
1,1-Dichloroethane	BRL	**	BRL			BRL		BRL
1,2-Dichloroethane	BRL	4	BRL			BRL		BRL
1,2-Dichloropropane	BRL	BRL	BRL			BRL		BRL
1,2-Dichlorobenzene	BRL	**	BRL			BRL		BRL
1,3-Dichlorobenzene	BRL	**	BRL			BRL		BRL
1,4-Dichlorobenzene	BRL	**	BRL			BRL		BRL
Trichloroethene	BRL	**	BRL			BRL		BRL
Dibromochloromethane	BRL	BRL	BRL			BRL		BRL
Bromoform	BRL	**	BRL			BRL		BRL
Chloroform	BRL	**	BRL			BRL		BRL
Bromodichloromethane	BRL	**	BRL			BRL		BRL
1,1,1-Trichloroethane	BRL	BRL	**			BRL		BRL
Carbon tetrachloride	BRL	BRL	BRL			BRL		BRL
1,2-Dichloropropane	BRL	**	BRL			BRL		BRL
Chlorobenzene	BRL	BRL	BRL			BRL		BRL
Ethylbenzene	BRL	BRL	BRL			BRL		BRL
Chloromethane	BRL	BRL	BRL			BRL		BRL

** = Detected but below reporting limit
BRL = Below reporting limit
Note: Metals results are for unfiltered samples except where noted

Subsurface conditions at the cooling tower were investigated during the final phase of soils and groundwater study by installating of a well, TW-6, in a downgradient direction from the tower. The results from the laboratory tests for the shallow surface soil sample No. 5 together with the groundwater sample (TW-6), and results of the upgradient well TW-3, are summarized on Table 5. Test results show that the surface soils around the cooling tower contain high levels of chromium and zinc. The concentration of chromium in sample No. 5 was elevated, but not to the extent of chromium and zinc. No organic compounds were present in the surface soils at this location.

Groundwater

Results of a groundwater sample from TW-6 indicate that metals concentrations are not elevated and are comparable to levels found upgradient. Additionally, no organics were identified in the groundwater. The results compare favorably with TW-3, the upgradient location, and the cooling tower does not appear to be affecting the groundwater.

OTHER AREAS

Monitoring wells TW-7 through TW-13 were installed primarily around the two tank farms on the west and south sides at the refinery, and TW-14 was installed at a hydraulically downgradient location as shown on Figure 1.

Soils

Soils conditions were the same as were observed in other areas of the refinery. No laboratory analyses were performed on samples from these locations since no visual or olfactory evidence of contamination was present.

TABLE 5

SUMMARY OF LABORATORY ANALYSES
COOLING TOWER
1988 - 1989 INITIAL AND FINAL SAMPLING

	Soil (mg/kg) Initial	Groundwater (mg/L) Final	
	Hole #5	(Up) TW-3	(Down) TW-6
Antimony	2.33	<0.01	0.01
Arsenic	19.6	<0.01	0.01
Beryllium	<0.5	<0.01	<0.01
Cadmium	4.83	0.02	<0.01
Chromium	5,440.0	0.04	0.04
Copper	26.8	<0.01	0.01
Lead	8.2	0.02	0.01
Mercury	<0.10	<0.001	<0.001
Nickel	5.41	<0.01	0.02
Selenium	<0.50	<0.01	<0.01
Silver	<0.50	<0.01	<0.01
Thallium	1.45	0.01	<0.01
Zinc	10,100.0	0.05	0.05
Cyanide	*	<0.05	<0.05
1,1,2-Trichloroethane	BRL	BRL	BRL
1,1,2,2-Tetrachloroethane	BRL	BRL	BRL
Toluene	BRL	BRL	BRL
1,1-Dichloroethane	BRL	BRL	BRL
1,2-Dichloroethane	BRL	BRL	BRL
1,2-Dichloropropane	BRL	BRL	BRL
1,2-Dichlorobenzene	BRL	BRL	BRL
1,3-Dichlorobenzene	BRL	BRL	BRL
1,4-Dichlorobenzene	BRL	BRL	BRL
Trichloroethene	BRL	BRL	BRL
Dibromochloromethane	BRL	BRL	BRL
Bromoform	BRL	BRL	BRL
Chloroform	BRL	BRL	BRL
Bromodichloromethane	BRL	BRL	BRL
1,1,1-Trichloroethane	BRL	BRL	BRL
Carbon tetrachloride	BRL	BRL	BRL
1,2-Dichloropropane	BRL	BRL	BRL
Chlorobenzene	BRL	BRL	BRL
Ethylbenzene	BRL	BRL	BRL
Chloromethane	BRL	BRL	BRL

* = Not Analyzed

Groundwater

Test results at locations TW-7 through TW-14 indicate that impacts to groundwater requiring remediation are not present. Metals concentrations from wells TW-7 through TW-14 are within the range observed for other wells. Results for some filtered samples indicated that sediment in the groundwater samples increased the levels of metals by one to two orders of magnitude. Organics were only identified at locations TW-9, TW-10, TW-11, and at low to very low levels. At locations TW-9 and TW-11, toluene was identified but at levels that are below quantification. Chloromethane was identified in TW-10 at a low level of 21 parts per billion. The presence of a chlorinated hydrocarbon at this location is suspect and is believed to have been introduced in the laboratory rather than at the refinery.

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REPORT LIMITATIONS

The scope of this report is limited to the matters expressly covered. This report is prepared for the sole benefit of **Southern Union Company**, and may not be relied upon by any other person or entity without the written authorization of Pilko & Associates, Inc.

In preparing this report, Pilko & Associates, Inc. has relied on information derived from secondary sources and personal interviews. Except as set forth in this report, Pilko & Associates, Inc. has made no independent investigation as to the accuracy or completeness of the information derived from the secondary sources and personal interviews and has assumed that such information was accurate and complete.

All recommendations, findings, and conclusions stated in this report are based upon facts and circumstances as they existed at the time that this report was prepared (e.g., Federal, State, and local laws, rules, regulations, market conditions, energy costs, wage rates, political climate, and other matters that Pilko & Associates, Inc. deemed relevant). A change in any fact or circumstance upon which this report is based may adversely affect the recommendations, findings, and conclusions expressed in this report.

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ATTACHMENTS

1. Boring Logs and Well Installation Details
2. Survey Elevations
3. Water Level Measurements and Elevations
4. Laboratory Results - Soils, (Near-Surface - November, 1988) Boreholes 2, 3, and 5
5. Laboratory Results - Soils, (Subsurface - December, 1988) TW-1 and TW-2
6. Laboratory Results - Groundwater, (Monitoring Wells - December 1, 1988) TW-1 and TW-2
7. Laboratory Results - Groundwater, (Monitoring Wells - December 28, 1988) TW-1 and TW-2
8. Laboratory Results - Groundwater, (Monitoring Wells - February, 1989) TW-1 through TW-14

CLOSURE PLAN
SOUTHERN UNION COMPANY
LEA REFINERY, NEW MEXICO
OVERFLOW POND

Prepared For
SOUTHERN UNION COMPANY
August 14, 1989

REED & ASSOCIATES, INC.
Hydrologists & Environmental Consultants

A Geraghty & Miller Company

RECEIVED

AUG 25 1989

OCD
HOBBS OFFICE

CLOSURE PLAN
SOUTHERN UNION COMPANY
LEA REFINERY, NEW MEXICO
OVERFLOW POND

Prepared For

SOUTHERN UNION COMPANY

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Hydrologists & Environmental Consultants
Midland - Corpus Christi - Austin

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CLOSURE PLAN
SOUTHERN UNION COMPANY
LEA REFINERY, NEW MEXICO
OVERFLOW POND

INTRODUCTION

This report describes the procedures proposed for the closure of a contaminated soil area at the prior location of the overflow pond at the Lea Refinery on State Highway 18 south of Lovington, Lea County, New Mexico (Figure 1). The Lea Refinery was formerly owned by Southern Union Company of Dallas, Texas. The property was recently sold to The Holly Corporation, also of Dallas. The refinery is not operating at present.

The overflow pond (Figure 2), a fiberglass-lined pit, was drained of fluid and backfilled with soil prior to the sale of the property. This pond had been used to receive overflow from the process area separator. Sludges were left in place for this closure.

Southern Union Company employed Reed and Associates, Inc. to oversee characterization sampling of the sludges remaining in the overflow pond and soil sampling below the fiberglass liner. Actual sampling was conducted by Chemical Waste Management, Inc. and their subcontractor Western

Technologies, Inc. This closure plan details the results of the investigations conducted at the overflow pond and makes recommendations for cleanup of the sludges and soils at the site.

SITE DESCRIPTION

Setting

The Lea Refinery is located about 4 miles southeast of Lovington, New Mexico on the Llano Estacado of eastern New Mexico and western Texas. The Llano Estacado is a depositional surface of low relief sloping uniformly to the southeast. There is no integrated drainage in the area and runoff flows to shallow depressions where it remains until it evaporates or seeps into the ground.

Elevations at the refinery range from about 3,845 feet on the northwest to 3,815 feet on the southeast. The topographic slope is approximately 25 feet per mile to the southeast.

The climate of this portion of New Mexico is characterized by low annual precipitation (12 to 15 inches per year), low humidity and high average annual temperature. The climate has been classified as marginal between semiarid and arid.

Geology

The area of interest is part of a large subsurface structural feature known as the Permian basin. Oil and gas exploration has revealed a complex subsurface geology which involves rocks from Precambrian to Permian in age. This structure is overlain by gently southeasterly dipping Triassic redbeds separated from the older rocks by an erosional unconformity.

Above the Triassic redbeds are the Pliocene age sediments of the Ogallala formation. These sediments form the Llano Estacado surface and were deposited by easterly flowing braided streams following the Laramide revolution and the raising of the Rocky Mountains to the west.

The Ogallala is composed of sands, silts, clays and gravels with no persistent marker beds in the formation. Basal gravel is present in many places, usually in buried stream valleys in the pre-Ogallala erosional surface. The upper portion of the Ogallala contains a dense caliche cap up to 8 feet thick at the refinery site.

Hydrology

The Ogallala formation is the major source of ground water in the region. Recharge to this aquifer occurs from rainfall on the outcrop. Only a small percentage of precipitation actually reaches the aquifer due to a combination of low rainfall, high evaporation rate, and a generally low infiltration rate. Water in the Ogallala is unconfined and contained in pore spaces of the clastic sediments.

The quality of water from the Ogallala in Lea County is generally fair with total dissolved solids usually less than 1,100 milligrams per liter (mg/l). The water is typically high in silica, contains moderate amounts of calcium and magnesium, and is low in sulfate, sodium and chloride. Brine contamination of the Ogallala, mostly the result of the past practice of placing produced brine from oil wells into shallow unlined surface pits for evaporation, is known to occur in parts of Lea County.

The ground water gradient at the Lea Refinery is to the southeast at about 10 feet per mile. Depth to water is 75 to 80 feet.

FIELD PROGRAM METHODOLOGY

Background Soil Sampling

Four soil samples (BG-1,2,3,4) were collected at random by Western Technologies, Inc. personnel from widely separated areas of the Lea Refinery (Figure 2). These samples were collected from the approximate depth of 1 to 2 feet using a clean stainless steel trowel. Samples to be analyzed for volatile organic compounds (VOC) and total metals were placed into 500 milliliter (ml) glass jars, sealed, and preserved by cooling in an ice chest. Samples for total petroleum hydrocarbons (TPH) were placed in 40 ml vials and similarly handled. Quality control and chain-of-custody procedures were employed.

Samples were sent to a laboratory chosen by Western Technologies, Inc. and analyzed for VOC by EPA Method 8240, TPH by Method 3050/418.1 and total metals by Method 3050/6010. The analytical results were used to establish background or baseline levels for VOC, TPH and total metals on the refinery site.

Borrow Pit Sampling

A borrow pit located off-site to the southwest of the refinery was sampled to determine the suitability of material from this pit for use as backfill for any excavation work to be performed at the overflow pond site. Two soil samples (BL-1, BL-2) were collected from the western working face of the pit.

Samples were collected with a clean stainless steel trowel by digging into the mining face to a depth of up to one foot. Samples for VOC and total metals were placed in 500 ml glass jars and those for TPH in 40 ml vials. All samples were shipped to the laboratory for analyses by EPA Methods 8240, 3050/418.1 and 3050/6010.

Overflow Pond Characterization Sampling

The limits of the overflow pond were determined from aerial photographs taken of the site while it was in use. Five boreholes (CP-1,2,3,4,5 in Figure 3) were drilled in the area of the overflow pond to retrieve samples of sludges which were left in place when the pond was backfilled with soil. Borehole CP-1 was advanced to a total depth of 50 feet to obtain soil samples below the fiberglass liner. Sample intervals were approximately every 2 feet to a depth of 20 feet, then every 5 feet for the remainder of the boring.

The fiberglass liner appeared to be intact in CP-1 at 8 feet in depth, in CP-2 at about 4 feet, and in CP-3 at 5-1/2 feet. No liner was found at CP-4 which contained no sludge and was apparently outside the limits of the pond. CP-5 was not advanced deep enough to encounter the liner. The top of the sludge in CP-1 was at a depth of 5 feet, in CP-2 at 3 feet, in CP-3 at 4 feet, and in CP-5 at 4 feet.

A hollow stem auger rig was used to advance the borings. Soil samples were collected with a split spoon. Six-inch long, 2-1/2-inch diameter brass liners were used in the split spoon to catch the driven sample. The brass liners were sealed with plastic end caps. Standard preservation and chain-of-custody procedures were followed. The deep borehole was grouted with cement (2% bentonite content) to prevent any downward migration of contaminants. The auger was decontaminated between borings and the split spoon between sampling to prevent cross contamination.

All samples were designated by borehole number and depth, such as CP-1-7-7.5 which designates a sample interval of 7 to 7.5 feet at borehole CP-1. All overflow pond samples were submitted to the laboratory for VOC analyses by EPA Method 8240, TPH by EPA Method 3050/418.1, and total metals by Method 3050/6010. All sludge samples were also run for EP Toxicity Metals by EPA Method 1310/3010/6010.

RESULTS

Background and Borrow Pit

The results of background and borrow pit soil analyses may be found in Table 1. Laboratory sheets are in Appendix A. None of the samples contained any detectable volatile organic compounds except for trace amounts of methylene chloride in BG-4 and BL-2. Western Technologies, Inc. has indicated that the presence of methylene chloride is due to laboratory contamination.

The borrow pit samples contained no detectable petroleum hydrocarbons. All refinery background samples contained detectable TPH in levels ranging from 3.9 to 28.3 milligrams per kilogram (mg/kg).

The differences between the borrow pit TPH concentrations and those of the refinery background soil samples possibly reflects the differences in the depths at which the samples were taken. The borrow pit samples were taken at a depth of about eight feet in sandy caliche. Background samples were of surface soils. Surface soils at the refinery may contain small amounts of non-volatile hydrocarbon residue built up over time due to general airborne emissions in the environs of the refinery.

TABLE 1
BACKGROUND AND SOIL PIT ANALYSES

VOLATILE ORGANIC COMPOUNDS IN UG/KG

	Background				Borrow Pit	
Compound	BG-1	BG-2	BG-3	BG-4	BL-1	BL-2
Detection Level	Low	Low	Low	Low	Low	Low
Chloromethane	<10	<10	<10	<10	<10	<10
Bromomethane	<10	<10	<10	<10	<10	<10
Vinyl Chloride	<10	<10	<10	<10	<10	<10
Chloroethane	<10	<10	<10	<10	<10	<10
Methylene Chloride	<5	<5	<5	5.98*	<5	7.1*
Acetone	<10	<10	<10	<10	<10	<10
Carbon Disulfide	<5	<5	<5	<5	<5	<5
1.1-Dichloroethene	<5	<5	<5	<5	<5	<5
1.1-Dichlorethane	<5	<5	<5	<5	<5	<5
1.2-Dichlorethane (total)	<5	<5	<5	<5	<5	<5
Chloroform	<5	<5	<5	<5	<5	<5
1.2-Dichloroethane	<5	<5	<5	<5	<5	<5
2-Butanone	<10	<10	<10	<10	<10	<10
1.1.1-Trichloroethane	<5	<5	<5	<5	<5	<5
Carbon Tetrachloride	<5	<5	<5	<5	<5	<5
Vinyl Acetate	<10	<10	<10	<10	<10	<10
Bromodichloromethane	<5	<5	<5	<5	<5	<5
1.2-Dichloropropane	<5	<5	<5	<5	<5	<5
cis-1.3-Dichloropropene	<5	<5	<5	<5	<5	<5
Trichloroethene	<5	<5	<5	<5	<5	<5
Dibromochloromethane	<5	<5	<5	<5	<5	<5
1.1.2-Trichloroethane	<5	<5	<5	<5	<5	<5
Benzene	<5	<5	<5	<5	<5	<5
trans-1.3-Dichloropropene	<5	<5	<5	<5	<5	<5
Bromoform	<5	<5	<5	<5	<5	<5
4-Methyl-2-Pentanone	<10	<10	<10	<10	<10	<10
2-Hexanone	<10	<10	<10	<10	<10	<10
Tetrachloroethene	<5	<5	<5	<5	<5	<5
1.1.2.2.-Tetrachloroethane	<5	<5	<5	<5	<5	<5
Toluene	<5	<5	<5	<5	<5	<5
Chlorobenzene	<5	<5	<5	<5	<5	<5
Ethylbenzene	<5	<5	<5	<5	<5	<5
Styrene	<5	<5	<5	<5	<5	<5
Xylene (total)	<5	<5	<5	<5	<5	<5
Acrolein	<10	<10	<10	<10	<10	<10
Acrylonitrile	<10	<10	<10	<10	<10	<10
TOTAL PETROLEUM HYDRODARBONS (MG/KG)	3.9	28.3	17.4	6.2	<1.65	<1.65

* Laboratory Contaminant

TABLE 1 CONTINUED
BACKGROUND AND BORROW PIT SOIL ANALYSES

TOTAL METALS IN UG/G	CD	Cu	Zn	Pb	Be	Sb	Ni	Cr	Ag	As	Se	Tl	Hg
Background													
BG-1	<0.5	10.3	28.4	6.9	<0.5	1.4	10.6	10.8	<0.5	2.2	<0.5	<0.5	<0.25
BG-2	<0.5	8.3	17.4	6.3	<0.5	<1.0	14.5	6.3	<0.5	2.1	<0.5	<0.5	<0.25
BG-3	<0.5	7.2	13.3	5.1	<0.5	1.2	14.6	5.1	<0.5	2.8	<0.5	<0.5	<0.25
BG-4	<0.5	11.7	55.8	8.5	1.7	<1.0	23.7	25.6	<0.5	2.4	<0.5	<0.5	<0.25
Borrow Pit													
BL-1	<0.5	3.7	5.8	<1.5	<0.5	<1.0	13.6	2.5	<0.5	2.1	<0.5	<0.5	<0.25
BL-2	<0.5	3.3	3.5	<1.5	<0.5	2.4	11.1	1.9	<0.5	3.2	<0.5	<0.5	<0.25

The total metals analyses were at or near laboratory detection limits in all samples for antimony, beryllium, cadmium, mercury, selenium, silver and thallium. Arsenic, chromium, copper, lead, nickel and zinc were present in most samples at detectable levels. The borrow pit samples contained slightly less copper, a tenth the zinc, none of the lead, a third to a tenth the chromium and about the same amount of nickel and arsenic as the refinery background samples. The differences in metal content between the borrow pit samples and the background soil samples may reflect the differences in geologic materials, depths of sampling and the leachability of the various metal ions.

In general the borrow pit samples contain the same or less VOC, TPH and total metals when compared to the refinery background soil samples. Material from this borrow pit is appropriate for use in backfilling excavations at the refinery.

Overflow Pond

The results of the overflow pond sludge analyses and the analyses of soils below the fiberglass liner may be found in Table 2. All original laboratory reports are in Appendix A.

The total petroleum hydrocarbons for the pond sludges ranged from a low of 4,506.5 mg/kg in CP-5 to 24,697.6 mg/kg in CP-

TABLE 2
OVERFLOW POND SOIL ANALYSES

VOLATILE ORGANIC COMPOUNDS IN UG/KG Compound	CP2A-3-3.5	CP3A-5-5.5	CP5-5-5.5		CP1-7-7.5		CP1-9-9.5	CP1-A-12-12.5	CP1-14-14.5	CP1-17-17.5	CP1-19.5-20	CP1-24.5-25	CP1-29-29.5	CP1-35.5-36	CP1-39.5-40	CP1-44.5-45	CP1-49.5-50
Detection Level	Med.	Low	Med.	Low	Med.	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low
Chloromethane	<1250	<10	<1250	<10	<1250	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Bromoethane	<1250	<10	<1250	<10	<1250	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Vinyl Chloride	<1250	<10	<1250	<10	<1250	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Chloroethane	<1250	<10	<1250	<10	<1250	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Methylene Chloride	7528*	<5	976*	6	6528*	<5	<5	12*	<5	<5	<5	<5	<5	<5	<5	14.9*	<5
Acetone	<1250	<10	<1250	<10	<1250	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Carbon Disulfide	<625	<5	<625	<5	<625	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
1.1-Dichloroethene	<625	<5	<625	<5	<625	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
1.1-Dichloroethane	<625	<5	<625	<5	<625	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
1.2-Dichloroethene (total)	<625	<5	<625	<5	<625	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Chloroform	<625	<5	<625	<5	<625	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
1.2-Dichloroethane	<625	<5	<625	<5	<625	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
2-Butanone	<1250	<10	<1250	<10	<1250	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
1.1.1-Trichloroethane	<625	<5	<625	<5	<625	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Carbon Tetrachloride	<625	<5	<625	<5	<625	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Vinyl Acetate	<1250	<10	<1250	<10	<1250	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Bromodichloromethane	<625	<5	<625	<5	<625	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
1.2-Dichloropropane	<625	<5	<625	<5	<625	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
cis-1.3-Dichloropropene	<625	<5	<625	<5	<625	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Trichloroethene	<625	<5	<625	<5	<625	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Dibromochloromethane	<625	<5	<625	<5	<625	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
1.1.2-Trichloroethane	<625	<5	<625	<5	<625	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Benzene	<625	<5	<625	<5	<625	1300	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
trans-1.3-Dichloropropene	<625	<5	<625	<5	<625	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Bromoform	<625	<5	<625	<5	<625	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
4-Methyl-2-Pentanone	<1250	<10	<1250	<10	<1250	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
2-Hexanone	<1250	<10	<1250	<10	<1250	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Tetrachloroethene	<625	<5	<625	<5	<625	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
1.1.2.2-Tetrachloroethane	<625	<5	<625	<5	<625	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Toluene	6124	<5	2912	1	<625	2500	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Chlorobenzene	<625	<5	<625	<5	<625	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Ethylbenzene	11593	7.13	4556	6	1803	950	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Styrene	<625	<5	<625	<5	<625	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Xylene (total)	8614	<5	6392	<5	6059	1500	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Acrolein	<1250	<10	<1250	<10	<1250	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Acrylonitrile	<1250	<10	<1250	<10	<1250	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
TOTAL PETROLEUM HYDROCARBONS (MG/KG)	22082.4	24697.6	4506.5		20025.9		15.4	111.9	2.4	<1.65	45.9	5.5	20.5	14	13.5	8.9	7.2

* Laboratory Contaminant

TABLE 2 CONTINUED
OVERFLOW POND SOIL ANALYSES

TOTAL METALS IN UG/G

Sample No.	Depth (Ft.)	Cd	Cu	Zn	Pb	Be	Sb	Ni	Cr	Ag	As	Se	Tl	Hg
CP-1	7-7.5	<0.5	9.3	14.5	2.5	<0.5	<1.0	4.2	5.1	<0.5	0.9	<0.5	<0.5	<0.25
CP-1	9.5-10	<0.5	29.3	25.9	<1.5	<0.5	2.8	11	1.8	<0.5	1.6	<0.5	<0.5	<0.25
CP-1	12-12.5	<0.5	24.4	25.8	<1.5	<0.5	2.1	10.3	1.7	<0.5	1.5	<0.5	<0.5	<0.25
CP-1D	12-12.5	<0.5	14.6	32.1	<1.5	<0.5	<1.0	11.6	1.9	<0.5	1.3	<0.5	<0.5	<0.25
CP-1	14.5-15	<0.5	11	23.5	2	<0.5	2.7	9.8	1.3	<0.5	0.9	<0.5	<0.5	<0.25
CP-1	17-17.5	<0.5	32	32.2	2.3	<0.5	<1.0	6	1.9	<0.5	0.7	<0.5	<0.5	<0.25
CP-1	19.5-20	<0.5	4.8	16.1	3	<0.5	1.5	5.6	2.9	<0.5	0.8	<0.5	<0.5	<0.25
CP-1	24.5-25	<0.5	4.6	13.1	2.3	<0.5	1.5	2.7	2.5	<0.5	0.9	<0.5	<0.5	<0.25
CP-1	29-29.5	<0.5	13.9	15.8	2.6	<0.5	<1.0	6.8	1.1	<0.5	1	<0.5	<0.5	<0.25
CP-1	35.5-36	<0.5	6.4	12	2.6	<0.5	<1.0	4	1.9	<0.5	0.9	<0.5	<0.5	<0.25
CP-1	39.5-40	<0.5	6.2	11.9	2.1	<0.5	<1.0	4	1.8	<0.5	1	<0.5	<0.5	<0.25
CP-1	44.5-45	<0.5	4.1	6.1	<1.5	<0.5	<1.0	2.6	2.2	<0.5	<0.5	<0.5	<0.5	<0.25
CP-1	49.5-50	<0.5	5.8	10.8	<1.5	<0.5	<1.0	3.7	2.8	<0.5	0.5	<0.5	<0.5	<0.25
CP-2	3-3.5	<0.5	18	44.8	5.5	0.6	1.9	10.2	10	<0.5	1.7	<0.5	<0.5	<0.25
CP-3	5-5.5	<0.5	16.8	62.9	9	1.3	2	18.3	46.6	<0.5	2.2	<0.5	<0.5	<0.25
CP-3D	5-5.5	<0.5	22.5	68.4	9.7	0.9	4.1	17	68.4	<0.5	2	<0.5	<0.5	<0.25
CP-5	5-5.5	<0.5	9	41.9	7.4	1	1.4	15.3	18.4	<0.5	1.7	<0.5	<0.5	<0.25

E.P. TOXICITY IN MG/L

Sample No.	Depth (Ft.)	Ba	Cd	Pb	As	Se	Cr	Ag	Hg
CP-1	7-7.5	1.76	<0.005	<0.005	<0.025	<0.025	<0.010	<0.005	<0.001
CP-2	3-3.5	1.99	<0.005	<0.005	<0.025	<0.025	<0.010	<0.005	<0.001
CP-3	5-5.5	2.41	<0.005	<0.005	<0.025	<0.025	<0.010	<0.005	<0.001
CP-3D	5-5.5	2.4	<0.005	<0.005	<0.025	<0.025	<0.010	<0.005	<0.001
CP-5	5-5.5	3.1	<0.005	<0.005	<0.025	<0.025	<0.010	<0.005	<0.001

Sludges

3. The TPH for samples obtained below the fiberglass pond liner in CP-1 were several orders of magnitude lower than the sludge TPH, indicating that the liner was effective in limiting downward migration of hydrocarbons. TPH values below the liner ranged from a high of 111.9 mg/kg at 12 feet in depth to background levels at a depth of 24.5 feet. TPH values slightly above background were noted in the 19.5 to 20 foot sample. Soils between 14 and 19.5 feet were below background with respect to TPH.

Volatile organic analyses were below laboratory detection limits for all soil samples taken below the fiberglass liner in CP-1. The VOC content of the sludges above the liner arebenzene (a high 1,300 ug/kg in CP-1 at 7 feet), ethylbenzene (up to 11,593 ug/kg), toluene (ranging up to 6,124 ug/kg), and xylenes (as high as 8,614 ug/kg).

The laboratory noted interference in the analyses of sludge constituents which made quantification difficult. Both low and medium detection levels were attempted with mixed results (note low vs. medium in Table 2). Quantities of constituents varied markedly in the same sample, depending on whether low or medium levels were utilized. However, no unusual volatile constituents appear to be present in the sludge.

The results of the total metal analyses of the overflow pond samples indicate that levels of antimony, arsenic, beryllium, cadmium, lead, mercury, nickel, selenium, silver and thallium are comparable to concentrations found in refinery background samples. Copper is slightly elevated above background levels (double or triple) in the upper 17.5 feet of boring CP-1 and slighty higher in sludges at CP-2 and CP-3. Zinc is slightly higher in CP-3. Chromium is lower than background in CP-1, but higher than background in the CP-3 sludge (twice background).

EP Toxicity extracts of pond sludges analyzed for the eight heavy metals were all below laboratory detection limits except for barium. Barium levels ranged from 1.76 to 3.10 mg/l in the sludge samples. The EPA Primary Drinking Water Standard for barium is 1.0 mg/l. The maximum contaminant level in soils by the EP Toxicity Method is 100 times the Drinking Water Standard or 100 mg/l.

The overflow pond sludges contain by-products of the petroleum refining process. These sludges do not contain volatile constituents or metal that can be classified as hazardous.

PROPOSED CLOSURE

Excavation of Soils

The overflow pond site will be remediated by removing the soils and sludges above the fiberglass liner and the liner itself. In addition, stained soil below the liner will also be removed. Excavation as deep as 12 feet may be required in the vicinity of CP-1 and as little as 4 feet at CP-2. A cleanup standard of 28 mg/kg TPH will be used (see RESULTS, Background and Borrow Pit). A total of about 1,400 cubic yards of material will be removed from the pond area.

OK

Excavation to the 20 foot level at CP-1 (TPH of 45.9 mg/kg) is not anticipated because a large amount of clean soil would have to be removed. TPH levels below background were obtained in the 14 to 19.5 foot level in CP-1. The increase in TPH at 19.5 feet may reflect downward migration from outside the limits of the fiberglass liner through fractures which are intercepted by CP-1. No volatile organic compounds were detected at this level.

The procedure recommended for soil excavation is as follows:

Step 1: Use a front-end loader to remove all stained soil at the site to just below the depth of the fiberglass liner. This procedure will remove the bulk of the highly contaminated soil and sludge at the pond site. This soil will be classified as non-hazardous for disposal purposes. Volume is estimated at about 800 cubic yards.

Step 2: Selectively excavate the soil in the area of CP-1 and other spot areas as necessary to a depth of about 12 feet with a backhoe. This soil will also be classified as non-hazardous. Volume is estimated at approximately 600 cubic yards.

An HNU organic vapor detector will be employed as an aid in the excavation process.

Disposal of Soils

All soils excavated in Step 1 and Step 2 will be loaded directly into trucks for transport to a non-hazardous solid waste disposal facility.

When, Where,
How, Who

Since have
Cr, should go
to HW facility
but as non-haz.
waste

Verification Sampling

Verification samples will be taken in the excavated area of the overflow pond to ensure that soils with a TPH content greater than 28 mg/kg have been removed. A minimum of five such grab samples will be collected in the excavation. All verification samples will be analyzed for TPH only.

Backfilling

The excavation at the overflow pond will be backfilled. Clean fill from the borrow pit sampled earlier (see FIELD PROGRAM METHODOLOGY) will be used to close the excavation and rebuild proper drainage at the site. Fill will be applied in maximum 6-inch lifts and compacted to prevent later slumpage.

It has been a pleasure preparing this closure plan for Southern Union Company.

HUGH B. ROBOTHAM
NEW MEXICO
9933
REGISTERED PROFESSIONAL ENGINEER

8-14-89

Respectfully submitted,

REED & ASSOCIATES, INC.

Hugh B Robotham

Hugh B. Robotham, P.E.

Allan T. Schmidt

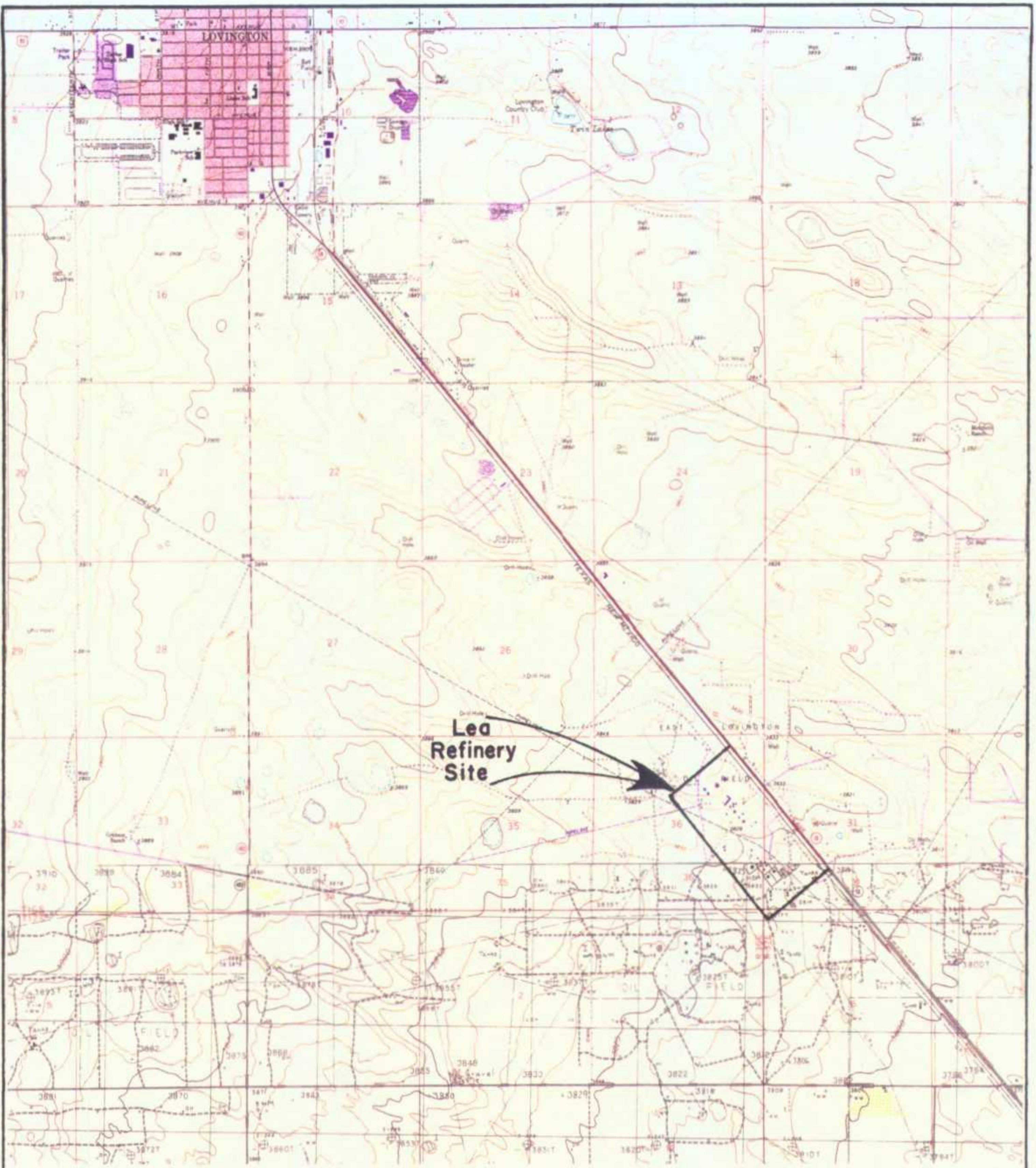
Allan T. Schmidt
Senior Geologist

REGISTERED GEOLOGIST
CERTIFICATE NO.
22748
ALLAN T.
SCHMIDT
Date Signed 8-14-89
ARIZONA U.S.A.

HBR\ATS\sne

Attachment(s)

FIGURES



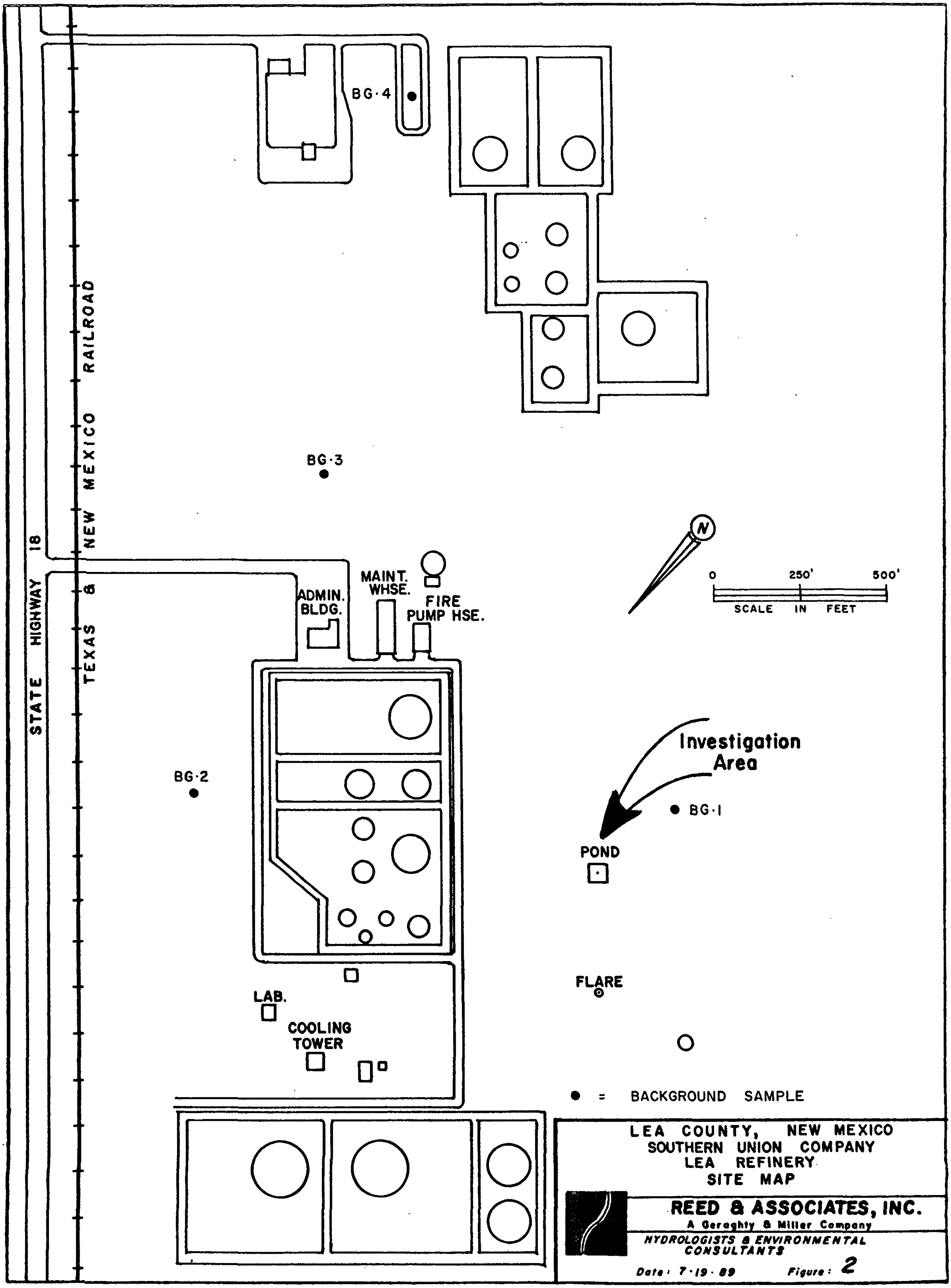
LEA COUNTY, NEW MEXICO
SOUTHERN UNION COMPANY

LOCATION MAP

REED & ASSOCIATES, INC.
A Geraghty & Miller Company

HYDROLOGISTS & ENVIRONMENTAL CONSULTANTS

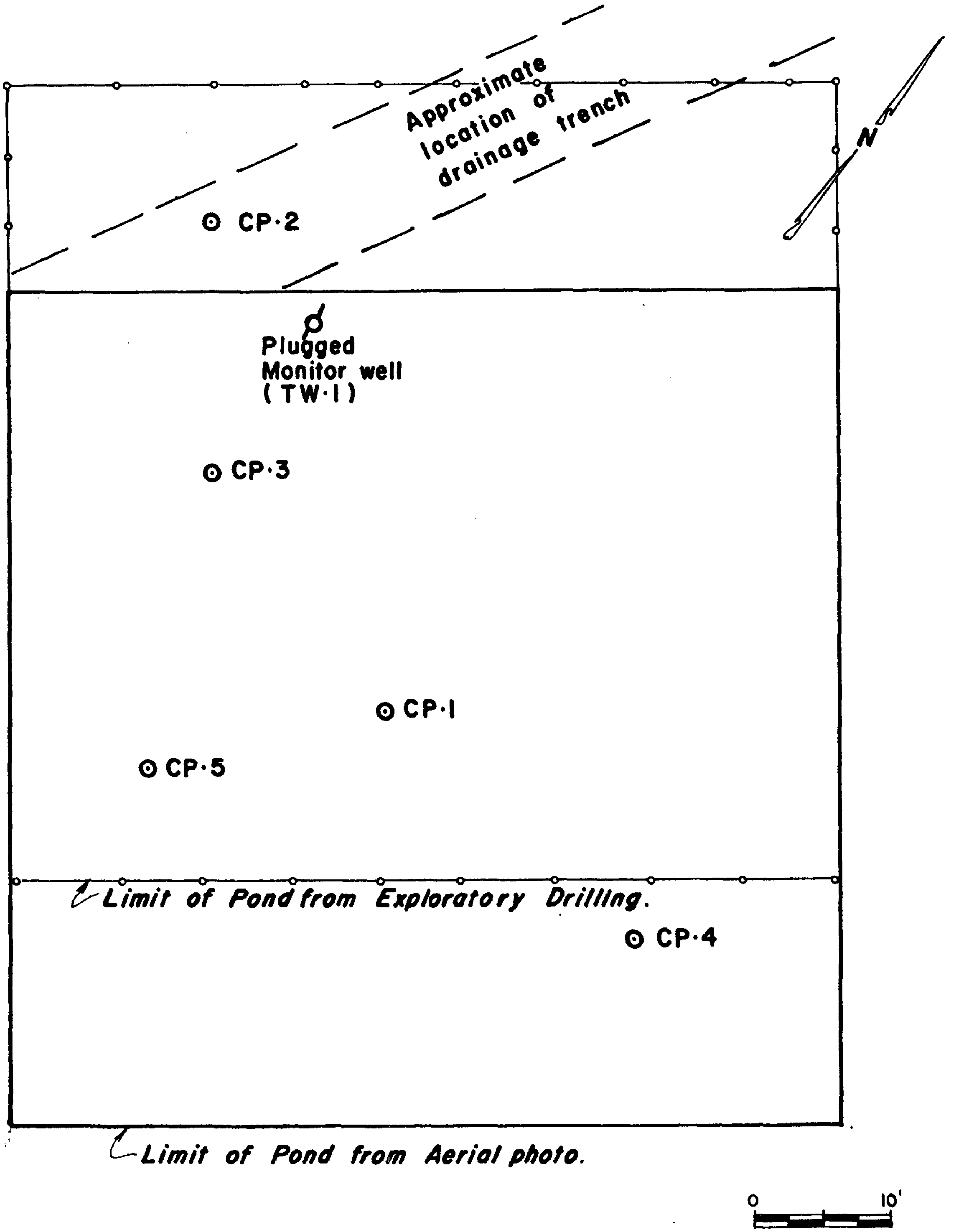
Date: 7-19-89 *Figure: 1*



LEA COUNTY, NEW MEXICO
SOUTHERN UNION COMPANY
LEA REFINERY
SITE MAP

REED & ASSOCIATES, INC.
A Geraghty & Miller Company
HYDROLOGISTS & ENVIRONMENTAL CONSULTANTS

Date: 7·19·89 *Figure:* 2



LEA COUNTY, NEW MEXICO

SOUTHERN UNION COMPANY LEA REFINERY
OVERFLOW POND
SAMPLE LOCATION MAP

REED & ASSOCIATES, INC.
A Geraghty & Miller Company
HYDROLOGISTS & ENVIRONMENTAL CONSULTANTS

Date: 7 28 89 *Figure:* 3

APPENDIX A

WESTERN TECHNOLOGIES INC.

8305 Washington Place, N.E.
Albuquerque, New Mexico 87113
(505) 823-4488

LETTER OF TRANSMITTAL

To REED + ASSOCIATES, INC.
1030 ANDREWS HIGHWAY SUITE 120
MIDLAND, TEXAS 79701

Date 7/19/89
Job No. 3259J018
Lab./Invoice No. —
Ref. No. —

Attn. ALLAN T. SCHMIDT

Project/Subject SURCO/LEA REFINING
HOBBS, NM

Please be informed that we are:

[✓ Enclosing]
Forwarding Separately
[✓ Per Your Request]
1 No. of Copies
Other

Engineering Reports
[✓ Laboratory Reports]
Field Reports
Proposals

More fully described as follows: FINAL LABORATORY REPORTS OF ANALYSIS OF CHARACTERIZATION SAMPLES FROM COOLING TOWER, POND, BACKGROUND AND BASELINE

For your:

[✓ Use]
Approval
Files

Information
Action
Other

Material forwarded by:

Our Messenger
Your Messenger
First Class Mail
Priority Mail
Certified Mail
Special Delivery
Other

[✓ Express Mail]
Air Priority
United Parcel Service
Motor Freight
Air Freight
City Delivery

Copies to: —

By John R. Dickey

HunTer / ESE
ENVIRONMENTAL SERVICES, INC.

7332 South Alton Way, Suite H
Englewood, CO 80112
Phone: 303-741-0639
Fax: 303-779-4215

JUL 5 1989

June 30, 1989

Mr. John Dickey
Western Technologies
8305 Washington Place, N.E.
Albuquerque, New Mexico 87113

Dear Mr. Dickey:

Please find enclosed a summary of data for samples received on June 14th, 15th, and 16th, 1989 and copies of evidence tape used as you requested. Copies of this data were faxed to your office on June 28, 1989. The enclosed pages contain results for samples CP-1 thru CP-5, BG, and BL samples for TRPH in soil; CP-1 thru CP-5, BG, and BL samples for volatile organic compounds by GC/MS and samples CCT-A thru CCT-G, D5, D6, E6, E7, BG, BL,and CP-1 thru CP-5 for metals. Data in these reports include the eight metals ommitted from the first data package, as per your request, as well as, the re-analysis of sample CP1-7-7.5 by GC/MS utilizing the modified E.P.A. Method 8240.

There has been report changes, concerning the Core Metal samples, to reflect the addition of the eight ommitted samples. Changes to the volatile organic compounds report were increase the detection limits for samples CP1-7-7.5, CP2A-5-5.5 and CP5-5-5.5, as these samples were analyzed by the medium soils method. The detection limits reported earlier dated June 27, 1989 were incorrect. The Methylene Chloride hit reported for sample CP1-7-7.5, utilizing method 8240, was not present when this sample was analyzed initially, indicating for the later analysis, laboratory contamination of this sample. Methylene Chloride is a commonly used extraction solvent in laboratories and was found in the medium level method blank.

We look forward to working with you in the future and please call if you have any questions regarding these results.

Best Regards,

Alan M. Fosdick

Alan M. Fosdick
Senior Associate Scientist
Laboratory Coordinator

cc: D.T. Blair
R.C. Greaves
S. Schoenwald

HUNTER/ESE REPORT: TRPH IN SOILS

CLIENT: WESTERN TECHNOLOGIES

ANALYST: STEVE CLARK
REPORT DATE: 06-21-89
ANALYSIS DATE: 06-21-89
EXTRACT DATE: 06-20-89

QA/QC SPIKE RECOVERIES

SP1:	96.92
SPM1:	88.39
SPM2:	102.87

SAMPLE NAME (FG)	(#)	SAMPLE WT. (KG)	EXTRACT VOL. (L)	PERCENT MOISTURE	IR ABSORBANCE	DILUTION FACTOR	SAMPLE CONC. (MG/KG)	REPORTED SAMPLE CONC. (MG/KG-DRY)
TBLK	9	0.0100	0.1	0.01	0.0009	1	10.0	10.0
SP1	9	0.0100	0.1	0.01	0.0282	1	431.6	431.6
SPM1*BL-1	9	0.0110	0.1	9.10	0.0270	1	413.1	413.1
SPM2*BL-1	9	0.0103	0.1	9.10	0.0293	1	479.1	479.1
CP-1	7-7.5	0.0097	0.1	3.22	0.0246	50	20025.9	20025.9
CP-1	9.5-10	0.0096	0.1	11.40	0.0011	1	15.4	15.4
CP-1	12-12.5	0.0103	0.1	10.90	0.0069	1	111.9	111.9
CP-1	14.5-15	0.0104	0.1	9.20	0.0004	1	2.4	2.4
CP-1	17-17.5	0.0098	0.1	6.50	0.0003	1	0.8	<1.65
CP-1	19.5-20	0.0093	0.1	4.07	0.0029	1	45.9	45.9
CP-1	24.5-25	0.0101	0.1	3.71	0.0006	1	5.5	5.5
CP-1	29-29.5	0.0100	0.1	6.06	0.0015	1	20.5	20.5
CP-1	35.5-36	0.0100	0.1	6.02	0.0011	1	14.0	14.0
CP-1	39.5-40	0.0103	0.1	5.81	0.0011	1	13.5	13.5
CP-1	44.5-45	0.0099	0.1	4.27	0.0008	1	8.9	8.9
CP-1	49.5-50	0.0101	0.1	5.15	0.0007	1	7.2	7.2
CP-2A	3-3.5	0.0107	0.1	13.90	0.0266	50	22082.4	22082.4
CP-3	5-5.5	0.0104	0.1	22.60	0.0260	50	24697.6	24697.6
CP-5	5-5.5	0.0102	0.1	15.60	0.0170	15	4506.5	4506.5
BG	1	0.0107	0.1	8.29	0.0005	1	3.9	3.9
BG	2	0.0101	0.1	5.59	0.0020	1	28.3	28.3
BG	3	0.0100	0.1	6.90	0.0013	1	17.4	17.4
BG	4	0.0101	0.1	13.70	0.0006	1	6.2	6.2
BL	1	0.0105	0.1	9.10	0.0002	1	-0.8	<1.65
BL	2	0.0109	0.1	9.34	0.0002	1	-0.8	<1.65

WESTERN TECHNOLOGIES Volatile Organic Compounds June 30, 1989

WESTERN TECHNOLOGIES June 30, 1989
Volatile Organic Compound Data

STATION LOCATION:	CP1-9-9.5	CP1-A-12-12	CP1-14-14.5	CP1-17-17.5	CP1-19.5-20	CP1-24.5-25	CP1-29-29.5	CP1-35.5-36	CP1-39.5-40	CP1-44.5-45	CP1-49.5-50
SAMPLE MATRIX	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
UNITS:	UG/KG (DRY)	UG/KG (DRY)	UG/KG (DRY)	UG/KG (DRY)	UG/KG (DRY)	UG/KG (DRY)	UG/KG (DRY)	UG/KG (DRY)	UG/KG (DRY)	UG/KG (DRY)	UG/KG (DRY)
COMPOUND											
Chloromethane	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Bromomethane	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Vinyl Chloride	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Chloroethane	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Methylene Chloride	<5	12*	<5	<5	<5	<5	<5	<5	<5	14.9*	<5
Acetone	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Carbon Disulfide	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,1-Dichloroethene	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,1-Dichloroethane	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,2-Dichloroethene (total)	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Chloroform	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,2-Dichloroethane	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
2-Butanone	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
1,1,1-Trichloroethane	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Carbon Tetrachloride	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Vinyl Acetate	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Bromodichloromethane	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,2-Dichloropropane	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
cis-1,3-Dichloropropene	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Trichloroethene	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Dibromochloromethane	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,1,2-Trichloroethane	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Benzene	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
trans-1,3-Dichloropropene	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Bromoform	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
4-Methyl-2-Pentanone	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
2-Hexanone	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Tetrachloroethene	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,1,2,2-Tetrachloroethane	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Toluene	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Chlorobenzene	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Ethylbenzene	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Styrene	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Xylene (total)	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Acrolein	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Acrylonitrile	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
SOIL VOLATILE SURROGATE RECOVERY	%	%	%	%	%	%	%	%	%	%	%
1,2-Dichloroethane-d4	104	102	105	103	104	103	98	101	102	89.9	92.2
Toluene-d8	100	98.4	104	105	98.4	100	95.5	102	101	92	92.2
Bromofluorobenzene	82.7	98	92.5	97.3	96.5	98.3	95.9	96.2	94.2	88.2	88.1

* Methylene Chloride is often a laboratory contamination and was found in the blank

WESTERN TECHNOLOGIES Volatile Organic Compounds June 30, 1989

STATION LOCATION:	CP1-7-7.5	CP2A-5-5.5	CP3A-5-5.5	CP5-5-5.5	BG-1	BG-2	BG-3	BG-4	BL-1	BL-2
SAMPLE MATRIX	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
UNITS:	UG/KG (DRY)	UG/KG (DRY)	UG/KG (DRY)	UG/KG (DRY)	UG/KG (DRY)	UG/KG (DRY)	UG/KG (DRY)	UG/KG (DRY)	UG/KG (DRY)	UG/KG (DRY)
COMPOUND										
Chloromethane	<1250	<1250	<10	<1250	<10	<10	<10	<10	<10	<10
Bromomethane	<1250	<1250	<10	<1250	<10	<10	<10	<10	<10	<10
Vinyl Chloride	<1250	<1250	<10	<1250	<10	<10	<10	<10	<10	<10
Chloroethane	<1250	<1250	<10	<1250	<10	<10	<10	<10	<10	<10
Methylene Chloride	6258*	7528*	<5	976*	<5	<5	<5	5.98*	<5	7.1*
Acetone	<1250	<1250	<10	<1250	<10	<10	<10	<10	<10	<10
Carbon Disulfide	<625	<625	<5	<625	<5	<5	<5	<5	<5	<5
1,1-Dichloroethene	<625	<625	<5	<625	<5	<5	<5	<5	<5	<5
1,1-Dichloroethane	<625	<625	<5	<625	<5	<5	<5	<5	<5	<5
1,2-Dichloroethene (total)	<625	<625	<5	<625	<5	<5	<5	<5	<5	<5
Chloroform	<625	<625	<5	<625	<5	<5	<5	<5	<5	<5
1,2-Dichloroethane	<625	<625	<5	<625	<5	<5	<5	<5	<5	<5
2-Butanone	<1250	<1250	<10	<1250	<10	<10	<10	<10	<10	<10
1,1,1-Trichloroethane	<625	<625	<5	<625	<5	<5	<5	<5	<5	<5
Carbon Tetrachloride	<625	<625	<5	<625	<5	<5	<5	<5	<5	<5
Vinyl Acetate	<1250	<1250	<10	<1250	<10	<10	<10	<10	<10	<10
Bromodichloromethane	<625	<625	<5	<625	<5	<5	<5	<5	<5	<5
1,2-Dichloropropane	<625	<625	<5	<625	<5	<5	<5	<5	<5	<5
cis-1,3-Dichloropropene	<625	<625	<5	<625	<5	<5	<5	<5	<5	<5
Trichloroethene	<625	<625	<5	<625	<5	<5	<5	<5	<5	<5
Dibromochloromethane	<625	<625	<5	<625	<5	<5	<5	<5	<5	<5
1,1,2-Trichloroethane	<625	<625	<5	<625	<5	<5	<5	<5	<5	<5
Benzene	<625	<625	<5	<625	<5	<5	<5	<5	<5	<5
trans-1,3-Dichloropropene	<625	<625	<5	<625	<5	<5	<5	<5	<5	<5
Bromoform	<625	<625	<5	<625	<5	<5	<5	<5	<5	<5
4-Methyl-2-Pentanone	<1250	<1250	<10	<1250	<10	<10	<10	<10	<10	<10
2-Hexanone	<1250	<1250	<10	<1250	<10	<10	<10	<10	<10	<10
Tetrachloroethene	<625	<625	<5	<625	<5	<5	<5	<5	<5	<5
1,1,2,2-Tetrachloroethane	<625	<625	<5	<625	<5	<5	<5	<5	<5	<5
Toluene	<625	6124	<5	2912	<5	<5	<5	<5	<5	<5
Chlorobenzene	<625	<625	<5	<625	<5	<5	<5	<5	<5	<5
Ethylbenzene	1803	11593	7.13	4556	<5	<5	<5	<5	<5	<5
Styrene	<625	<625	<5	<625	<5	<5	<5	<5	<5	<5
Xylene (total)	6059	8614	<5	6392	<5	<5	<5	<5	<5	<5
Acrolein	<1250	<1250	<10	<1250	<10	<10	<10	<10	<10	<10
Acrylonitrile	<1250	<1250	<10	<1250	<10	<10	<10	<10	<10	<10
SOIL VOLATILE SURROGATE RECOVERY	%	%	%	%	%	%	%	%	%	%
1,2-Dichloroethane-d4	101	110	103	103	112	105	117	111	120	120
Toluene-d8	99.9	89.2	93.3	85.8	106	105	115	114	103	103
Bromofluorobenzene	99.3	91	108	90.7	83	83	89	83	102	98

WESTERN TECHNOLOGIES Volatile Organic Compounds June 30,1989

STATION LOCATION:	CP1-9-9.5	CP1-9-9.5	METHOD(LOW)	METHOD(MED)
SAMPLE MATRIX	MS-SOIL	MSD-SOIL	SOIL	SOIL
UNITS:	% REC	% REC	UG/KG (DRY)	UG/KG (DRY)
COMPOUND				
Chloromethane	-	-	<10	<1250
Bromomethane	-	-	<10	<1250
Vinyl Chloride	-	-	<10	<1250
Chloroethane	-	-	<10	<1250
Methylene Chloride	-	-	<5	1600*
Acetone	-	-	<5	<1250
Carbon Disulfide	-	-	<5	<625
1,1-Dichloroethene	91.7	92.3	<5	<625
1,1-Dichloroethane	-	-	<5	<625
1,2-Dichloroethene (total)	-	-	<5	<625
Chloroform	-	-	<5	<625
1,2-Dichloroethane	-	-	<5	<625
2-Butanone	-	-	<10	<1250
1,1,1-Trichloroethane	-	-	<5	<625
Carbon Tetrachloride	-	-	<5	<625
Vinyl Acetate	-	-	<10	<1250
Bromodichloromethane	-	-	<5	<625
1,2-Dichloropropane	-	-	<5	<625
cis-1,3-Dichloropropene	-	-	<5	<625
Trichloroethene	78.9	96.9	<5	<625
Dibromochloromethane	-	-	<5	<625
1,1,2-Trichloroethane	-	-	<5	<625
Benzene	88.8	109	<5	<625
trans-1,3-Dichloropropene	-	-	<5	<625
Bromoform	-	-	<5	<625
4-Methyl-2-Pentanone	-	-	<10	<1250
2-Hexanone	-	-	<10	<1250
Tetrachloroethene	-	-	<5	<625
1,1,2,2-Tetrachloroethane	-	-	<5	<625
Toluene	101	97.8	<5	<625
Chlorobenzene	104	99.4	<5	<625
Ethylbenzene	-	-	<5	<625
Styrene	-	-	<5	<625
Xylene (total)	-	-	<5	<625
Acrolein	-	-	<10	<1250
Acrylonitrile	-	-	<10	<1250

SOIL VOLATILE SURROGATE RECOVERY	%	%	%	%
1,2-Dichloroethane-d4	104	102	114	101
Toluene-d8	96.7	92.9	91.9	100
Bromofluorobenzene	99.4	92	106	99.7

WESTERN TECHNOLOGIES Volatile Organic Compounds June 30, 1989

Western Technologies sample CP1-7-7.5 by modified method 8240 June 30, 1989

STATION LOCATION:	CP1-7-7.5
SAMPLE MATRIX	SOIL
UNITS:	UG/KG (DRY)
COMPOUND	
Chloromethane	<10
Bromomethane	<10
Vinyl Chloride	<10
Chloroethane	<10
Methylene Chloride	<5
Acetone	<10
Carbon Disulfide	<5
1,1-Dichloroethene	<5
1,1-Dichloroethane	<5
1,2-Dichloroethene (total)	<5
Chloroform	<5
1,2-Dichloroethane	<5
2-Butanone	<10
1,1,1-Trichloroethane	<5
Carbon Tetrachloride	<5
Vinyl Acetate	<10
Bromodichloromethane	<5
1,2-Dichloropropane	<5
cis-1,3-Dichloropropene	<5
Trichloroethene	<5
Dibromochloromethane	<5
1,1,2-Trichloroethane	<5
Benzene	1300
trans-1,3-Dichloropropene	<5
Bromoform	<5
4-Methyl-2-Pentanone	<10
2-Hexanone	<10
Tetrachloroethene	<5
1,1,2,2-Tetrachloroethane	<5
Toluene	2500
Chlorobenzene	<5
Ethylbenzene	950
Styrene	<5
Xylene (total)	1500
Acrolein	<10
Acrylonitrile	<10
Tetrabutylbenzene	36
p-Isoprpylbenzene	7
n-Butylbenzene	4

June 30, 1989

WESTERN TECHNOLOGIES
CORE SAMPLES
TOTAL METALS
REPORTED AS UG/GM(DRY)

SAMPLE	FT	%MOIST	CD	CU	ZN	PB	BE	SB	NI	CR	AG	AS	SE	TL	HG
BG-1	---------	8.3	<0.5	10.3	28.4	6.9	<0.5	1.4	10.6	10.8	<0.5	2.2	<0.5	<0.5	<0.25
BG-2	---------	5.59	<0.5	8.3	17.4	6.3	<0.5	<1.0	14.5	6.3	<0.5	2.1	<0.5	<0.5	<0.25
BG-3	---------	6.9	<0.5	7.2	13.3	5.1	<0.5	1.2	14.6	5.1	<0.5	2.8	<0.5	<0.5	<0.25
BG-4	---------	13.7	<0.5	11.7	55.8	8.5	1.7	<1.0	23.7	25.6	<0.5	2.4	<0.5	<0.5	<0.25
BL-1	---------	9.11	<0.5	3.7	5.8	<1.5	<0.5	<1.0	13.6	2.5	<0.5	2.1	<0.5	<0.5	<0.25
BL-2	---------	9.34	<0.5	3.3	3.5	<1.5	<0.5	2.4	11.1	1.9	<0.5	3.2	<0.5	<0.5	<0.25
CP-1	7-7.5	3.23	<0.5	9.3	14.5	2.5	<0.5	<1.0	4.2	5.1	<0.5	0.9	<0.5	<0.5	<0.25
CP-1	9.5-10	11.5	<0.5	29.3	25.9	<1.5	<0.5	2.8	11.0	1.8	<0.5	1.6	<0.5	<0.5	<0.25
CP-1	12-12.5	10.9	<0.5	24.4	25.8	<1.5	<0.5	2.1	10.3	1.7	<0.5	1.5	<0.5	<0.5	<0.25
CP-1(SPL)	12-12.5	10.5	<0.5	14.6	32.1	<1.5	<0.5	<1.0	11.6	1.9	<0.5	1.3	<0.5	<0.5	<0.25
CP-1	14.5-15	9.2	<0.5	11.0	23.5	2.0	<0.5	2.7	9.8	1.3	<0.5	0.9	<0.5	<0.5	<0.25
CP-1	17-17.5	6.51	<0.5	32.0	32.2	2.3	<0.5	<1.0	6.0	1.9	<0.5	0.7	<0.5	<0.5	<0.25
CP-1	19.5-20	4.08	<0.5	4.8	16.1	3.0	<0.5	1.5	5.6	2.9	<0.5	0.8	<0.5	<0.5	<0.25
CP-1	24.5-25	3.72	<0.5	4.6	13.1	2.3	<0.5	1.5	2.7	2.5	<0.5	0.9	<0.5	<0.5	<0.25
CP-1	29-29.5	6.07	<0.5	13.9	15.8	2.6	<0.5	<1.0	6.8	1.1	<0.5	1.0	<0.5	<0.5	<0.25
CP-1	35.5-36	6.03	<0.5	6.4	12.0	2.6	<0.5	<1.0	4.0	1.9	<0.5	0.9	<0.5	<0.5	<0.25
CP-1	39.5-40	5.81	<0.5	6.2	11.9	2.1	<0.5	<1.0	4.0	1.8	<0.5	1.0	<0.5	<0.5	<0.25
CP-1	44.5-45	4.27	<0.5	4.1	6.1	<1.5	<0.5	<1.0	2.6	2.2	<0.5	<0.5	<0.5	<0.5	<0.25
CP-1	49.5-50	5.16	<0.5	5.8	10.8	<1.5	<0.5	<1.0	3.7	2.8	<0.5	0.5	<0.5	<0.5	<0.25
CP-2A	3-3.5	13.9	<0.5	18.0	44.8	5.5	0.6	1.9	10.2	10.0	<0.5	1.7	<0.5	<0.5	<0.25
CP-3	5-5.5	22.6	<0.5	16.8	62.9	9.0	1.3	2.0	18.3	46.6	<0.5	2.2	<0.5	<0.5	<0.25
CP-3(SPL)	5-5.5	21.9	<0.5	22.5	68.4	9.7	0.9	4.1	17.0	68.4	<0.5	2.0	<0.5	<0.5	<0.25
CP-5	5-5.5	15.6	<0.5	9.0	41.9	7.4	1.0	1.4	15.3	18.4	<0.5	1.7	<0.5	<0.5	<0.25

WESTERN TECHNOLOGIES
CORE SAMPLES
TOTAL METALS

June 30, 1989

DIGEST BLANK Q.C.(MG/L)

SAMPLE	CD	CU	ZN	PB	BE	SB	NI	CR	AG	AS	SE	TL	HG
D.BLK1	<0.005	<0.005	<0.005	<0.015	<0.005	<0.010	<0.010	<0.006	<0.005	<0.005	1.300	<0.005	<0.0005
D.BLK2	<0.005	0.006	0.012	0.021	<0.005	<0.010	<0.010	<0.006	<0.005	<0.005	<0.005	<0.005	<0.0005
D.BLK3	<0.005	0.009	0.014	<0.015	<0.005	<0.010	<0.010	<0.006	<0.005	<0.005	1.600	<0.005	<0.0005

DIGEST BLANK SPIKES
%RECOVERIES

D.B.SP1	90	92	86	92	89	95	95	96	95	89	102	90	100
D.B.SP2	89	94	81	84	82	86	88	86	85	99	103	95	130
D.B.SP3	89	94	81	83	83	88	81	82	82	66	120	110	100

ICAP
MS/MSD

METHOD SPIKE/METHOD SPIKE DUPLICATE
%RECOVERIES

SAMPLE	FT	CD	CU	ZN	PB	BE	SB	NI	CR	AG
E6MS	15.5-16	87	90	84	86	101	38	88	87	90
E6MSD	15.5-16	87	92	88	87	103	41	89	88	90
E7MS	4-4.5	80	86	67	69	69	56	67	68	75
E7MSD	4-4.5	83	88	64	69	67	55	68	69	76
CP-1MS	7-7.5	88	89	73	81	84	40	85	84	84
CP-1MSD	7-7.5	88	92	79	80	83	33	84	84	83

GFAAS(AS,SE,TL)
MS/MSD

SAMPLE	FT	AS	SE	TL
D5MS	2.5-3	102	0	67
D5MSD	2.5-3	91	0	70
E7MS	4-4.5	78	30	66
E7MSD	4-4.5	73	34	67
D6MS	5.5-6	126	51	68
D6MSD	5.5-6	139	52	70

CVAAS(HG)
MS/MSD

SAMPLE	FT	HG
D5MS	2.5-3	105
D5MSD	2.5-3	105
E7MS	4-4.5	95
E7MSD	4-4.5	100
D6MS	5.5-6	110
D6MSD	5.5-6	100

June 30, 1989

WESTERN TECHNOLOGIES
E.P.TOXICITY EXTRACTS
(MG/L)

SAMPLE	BA	CD	PB	AS	SE	CR	AG	HG
CP-1 (7-7.5)	1.76	<0.005	<0.015	<0.025	<0.025	<0.010	<0.005	<0.001
CP-2A (3-3.5)	1.99	<0.005	<0.015	<0.025	<0.025	<0.010	<0.005	<0.001
CP-3 (5-5.5)	2.41	<0.005	<0.015	<0.025	<0.025	<0.010	<0.005	<0.001
CP-3(SPL(5-5.5)	2.40	<0.005	<0.015	<0.025	<0.025	<0.010	<0.005	<0.001
CP-5 (5-5.5)	3.10	<0.005	<0.015	<0.025	<0.025	<0.010	<0.005	<0.001

WESTERN TECHNOLOGIES
E.P.TOXICITY EXTRACTIONS
(MG/L)

June 30, 1989

EXTRACT/DIGEST BLANK

SAMPLE	BA	CD	PB	AS	SE	CR	AG	HG
EXT.BLK	<0.005	<0.005	<0.015	<0.025	<0.025	<0.010	<0.005	<0.001
DIG.BLK-1	<0.005	<0.005	<0.015	<0.025	<0.025	<0.010	<0.005	<0.001
DIG.BLK-2	<0.005	<0.005	<0.015	<0.025	<0.025	<0.010	<0.005	<0.001
DIG.BLK-3	<0.005	<0.005	<0.015	<0.025	<0.025	<0.010	<0.005	<0.001

EXTRACT/DIGEST BLANK SPIKE

SAMPLE	BA	CD	PB	AS	SE	CR	AG	HG
E.B.SPK	95	86	88	89	88	91	90	61
D.B.SPK-1	98	91	91	91	92	94	93	133
D.B.SPK-2	97	89	90	90	91	91	91	110
D.B.SPK-3	98	98	90	90	91	90	89	97

METHOD SPIKE/METHOD SPIKE DUPLICATE

SAMPLE	BA	CD	PB	AS	SE	CR	AG	HG
A3MS	93	83	83	88	94	83	87	99
A3MSD	90	83	84	87	93	83	86	89
D3MS	94	82	84	88	92	82	87	111
D3MSD	90	83	84	89	92	82	86	119
F4MS	92	84	83	88	92	81	55	119
F4MSD	91	81	82	85	92	80	81	120

HUNTER ENVIRONMENTAL SERVICES, INC. | ESE

7332 South Alton Way, Suite H
Englewood, CO 80112
Phone: 303-741-0639
Fax: 303-779-4215

TELEFAX TRANSMITTAL

DATE: 8/4/89

ATTENTION: HUGH ROBTHAM

5 pages (including this cover sheet) are being sent.

MESSAGE: INCLUDED ARE RESULTS FOR:

1) SAMPLE CP1-7-7.5 REPORTED AS LOW AND MEDIUM LEVEL.

2) SAMPLE CP2A-3-3.5 REPORTED AS A MEDIUM LEVEL ONLY.

*3) SAMPLE CP3A-5-5.5 WHICH WAS A MISTAKE AND SHOULD HAVE BEEN REPORTED AS LOW LEVEL.

IF YOU HAVE ANY QUESTIONS PLEASE CALL.

FROM: RANDY GREAVES

PROJECT NUMBER: GM1710

TIME: 12:45

FAX # OR LOCATION: 915-699-1978
(destination)

If you do not receive all pages, please call (303) 741-0639.

Operator initials: KM

TERN TECHNOLOGIES Volatile Organic Compounds June 30, 1989

HOD:	8240	8240	8240	8240	8240	8240	8240	8240	8240	8240
EL:	MEDIUM	MEDIUM	LOW	LOW	LOW	LOW	LOW	LOW	LOW	LOW
TION LOCATION:	CP1-7-7.5	CP2A-3-3.5	CP3A-5-5.5	CP5-5-5.5	BG-1	BG-2	BG-3	BG-4	BL-1	BL-2
PLE MATRIX	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
TS:	UG/KG (DRY)	UG/KG (DRY)	UG/KG (DRY)	UG/KG (DRY)	UG/KG (DRY)	UG/KG (DRY)	UG/KG (DRY)	UG/KG (DRY)	UG/KG (DRY)	UG/KG (DRY)
POUND										
oromethane	<1250	<1250	<10	<10	<10	<10	<10	<10	<10	<10
omethane	<1250	<1250	<10	<10	<10	<10	<10	<10	<10	<10
yl Chloride	<1250	<1250	<10	<10	<10	<10	<10	<10	<10	<10
oroethane	<1250	<1250	<10	<10	<10	<10	<10	<10	<10	<10
hylene Chloride	6258*	7528*	<5	6	<5	<5	<5	5.98*	<5	7.1*
tone	<1250	<1250	<10	<10	<10	<10	<10	<10	<10	<10
bon Disulfide	<625	<625	<5	<5	<5	<5	<5	<5	<5	<5
-Dichloroethene	<625	<625	<5	<5	<5	<5	<5	<5	<5	<5
-Dichloroethane	<625	<625	<5	<5	<5	<5	<5	<5	<5	<5
-Dichloroethene (total)	<625	<625	<5	<5	<5	<5	<5	<5	<5	<5
oroform	<625	<625	<5	<5	<5	<5	<5	<5	<5	<5
-Dichloroethane	<625	<625	<5	<5	<5	<5	<5	<5	<5	<5
utanone	<1250	<1250	<10	<10	<10	<10	<10	<10	<10	<10
.1-Trichloroethane	<625	<625	<5	<5	<5	<5	<5	<5	<5	<5
bon Tetrachloride	<625	<625	<5	<5	<5	<5	<5	<5	<5	<5
yl Acetate	<1250	<1250	<10	<10	<10	<10	<10	<10	<10	<10
odichloromethane	<625	<625	<5	<5	<5	<5	<5	<5	<5	<5
-Dichloropropane	<625	<625	<5	<5	<5	<5	<5	<5	<5	<5
-1.3-Dichloropropene	<625	<625	<5	<5	<5	<5	<5	<5	<5	<5
chloroethene	<625	<625	<5	<5	<5	<5	<5	<5	<5	<5
omochloromethane	<625	<625	<5	<5	<5	<5	<5	<5	<5	<5
.2-Trichloroethane	<625	<625	<5	<5	<5	<5	<5	<5	<5	<5
zene	<625	<625	<5	<5	<5	<5	<5	<5	<5	<5
ns-1.3-Dichloropropene	<625	<625	<5	<5	<5	<5	<5	<5	<5	<5
oform	<625	<625	<5	<5	<5	<5	<5	<5	<5	<5
ethyl-2-Pentanone	<1250	<1250	<10	<10	<10	<10	<10	<10	<10	<10
exanone	<1250	<1250	<10	<10	<10	<10	<10	<10	<10	<10
achloroethene	<625	<625	<5	<5	<5	<5	<5	<5	<5	<5
.2.2-Tetrachloroethane	<625	<625	<5	<5	<5	<5	<5	<5	<5	<5
uene	<625	6124	<5	1	<5	<5	<5	<5	<5	<5
orobenzene	<625	<625	<5	<5	<5	<5	<5	<5	<5	<5
ylbenzene	1803	11593	7.13	6	<5	<5	<5	<5	<5	<5
ene	<625	<625	<5	<5	<5	<5	<5	<5	<5	<5
ene (total)	6059	8614	<5	<5	<5	<5	<5	<5	<5	<5
olein	<1250	<1250	<10	<10	<10	<10	<10	<10	<10	<10
ylonitrile	<1250	<1250	<10	<10	<10	<10	<10	<10	<10	<10
VOLATILE ROGATE RECOVERY	%	%	%	%	%	%	%	%	%	%
-Dichloroethane-d4	101	110	103	103	112	105	117	111	120	120
ene-d8	99.9	89.2	93.3	85.8	106	105	115	114	103	103
ofluorobenzene	99.3	91	108	90.7	83	83	89	83	102	98

UTILITY LOCATION PLAN

NOT OT SCALE

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NOTES

REFERENCE DRAWINGS

NO.	REVISIONS	BY	CHK.	DATE	APPR.	APPR.	NO.	REVISIONS	BY	CHK.	DATE	APPR.	APPR.

DRAWING TITLE

PLATE 1
LEA REFINING COMPANY
WASTEWATER COLLECTION
AND TREATMENT SYSTEM

LEA REFINING CO.
ENGINEERING DEPARTMENT
P.O. DRAWER 159
ARTESIA, NEW MEXICO

DRAWN BY	CHK'D BY	SCALE	
DATE	APPR BY	DRAWING NUMBER	REV.

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CLOSURE PLAN
SOUTHERN UNION COMPANY
LEA REFINERY, NEW MEXICO
COOLING TOWER AREA

Prepared For
SOUTHERN UNION COMPANY
AUGUST 1, 1989

REED & ASSOCIATES, INC.
Hydrologists & Environmental Consultants

A Geraghty & Miller Company

CLOSURE PLAN
SOUTHERN UNION COMPANY
LEA REFINERY, NEW MEXICO
COOLING TOWER AREA

Prepared For

SOUTHERN UNION COMPANY

By

REED & ASSOCIATES, INC.
Hydrologists & Environmental Consultants
Midland - Corpus Christi - Austin

August 1, 1989

REED & ASSOCIATES, INC.
A Geraghty & Miller Company

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CLOSURE PLAN
SOUTHERN UNION COMPANY
LEA REFINERY, NEW MEXICO
COOLING TOWER AREA

INTRODUCTION

This report describes the procedures proposed for the closure of a contaminated soils area near the cooling tower at the Lea Refinery on State Highway 18 south of Lovington, Lea County, New Mexico (Figures 1 and 2). The Lea Refinery was formerly owned by Southern Union Company of Dallas, Texas. The property was recently sold to The Holly Corporation, also of Dallas. The refinery is not operating at present.

The operation of the cooling tower in the period 1974 to 1981 involved the use of a zinc chromate solution for corrosion control. The zinc chromate was stored in an above ground tank adjacent to the cooling tower. In the process of filling the tank with the zinc chromate and transferring the solution to the cooling tower there were apparently minor, periodic spills.

All blowdown from the cooling tower was injected into a permitted injection well. The use of zinc chromate inhibitors was discontinued in October 1981. The storage tank for the solution has been removed.

Southern Union Company employed Reed and Associates, Inc. to oversee characterization sampling of the soils near the cooling tower conducted by Chemical Waste Management, Inc. and their subcontractor Western Technologies, Inc. This closure plan details the results of the investigations conducted at the cooling tower and makes recommendations for cleanup of the soils at the site.

SITE DESCRIPTION

Setting

The Lea Refinery is located about 4 miles southeast of Lovington, New Mexico on the Llano Estacado of eastern New Mexico and western Texas. The Llano Estacado is a depositional surface of low relief sloping uniformly to the southeast. There is no integrated drainage in the area and runoff flows to shallow depressions where it remains until it evaporates or seeps into the ground.

Elevations at the refinery range from about 3,845 feet on the northwest to 3,815 feet on the southeast. The topographic slope is approximately 25 feet per mile to the southeast.

The climate of this portion of New Mexico is characterized by low annual precipitation (12 to 15 inches per year), low humidity and high average annual temperature. The climate has been classified as marginal between semiarid and arid.

Geology

The area of interest is part of a large subsurface structural feature known as the Permian basin. Oil and gas exploration has revealed a complex subsurface geology which involves rocks from Precambrian to Permian in age. This structure is overlain by gently southeasterly dipping Triassic redbeds separated from the older rocks by an erosional unconformity.

Above the Triassic redbeds are the Pliocene age sediments of the Ogallala formation. These sediments form the Llano Estacado surface and were deposited by easterly flowing braided streams following the Laramide revolution and the raising of the Rocky Mountains to the west.

The Ogallala is composed of sands, silts, clays and gravels with no persistent marker beds in the formation. Basal gravel is present in many places, usually in buried stream valleys in the pre-Ogallala erosional surface. The upper portion of the Ogallala contains a dense caliche cap up to 8 feet thick at the refinery site.

Hydrology

The Ogallala formation is the major source of ground water in the region. Recharge to this aquifer occurs from rainfall on the outcrop. Only a small percentage of precipitation actually reaches the aquifer due to a combination of low rainfall, high evaporation rate, and a generally low infiltration rate. Water in the Ogallala is unconfined and contained in pore spaces of the clastic sediments.

The quality of water from the Ogallala in Lea County is generally fair with total dissolved solids usually less than 1,100 milligrams per liter (mg/l). The water is typically high in silica, contains moderate amounts of calcium and magnesium, and is low in sulfate, sodium and chloride. Brine contamination of the Ogallala, mostly the result of the past practice of placing produced brine from oil wells into shallow unlined surface pits for evaporation, is known to occur in parts of Lea County.

The ground water gradient at the Lea Refinery is to the southeast at about 10 feet per mile. Depth to water is 75 to 80 feet.

FIELD PROGRAM METHODOLOGY

Background Soil Sampling

Four soil samples (BG-1, 2, 3, 4) were collected at random by Western Technologies, Inc. personnel from widely separated areas of the Lea Refinery (Figure 2). These samples were collected from the approximate depth of 1 to 2 feet using a clean stainless steel trowel. Samples were placed into 500 milliliter (ml) glass jars, sealed, and preserved by cooling in an ice chest. Quality control and chain-of-custody procedures were employed.

Samples were sent to a Western Technologies, Inc. laboratory and analyzed for total metals by EPA Method 3050/6010. The analytical results were used to establish background or baseline levels for metals on the refinery site.

Surface Soil Characterization Sampling

Forty-eight surface soil samples were collected around the cooling tower in the area of green and yellow stained soil. These sample locations were on a grid pattern as seen in Figure 3. Five duplicate samples were also collected and analyzed for quality control. Samples were designated with the prefix CCT (characterization, cooling tower) and given a suffix of a letter and number corresponding to grid column and row.

All soil samples were collected from the surface to an approximate depth of 6 inches using a clean stainless steel trowel. Soil samples were placed into clean 500 ml glass jars, sealed and placed in an ice chest. Quality control and chain-of-custody procedures were followed.

All samples were submitted to the laboratory for EP Toxicity Metals analyses by EPA Method 1310/3010/6010 and total metals by EPA Method 3050/6010.

Subsurface Soil Characterization Sampling

Four boreholes (D5, D6, E6, E7) were each advanced to a total depth of 31 feet in the area near the cooling tower where soil staining was most significant (Figure 6). These borings were constructed to determine the vertical extent of soil contamination.

A hollow stem auger rig was used to advance the borings. Soil samples were collected with a split spoon sampler at depths of approximately 2-1/2, 5, 10, 15, 20, 25, and 30 feet. Six-inch long, 2-1/2-inch diameter brass liners were used in the split spoon to catch the driven sample. The brass liners were sealed with plastic end caps. Standard chain-of-custody procedures were followed. All drill cuttings were collected and placed in 55-gallon steel drums to be disposed of when excavation of contaminated soils commences. All boreholes were grouted with neat cement to prevent additional downward migration of contaminants. The auger was decontaminated between borings and the split spoon between sampling to prevent cross contamination.

The 2-1/2 foot samples were analyzed for EP Toxicity Metals by EPA Method 1310/3010/6010 and total metals by Method 3050/6010. The remaining subsurface samples were analyzed for total metals only.

Borrow Pit Sampling

A borrow pit located off-site to the southwest of the refinery was sampled to determine the suitability of material from this pit for use as backfill for any excavation work to be performed at the cooling tower site. Two soil samples (BL-1, BL-2) were collected from the western working face of the pit.

Samples were collected with a clean stainless steel trowel by digging into the mining face to a depth of up to one foot. Samples were placed in 500 ml glass jars and shipped to the laboratory for total metals analyses by EPA Method 3050/6010.

RESULTS

Background and Borrow Pit

The results of background and borrow pit soil analyses may be found in Table 1. Laboratory sheets are in Appendix A. Total metals analyses indicate that background levels of

TABLE 1

BACKGROUND AND BORROW PIT SOIL ANALYSES
TOTAL METALS IN UG/G (PPM)

SAMPLE NO.	Cd	Cu	Zn	Pb	Be	Sb	Ni	Cr	Ag	As	Se	Tl	Hg
Background													
BG-1	<0.5	10.3	28.4	6.9	<0.5	1.4	10.6	10.8	<0.5	2.2	<0.5	<0.5	<0.25
BG-2	<0.5	8.3	17.4	6.3	<0.5	<1.0	14.5	6.3	<0.5	2.1	<0.5	<0.5	<0.25
BG-3	<0.5	7.2	13.3	5.1	<0.5	1.2	14.6	5.1	<0.5	2.8	<0.5	<0.5	<0.25
BG-4	<0.5	11.7	55.8	8.5	1.7	<1.0	23.7	25.6	<0.5	2.4	<0.5	<0.5	<0.25
Borrow Pit													
BL-1	<0.5	3.7	5.8	<1.5	<0.5	<1.0	13.6	2.5	<0.5	2.1	<0.5	<0.5	<0.25
BL-2	<0.5	3.3	3.5	<1.5	<0.5	2.4	11.1	1.9	<0.5	3.2	<0.5	<0.5	<0.25

chromium and zinc, the principal metals found in the inhibitor solution at the cooling tower, are above laboratory detection limits for all background samples submitted and are common constituents of the near surface refinery soils.

Total chromium concentrations in the background samples range from 5.1 to 25.6 micrograms per gram (ug/g). Total zinc concentrations in the background samples range from 13.3 to 55.8 ug/g.

Borrow pit soil samples are lower in total chrome and zinc concentration than refinery background samples. Total chrome for borrow samples ranges from 1.9 to 2.5 ug/g and total zinc ranges from 3.5 to 5.8 ug/g. The differences in magnitude between these borrow pit sample concentrations and the refinery background soil samples probably reflect the differences in the geologic materials involved. The borrow pit samples were taken at a depth of about eight feet in sandy caliche. Caliche is a material thought to have formed as a result of the leaching of surface soils and redeposition of calcium carbonate in the subsoil. Background samples were of surface soils which overlie the caliche. The surface soils contain a residue of materials of low solubility which tend to become concentrated over time. The higher total metal content of the surface soils may reflect this process.

Cooling Tower

The results of surface soil analyses may be found in Table 2 and subsurface soils in Table 3. All original laboratory reports are in Appendix A.

The EP Toxicity extracts for the surface soil samples for chromium ranged from less than the laboratory detection limit of 0.01 milligrams per liter (mg/l) to a high of 36.19 mg/l at sample location E5 about twenty feet north of the cooling tower. The EP Toxicity results for subsurface samples ranged from 0.05 to 1.83 mg/l, the highest reading at a depth of 2.5 to 3 feet at sample location D6. As specified in Title 40, Code of Federal Regulations, Part 261.24, the EP Toxicity limit for chromium is 5.0 mg/l.

In general, it appears that soils above the EP Toxicity limit conform to the area of yellow colored staining nearest the northern corner of the cooling tower. The coloration differences probably reflect the ionic states of the chromium contaminants present, the greenish stain representing the relatively stable trivalent form of

TABLE 2
SURFACE SOIL CHARACTERIZATION ANALYSES

TOTAL METALS in UG/G (PPM)

SAMPLE NO.	Cd	Cu	Zn	Pb	Be	Sb	Ni	Cr	Ag	As	Se	Tl	Hg
CCT-A3	<0.5	21.9	118	20.3	<0.5	2.6	10.7	77.1	<0.5	7.3	<0.5	<0.5	<0.25
CCT-A4	<0.5	35.3	271	13.7	0.6	1.4	13.9	95.7	<0.5	9.8	<0.5	<0.5	<0.25
CCT-A5	<0.5	52.8	251	44.1	<0.5	1.3	11.3	164	<0.5	4.6	<0.5	<0.5	<0.25
CCT-A6	1.3	53.3	424	69.7	<0.5	1.9	13.5	251	<0.5	6.4	<0.5	<0.5	<0.25
CCT-B3	<0.5	19.4	82.5	9.7	<0.5	1.6	15.4	36.4	<0.5	4.4	<0.5	<0.5	<0.25
CCT-B4	0.9	143	1404	29.0	<0.5	4.5	20.1	1502	<0.5	16.5	<0.5	<0.5	<0.25
CCT-B5	<0.5	7.4	43.5	9.2	<0.5	1.1	6.7	17.1	<0.5	3.8	<0.5	<0.5	<0.25
CCT-B5D	<0.5	8.6	44.6	9.2	<0.5	2.1	7.9	21.6	<0.5	4.2	<0.5	<0.5	<0.25
CCT-B6	4.1	30.1	346	123	<0.5	2.3	11.1	197	<0.5	<0.5	<0.5	<0.5	<0.25
CCT-B10	<0.5	9.6	81.7	30.2	0.6	1.6	9.6	77.1	<0.5	6.4	<0.5	<0.5	<0.25
CCT-C1	<0.5	13.1	102	9.1	<0.5	1.3	14.8	49.8	<0.5	5.6	<0.5	<0.5	<0.25
CCT-C2	<0.5	16.8	109	17.9	<0.5	1.3	15.7	55	<0.5	5.5	<0.5	<0.5	<0.25
CCT-C3	<0.5	8.8	96.6	6.6	0.6	1.8	8.3	59.1	<0.5	5.3	<0.5	<0.5	<0.25
CCT-C4	<0.5	15.6	312	97.8	<0.5	1.6	14.8	515	<0.5	7.7	<0.5	<0.5	<0.25
CCT-C5	<0.5	9.5	108	17.6	<0.5	1.7	12.5	152	<0.5	3.6	<0.5	<0.5	<0.25
CCT-C6	<0.5	30.7	434	377	<0.5	2.4	23.9	435	<0.5	5.6	<0.5	<0.5	<0.25
CCT-C10	0.6	46.2	1080	68.5	0.7	2.7	15.9	636	<0.5	47.4	<0.5	<0.5	<0.25
CCT-D1	<0.5	9.2	59.5	15.2	<0.5	<1.0	15.6	15.5	<0.5	6.8	<0.5	<0.5	<0.25
CCT-D2	<0.5	12.9	185	13.5	<0.5	1.6	9.6	265	<0.5	10.1	<0.5	<0.5	<0.25
CCT-D2D	<0.5	15.5	223	11.3	0.8	<1.0	14.8	408	<0.5	10.5	<0.5	<0.5	<0.25
CCT-D3	<0.5	9.5	121	8.3	0.6	1.2	10.1	96.5	<0.5	4.4	<0.5	<0.5	<0.25
CCT-D4	<0.5	9.7	425	14.5	<0.5	2.7	11.9	641	<0.5	4.2	<0.5	<0.5	<0.25
CCT-D5	<0.5	14.9	919	13.5	<0.5	2.8	16.1	1919	<0.5	11.3	<0.5	<0.5	<0.25
CCT-D6	<0.5	47.2	12038	38.7	0.7	5.3	14.9	5422	<0.5	15.5	<0.5	<0.5	<0.25
CCT-D10	<0.5	8.3	173	7.4	<0.5	<1.0	8	109	<0.5	18.9	<0.5	<0.5	<0.25
CCT-E1	<0.5	8.3	110	6.7	<0.5	1.1	9.1	65	<0.5	5.4	<0.5	<0.5	<0.25
CCT-E2	<0.5	7.8	800	6.3	0.8	<1.0	11.3	908	<0.5	3.8	<0.5	<0.5	<0.25
CCT-E3	2.2	127	13773	130	0.7	7	18	5301	<0.5	102	<0.5	<0.5	<0.25
CCT-E4	0.6	7.7	145	6.4	0.6	2.8	11.5	118	<0.5	2.3	<0.5	<0.5	<0.25
CCT-E5	1.9	13.8	22334	21.9	0.7	4	10.9	6527	<0.5	8.4	<0.5	<0.5	<0.25
CCT-E6	<0.5	31.3	1437	21.7	0.8	3.7	14.8	1532	<0.5	19.3	<0.5	<0.5	<0.25

TABLE 2 CONTINUED

TOTAL METALS in UG/G (PPM)

SAMPLE NO.	Cd	Cu	Zn	Pb	Be	Sb	Ni	Cr	Ag	As	Se	Tl	Hg
CCT-E6D	<0.5	25.6	1432	15.6	0.7	3.5	13.8	1484	<0.5	15.1	<0.5	<0.5	<0.25
CCT-E7	<0.5	18.3	1566	10	<0.5	1.9	8.3	994	<0.5	30.9	<0.5	<0.5	<0.25
CCT-E8	0.8	75.6	2440	19.7	<0.5	2.9	16.6	1614	<0.5	56.5	<0.5	<0.5	<0.25
CCT-E9	1.4	61.4	1679	29.7	0.6	3.2	18.6	1710	<0.5	40.3	<0.5	<0.5	<0.25
CCT-E10	<0.5	18.8	409	11.4	<0.5	1.9	14.1	354	<0.5	20.6	<0.5	<0.5	<0.25
CCT-E10D	<0.5	18.9	391	12.6	0.6	2.4	17.1	366	<0.5	22.6	<0.5	<0.5	<0.25
CCT-F1	<0.5	9.1	80.9	6.6	0.6	<1.0	14	54.8	<0.5	3.8	<0.5	<0.5	<0.25
CCT-F2	<0.5	7.9	31.7	5.4	0.7	1.5	7.7	29.2	<0.5	5.8	<0.5	<0.5	<0.25
CCT-F3	<0.5	7.2	32.9	6	0.6	<1.0	8	35.2	<0.5	4.2	<0.5	<0.5	<0.25
CCT-F3D	<0.5	7.4	41.2	4	<0.5	<1.0	8.5	39.3	<0.5	3.8	<0.5	<0.5	<0.25
CCT-F4	<0.5	8.5	147	4.4	<0.5	<1.0	14.8	137	<0.5	5.3	<0.5	<0.5	<0.25
CCT-F5	<0.5	7.8	144	3.6	<0.5	1.7	16.4	55.1	<0.5	2.6	<0.5	<0.5	<0.25
CCT-F6	<0.5	7.2	177	4.5	<0.5	<1.0	16.1	191	<0.5	3	<0.5	<0.5	<0.25
CCT-F7	<0.5	12	236	8	<0.5	<1.0	14.3	205	1.2	3.9	<0.5	<0.5	<0.25
CCT-F8	0.7	12.9	255	24.3	<0.5	1.5	15.7	281	<0.5	3.9	<0.5	<0.5	<0.25
CCT-G1	<0.5	9.4	115	6.2	0.6	1.3	13.6	67.6	<0.5	3.2	<0.5	<0.5	<0.25
CCT-G2	<0.5	7.3	56.8	5.8	0.5	1.4	12.9	17.3	<0.5	2.5	<0.5	<0.5	<0.25
CCT-G3	<0.5	7.2	39.9	5	<0.5	<1.0	11.8	26.3	<0.5	2.6	<0.5	<0.5	<0.25
CCT-G4	<0.5	8.5	116	5.2	<0.5	<1.0	13.2	76	<0.5	3.2	<0.5	<0.5	<0.25
CCT-G5	<0.5	7.5	557	4	<0.5	<1.0	13	290	<0.5	2.2	<0.5	<0.5	<0.25
CCT-G6	<0.5	7.9	123	5.4	<0.5	<1.0	10.7	50.8	<0.5	2.6	<0.5	<0.5	<0.25
CCT-G7	<0.5	8.5	188	6.6	<0.5	1.8	11.2	156	<0.5	3.3	<0.5	<0.5	<0.25

TABLE 2 CONTINUED

EP TOXICITY in mg/l (PPM)

SAMPLE NO.	Ba	Cd	Pb	As	Se	Cr	Ag	Hg
CCT-A3	1.15	<0.005	0.02	0.15	<0.025	0.14	<0.005	<0.001
CCT-A4	1.25	<0.005	<0.015	0.11	<0.025	0.02	<0.005	<0.001
CCT-A5	1.2	<0.005	<0.015	0.04	<0.025	0.04	<0.005	<0.001
CCT-A6	1.19	0.01	<0.015	0.03	<0.025	0.01	<0.005	<0.001
CCT-B3	1.09	<0.005	<0.015	0.05	<0.025	0.02	<0.005	<0.001
CCT-B4	0.86	<0.005	<0.015	0.05	<0.025	0.06	<0.005	<0.001
CCT-B5	1.35	<0.005	<0.015	0.04	<0.025	<0.010	<0.005	<0.001
CCT-B50	1.18	<0.005	<0.015	0.03	<0.025	<0.010	<0.005	<0.001
CCT-B6	0.42	0.05	0.02	0.04	<0.025	0.02	<0.005	<0.001
CCT-B10	1.05	<0.005	<0.015	0.07	<0.025	0.03	<0.005	<0.001
CCT-C1	0.85	<0.005	<0.015	0.05	<0.025	0.02	<0.005	<0.001
CCT-C2	0.92	<0.005	<0.015	0.05	<0.025	0.04	<0.005	<0.001
CCT-C3	1.01	<0.005	<0.015	0.04	<0.025	0.02	<0.005	<0.001
CCT-C4	0.53	<0.005	<0.015	0.05	<0.025	0.29	<0.005	<0.001
CCT-C5	0.52	<0.005	<0.015	<0.025	<0.025	0.02	<0.005	<0.001
CCT-C6	0.6	0.01	0.08	0.03	<0.025	0.26	<0.005	<0.001
CCT-C10	0.65	<0.005	<0.015	0.19	<0.025	0.32	<0.005	<0.001
CCT-D1	1.12	<0.005	<0.015	0.05	<0.025	<0.010	<0.005	<0.001
CCT-D2	0.67	<0.005	<0.015	0.07	<0.025	0.15	<0.005	<0.001
CCT-D20	0.85	<0.005	<0.015	0.06	<0.025	0.13	<0.005	<0.001
CCT-D3	1.05	<0.005	<0.015	0.04	<0.025	0.02	<0.005	<0.001
CCT-D4	0.95	<0.005	<0.015	0.04	<0.025	0.51	<0.005	<0.001
CCT-D5	0.49	<0.005	<0.015	<0.025	<0.025	0.44	<0.005	<0.001
CCT-D6	0.64	<0.005	<0.015	0.06	<0.025	24.35	<0.005	<0.001
CCT-D10	0.73	<0.005	<0.015	0.11	<0.025	0.08	<0.005	<0.001
CCT-E1	0.71	<0.005	<0.015	0.03	<0.025	0.05	<0.005	<0.001
CCT-E2	0.69	<0.005	<0.015	0.04	<0.025	2.54	<0.005	<0.001

TABLE 2 CONTINUED

EP TOXICITY in mg/l (PPM)

SAMPLE NO.	Ba	Cd	Pb	As	Se	Cr	Ag	Hg
CCT-E3	0.57	0.01	<0.015	0.21	<0.025	0.44	<0.005	<0.001
CCT-E4	0.9	<0.005	<0.015	0.04	<0.025	0.05	<0.005	<0.001
CCT-E5	1.2	0.03	<0.015	0.04	<0.025	36.19	<0.005	<0.001
CCT-E6	0.86	<0.005	0.08	0.07	<0.025	0.54	<0.005	<0.001
CCT-E6D	0.85	<0.005	<0.015	0.07	<0.025	0.54	<0.005	<0.001
CCT-E7	0.98	<0.005	<0.015	0.08	<0.025	0.61	<0.005	<0.001
CCT-E8	0.97	0.01	<0.015	0.14	<0.025	1.29	<0.005	<0.001
CCT-E9	0.95	<0.005	<0.015	0.06	<0.025	0.14	<0.005	<0.001
CCT-E10	0.92	<0.005	<0.015	0.07	<0.025	0.09	<0.005	<0.001
CCT-E10D	0.94	<0.005	<0.015	0.07	<0.025	0.09	<0.005	<0.001
CCT-F1	1.21	<0.005	<0.015	0.03	<0.025	<0.010	<0.005	<0.001
CCT-F2	0.93	<0.005	<0.015	0.06	<0.025	<0.010	<0.005	<0.001
CCT-F3	0.87	<0.005	<0.015	0.04	<0.025	0.01	<0.005	<0.001
CCT-F3D	0.87	<0.005	<0.015	0.06	<0.025	<0.010	<0.005	<0.001
CCT-F4	0.86	<0.005	<0.015	0.08	<0.025	0.06	<0.005	<0.001
CCT-F5	0.87	<0.005	<0.015	<0.025	<0.025	<0.010	<0.005	<0.001
CCT-F6	0.93	<0.005	<0.015	<0.025	<0.025	0.08	<0.005	<0.001
CCT-F7	0.88	<0.005	<0.015	0.03	<0.025	0.03	<0.005	<0.001
CCT-F8	1.13	<0.005	<0.015	<0.025	<0.025	0.03	<0.005	<0.001
CCT-G1	0.45	<0.005	<0.015	0.03	<0.025	<0.010	<0.005	<0.001
CCT-G2	0.59	<0.005	<0.015	<0.025	<0.025	<0.010	<0.005	<0.001
CCT-G3	1.81	<0.005	<0.015	0.03	<0.025	0.02	<0.005	<0.001
CCT-G4	1.91	<0.005	<0.015	0.03	<0.025	0.11	<0.005	<0.001
CCT-G5	1.84	<0.005	<0.015	<0.025	<0.025	0.66	<0.005	<0.001
CCT-G6	1.61	<0.005	<0.015	<0.025	<0.025	0.07	<0.005	<0.001
CCT-G7	1.21	<0.005	<0.015	0.03	<0.025	0.26	<0.005	<0.001

TABLE 3
SUBSURFACE SOIL CHARACTERIZATION ANALYSES

TOTAL METALS in UG/G (PPM)

SAMPLE NO.	Depth (Ft.)	Cd	Cu	Zn	Pb	Be	Sb	Ni	Cr	Ag	As	Se	Tl	Hg
D6	2.5-3	<0.5	8.1	405.9	<1.5	<0.5	2.2	6.6	109.3	<0.5	5.5	<0.5	<0.5	<0.25
D6	5.5-6	<0.5	9.7	10.6	<1.5	<0.5	<1.0	8.6	38.3	<0.5	4.5	<0.5	<0.5	<0.25
D6	10.5-11	<0.5	4.6	3.5	<1.5	<0.5	2.2	9.1	40.9	<0.5	2.4	<0.5	<0.5	<0.25
D6	15.5-16	<0.5	6.2	2.3	<1.5	<0.5	<1.0	15.7	38.2	<0.5	1.2	<0.5	<0.5	<0.25
D6	20.5-21	<0.5	108.6	24.8	3.7	0.7	<1.0	11.4	46.9	<0.5	2	<0.5	<0.5	<0.25
D6	25.5-26	<0.5	14.2	7.7	1.8	<0.5	1.7	3.9	6.5	<0.5	<0.5	<0.5	<0.5	<0.25
D6	30.5-31	<0.5	6.1	4.7	<1.5	<0.5	1.4	5.4	10	<0.5	1	<0.5	<0.5	<0.25
E6	5.5-6	<0.5	8.5	3.4	<1.5	<0.5	2.8	8.2	3.2	<0.5	4	<0.5	<0.5	<0.25
E6	10.5-11	<0.5	3.9	4.4	<1.5	<0.5	1.5	9.3	9	<0.5	2.9	<0.5	<0.5	<0.25
E6	15.5-16	<0.5	7.4	7.5	1.8	<0.5	<1.0	7.1	3.9	<0.5	1.9	<0.5	<0.5	<0.25
E6	20.5-21	<0.5	14.7	14.6	3	<0.5	1.6	11.8	22.5	<0.5	3.7	<0.5	<0.5	<0.25
E6	25.5-26	<0.5	35	21	2.2	<0.5	<1.0	6	12.2	<0.5	0.8	<0.5	<0.5	<0.25
E6	30.5-31	<0.5	5.1	8.2	2.1	<0.5	<1.0	4.6	11.9	<0.5	0.6	<0.5	<0.5	<0.25
E7	4-4.5	<0.5	6.5	6.8	<1.5	<0.5	1.6	8.3	3.1	1.6	4.1	<0.5	<0.5	<0.25
E7	5.5-6	<0.5	10.4	17.7	<1.5	<0.5	<1.0	8.5	2.7	<0.5	2.7	<0.5	<0.5	<0.25
E7	10.5-11	<0.5	13	14.1	<1.5	<0.5	<1.0	7.3	1.2	<0.5	1.4	<0.5	<0.5	<0.25
E7	15.5-16	<0.5	4.2	9.2	3.7	<0.5	<1.0	8.9	2.8	<0.5	0.6	<0.5	<0.5	<0.25
E7D	15.5-16	<0.5	5.1	19.7	2.7	<0.5	<1.0	10.1	2.6	<0.5	0.7	<0.5	<0.5	<0.25
E7	21.5-22	<0.5	4.8	47.4	4.9	<0.5	<1.0	4.3	4.4	<0.5	0.7	<0.5	<0.5	<0.25
E7	25.5-26	<0.5	4.5	12.7	3	<0.5	<1.0	3.7	4	<0.5	0.6	<0.5	<0.5	<0.25
E7	30.5-31	<0.5	8.6	24.5	3.6	<0.5	<1.0	5.4	12.9	<0.5	<0.5	<0.5	<0.5	<0.25
D5	2.5-3	<0.5	7.6	1.3	<1.5	<0.5	2.3	9.5	5.9	<0.5	7	<0.5	<0.5	<0.25
D5	5.5-6	<0.5	7.5	6.1	<1.5	<0.5	1.4	9	7.5	<0.5	6.8	<0.5	<0.5	<0.25
D5	10.5-11	<0.5	3.9	5.7	<1.5	<0.5	1.3	15.3	41.9	<0.5	2.1	<0.5	<0.5	<0.25
D5D	10.5-11	<0.5	3.5	2.9	<1.5	<0.5	2.7	13.2	41.4	<0.5	1.4	<0.5	<0.5	<0.25
D5	15.5-16	<0.5	4.2	3.5	<1.5	<0.5	2.4	11.5	10.7	<0.5	1.1	<0.5	<0.5	<0.25
D5	20.5-21	<0.5	21.6	17.9	3.1	1	2.4	11.9	40.2	<0.5	2.3	<0.5	<0.5	<0.25

TABLE 3 CONTINUED

TOTAL METALS in UG/G (PPM)

SAMPLE NO.	Depth (Ft.)	Cd	Cu	Zn	Pb	Be	Sb	Ni	Cr	Ag	As	Se	Tl	Hg
D5	25.5-26	<0.5	6.1	5.9	7.5	<0.5	1.1	3.3	6.7	<0.5	0.8	<0.5	<0.5	<0.25
D5	30.5-31	<0.5	3.9	4.8	<1.5	<0.5	1.6	3.5	3.7	<0.5	0.9	<0.5	<0.5	<0.25

EP Toxicity Metals in mg/l

SAMPLE NO.	Depth (Ft.)	Ba	Cd	Pb	As	Se	Cr	Ag	Hg
D6	2.5-3	1.85	<0.005	<0.015	0.03	<0.025	1.83	<0.005	<0.001
D6(SPL)	2.5-3	1.83	<0.005	<0.015	0.05	<0.025	1.66	<0.005	<0.001
E6	5.5-6	1.3	<0.005	<0.015	<0.025	<0.025	0.05	<0.005	<0.001
E7	4-4.5	1.76	<0.005	<0.015	0.04	<0.025	0.05	<0.005	<0.001
D5	2.5-3	1.39	<0.005	<0.015	0.06	<0.025	0.11	<0.005	<0.001

chromium ion and the yellowish stain reflecting the more leachable (higher EP Toxicity) hexavalent form.

The EP Toxicity surface sample results for chromium have been contoured and are presented as Figure 3. The surface area of concentrations greater than 5.0 mg/l is approximately 300 square feet.

Total chromium levels in the surface soils ranged from a low of 17.1 ug/g (background) to a high of 6,527 ug/g at sample point E5. The relative total chrome concentrations fit very well with the ranges of EP Toxicity values denoted above. Total zinc values in the surface samples ranged from a background low of 31.7 ug/g to a high of 22,334 ug/g, also at E5.

Subsurface total chromium values spread from a background low of 1.2 ug/g at the 10.5 to 11 foot depth in E7 to a high of 109.3 ug/g from 2.5 to 3 feet at sample point D6. Chromium levels above background in the 40 to 50 ug/g range have been found as deep as 21 feet (borings D5 and D6).

Subsurface total zinc values ranged from 1.3 to 405.9 ug/g. No total zinc values above background were noted below a depth of 3 feet. This variance from the discovery of elevated chromium at depth reflects the lower mobility of the zinc contaminants present.

Total chromium and zinc values have been plotted and contoured on Figures 4 and 5. The area of elevated total metals above background at the surface is similar on both figures. Subsurface values for these metals are posted on Figure 6.

The approximate surface area covered by soils with chromium concentrations above background is 12,700 square feet (Figure 4). An estimated area of 675 square feet near the northern corner of the cooling tower is underlain by soils with elevated chromium levels to 21 feet in depth (Figure 6).

PROPOSED CLOSURE

Excavation of Soils

The cooling tower site will be remediated by removing metal contaminated soils to background levels using the total chromium concentration as a guideline. The cut-off value for excavation will be 25 ug/g total chromium (see RESULTS, Background and Borrow Pit).

As discussed in the RESULTS section of this report, no EP Toxicity levels for chromium greater than the 5.0 mg/l limit are known to be present in the subsurface soils below a depth of 2.5 feet. However, total chromium levels greater than background have been found to a depth of 21 feet in borings D5 and D6. The total chromium concentration at this depth is in the 40 to 50 ug/g range. No values above background were noted in any samples taken below 21 feet.

The procedure to be used for soil excavation is as follows:

Step 1: Employ a backhoe to selectively remove all yellow stained soils in the area approximately delineated by the 5 mg/l contour line on Figure 3. The depth of excavation is expected to be a maximum of 2.5 feet. This soil will be classified as hazardous for disposal purposes. Volume is estimated at 30 cubic yards.

Step 2: Use a front-end loader to scrape all stained soil at the site to a depth of about six inches. This procedure will remove the bulk of the surface contamination noted on Figure 4. This soil will be classified as non-hazardous for disposal purposes. Volume is estimated at about 235 cubic yards.

Step 3: Selectively excavate the soil in the area of D5, D6 and E5 to a depth of 21 feet with a track backhoe (see Figure 6). This soil will also be classified as non-hazardous. The volume of contaminated soil is estimated at 600 to 700 cubic yards.

Because of the small areal size of the deep excavation, a pad will have to be cut into nearby clean soils to lower the backhoe working surface as digging commences. Soil from this clean area will be stockpiled separately.

Tower Foundation

The northern corner of the cooling tower concrete foundation is greenish-stained, denoting some spillage of zinc chromate solution. Although the quantity of material making up this stained area is minimal, it is recommended that the stained portion of the foundation be sand-blasted and that the resultant residue be disposed of with the Step 1 excavated soils.

Disposal of Soils

All soils excavated in Step 1 will be directly loaded into trucks for transport to a hazardous solid waste disposal site. Steps 2 and 3 soils will be stockpiled. A composite sample of these soils will be taken and run for EP Toxic chrome. "Clean" soil excavated to provide a backhoe pad will be analyzed for total chrome. If this soil proves to be at background levels, it can later be utilized in backfilling the deep excavation. After verification of the non-hazardous character of stockpiled Step 2 and Step 3 soils, this material will be transported to an appropriate non-hazardous solid waste disposal facility.

Verification Sampling

Verification samples will be taken in the excavated area around the cooling tower to ensure that all soils with a total chromium content greater than 25 ug/g have been removed. A minimum of five such grab samples will be collected in the deep excavation (Step 3) and four additional grab samples will be collected in the scraped area (Step 2). All verification samples will be analyzed for total chromium content only.

Backfilling

Following verification sampling and the determination that all soils with chromium content greater than the cleanup standard have been removed, the excavation at the cooling tower will be backfilled. Clean fill from the borrow pit sampled earlier (see FIELD PROGRAM METHODOLOGY) and from the backhoe pad area (Excavation of Soils, Step 3) will be used to close the cooling tower excavation. The Step 2 scraped area will be rebuilt for proper drainage. Compaction of the deeply excavated area will not be possible due to the steepness of the pit walls. It is recommended that sufficient fill be mounded over the pit to allow for settling.

Contingency Plan

It is possible that excavation may reveal stained soils beneath the cooling tower foundation or that verification sampling may indicate that these soils contain total chromium above background levels. It is also possible that excavation to 21 feet in depth may not be feasible due to caving of pit walls. Should there be any variation from the proposed closure plan, the Southern Union Company representative will be contacted and advised of the apparent extent and hazardous or non-hazardous nature of any contaminated soil remaining in place. Alternative closure options will be pursued at that time.

It has been a pleasure preparing this closure plan for Southern Union Company.

Respectfully submitted,

REED & ASSOCIATES, INC.

Hugh B Robotham

Hugh B. Robotham, P.E.

Allan T. Schmidt

Allan T. Schmidt
Senior Geologist

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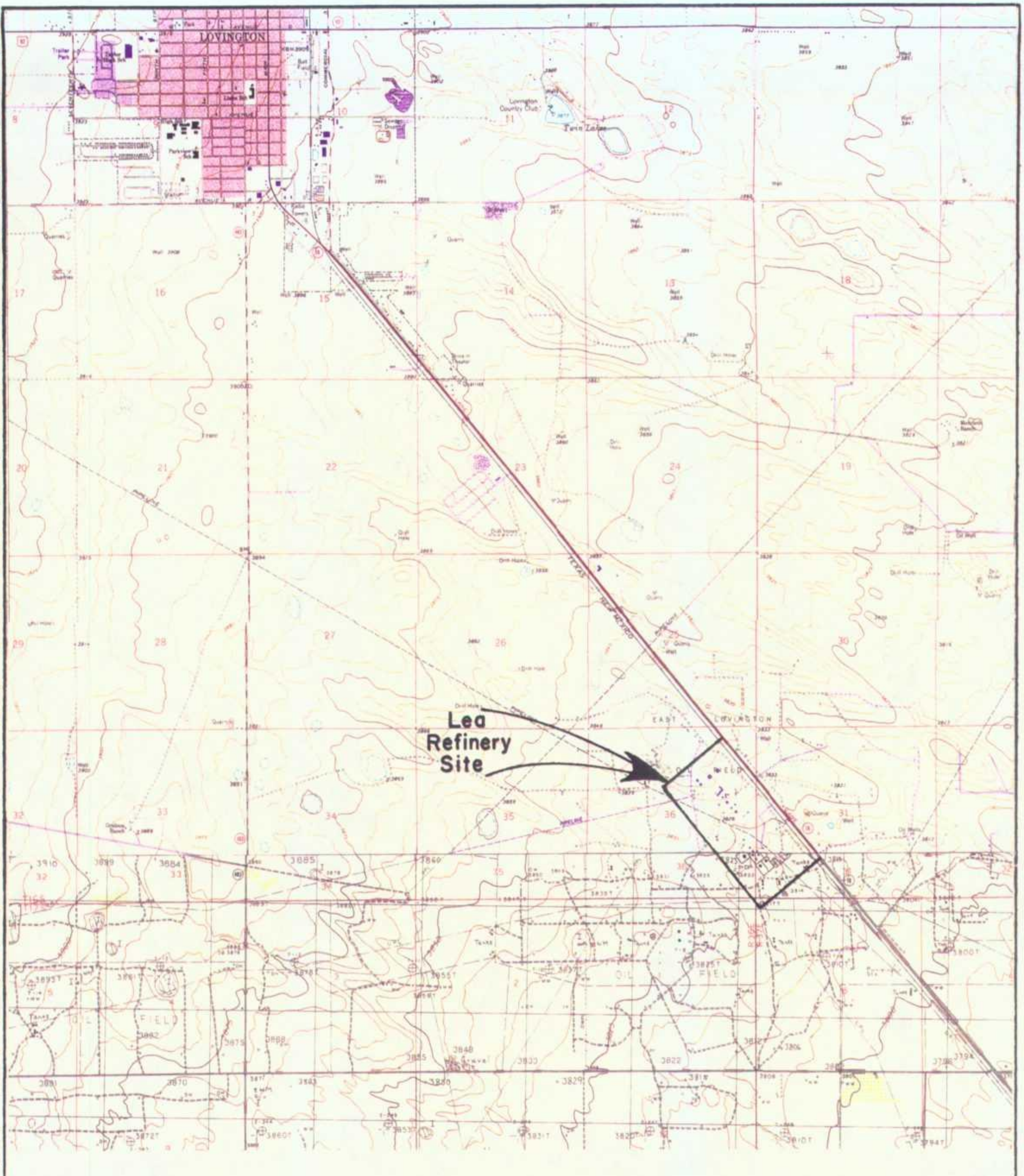
REGISTERED PROFESSIONAL ENGINEER

8-1-89

REGISTERED GEOLOGIST
CERTIFICATE NO.
22748
ALLAN T.
SCHMIDT
Date Signed 8-1-89
ARIZONA U.S.A.

HBR/ATS/sne

FIGURES

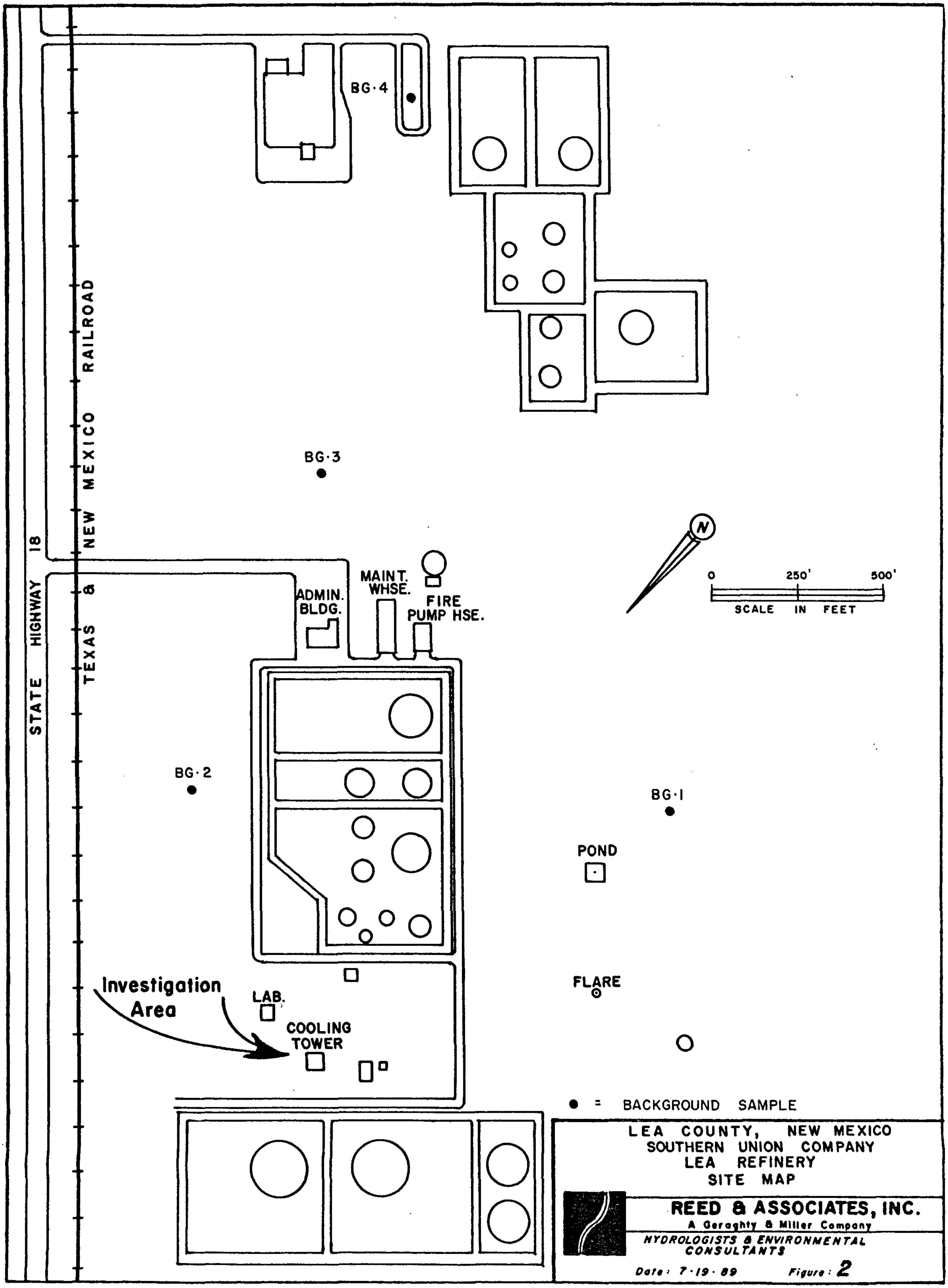


LEA COUNTY, NEW MEXICO
SOUTHERN UNION COMPANY

LOCATION MAP

REED & ASSOCIATES, INC.
A Geraghty & Miller Company
HYDROLOGISTS & ENVIRONMENTAL CONSULTANTS

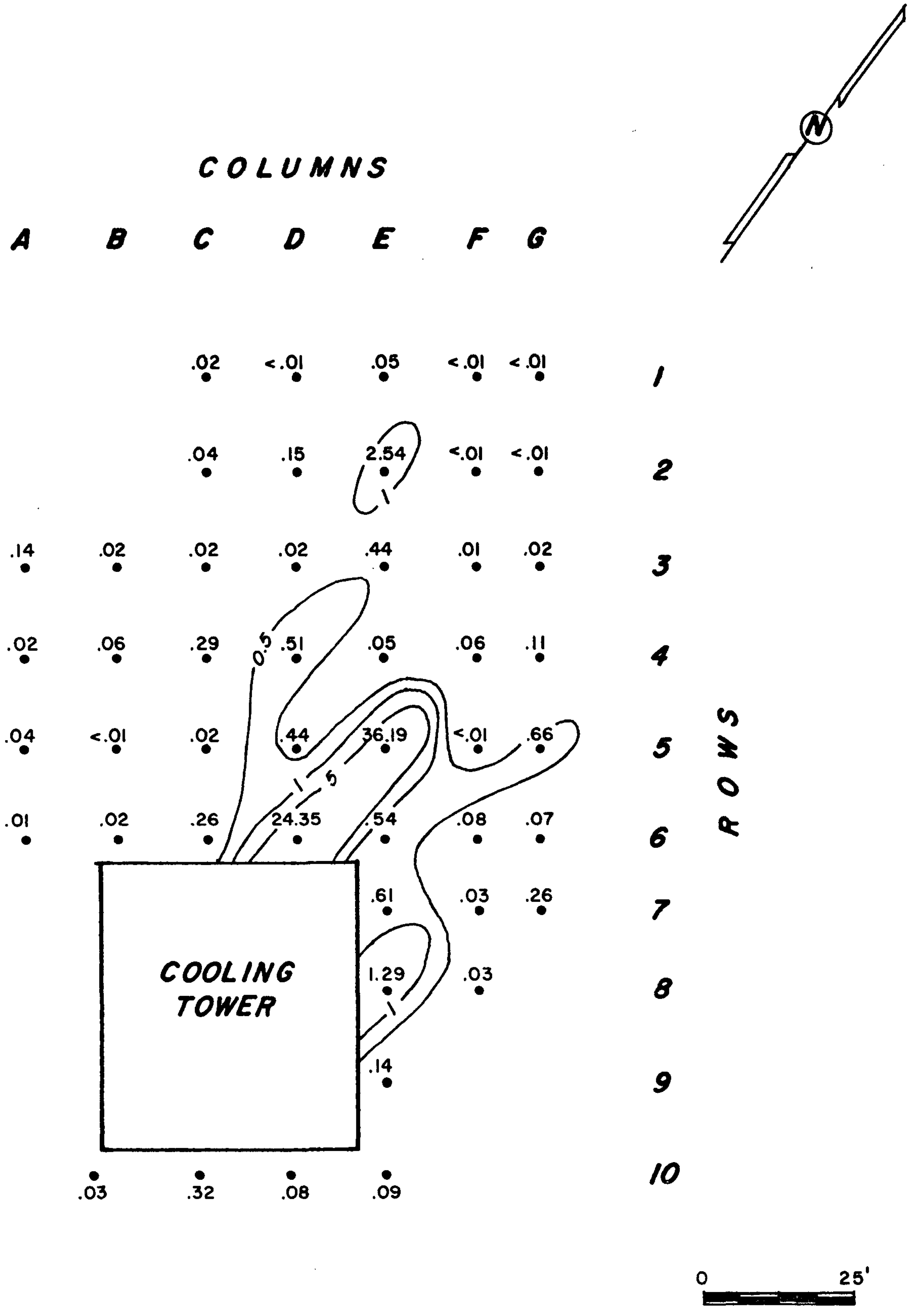
Date: 7·19·89 *Figure: 1*



LEA COUNTY, NEW MEXICO
SOUTHERN UNION COMPANY
LEA REFINERY
SITE MAP

REED & ASSOCIATES, INC.
A Geraghty & Miller Company
HYDROLOGISTS & ENVIRONMENTAL CONSULTANTS

Date: 7·19·89 *Figure:* 2

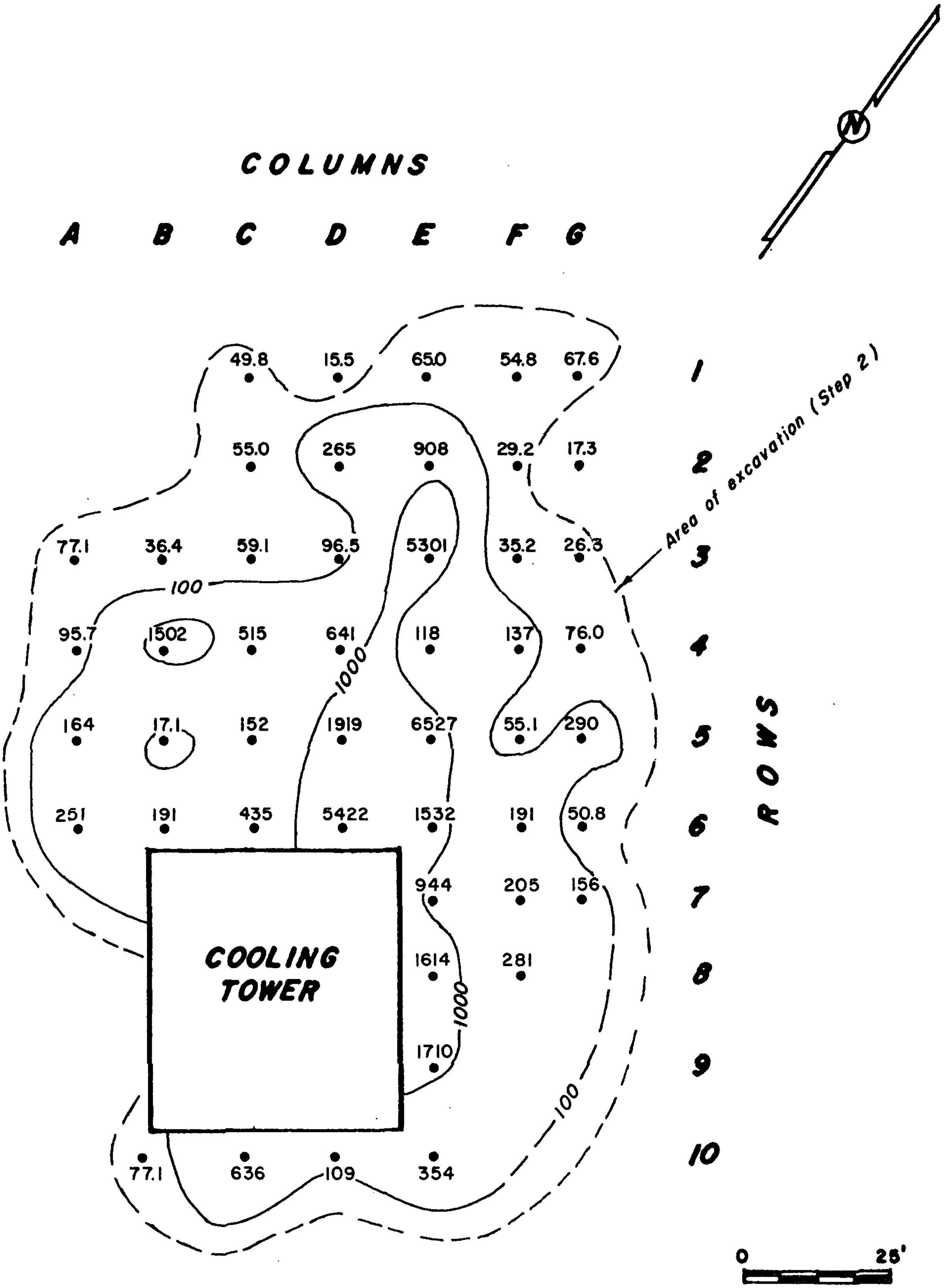


2.54 Value in mg/l.

LEA COUNTY, NEW MEXICO
SOUTHERN UNION COMPANY-LEA REFINERY
EP TOXICITY CHROMIUM CONCENTRATION
SURFACE SAMPLING

REED & ASSOCIATES, INC.
A Geraghty & Miller Company
HYDROLOGISTS & ENVIRONMENTAL CONSULTANTS

Date: 7-24-89 *Figure:* 3

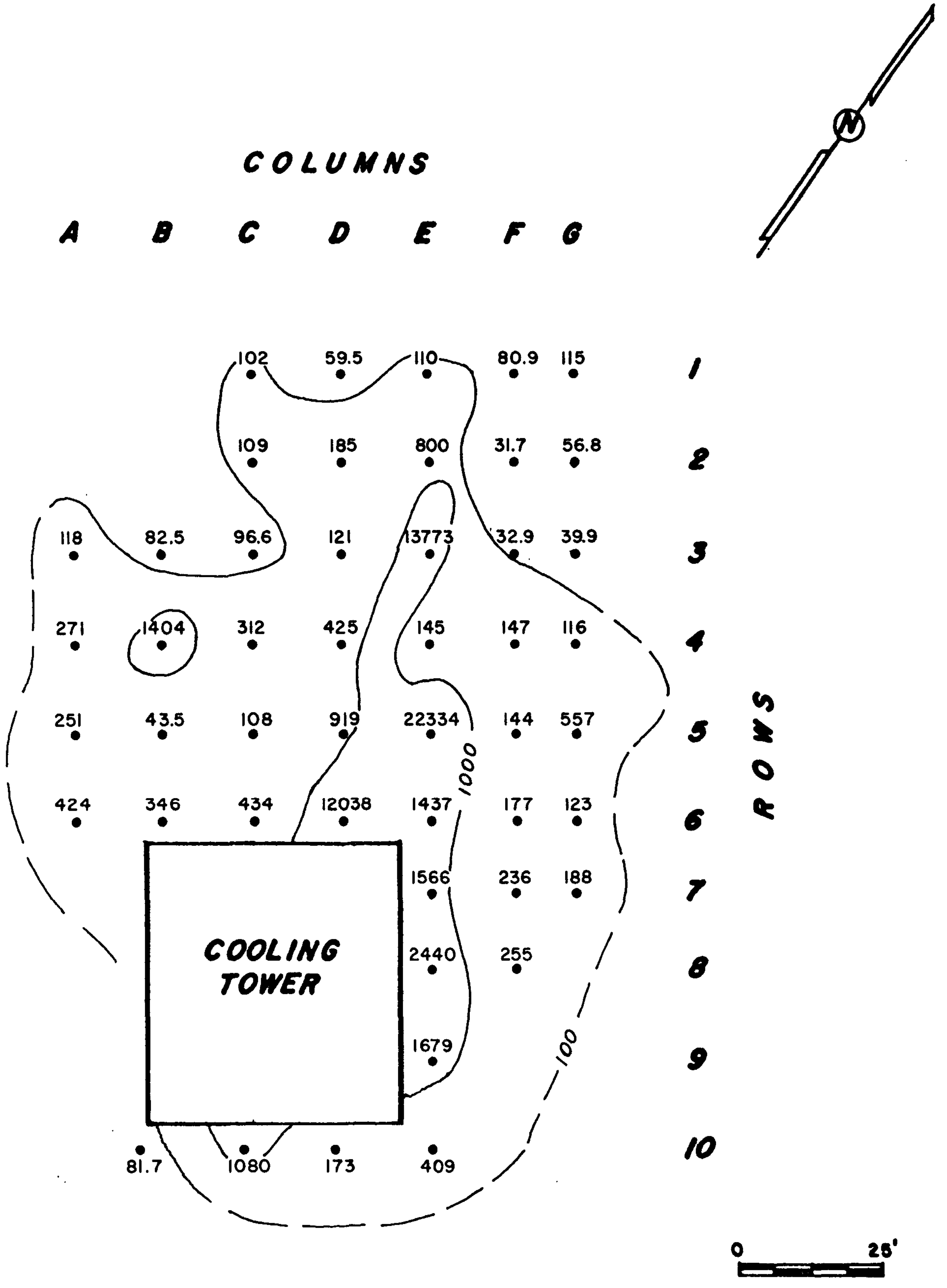


1919 Value in ug/g

LEA COUNTY, NEW MEXICO
SOUTHERN UNION COMPANY - LEA REFINERY
TOTAL CHROMIUM CONCENTRATION MAP,
SURFACE SAMPLING

REED & ASSOCIATES, INC.
A Geraghty & Miller Company
HYDROLOGISTS & ENVIRONMENTAL CONSULTANTS

Date: 7-25-89 Figure: 4

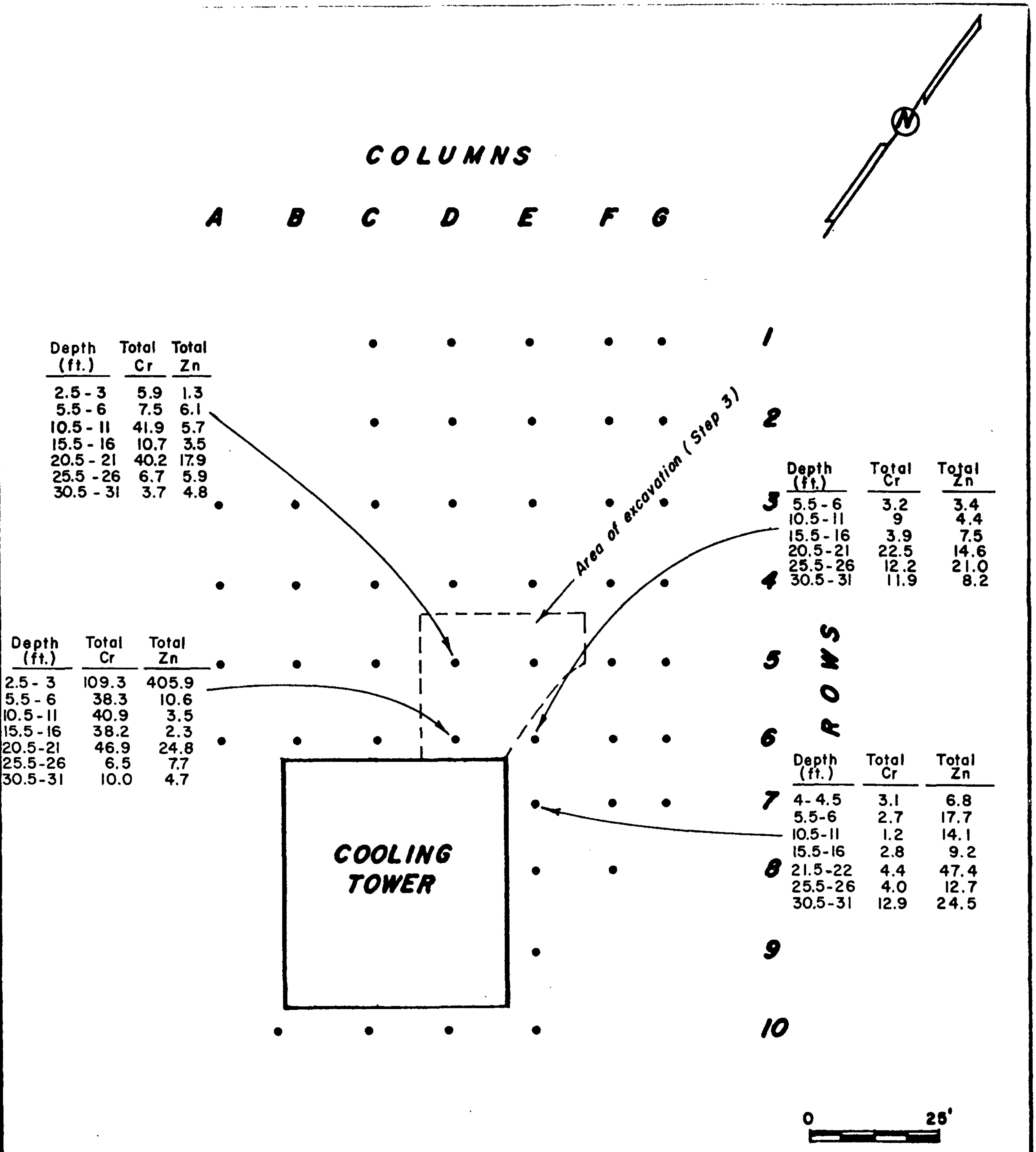


236 Value in ug/g

LEA COUNTY, NEW MEXICO
SOUTHERN UNION COMPANY-LEA REFINERY
TOTAL ZINC CONCENTRATION MAP
SURFACE SAMPLING

REED & ASSOCIATES, INC.
A Geraghty & Miller Company
HYDROLOGISTS & ENVIRONMENTAL CONSULTANTS

Date: 7·25·89 Figure: 5



Depth (ft.)	Total Cr	Total Zn
2.5 - 3	5.9	1.3
5.5 - 6	7.5	6.1
10.5 - 11	41.9	5.7
15.5 - 16	10.7	3.5
20.5 - 21	40.2	17.9
25.5 - 26	6.7	5.9
30.5 - 31	3.7	4.8

Depth (ft.)	Total Cr	Total Zn
2.5 - 3	109.3	405.9
5.5 - 6	38.3	10.6
10.5 - 11	40.9	3.5
15.5 - 16	38.2	2.3
20.5 - 21	46.9	24.8
25.5 - 26	6.5	7.7
30.5 - 31	10.0	4.7

Depth (ft.)	Total Cr	Total Zn
5.5 - 6	3.2	3.4
10.5 - 11	9	4.4
15.5 - 16	3.9	7.5
20.5 - 21	22.5	14.6
25.5 - 26	12.2	21.0
30.5 - 31	11.9	8.2

Depth (ft.)	Total Cr	Total Zn
4 - 4.5	3.1	6.8
5.5 - 6	2.7	17.7
10.5 - 11	1.2	14.1
15.5 - 16	2.8	9.2
21.5 - 22	4.4	47.4
25.5 - 26	4.0	12.7
30.5 - 31	12.9	24.5

LEA COUNTY, NEW MEXICO
SOUTHERN UNION COMPANY - LEA REFINERY
TOTAL CHROMIUM and ZINC
CONCENTRATION MAP, SUBSURFACE SAMPLING

REED & ASSOCIATES, INC.
A Geraghty & Miller Company
HYDROLOGISTS & ENVIRONMENTAL CONSULTANTS

Date: 7-25-89 Figure: 6

APPENDIX A

WESTERN TECHNOLOGIES INC.

8305 Washington Place, N.E.
Albuquerque, New Mexico 87113
(505) 823-4488

LETTER OF TRANSMITTAL

To REED + ASSOCIATES, INC.
1030 ANDREWS HIGHWAY SUITE 120
MIDLAND, TEXAS 79701

Date 7/19/89
Job No. 3259J018
Lab./Invoice No. —
Ref. No. —

Attn. ALLAN T. SCHMIDT

Project/Subject SURCO/LEA REFINING
HOBBS, NM

Please be informed that we are:

- [✓ Enclosing]
- Forwarding Separately
- [✓ Per Your Request]
- 1 No. of Copies
- Other
- Engineering Reports
- [✓ Laboratory Reports]
- Field Reports
- Proposals

More fully described as follows: FINAL LABORATORY REPORTS OF ANALYSIS OF CHARACTERIZATION SAMPLES FROM COOLING TOWER, POND, BACKGROUND AND BASELINE

For your:

- [✓ Use]
- Approval
- Files
- Information
- Action
- Other

Material forwarded by:

- Our Messenger
- Your Messenger
- First Class Mail
- Priority Mail
- Certified Mail
- Special Delivery
- Other
- [✓ Express Mail]
- Air Priority
- United Parcel Service
- Motor Freight
- Air Freight
- City Delivery

Copies to: —

By John R. Dickey

WESTERN TECHNOLOGIES
SURFACE SAMPLES
CCT-A THRU G   REPORTED AS UG/GM(DRY)

June 30, 1989

SAMPLE	%MOIST	CD	CU	ZN	PB	BE	SB	NI	CR	AG	AS	SE	TL	HG
CCT-A3	7.92	<0.5	21.9	118	20.3	<0.5	2.6	10.7	77.1	<0.5	7.3	<0.5	<0.5	<0.25
CCT-A4	8.79	<0.5	35.3	271	13.7	0.6	1.4	13.9	95.7	<0.5	9.8	<0.5	<0.5	<0.25
CCT-A5	7.25	<0.5	52.8	251	44.1	<0.5	1.3	11.3	164	<0.5	4.6	<0.5	<0.5	<0.25
CCT-A6	10.4	1.3	53.3	424	69.7	<0.5	1.9	13.5	251	<0.5	6.4	<0.5	<0.5	<0.25
CCT-B3	6.64	<0.5	19.4	82.5	9.7	<0.5	1.6	15.4	36.4	<0.5	4.4	<0.5	<0.5	<0.25
CCT-B4	7.40	0.9	143	1404	29.0	<0.5	4.5	20.1	1502	<0.5	16.5	<0.5	<0.5	<0.25
CCT-B5	6.40	<0.5	7.4	43.5	9.2	<0.5	1.1	6.7	17.1	<0.5	3.8	<0.5	<0.5	<0.25
CCT-B5D	6.34	<0.5	8.6	44.6	9.2	<0.5	2.1	7.9	21.6	<0.5	4.2	<0.5	<0.5	<0.25
CCT-B6	22.0	4.1	30.1	346	123	<0.5	2.3	11.1	197	<0.5	<0.5	<0.5	<0.5	<0.25
CCT-B10	6.29	<0.5	9.6	81.7	30.2	0.6	1.6	9.6	77.1	<0.5	6.4	<0.5	<0.5	<0.25
CCT-C1	8.71	<0.5	13.1	102	9.1	<0.5	1.3	14.8	49.8	<0.5	5.6	<0.5	<0.5	<0.25
CCT-C2	8.46	<0.5	16.8	109	17.9	<0.5	1.3	15.7	55.0	<0.5	5.5	<0.5	<0.5	<0.25
CCT-C3	6.33	<0.5	8.8	96.6	6.6	0.6	1.8	8.3	59.1	<0.5	5.3	<0.5	<0.5	<0.25
CCT-C4	5.34	<0.5	15.6	312	97.8	<0.5	1.6	14.8	515	<0.5	7.7	<0.5	<0.5	<0.25
CCT-C5	14.0	<0.5	9.5	108	17.6	<0.5	1.7	12.5	152	<0.5	3.6	<0.5	<0.5	<0.25
CCT-C6	4.33	<0.5	30.7	434	377	<0.5	2.4	23.9	435	<0.5	5.6	<0.5	<0.5	<0.25
CCT-C10	4.04	0.6	46.2	1080	68.5	0.7	2.7	15.9	636	<0.5	47.4	<0.5	<0.5	<0.25
CCT-D1	7.66	<0.5	9.2	59.5	15.2	<0.5	<1.0	15.6	15.5	<0.5	6.8	<0.5	<0.5	<0.25
CCT-D2	8.74	<0.5	12.9	185	13.5	<0.5	1.6	9.6	265	<0.5	10.1	<0.5	<0.5	<0.25
CCT-D2D	9.17	<0.5	15.5	223	11.3	0.8	<1.0	14.8	408	<0.5	10.5	<0.5	<0.5	<0.25
CCT-D3	11.8	<0.5	9.5	121	8.3	0.6	1.2	10.1	96.5	<0.5	4.4	<0.5	<0.5	<0.25
CCT-D4	8.81	<0.5	9.7	425	14.5	<0.5	2.7	11.9	641	<0.5	4.2	<0.5	<0.5	<0.25
CCT-D5	9.06	<0.5	14.9	919	13.5	<0.5	2.8	16.1	1919	<0.5	11.3	<0.5	<0.5	<0.25
CCT-D6	15.6	<0.5	47.2	12038	38.7	0.7	5.3	14.9	5422	<0.5	15.5	<0.5	<0.5	<0.25
CCT-D10	6.02	<0.5	8.3	173	7.4	<0.5	<1.0	8.0	109	<0.5	18.9	<0.5	<0.5	<0.25
CCT-E1	4.59	<0.5	8.3	110	6.7	<0.5	1.1	9.1	65.0	<0.5	5.4	<0.5	<0.5	<0.25
CCT-E2	6.48	<0.5	7.8	800	6.3	0.8	<1.0	11.3	908	<0.5	3.8	<0.5	<0.5	<0.25
CCT-E3	27.9	2.2	127	13773	130	0.7	7.0	18.0	5301	<0.5	102	<0.5	<0.5	<0.25
CCT-E4	5.12	0.6	7.7	145	6.4	0.6	2.8	11.5	118	<0.5	2.3	<0.5	<0.5	<0.25
CCT-E5	9.60	1.9	13.8	22334	21.9	0.7	4.0	10.9	6527	<0.5	8.4	<0.5	<0.5	<0.25
CCT-E6	8.55	<0.5	31.3	1437	21.7	0.8	3.7	14.8	1532	<0.5	19.3	<0.5	<0.5	<0.25
CCT-E6D	7.84	<0.5	25.6	1432	15.6	0.7	3.5	13.8	1484	<0.5	15.1	<0.5	<0.5	<0.25
CCT-E7	7.00	<0.5	18.3	1566	10.0	<0.5	1.9	8.3	994	<0.5	30.9	<0.5	<0.5	<0.25
CCT-E8	13.9	0.8	75.6	2440	19.7	<0.5	2.9	16.6	1614	<0.5	56.5	<0.5	<0.5	<0.25
CCT-E9	16.4	1.4	61.4	1679	29.7	0.6	3.2	18.6	1710	<0.5	40.3	<0.5	<0.5	<0.25
CCT-E10	10.7	<0.5	18.8	409	11.4	<0.5	1.9	14.1	354	<0.5	20.6	<0.5	<0.5	<0.25
CCT-E10D	11.8	<0.5	18.9	391	12.6	0.6	2.4	17.1	366	<0.5	22.6	<0.5	<0.5	<0.25
CCT-F1	7.04	<0.5	9.1	80.9	6.6	0.6	<1.0	14.0	54.8	<0.5	3.8	<0.5	<0.5	<0.25

WESTERN TECHNOLOGIES CONTINUED June 30, 1989
SURFACE SAMPLES
CCT-A THRU G   REPORTED AS UG/GM(DRY)

SAMPLE	%MOIST	CD	CU	ZN	PB	BE	SB	NI	CR	AG	AS	SE	TL	HG
CCT-F2	6.62	<0.5	7.9	31.7	5.4	0.7	1.5	7.7	29.2	<0.5	5.8	<0.5	<0.5	<0.25
CCT-F3	6.03	<0.5	7.2	32.9	6.0	0.6	<1.0	8.0	35.2	<0.5	4.2	<0.5	<0.5	<0.25
CCT-F3D	7.01	<0.5	7.4	41.2	4.0	<0.5	<1.0	8.5	39.3	<0.5	3.8	<0.5	<0.5	<0.25
CCT-F4	6.02	<0.5	8.5	147	4.4	<0.5	<1.0	14.8	137	<0.5	5.3	<0.5	<0.5	<0.25
CCT-F5	7.69	<0.5	7.8	144	3.6	<0.5	1.7	16.4	55.1	<0.5	2.6	<0.5	<0.5	<0.25
CCT-F6	6.46	<0.5	7.2	177	4.5	<0.5	<1.0	16.1	191	<0.5	3.0	<0.5	<0.5	<0.25
CCT-F7	8.09	<0.5	12.0	236	8.0	<0.5	<1.0	14.3	205	1.2	3.9	<0.5	<0.5	<0.25
CCT-F8	18.3	0.7	12.9	255	24.3	<0.5	1.5	15.7	281	<0.5	3.9	<0.5	<0.5	<0.25
CCT-G1	6.40	<0.5	9.4	115	6.2	0.6	1.3	13.6	67.6	<0.5	3.2	<0.5	<0.5	<0.25
CCT-G2	4.61	<0.5	7.3	56.8	5.8	0.5	1.4	12.9	17.3	<0.5	2.5	<0.5	<0.5	<0.25
CCT-G3	7.87	<0.5	7.2	39.9	5.0	<0.5	<1.0	11.8	26.3	<0.5	2.6	<0.5	<0.5	<0.25
CCT-G4	4.39	<0.5	8.5	116	5.2	<0.5	<1.0	13.2	76.0	<0.5	3.2	<0.5	<0.5	<0.25
CCT-G5	7.69	<0.5	7.5	557	4.0	<0.5	<1.0	13.0	290	<0.5	2.2	<0.5	<0.5	<0.25
CCT-G6	6.89	<0.5	7.9	123	5.4	<0.5	<1.0	10.7	50.8	<0.5	2.6	<0.5	<0.5	<0.25
CCT-G7	6.25	<0.5	8.5	188	6.6	<0.5	1.8	11.2	156	<0.5	3.3	<0.5	<0.5	<0.25

WESTERN TECHNOLOGIES
SURFACE SAMPLES CCT-A THRU CCT-G
Q.C. SUMMARY

June 30, 1989

DIGEST BLANK Q.C (MG/L)

IDL SAMPLE	CD	CU	ZN	PB	BE	SB	NI	CR	AG	AS	SE	TL	HG
D.BLK1	<0.005	0.016	<0.005	0.021	<0.005	<0.010	<0.010	<0.006	<0.005	<0.005	<0.005	<0.005	<0.0005
D.BLK2	<0.005	0.009	<0.005	0.018	<0.005	<0.010	<0.010	<0.006	<0.005	<0.005	<0.005	<0.005	<0.0005
D.BLK3	<0.005	<0.005	0.009	<0.015	<0.005	<0.010	<0.010	0.006	<0.005				<0.0005

DIGEST BLANK SPIKES
*RECOVERIES

DB.SPK1	92	93	88	92	94	90	95	95	94	90	100	102	110
DB.SPK2	93	94	89	93	90	90	95	95	95	92	106	94	95
DB.SPK3	90	91	88	88	89	91	100	100	100				95

WESTERN TECHNOLOGIES
SURFACE SAMPLES CCT-A THRU CCT-G
Q.C. SUMMARY CONTINUED
ICAP
MS/MSD

June 30, 1989

METHOD SPIKE/METHOD SPIK
*RECOVERIES

SAMPLE	CD	CU	ZN	PB	BE	SB	NI
A3-MS	87	95	113	89	101	67	88
A3-MSD	89	98	123	114	101	63	88
F3-MS	91	90	80	87	105	68	89
F3-MSD	91	91	87	87	104	57	89
F4-MS	85	102	114	86	91	46	83
F4-MSD	85	91	93	86	92	46	84

GFAAS(AS,SE,TL)
MS/MSD

SAMPLE	AS	SE	TL
C4MS	170	69	68
C4MSD	53	69	76
E5MS	112	90	77
E5MSD	76	78	76
F5MS	59	85	82
F5MSD	69	93	83

CVAAS(HG)
MS/MSD

SAMPLE	HG
A3MS	100
A3MSD	105
D3MS	105
D3MSD	100
F2MS	95
F2MSD	105

June 30, 1989

WESTERN TECHNOLOGIES
CORE SAMPLES
TOTAL METALS
REPORTED AS UG/GM(DRY)

SAMPLE	FT	%MOIST	CD	CU	ZN	PB	BE	SB	NI	CR	AG	AS	SE	TL	HG
D6	2.5-3	6.55	<0.5	8.1	405.9	<1.5	<0.5	2.2	6.6	109.3	<0.5	5.5	<0.5	<0.5	<0.25
D6	5.5-6	7.42	<0.5	9.7	10.6	<1.5	<0.5	<1.0	8.6	38.3	<0.5	4.5	<0.5	<0.5	<0.25
D6	10.5-11	7.21	<0.5	4.6	3.5	<1.5	<0.5	2.2	9.1	40.9	<0.5	2.4	<0.5	<0.5	<0.25
D6	15.5-16	11.7	<0.5	6.2	2.3	<1.5	<0.5	<1.0	15.7	38.2	<0.5	1.2	<0.5	<0.5	<0.25
D6	20.5-21	12.7	<0.5	108.6	24.8	3.7	0.7	<1.0	11.4	46.9	<0.5	2.0	<0.5	<0.5	<0.25
D6	25.5-26	3.89	<0.5	14.2	7.7	1.8	<0.5	1.7	3.9	6.5	<0.5	<0.5	<0.5	<0.5	<0.25
D6	30.5-31	5.98	<0.5	6.1	4.7	<1.5	<0.5	1.4	5.4	10.0	<0.5	1.0	<0.5	<0.5	<0.25
E6	5.5-6	4.48	<0.5	8.5	3.4	<1.5	<0.5	2.8	8.2	3.2	<0.5	4.0	<0.5	<0.5	<0.25
E6	10.5-11	7.84	<0.5	3.9	4.4	<1.5	<0.5	1.5	9.3	9.0	<0.5	2.9	<0.5	<0.5	<0.25
E6	15.5-16	6.1	<0.5	7.4	7.5	1.8	<0.5	<1.0	7.1	3.9	<0.5	1.9	<0.5	<0.5	<0.25
E6	20.5-21	12.3	<0.5	14.7	14.6	3.0	<0.5	1.6	11.8	22.5	<0.5	3.7	<0.5	<0.5	<0.25
E6	25.5-26	4.88	<0.5	35.0	21.0	2.2	<0.5	<1.0	6.0	12.2	<0.5	0.8	<0.5	<0.5	<0.25
E6	30.5-31	5.97	<0.5	5.1	8.2	2.1	<0.5	<1.0	4.6	11.9	<0.5	0.6	<0.5	<0.5	<0.25
E7	4-4.5	7.14	<0.5	6.5	6.8	<1.5	<0.5	1.6	8.3	3.1	1.6	4.1	<0.5	<0.5	<0.25
E7	5.5-6	9.26	<0.5	10.4	17.7	<1.5	<0.5	<1.0	8.5	2.7	<0.5	2.7	<0.5	<0.5	<0.25
E7	10.5-11	8.16	<0.5	13.0	14.1	<1.5	<0.5	<1.0	7.3	1.2	<0.5	1.4	<0.5	<0.5	<0.25
E7	15.5-16	9.18	<0.5	4.2	9.2	3.7	<0.5	<1.0	8.9	2.8	<0.5	0.6	<0.5	<0.5	<0.25
E7(SPL)	15.5-16	12	<0.5	5.1	19.7	2.7	<0.5	<1.0	10.1	2.6	<0.5	0.7	<0.5	<0.5	<0.25
E7	21.5-22	2.34	<0.5	4.8	47.4	4.9	<0.5	<1.0	4.3	4.4	<0.5	0.7	<0.5	<0.5	<0.25
E7	25.5-26	7.07	<0.5	4.5	12.7	3.0	<0.5	<1.0	3.7	4.0	<0.5	0.6	<0.5	<0.5	<0.25
E7	30.5-31	29.9	<0.5	8.6	24.5	3.6	<0.5	<1.0	5.4	12.9	<0.5	<0.5	<0.5	<0.5	<0.25
D5	2.5-3	7.1	<0.5	7.6	1.3	<1.5	<0.5	2.3	9.5	5.9	<0.5	7.0	<0.5	<0.5	<0.25
D5	5.5-6	10.1	<0.5	7.5	6.1	<1.5	<0.5	1.4	9.0	7.5	<0.5	6.8	<0.5	<0.5	<0.25
D5	10.5-11	8.4	<0.5	3.9	5.7	<1.5	<0.5	1.3	15.3	41.9	<0.5	2.1	<0.5	<0.5	<0.25
D5(SPL)	10.5-11	9.76	<0.5	3.5	2.9	<1.5	<0.5	2.7	13.2	41.4	<0.5	1.4	<0.5	<0.5	<0.25
D5	15.5-16	9.44	<0.5	4.2	3.5	<1.5	<0.5	2.4	11.5	10.7	<0.5	1.1	<0.5	<0.5	<0.25
D5	20.5-21	21.3	<0.5	21.6	17.9	3.1	1.0	2.4	11.9	40.2	<0.5	2.3	<0.5	<0.5	<0.25
D5	25.5-26	2.73	<0.5	6.1	5.9	7.5	<0.5	1.1	3.3	6.7	<0.5	0.8	<0.5	<0.5	<0.25
D5	30.5-31	4.04	<0.5	3.9	4.8	<1.5	<0.5	1.6	3.5	3.7	<0.5	0.9	<0.5	<0.5	<0.25
BG-1	---------	8.3	<0.5	10.3	28.4	6.9	<0.5	1.4	10.6	10.8	<0.5	2.2	<0.5	<0.5	<0.25
BG-2	---------	5.59	<0.5	8.3	17.4	6.3	<0.5	<1.0	14.5	6.3	<0.5	2.1	<0.5	<0.5	<0.25
BG-3	---------	6.9	<0.5	7.2	13.3	5.1	<0.5	1.2	14.6	5.1	<0.5	2.8	<0.5	<0.5	<0.25
BG-4	---------	13.7	<0.5	11.7	55.8	8.5	1.7	<1.0	23.7	25.6	<0.5	2.4	<0.5	<0.5	<0.25
BL-1	---------	9.11	<0.5	3.7	5.8	<1.5	<0.5	<1.0	13.6	2.5	<0.5	2.1	<0.5	<0.5	<0.25
BL-2	---------	9.34	<0.5	3.3	3.5	<1.5	<0.5	2.4	11.1	1.9	<0.5	3.2	<0.5	<0.5	<0.25

WESTERN TECHNOLOGIES
CORE SAMPLES
TOTAL METALS

June 30, 1989

DIGEST BLANK Q.C.(MG/L)

SAMPLE	CD	CU	ZN	PB	BE	SB	NI	CR	AG	AS	SE	TL	HG
D.BLK1	<0.005	<0.005	<0.005	<0.015	<0.005	<0.010	<0.010	<0.006	<0.005	<0.005	1.300	<0.005	<0.0005
D.BLK2	<0.005	0.006	0.012	0.021	<0.005	<0.010	<0.010	<0.006	<0.005	<0.005	<0.005	<0.005	<0.0005
D.BLK3	<0.005	0.009	0.014	<0.015	<0.005	<0.010	<0.010	<0.006	<0.005	<0.005	1.600	<0.005	<0.0005

DIGEST BLANK SPIKES
%RECOVERIES

SAMPLE	CD	CU	ZN	PB	BE	SB	NI	CR	AG	AS	SE	TL	HG
D.B.SP1	90	92	86	92	89	95	95	96	95	89	102	90	100
D.B.SP2	89	94	81	84	82	86	88	86	85	99	103	95	130
D.B.SP3	89	94	81	83	83	88	81	82	82	66	120	110	100

ICAP
MS/MSD

METHOD SPIKE/METHOD SPIKE DUPLICATE
%RECOVERIES

SAMPLE	FT	CD	CU	ZN	PB	BE	SB	NI	CR	AG
E6MS	15.5-16	87	90	84	86	101	38	88	87	90
E6MSD	15.5-16	87	92	88	87	103	41	89	88	90
E7MS	4-4.5	80	86	67	69	69	56	67	68	75
E7MSD	4-4.5	83	88	64	69	67	55	68	69	76
CP-1MS	7-7.5	88	89	73	81	84	40	85	84	84
CP-1MSD	7-7.5	88	92	79	80	83	33	84	84	83

GFAAS(AS,SE,TL)
MS/MSD

SAMPLE	FT	AS	SE	TL
D5MS	2.5-3	102	0	67
D5MSD	2.5-3	91	0	70
E7MS	4-4.5	78	30	66
E7MSD	4-4.5	73	34	67
D6MS	5.5-6	126	51	68
D6MSD	5.5-6	139	52	70

CVAAS(HG)
MS/MSD

SAMPLE	FT	HG
D5MS	2.5-3	105
D5MSD	2.5-3	105
E7MS	4-4.5	95
E7MSD	4-4.5	100
D6MS	5.5-6	110
D6MSD	5.5-6	100

June 30, 1989

WESTERN TECHNOLOGIES
E.P.TOXICITY EXTRACTS
(MG/L)

SAMPLE	BA	CD	PB	AS	SE	CR	AG	HG
CCT-A3	1.15	<0.005	0.02	0.15	<0.025	0.14	<0.005	<0.001
CCT-A4	1.25	<0.005	<0.015	0.11	<0.025	0.02	<0.005	<0.001
CCT-A5	1.20	<0.005	<0.015	0.04	<0.025	0.04	<0.005	<0.001
CCT-A6	1.19	0.01	<0.015	0.03	<0.025	0.01	<0.005	<0.001
CCT-B3	1.09	<0.005	<0.015	0.05	<0.025	0.02	<0.005	<0.001
CCT-B4	0.86	<0.005	<0.015	0.05	<0.025	0.06	<0.005	<0.001
CCT-B5	1.35	<0.005	<0.015	0.04	<0.025	<0.010	<0.005	<0.001
CCT-B5D	1.18	<0.005	<0.015	0.03	<0.025	<0.010	<0.005	<0.001
CCT-B6	0.42	0.05	0.02	0.04	<0.025	0.02	<0.005	<0.001
CCT-B10	1.05	<0.005	<0.015	0.07	<0.025	0.03	<0.005	<0.001
CCT-C1	0.85	<0.005	<0.015	0.05	<0.025	0.02	<0.005	<0.001
CCT-C2	0.92	<0.005	<0.015	0.05	<0.025	0.04	<0.005	<0.001
CCT-C3	1.01	<0.005	<0.015	0.04	<0.025	0.02	<0.005	<0.001
CCT-C4	0.53	<0.005	<0.015	0.05	<0.025	0.29	<0.005	<0.001
CCT-C5	0.52	<0.005	<0.015	<0.025	<0.025	0.02	<0.005	<0.001
CCT-C6	0.60	0.01	0.08	0.03	<0.025	0.26	<0.005	<0.001
CCT-C10	0.65	<0.005	<0.015	0.19	<0.025	0.32	<0.005	<0.001
CCT-D1	1.12	<0.005	<0.015	0.05	<0.025	<0.010	<0.005	<0.001
CCT-D2	0.67	<0.005	<0.015	0.07	<0.025	0.15	<0.005	<0.001
CCT-D2D	0.85	<0.005	<0.015	0.06	<0.025	0.13	<0.005	<0.001
CCT-D3	1.05	<0.005	<0.015	0.04	<0.025	0.02	<0.005	<0.001
CCT-D4	0.95	<0.005	<0.015	0.04	<0.025	0.51	<0.005	<0.001
CCT-D5	0.49	<0.005	<0.015	<0.025	<0.025	0.44	<0.005	<0.001
CCT-D6	0.64	<0.005	<0.015	0.06	<0.025	24.35	<0.005	<0.001
CCT-D10	0.73	<0.005	<0.015	0.11	<0.025	0.08	<0.005	<0.001
CCT-E1	0.71	<0.005	<0.015	0.03	<0.025	0.05	<0.005	<0.001
CCT-E2	0.69	<0.005	<0.015	0.04	<0.025	2.54	<0.005	<0.001
CCT-E3	0.57	0.01	<0.015	0.21	<0.025	0.44	<0.005	<0.001
CCT-E4	0.90	<0.005	<0.015	0.04	<0.025	0.05	<0.005	<0.001
CCT-E5	1.20	0.03	<0.015	0.04	<0.025	36.19	<0.005	<0.001
CCT-E6	0.86	<0.005	0.08	0.07	<0.025	0.54	<0.005	<0.001
CCT-E6D	0.85	<0.005	<0.015	0.07	<0.025	0.54	<0.005	<0.001
CCT-E7	0.98	<0.005	<0.015	0.08	<0.025	0.61	<0.005	<0.001
CCT-E8	0.97	0.01	<0.015	0.14	<0.025	1.29	<0.005	<0.001
CCT-E9	0.95	<0.005	<0.015	0.06	<0.025	0.14	<0.005	<0.001
CCT-E10	0.92	<0.005	<0.015	0.07	<0.025	0.09	<0.005	<0.001
CCT-E10D	0.94	<0.005	<0.015	0.07	<0.025	0.09	<0.005	<0.001
CCT-F1	1.21	<0.005	<0.015	0.03	<0.025	<0.010	<0.005	<0.001
CCT-F2	0.93	<0.005	<0.015	0.06	<0.025	<0.010	<0.005	<0.001
CCT-F3	0.87	<0.005	<0.015	0.04	<0.025	0.01	<0.005	<0.001
CCT-F3D	0.87	<0.005	<0.015	0.06	<0.025	<0.010	<0.005	<0.001
CCT-F4	0.86	<0.005	<0.015	0.08	<0.025	0.06	<0.005	<0.001
CCT-F5	0.87	<0.005	<0.015	<0.025	<0.025	<0.010	<0.005	<0.001
CCT-F6	0.93	<0.005	<0.015	<0.025	<0.025	0.08	<0.005	<0.001
CCT-F7	0.88	<0.005	<0.015	0.03	<0.025	0.03	<0.005	<0.001
CCT-F8	1.13	<0.005	<0.015	<0.025	<0.025	0.03	<0.005	<0.001
CCT-G1	0.45	<0.005	<0.015	0.03	<0.025	<0.010	<0.005	<0.001
CCT-G2	0.59	<0.005	<0.015	<0.025	<0.025	<0.010	<0.005	<0.001
CCT-G3	1.81	<0.005	<0.015	0.03	<0.025	0.02	<0.005	<0.001
CCT-G4	1.91	<0.005	<0.015	0.03	<0.025	0.11	<0.005	<0.001
CCT-G5	1.84	<0.005	<0.015	<0.025	<0.025	0.66	<0.005	<0.001
CCT-G6	1.61	<0.005	<0.015	<0.025	<0.025	0.07	<0.005	<0.001
CCT-G7	1.21	<0.005	<0.015	0.03	<0.025	0.26	<0.005	<0.001
D6 (2.5-3)	1.85	<0.005	<0.015	0.03	<0.025	1.83	<0.005	<0.001
D6(SPL) (2.5-3)	1.83	<0.005	<0.015	0.05	<0.025	1.66	<0.005	<0.001
E6 (5.5-6)	1.30	<0.005	<0.015	<0.025	<0.025	0.05	<0.005	<0.001
E7 (4-4.5)	1.76	<0.005	<0.015	0.04	<0.025	0.05	<0.005	<0.001
D5 (2.5-3)	1.39	<0.005	<0.015	0.06	<0.025	0.11	<0.005	<0.001

WESTERN TECHNOLOGIES
E.P.TOXICITY EXTRACTIONS
(MG/L)

June 30, 1989

EXTRACT/DIGEST BLANK

SAMPLE	BA	CD	PB	AS	SE	CR	AG	HG
EXT.BLK	<0.005	<0.005	<0.015	<0.025	<0.025	<0.010	<0.005	<0.001
DIG.BLK-1	<0.005	<0.005	<0.015	<0.025	<0.025	<0.010	<0.005	<0.001
DIG.BLK-2	<0.005	<0.005	<0.015	<0.025	<0.025	<0.010	<0.005	<0.001
DIG.BLK-3	<0.005	<0.005	<0.015	<0.025	<0.025	<0.010	<0.005	<0.001

EXTRACT/DIGEST BLANK SPIKE

SAMPLE	BA	CD	PB	AS	SE	CR	AG	HG
E.B.SPK	95	86	88	89	88	91	90	61
D.B.SPK-1	98	91	91	91	92	94	93	133
D.B.SPK-2	97	89	90	90	91	91	91	110
D.B.SPK-3	98	38	90	90	91	90	89	97

METHOD SPIKE/METHOD SPIKE DUPLICATE

SAMPLE	BA	CD	PB	AS	SE	CR	AG	HG
A3MS	93	83	83	88	94	83	87	99
A3MSD	90	83	84	87	93	83	86	89
D3MS	94	82	84	88	92	82	87	111
D3MSD	90	83	84	89	92	82	86	119
F4MS	92	84	83	88	92	81	55	119
F4MSD	91	81	82	85	92	80	81	120