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REPORTS

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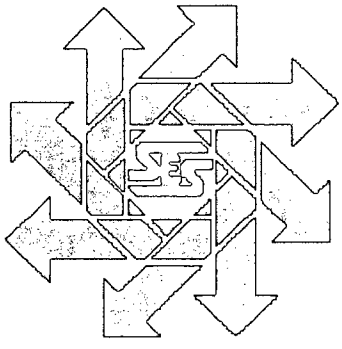
Chevron USA
CDU Tract 19
Remediation/Cleanup Work Plan
Lea County, New Mexico

February 19, 2001



Prepared for:

Chevron USA
Permian Basin Business Unit
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Eunice, New Mexico 88231

By:

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TABLE OF CONTENTS

I. Purpose

The purpose of this work plan is to propose a plan for the cleanup of the area identified by the Site Investigation of the CDU Tract 19 dated February 9, 2001. The site is located in Unit J, Section 29, T21S, R37E in Lea County, New Mexico. This plan will allow closure in a manner that will protect the population, environment and groundwater of the area surrounding the subject location. The site is situated on a relatively level site. (Vicinity Map)

II. Background

The subject site is a suspected pit area which has been used for various purposed by previous owner since the late 1940s. Aerial photographs of the subject site reveal activity at the site from 1949 through at least 1977.

III. Contaminant and Size of Area

The suspected contaminant is crude oil and produced water associated with the tank battery at the site. The approximate size of the total fenced area surrounding the pit is 53,000 sq. ft. The estimated square footage of hydrocarbon and produced water contamination is reported separately in the February 9 Site Investigation (Site Plan). The crude oil and produced water is considered exempt oilfield waste. No evidence of other contaminants was observed.

IV. Vertical and Horizontal Extent of Contamination

The vertical and horizontal extent of the contamination has been performed and reported in the February 9 Site Investigation.

V. Groundwater

The monitor well installed at the subject site was completed to a depth of 104.10 below the top of casing (BTOC) and contains groundwater standing in the casing at 93.11 ft. BTOC. The top of casing is approximately 3 ft. above ground level.

VI. Action Plan

Closure

The site will be excavated both horizontally and vertically for the removal of the most highly contaminated oily soils (source material). The Site Investigation dated February 9, 2001 identified the depth of the source material varies throughout the site from 0 to approximately 10 feet. The excavated soils will be stabilized with surrounding soils, which will allow any BTEX to naturally attenuate. In the event that a portion of the source material is unable to be stabilized, that material will be transported to a NMOCD approved facility for disposal.

An impermeable liner of 20-millimeter plastic will be installed in the bottom of the excavation in a manner so that any downward infiltrating water will be diverted to the side edges of the liner. This type of installation will prevent ponding of water on top of the liner and minimize any downward migration of water due to inadvertent puncturing of the liner. Any clean soil excavated to facilitate liner installation may be stockpiled on site for later backfill. The liner and placement of clean backfill will greatly minimize if not eliminate human exposure to organic constituents from any of the exposure pathways listed in the Site Investigation.

The stabilized source material will be backfilled on top of the liner. The surface will be returned to its natural contour and seeded at the completion of the project.

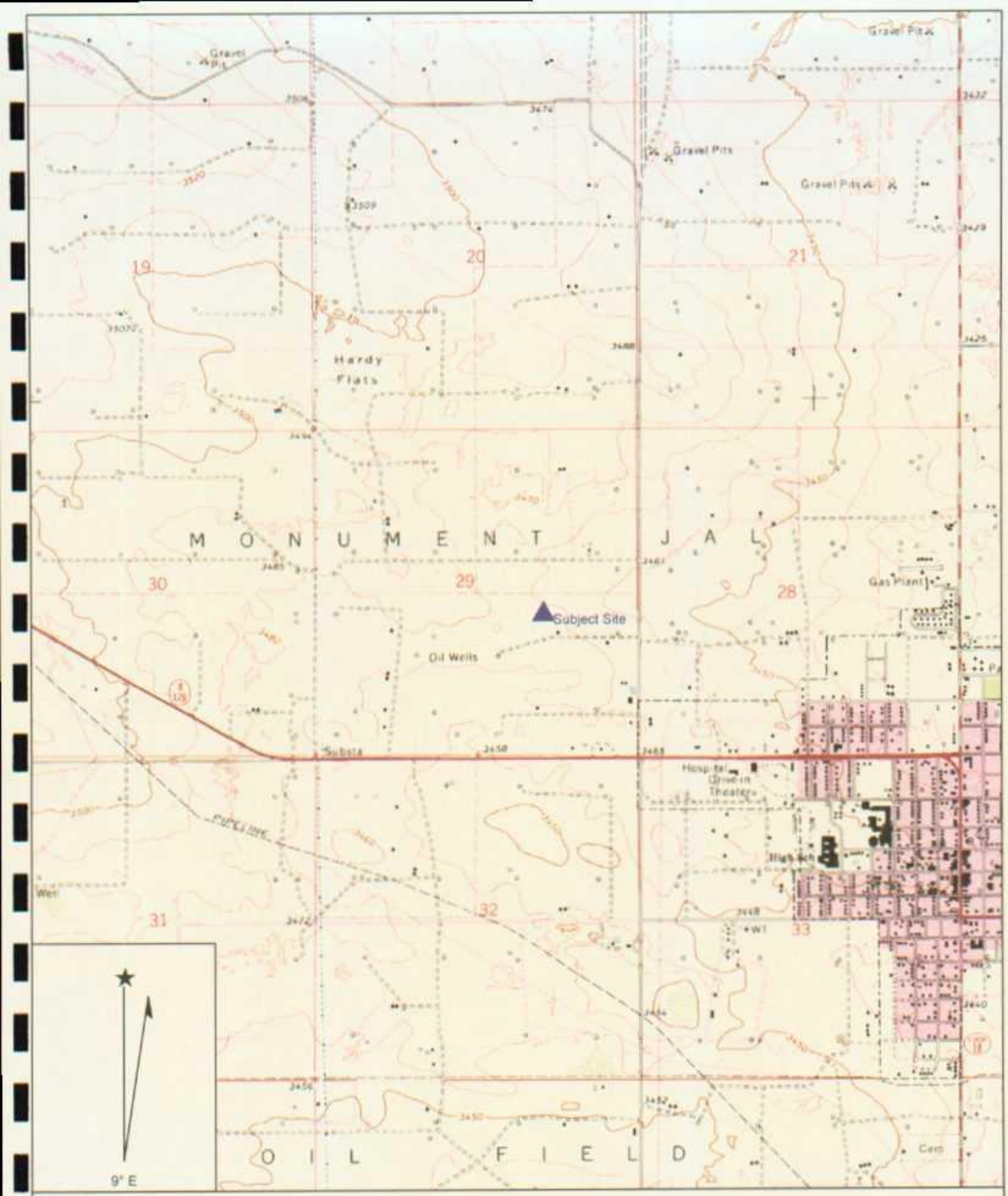
The bottom and sides of the excavation will be sampled at the final excavation depths. These samples will be tested for TPH, BTEX and Chlorides with a third party laboratory for confirmation and documentation of any contamination levels left in place.

After completion of the project, the appropriate reports will be filed with the NMOCD in the closure report.

VII. Maps and Figures

Figure 1. Vicinity Map
Figure 2. Site Plan (Location of Boreholes and Monitor Well)

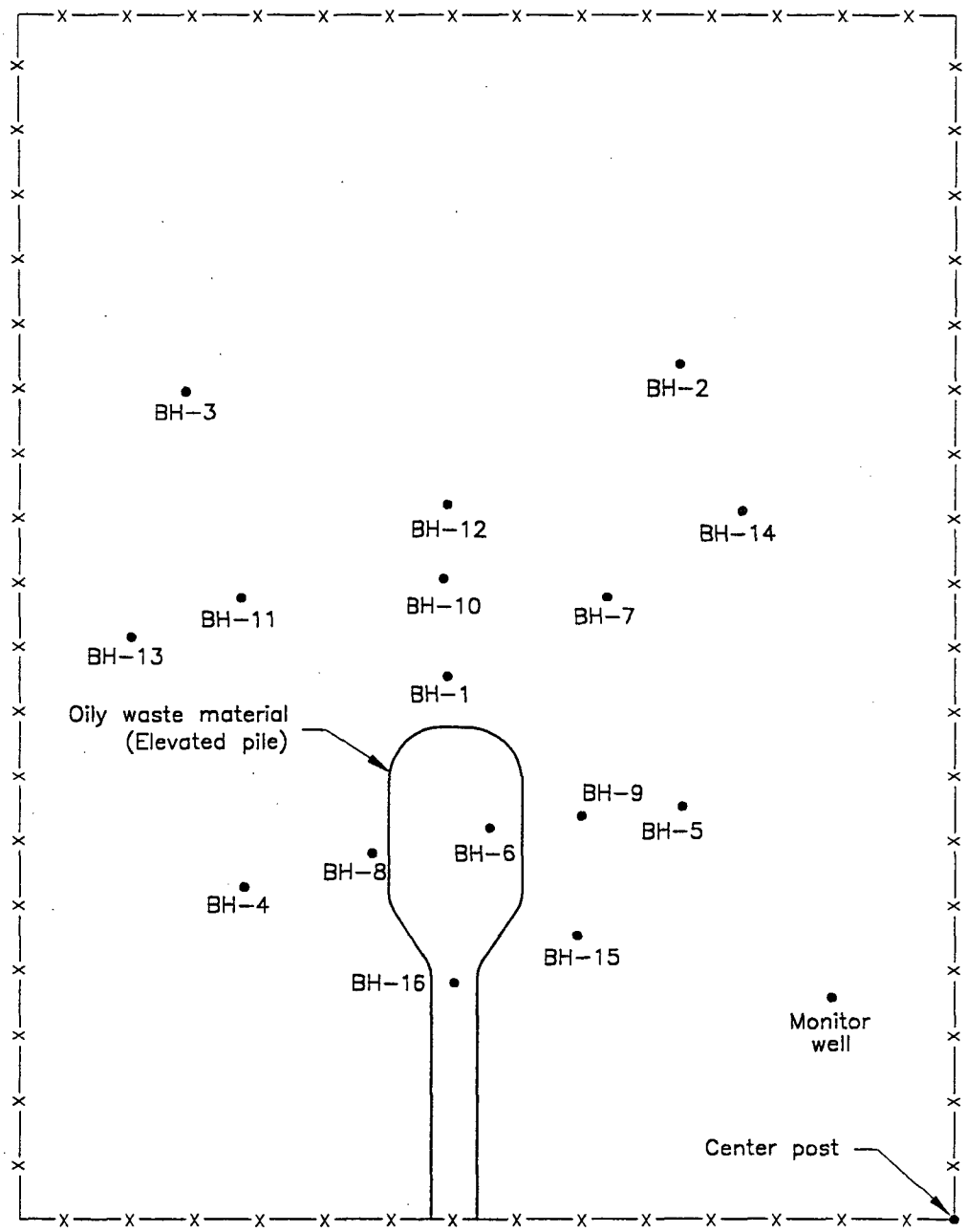
Figure 1
Vicinity Map

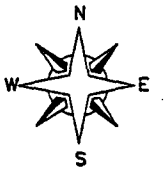


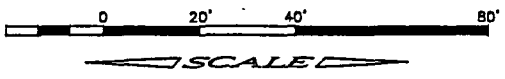
Name: EUNICE
Date: 2/22/2001
Scale: 1 inch equals 2000 feet

Location: 032° 26' 57.6" N 103° 10' 57.0" W
Caption: Chevron USA
CDU Tract 19
Vicinity Map

Figure 2
Site Plan
(Location of Boreholes and Monitor Well)







DRAWING TITLE

FIGURE 2
LOCATION OF SOIL BORINGS AND MONITOR WELL, CHEVRON CDU TRACT 19, EUNICE, NEW MEXICO

DRAWN BY	CHK'D BY	SCALE	
EJS	DB	1" = 40'	
DATE	APPR BY	DRAWING NUMBER	REV.
02-14-01	-	CHEV01.DWG	0

Safety & Environmental Solutions, Inc.

Chevron USA
Site Investigation
CDU Tract 19
Lea County, New Mexico

February 9, 2001

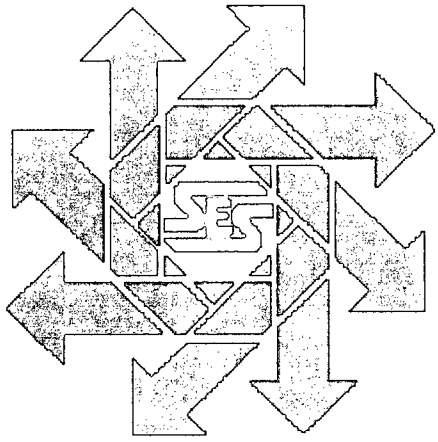


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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

I. Background

In December 2000 Safety & Environmental Solutions, Inc. (SESI) was engaged by Chevron USA, West Permian Basin Unit, to perform a site investigation at a location where a pile of oily waste material was located. The investigation was conducted voluntarily by Chevron at the request of the landowner, and not in response to regulatory directives. The subject area is identified as Chevron CDU Tract 19 and is located in Unit J of Section 29, Township 21 S, Range 37 E in Lea County, New Mexico. The area is approximately 1.5 miles northwest of the community of Eunice, New Mexico. (Figure 1). The area of waste material is in a fenced area immediately north and adjacent to the CDU 19 tank battery. The area encompassed by the fence is approximately 53,000 sq.ft.

The purpose of the investigation was two-fold. First, the investigation was performed to delineate the horizontal and vertical extent of the oily material. Secondly, analytical data collected from the sampling effort was to be used as inputs to the American Petroleum Institute's (API) VADSAT model to assess the effects on groundwater quality from subsurface petroleum hydrocarbon releases.

VADSAT is an interactive program to simulate the movement of conservative inorganic or reactive organic species present in land-disposed waste. Program output is used to assess effects of land disposal practices on groundwater quality. Compounds considered include organic species that dissolve from oily wastes, and inorganic salts that migrate by convection and dispersion in the aqueous phase. Adsorption, biodecay and volatilization at the ground surface are considered for organic species, while salts are considered non-reactive. Release scenarios that may be modeled include both surface and subsurface releases. The latter are distinguished by the presence of overlying soil cover which acts to impede evaporation losses of volatile compounds. The program can also model effectiveness of clay and synthetic liners.

VADSAT is based on coupled analytical solutions of the unsaturated and saturated zone flow and transport equations, which can be solved with minimal computational effort. It is well suited for conducting uncertainty analyses to assess effects of variable soil and waste characteristics on the risk of groundwater contamination at land-disposal sites. The VADSAT model was developed in 1995 by Environmental Systems and Technologies, Inc., of Blacksburg, Virginia, under contract from the API, and use of the model by SESI is by license from the API.

II. Work Performed

Soil Boring and Sampling

Drilling began on December 6, 2000, using SESI personnel from Hobbs. A Giddings trailer-mounted drill, Model 25-SCT was used to bore test holes with a 7 in. hollow-stem auger. Samples from the test holes generally were collected in thin-walled sampling tubes at 10 ft. intervals feet using SOPs found in Environmental Protection Agency, 1984, Characterization of Hazardous Waste Site - A Methods Manual: Vol. II. At some

locations, depending on whether oily material was observed, additional samples were collected in the 0-3 ft. (surface) interval and at 5 ft. intervals. Locations of the boreholes are shown in Figure 2 and borehole lithologic logs are found in Appendix A.

Field testing was performed on these soil samples for Total Petroleum Hydrocarbons (TPH) (EPA Method 418.1) using a GAC Mega Total Petroleum Hydrocarbon analyzer. The samples were preserved on ice and delivered along with Chain of Custody to Cardinal Laboratories for testing. Laboratory samples were analyzed for Total Petroleum Hydrocarbons (EPA Method SW 846 418.1, or 8015), BTEX (EPA Method SW-846-8260) and Chlorides (EPA Method 600/4-79-020 325.3). Copies of the analytical results are found in Appendix B.

At the completion of drilling, the boreholes were backfilled with cuttings if the depth was 20 ft. or less. A 10 ft. bentonite plug was placed in the deeper boreholes and the remainder of the hole to the surface was filled with drill cuttings. The hole locations were temporary flagged so that accurate bearing and distance measurements could be established from a center post located in the southeast corner of the fenced area.

Monitor Well Placement and Sampling

Following drilling of the borehole samples, a monitor well was drilled and installed to determine depth to water and to collect a water sample for analysis. The boring for the well was started using the Giddings drill-rig, but a sheared pin downhole necessitated abandoning a 5 ft. auger section at a depth of 53 ft. in sandstone. An air-rotary drill rig (Eades Drilling of Hobbs) was used to drill to 102 ft., but sand flowing into the well bore precluded installation of well screen and pipe. Adkins Engineering of Roswell went down the hole with hollow stem augers, cleaned out the hole and placed 2-in. screen and casing through the augers. Monitor well lithologic and completion information can be found in Appendix A.

The monitor well was sampled on January 30, four days after completion. The depth to water at the time of sampling was 93.11 ft. below the top of casing (BTOC), and the total depth of the well is 104.10 ft. (BTOC). Approximately 11 gallons of water were purged before sampling the well (6 casing volumes). The sample was placed in an iced cooler and delivered to Cardinal Laboratories where it was analyzed for Total Petroleum Hydrocarbons, BTEX, and major cations and anions (water chemistry parameters). Copies of the analytical results are found in Appendix B.

III. Results of Soil and Water Testing

Soil Sampling Results

Soil sampling results for TPH, BTEX and chlorides from the 16 boreholes are tabulated in Table 1.

Table 1. Borehole Soil Sampling Results, Chevron CDU-19

Borehole & Depth	Concentration (mg/Kg)					
BH-1	TPH	Benzene	Toluene	E-benzene	Xylenes	Cl
0-3	24,325	<0.005	0.010	0.008	0.028	83
5-7	4,269	<0.005	0.008	0.055	0.193	66
10-11	7,008	<0.005	<0.005	<0.005	<0.015	149
15-16	196	<0.005	<0.005	<0.005	0.016	397
20-21	618	<0.005	<0.005	<0.005	0.016	348

Borehole & Depth	Concentration (mg/Kg)					
BH-2	TPH	Benzene	Toluene	E-benzene	Xylenes	Cl
0-3	--	--	--	--	--	--
5-6	--	--	--	--	--	--
10-11	<10	<0.005	<0.005	<0.005	<0.015	99

Borehole & Depth	Concentration (mg/Kg)					
BH-3	TPH	Benzene	Toluene	E-benzene	Xylenes	Cl
0-3	--	--	--	--	--	--
5-6	--	--	--	--	--	--
10-11	<10	<0.005	<0.005	<0.005	<0.015	83

Borehole & Depth	Concentration (mg/Kg)					
BH-4	TPH	Benzene	Toluene	E-benzene	Xylenes	Cl
0-3	--	--	--	--	--	--
5-6	--	--	--	--	--	--
10-11	31.4	<0.005	<0.005	<0.005	0.016	464

Borehole & Depth	Concentration (mg/Kg)					
BH-5	TPH	Benzene	Toluene	E-benzene	Xylenes	Cl
0-3	--	--	--	--	--	--
5-6	--	--	--	--	--	--
10-11	<10	<0.005	<0.005	<0.005	0.016	265

Borehole & Depth	Concentration (mg/Kg)					
BH-6	TPH	Benzene	Toluene	E-benzene	Xylenes	Cl
0-3	--	--	--	--	--	--
5-6	68,100	0.889	2.57	13.9	21.5	3,064
10-11	--	--	--	--	--	--
15-16	58.2	<0.005	<0.005	<0.005	<0.015	3,230
20-21	<10	<0.005	<0.005	<0.005	0.020	3,975

Borehole & Depth	Concentration (mg/Kg)					
BH-7	TPH	Benzene	Toluene	E-benzene	Xylenes	Cl
0-3	--	--	--	--	--	--
5-6	41,100	<0.005	<0.005	<0.005	<0.015	66
10-11	--	--	--	--	--	--
15-16	23,200	<0.005	0.010	0.161	0.323	99
20-21	32,300	0.006	0.013	0.055	<0.015	116
25	17,900	<0.005	<0.005	0.007	0.532	99
30	16,600	<0.005	<0.005	<0.005	0.114	149
35	14,900	<0.005	<0.005	0.011	0.017	99
45	10,100	<0.200	<0.200	<0.200	<0.600	129
60	6,860	<1.00	<1.00	<1.00	<3.00	81
70	12,900	<0.500	<0.500	<0.500	<1.50	145

Table 1. Borehole Soil Sampling Results, Chevron CDU-19

Borehole & Depth	Concentration (mg/Kg)					
BH-8	TPH	Benzene	Toluene	E-benzene	Xylenes	Cl
0-3	397	<0.200	<0.200	<0.200	<0.600	166
5-6	--	--	--	--	--	--
10-11	149	<0.200	<0.200	<0.200	<0.600	132

Borehole & Depth	Concentration (mg/Kg)					
BH-9	TPH	Benzene	Toluene	E-benzene	Xylenes	Cl
0-3	2,010	<0.200	<0.200	<0.200	<0.600	66
5-6	--	--	--	--	--	--
10-11	42,800	0.026	0.043	<0.050	<0.150	298
15-16	--	--	--	--	--	--
20-21	5,980	0.003	0.11	0.007	0.029	994

Borehole & Depth	Concentration (mg/Kg)					
BH-10	TPH	Benzene	Toluene	E-benzene	Xylenes	Cl
0-3	<10	<0.200	<0.200	<0.200	<0.600	116
5-6	--	--	--	--	--	--
10-11	18,400	1.43	0.634	0.574	19.6	66
15-16	--	--	--	--	--	--
20-21	11,800	0.060	0.061	0.139	0.385	116
25	9,500	0.009	0.039	0.020	0.131	248
30-31	--	--	--	--	--	--
35	3,430	<0.200	<0.200	<0.200	<0.600	99
40	--	--	--	--	--	--
45	26.7	<0.200	<0.200	<0.200	<0.600	99

Borehole & Depth	Concentration (mg/Kg)					
BH-11	TPH	Benzene	Toluene	E-benzene	Xylenes	Cl
0-3	3,220	<0.200	<0.200	<0.200	<0.600	50
5-6	--	--	--	--	--	--
10-11	31,000	0.329	0.188	0.441	1.71	33
15-16	--	--	--	--	--	--
20-21	22,600	0.070	0.094	0.323	1.090	66
25	--	--	--	--	--	--
30-31	14,300	0.030	0.030	0.045	0.220	50
35	--	--	--	--	--	--
40-41	14,626	0.033	0.024	<0.002	0.075	66
45-46	4,380	0.002	0.003	0.004	<0.006	66

Borehole & Depth	Concentration (mg/Kg)					
BH-12	TPH	Benzene	Toluene	E-benzene	Xylenes	Cl
0-3	5,860	0.002	0.006	<0.002	0.008	66
5-6	--	--	--	--	--	--
10-11	1,900	<0.002	<0.002	<0.002	0.014	132

Table 1. Borehole Soil Sampling Results, Chevron CDU-19

Borehole & Depth	Concentration (mg/Kg)					
BH-13	TPH	Benzene	Toluene	E-benzene	Xylenes	Cl
0-3	<10	<0.002	<0.002	<0.002	<0.006	50
5-6	--	--	--	--	--	--
10	6,890	<0.002	<0.002	<0.002	<0.006	50
15	442	<0.002	<0.002	<0.002	<0.006	66
20	105	<0.002	<0.002	<0.002	<0.006	50

Borehole & Depth	Concentration (mg/Kg)					
BH-14	TPH	Benzene	Toluene	E-benzene	Xylenes	Cl
0-3	<10	<0.002	<0.002	<0.002	<0.006	83
5-6	--	--	--	--	--	--
10	10.7	<0.002	<0.002	<0.002	<0.006	331

Borehole & Depth	Concentration (mg/Kg)					
BH-15	TPH	Benzene	Toluene	E-benzene	Xylenes	Cl
0-3	109	<0.002	<0.002	<0.002	<0.006	33
5-6	--	--	--	--	--	--
10	<10	<0.002	<0.002	<0.002	<0.006	596
15	<10	<0.002	<0.002	<0.002	<0.006	977

Borehole & Depth	Concentration (mg/Kg)					
BH-16	TPH	Benzene	Toluene	E-benzene	Xylenes	Cl
0-3	28,500	<0.002	<0.002	<0.002	<0.006	132
5-6	--	--	--	--	--	--
10	--	--	--	--	--	--
15	<10	<0.002	<0.002	<0.002	<0.006	2,900

Borehole & Depth	Concentration (mg/Kg)					
MW-1	TPH	Benzene	Toluene	E-benzene	Xylenes	Cl
0-3	--	--	--	--	--	--
5-6	--	--	--	--	--	--
10	--	--	--	--	--	--
15	<10	<0.002	<0.002	<0.002	<0.006	911

Laboratory TPH concentrations ranged from less than 10 mg/Kg in three boreholes to 68,100 mg/Kg in BH-6 at a depth of 5-6 ft. The average TPH, calculated using the maximum TPH found in each borehole, was 24,316 mg/Kg.

Nine boreholes were found to have a TPH concentration of 1,000 mg/Kg or greater. To assist in interpretation, Figure 3 shows the 1,000 mg/Kg TPH concentration contour line and the maximum TPH above 1,000 mg/Kg found in the boreholes. The area within the 1,000 mg/Kg contour is approximately 8,600 sq. ft. Table 2 below shows the maximum depth where a concentration of 1,000 mg/Kg or greater was found.

Table 2. Maximum Depth of TPH concentrations greater than 1,000 mg/Kg

Top 11 ft.	> 11 – 21 ft.	> 21 ft.
BH-1, 6, 12,13,16	BH-9	BH-7, 10, 11

Note: BH-7, 9, 11 and 12 had concentrations exceeding 1,000 mg/Kg at the base of the borehole.

While six of the nine boreholes showed most of the TPH contamination in a zone above 20 ft., three of the boreholes exhibited contamination at greater depths. In BH-7, a TPH concentration of 12,900 mg/Kg was found at 70 ft., the maximum depth drilled. At BH-11, TPH was decreasing but still elevated at the bottom of the borehole in the 45-46 ft. interval. In BH-10, elevated TPH was not observed below 35 ft.

In contrast to the TPH concentrations, concentrations of benzene were generally low and detected in samples from only 6 of the 16 boreholes. The maximum concentration of benzene was 1.43 mg/Kg in BH-10 at a depth interval of 10-11 ft. The average concentration of benzene, calculated using the maximum concentration found in each borehole (where detected), was 0.447 mg/Kg.

Chloride concentrations ranged from a low of 33 mg/Kg in BH-11 and BH-15, to a high of 3,975 mg/Kg in BH-6. The average concentration, calculated using the maximum concentration found in each borehole, was 791 mg/Kg. To assist in the interpretation of results, Figure 4 shows chloride concentration contours are for concentrations of 250, 500 and 1,000 mg/Kg. The area within the 250 mg/Kg contour line is approximately 5,240 sq. ft. Nine boreholes (including that for MW-1) had chloride soil concentrations exceeding 250 mg/Kg. Table 4 shows that depth intervals for the elevated chloride concentrations. Unlike the TPH concentrations, which were elevated mainly in the shallow soil intervals, chloride concentrations are elevated in the deeper intervals to at least 20 ft. indicating some vertical leaching has occurred.

Table 3. Depth Interval For Maximum Chloride Concentrations Greater Than 250 mg/Kg.

0 - 6 ft.	> 6 – 11 ft.	> 11 – 21 ft.
None	BH-4, 5, 14	BH-1, 6, 9, 15, 16, MW-1

Examination of the distribution of TPH (Figure 3) and chlorides (Figure 4) shows a spatial variation between the two constituents. TPH is elevated in the center of the oily waste pile and to the northwest. Chlorides are highly elevated only in the immediate area of the pile and in the vicinity of the monitor well. Given this distribution and the lack of elevated chlorides to the north and northwest of the pile, it appears that deposition of at least some of the waste occurred during different periods.

Chloride deposition likely occurred first prior to the effective date of the NMOCD Order R-3221 in the 1960's. Prior to that time, produced water was commonly disposed into unlined pits in Lea County. The second period of deposition, which included oily waste, likely occurred later and included deposition north and northwest of the current pile. If the oily waste disposal had occurred first it likely would have precluded some downward vertical movement by the chlorides due to clogging of the pore space by the oily hydrocarbon material. Since extensive hydrocarbons have not been found at depth in the center of the pile, the above description is the likely depositional sequence.

Groundwater Sampling Results

The result of the sampling of the monitor well is shown in Table 4. A complete copy of the water analysis is included in Appendix B. No BTEX was found in the groundwater at the low detection limit of 0.002 mg/L. However, chlorides were elevated above the New Mexico Water Quality Control Commission Ground Water Standard of 250 mg/L. The source of the elevated chloride level is unknown at this time. Historically, brine production in the Eunice area ranged between 10 and 50 acre-feet per square mile (Nicholson and Clebsch, 1961). Much, if not most, of the brine was disposed of in unlined surface pits in the area until the requirements of Order R-3221 were established. As far back as 1951, some water wells in the area had chloride concentrations as high as 1,750 mg/L and more recent measurements show chlorides as high as 1,500 mg/L in some wells within a mile of the current site.

IV. VADSAT Modeling of Contaminant Movement

The VADSAT model was utilized to simulate contaminate transport of organics and chloride through the vadose (unsaturated) zone to the groundwater. For organics, benzene and xylenes were modeled because benzene, a known carcinogen, is most mobile and xylene was most predominate BTEX constituent in the soils analyzed. The length of time chosen for model simulation is important because the NMOCD is looking at a minimum time period of 200 years for protection of groundwater from constituents which might be leached from the pit.

Over 40 physical and chemical variables are required to be determined prior to running the VADSAT model. Many of these are site specific (e.g. constituent concentration, waste area and thickness, depth to groundwater), while others are characteristic of the pit locale (e.g. soil type, infiltration rate, hydraulic conductivity, aquifer thickness and gradient). Some variables are essentially generic to the model and generally do not need to be changed unless there is site specific data showing a need to modify the variables (e.g. constituent physical and chemical properties, van Genuchten pore size distribution, residual water content).

Table 4. Monitor Well Groundwater Sampling Results, CDU-19

Constituent / Date	TPH	Benzene (mg/L)	Toluene (mg/L)	Ethyl-benzene (mg/L)	Xylenes (mg/L)
1/29/01	- -	<0.002	<0.002	<0.002	<0.002

Constituent / Date	Polynuclear Aromatic Hydrocarbons (PAH) (mg/L)
1/29/01	Phenanthrene 0.002 mg/L; Naphthalene and 16 other PAHs less than 0.002 mg/L

Constituent / Date	Sodium (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Potassium (mg/L)	Chloride	Sulfate
1/29/01	643	377	127	4.94	1,344	294

Constituent / Date	Total Alkalinity (mg/L CaC03)	Carbonate (mg/L)	Bi-carbonate (mg/L).	pH (standard units)	Conductivity (mS/cm)	Total Dissolved Solids (mg/L)
1/29/01	172	0	210	7.28 (s.u.)	4,890	3,182

Following running of several simulations using a combination of variables, several were selected as being most sensitive for certain constituents and were varied between runs. For benzene the most sensitive variable was depth to groundwater, while infiltration rate was the most sensitive variable for chloride. The results of the modeling runs utilizing differing combinations of variables are shown in Tables 5 and 6, and discussed below.

Benzene Simulations

Numerous simulations of benzene transport were made starting with the highest TPH and benzene concentration found in any sample; depth to groundwater; and the most likely values of saturated and unsaturated zone hydraulic conductivity and infiltration rate (Table 5). No benzene breakthrough at a depth to water of 90 ft. (as measured from the surface) was found. Only after the benzene concentration was raised to 15 mg/Kg (about 10 times the maximum observed) and the water table raised to within 30 ft. of the surface was benzene found at the water table. Even then, the maximum concentration was 0.000058 mg/L, about 100 times less than the EPA drinking water standard of 0.005 mg/L and nearly 200 times less than the NM WQCC groundwater standard. Benzene breakthrough occurred at a time of 18.5 years into the simulation. Similar simulations were performed for xylene with the same results, i.e. no xylene will reach the groundwater even under worst case conditions.

The results of the modeling show that even for the worst case scenario, benzene and other BTEX organics are not a threat to groundwater at this location.

Table 5. VADSAT Model Simulation Summary Table - Benzene and Xylene

Run Number	Waste Zone Thickness (feet)	Chemical Concentration (mg/Kg)	TPH Concentration (mg/Kg)	Vadose Zone Saturated Hydraulic Conductivity (m/d)	Depth to Groundwater (from base of waste zone, feet)	Infiltration Rate (in/yr)	Result (benzene max. conc. mg/L , year)
Benzene Simulations							
1	10 ft.	0.071	9,829	0.035	80	0.5	No benzene in groundwater
2	10 ft.	0.447	24,316	0.035	80	0.5	No benzene in groundwater
3	10 ft.	0.071	9,829	0.350	80	0.5	No benzene in groundwater
4	10 ft.	0.447	24,316	0.350	80	0.5	No benzene in groundwater
5	10 ft.	1.43	68,100	0.350	80	0.5	No benzene in groundwater
6	10 ft.	0.071	9,829	7.128	80	0.5	No benzene in groundwater
7	10 ft.	0.071	9,829	7.128	80	0.5	No benzene in groundwater
8	10 ft.	1.43	68,100	7.128	80	0.5	No benzene in groundwater
9	10 ft.	1.43	68,100	7.128	80	5.0	No benzene in groundwater
10	10 ft.	15.0	68,100	7.128	80	5.0	No benzene in groundwater
11	10 ft.	15.0	68,100	7.128	80	5.0	No benzene in groundwater
12	10 ft.	15.0	68,100	7.128	30	5.0	2.4 E-12 mg/L, 35 yrs.
13	10 ft.	15.0	68,100	7.128	10	5.0	5.6 E-5 mg/L, 17 yrs.
14	20 ft.	15.0	68,100	7.128	70	5.0	No benzene in groundwater
15	20 ft.	15.0	68,100	7.128	10	5.0	5.8 E-5 mg/L, 18.5 yrs.
Xylene Simulation							
1	10 ft.	21.5	68,100	7.128	80	0.5	No xylene in groundwater

Notes:

1. Benzene values of 0.071, 0.447 and 1.43 mg/Kg are geometric mean, average, and maximum benzene concentrations, respectively.
2. Benzene value of 15 mg/Kg selected to determine a breakthrough value for benzene under the simulated conditions.
3. Xylene value of 21.5 mg/Kg is maximum concentration value at the site.
4. TPH values of 9,829; 24,316; and 68,110 mg/Kg are geometric mean, average, and maximum benzene concentrations, respectively.
5. Vadose zone saturated hydraulic conductities of 0.035 and 0.035 are composite values for coupled caliche-sandstone and sand lithologies. The value of 7.128 is an estimated hydraulic conductivity for sand only.
6. Infiltration (ground water recharge) rate for southern Lea county is estimated at 0.25 to 0.5 in/yr. A higher value may occur in depressions or swales that collect water during rainfall events. The value of 5 in/yr is a likely maximum for the area.
7. In the "Result" column, "No benzene in groundwater" means no benzene in groundwater now or at anytime in the future
8. In the "Result" column, "No xylene in groundwater" means no xylene in groundwater now or at anytime in the future
9. VATSAT print-outs for Run #'s 14 and 15 are shown in Appendix C.

Chloride Simulations

Chloride was modeled in a manner similar to benzene (Table 6). However, because chloride is a very conservative contaminant (i.e. does not degrade or combine with other chemicals in the subsurface to decrease its concentration), the initial concentration and infiltration rate are the main drivers of contamination to the water table.

When the model was run using chemical and physical variables most likely at the CDU-19 site (Run 14, Table 6), it showed the first chloride appearing at the water table after 50 years. Concentrations would not be measurable until about 115 years (10 mg/L). Concentrations would exceed 250 mg/L (the WQCC groundwater standard) at about 150 years. At the end of the model period, 200 years, concentrations at the water table are predicted at over 1,800 mg/L and are still increasing.

Although the model predicts highly elevated chloride concentrations at the water table, it likely does so because the mass of salt is concentrated in a relatively small volume of water. A much more reasonable result is the concentration predicted for the monitor well located southeast of the waste pile at the site. Based on the groundwater contour map found in Nickolson and Clebsch (1961), the location is believed downgradient from the pile. The model shows that a chloride concentration increase of 97 mg/L could be expected in the upper foot of groundwater in the vicinity of the well at the end of the 200-year period. If desired, additional simulations could be performed to estimate chloride concentrations in the saturated thickness of the well, or at the property boundary.

L WHO'S PROPERTY ?

Although the WQCC Regulations do not directly apply to the groundwater contamination at the site, the NMOCD is applying the methodology of the WQCC regulations in evaluating the future risk to groundwater. The regulations allow degradation of the groundwater up to the listed standard, but once reached no further degradation is allowed. At the CDU-19 site, the chloride concentration at 1,344 mg/L already exceeds the groundwater standard of 250 mg/L, and no further groundwater degradation is permitted. A no-action closure, with all existing material left in place as-is, may not be suitable at this location.

Modeling Closure Alternatives

Using the physical and chemical information shown in Table 6, two additional scenarios were considered. The first makes use of a clay liner, which is compacted to a hydraulic conductivity of 10^{-7} cm/sec. The second utilizes a synthetic liner of essentially zero permeability (10^{-9} cm/sec). Use of the former hydraulic conductivity shows chloride still causing a breakthrough and an exceedance of concentration at the water table. Modeling using the synthetic liner does not produce a chloride breakthrough during the 200-year time period evaluated.

Table 6. VADSAT Model Simulation Summary Table - Chloride

Run Number	Waste Zone Thickness (feet)	Chloride Concentration (mg/Kg)	Vadose Zone Saturated Hydraulic Conductivity (m/d)	Depth to Groundwater (from base of waste zone, feet)	Infiltration Rate (in/yr)	Liner Installed?, Hydraulic Conductivity (cm/sec)	Result (Chloride water table max. conc. mg/L , year; monitor well max conc. mg/L (depth), year)
1	10 ft.	318	0.035	80	0.5	No	No chloride in groundwater in 50 years
2	10 ft.	3,975	0.035	80	0.5	No	No chloride in groundwater in 50 years
3	10 ft.	318	0.035	80	0.5	No	386 mg/L, 40 mg/L (0.8 ft.), 200 yrs.
4	10 ft.	3,975	0.035	80	0.5	No	4,825 mg/L, 500 mg/L (0.8 ft.) 200 yrs.
5	10 ft.	3,975	0.035	80	0.5	Yes, 1.2E-9	No chloride in groundwater in 200 years
6	10 ft.	3,975	0.035	80	0.5	Yes, 1E-7	4,825 mg/L, 500 mg/L (0.8 ft.) 200 yrs.
7	10 ft.	3,975	7.128	80	0.5	No	0.092 mg/L, 0.005 mg/L (0.8 ft.), 50 yrs.
8	10 ft.	791	0.035	80	0.5	No	960 mg/L, 100 mg/L (0.8 ft.), 200 yrs.
9	10 ft.	3,975	7.128	80	5.0	No	14,670 mg/L, 19.3 yrs; 8,529 mg/L (0.8 ft.), 21.0 yrs.
10	10 ft.	3,975	7.128	80	5.0	Yes, 1E-7	15,260 mg/L, 70.7 yrs.; 4,070 mg/L (0.8 ft.) 72.3 yrs.
11	10 ft.	3,975	7.128	80	5.0	Yes, 1.2E-9	No chloride in groundwater in 200 years
12	10 ft.	3,975	0.035	80	5.0	No	9,233 mg/L, 36.2 yrs.; 5,422 mg/L (0.8 ft.) 37.8 yrs.
13	10 ft.	3,975	0.035	80	5.0	No	5,367 mg/L (1.0 ft.) 37.7 yrs.; 836 mg/L (10 ft.) 38.7 yrs.
14	20 ft.	791	0.035	70	0.5	No	1,836 mg/L, 97.2 mg/L (1 ft.), 2.1E-5 mg/L (11 ft.) 200 yrs.
15	20 ft.	791	0.035	70	5.0	No	2,914, 38.2 yrs.; 1,103 (1 ft.) 39.0 yrs.; 0.66 (11 ft.) 40.3 yrs.
16	20 ft.	791	0.035	70	0.5	Yes, 1E-7	1,836 mg/L, 97.2 mg/L (1 ft.), 2.1E-5 mg/L(11 ft.) 200 yrs.
17	20 ft.	791	0.035	70	5.0	Yes, 1E-7	3,067, 134 yrs.; 406 (1 ft.) 135 yrs; 8.8E-5 (11 ft.) 135 yrs.
18	20 ft.	791	7.128	70	5.0	Yes, 1.2E-9	No chloride in groundwater in 200 years

Notes:

1. Chloride values of 318,791, and 3,975 mg/Kg are geometric mean, average, and maximum chloride concentrations, respectively.
2. Vadose zone saturated hydraulic conductities of 0.035 and 0.035 are composite values for coupled caliche-sandstone and sand lithologies. The value of 7.128 is an estimated hydraulic conductivity for sand only.
3. Infiltration (ground water recharge) rate for southern Lea county is estimated at 0.25 to 0.5 in/yr. A higher value may occur in depressions or swales that collect water during rainfall events. The value of 5 in/yr is a likely maximum for the area.
4. A liner hydraulic conductivity of 1E-7 (10-7) cm/sec is considered the minimum permeability for clay. A value of 1.2 E-9 is the VADSAT default value for an impermeable liner.
5. Run 13 is a repeat of Run 12, but for 100 yrs. (vs. 200) and groundwater depth of 1 and 10 ft.
6. VADSAT print-outs for Run #'s 14 and 18 are shown in Appendix C.

V. Conclusions and Recommendations

Results of the soil and groundwater sampling program coupled with the VADSAT modeling do not show a risk to groundwater from organic constituents in the oily soils at the site if the existing material is left in place. However, modeling of chloride movement beneath the pile shows the potential for increased concentration of chloride in groundwater above existing levels beneath the site and in the nearby downgradient monitor well.

Based on evaluation of the soil sampling results and simulation of contaminant movement in the subsurface, SESI recommends the removal of the top 10 ft. of oily waste material at the site. From Figure 3, the estimated area of contaminated material encompassed by the TPH is approximately 8,500 sq. ft. Therefore, the approximate volume of soil to be removed is estimated at 85,000 cubic ft. (3,150 cubic yards).

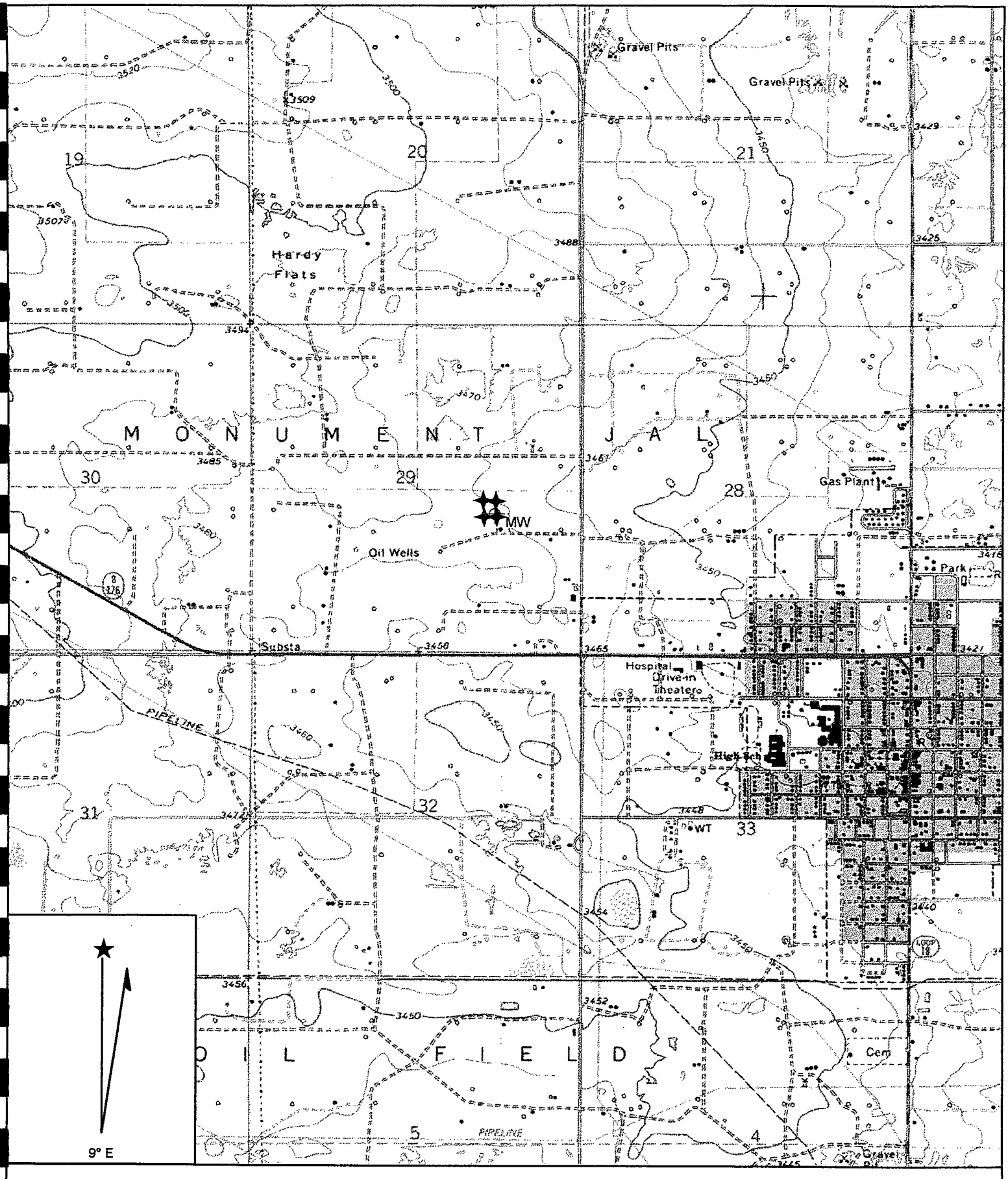
Once removed, a sturdy synthetic liner should be placed in the excavation and the location backfilled with clean fill material. The liner should be domed and installed in a manner so that any downward infiltrating water will be diverted to the side edges of the liner. This type of installation will prevent ponding of water on top of the liner and minimize any downward migration of water due to inadvertent puncturing of the liner. The liner and placement of clean backfill will greatly minimize if not eliminate human exposure to organic constituents from any of the exposure pathways listed above.

VI. References

Nicholson, A. N., Jr., and Clebsch, A., Jr., 1961. *Geology and Ground-water Conditions in Southern Lea County, New Mexico.* Ground-Water Report 6, New Mexico Bureau of Mines and Mineral Resources, Socorro, New Mexico, 120 p.

VII. Report Figures

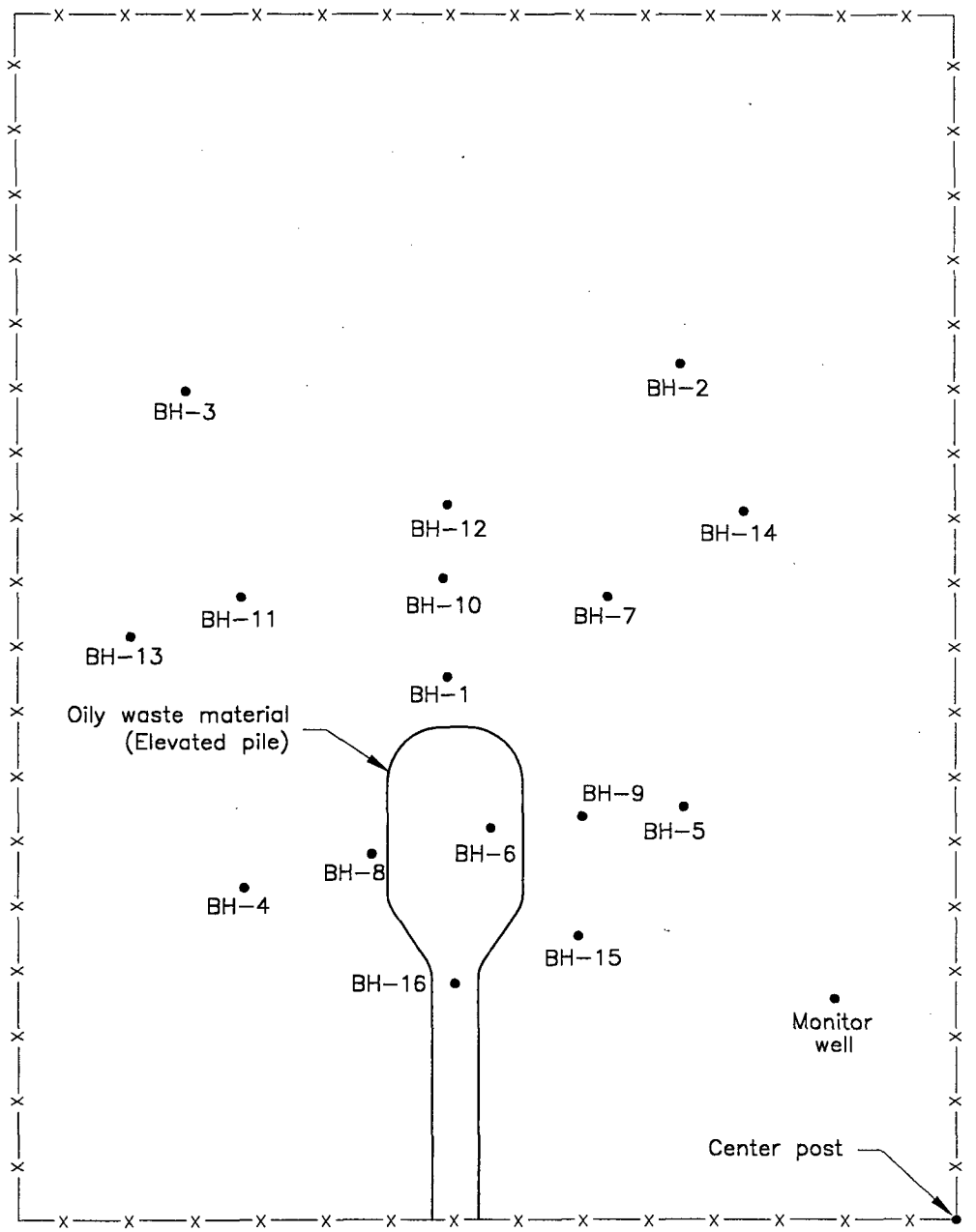
Figure 1.
Vicinity Map

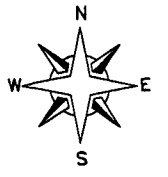


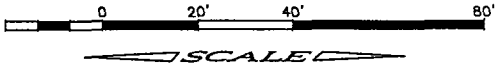
Name: EUNICE
Date: 1/31/2001
Scale: 1 inch equals 2000 feet

Location: 032° 26' 43.8" N 103° 10' 48.0" W
Caption: Chevron CDU Tract 19

Figure 2.
Location of Soil Borings and Monitor Well







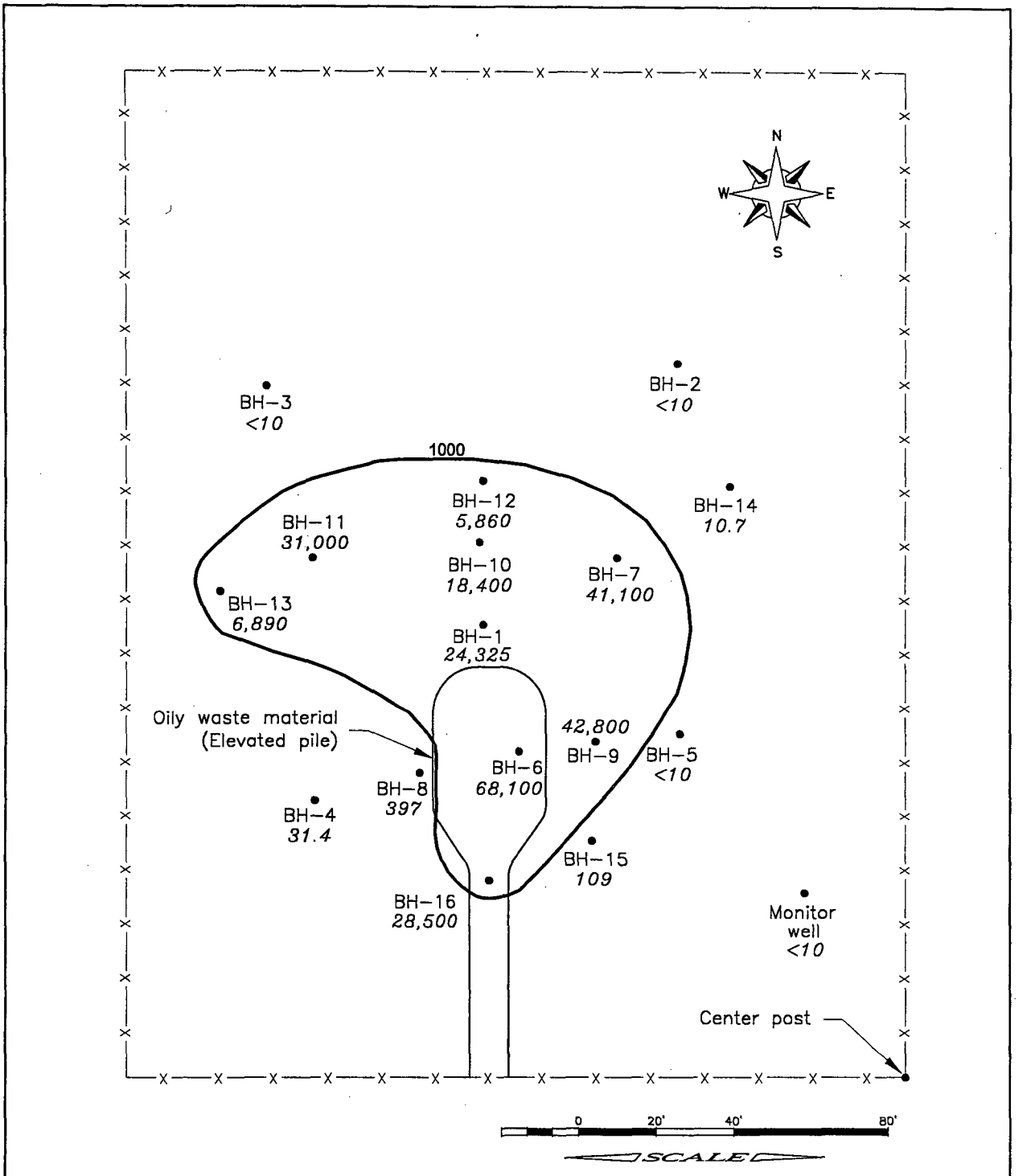
DRAWING TITLE

FIGURE 2
LOCATION OF SOIL BORINGS AND MONITOR WELL, CHEVRON CDU TRACT 19, EUNICE, NEW MEXICO

DRAWN BY	CHK'D BY	SCALE	
EJS	DB	1" = 40'	
DATE	APPR BY	DRAWING NUMBER	REV.
02-14-01	–	CHEV01.DWG	0

Safety & Environmental Solutions, Inc.

Figure 3.
Location of Elevated Borehole TPH Concentrations >1,000 mg/Kg



LEGEND:

1000 — TPH CONTOUR, CONCENTRATIONS IN mg/kg

BH–7 41,000 — MAXIMUM BOREHOLE CONCENTRATION

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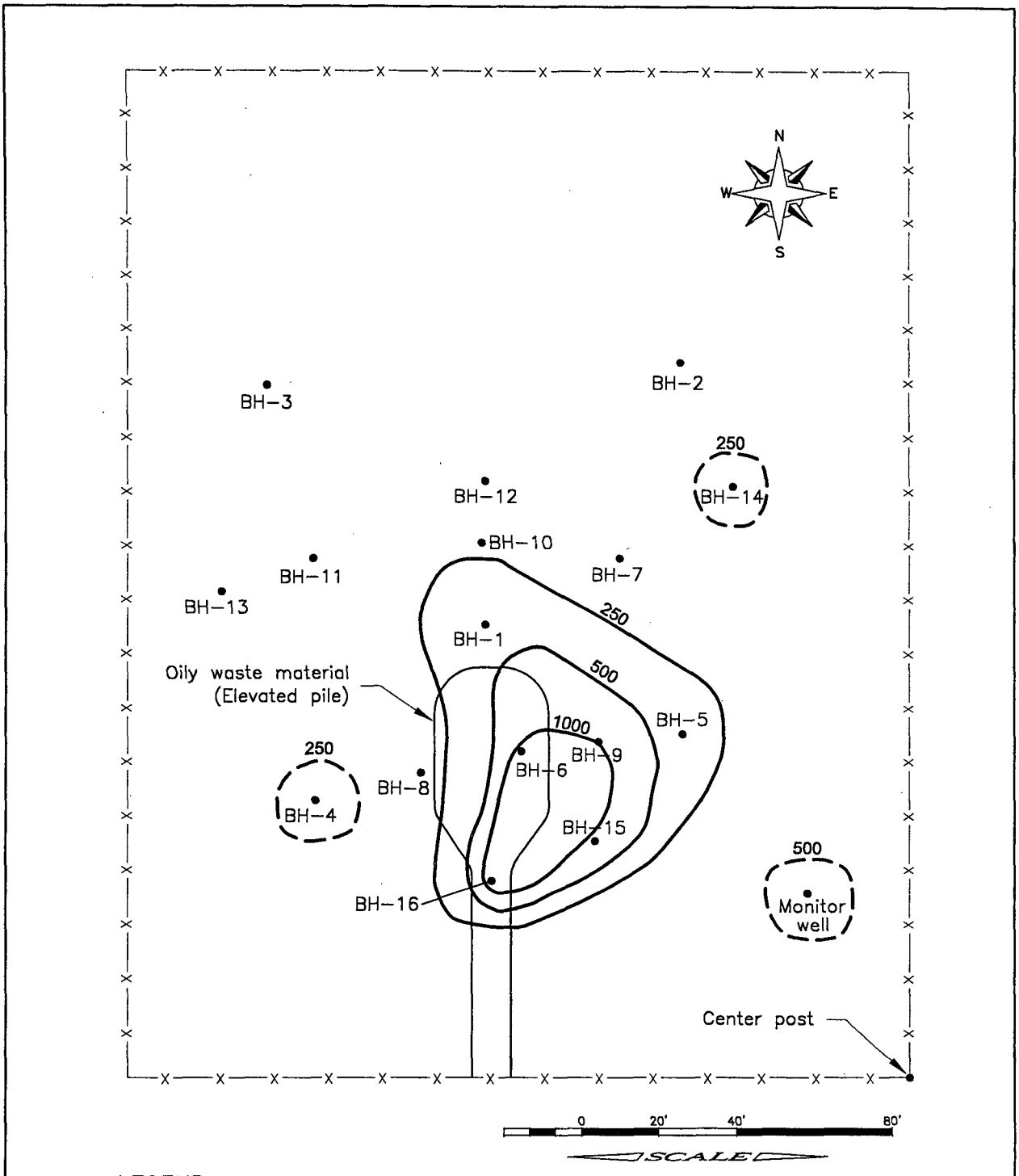
DRAWING TITLE: FIGURE 3 LOCATION OF ELEVATED BOREHOLE TPH CONCENTRATION >1,000 mg/kg CHEVRON CDU TRACT 19, EUNICE, NEW MEXICO			
DRAWN BY: EJS	CHK'D BY: DB	SCALE: 1" = 40'	
DATE: 02–14–01	APPR BY: –	DRAWING NUMBER: CHEV01.DWG	REV.: 0

Figure 4. Location of Elevated Borehole Chloride Concentrations >250 mg/Kg



LEGEND:

250 — CHLORIDE CONTOUR, CONCENTRATIONS IN mg/kg

(SEE TABLE 1 FOR CONCENTRATIONS)

DRAWING TITLE **FIGURE 4**
LOCATION OF ELEVATED BOREHOLE CHLORIDE CONCENTRATIONS >250 mg/kg CHEVRON CDU TRACT 19, EUNICE, NEW MEXICO

DRAWN BY	CHK'D BY	SCALE	
EJS	DB	1" = 40'	
DATE	APPR BY	DRAWING NUMBER	REV.
02-14-01	–	CHEV01.DWG	0

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VIII. Report Appendices

Appendix A. Borehole Lithologic Logs

Appendix B. Laboratory Analytical Reports

Appendix C. VADSAT Model Simulation Results

Appendix A
Borehole Lithologic Logs

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LOG OF BORING BH-1

Chevron USA
Site Assessment
CDU Tract 19
Eunice, New Mexico
(Section 29, T 21 S, R 37 E, Lea County)

Date Completed	: 12/6/00	Company Rep.	: R. Massey
Drilling Method	: H.S.A.	Boring Location	:
Driller	: D. Whatley	Logged By	: D. Whatley
Hole Diameter	: 7.0 in.		
Sampling Method	: Thin Wall Sampling Tube		

Depth in Feet	USCS	GRAPHIC	DESCRIPTION	Samples	Lab No.	TPH (mg/Kg)	Benzene (mg/Kg)	Toluene (mg/Kg)	Ethyl Benzene (mg/Kg)	Total Xylenes (mg/Kg)	Chlorides (mg/L)
0	SW		0-3 ft. SAND, well graded, saturated	1	H5410-1	24,325	<0.005	0.010	0.008	0.028	83
5	CA		5-7 ft. CALICHE, with poorly graded sand, slight H/C odor	2	H5410-2	4,269	<0.005	0.008	0.055	0.193	66
10	CA		10-11 ft. CALICHE, with poorly graded sand and clayey gravels, no odor	3	H5410-3	7,008	<0.005	<0.005	<0.005	<0.015	149
15	CA		15-16 ft. CALICHE, with poorly graded sand and clayey gravels, no odor	4	H5410-4	196	<0.005	<0.005	<0.005	0.016	397
20	CA		20-21 ft. CALICHE, with well graded sand, no odor	5	H5410-5	618	<0.005	<0.005	<0.005	0.016	348
25											

Well: BH-1
Elev.: 0

See location map for boring placement
Backfilled hole with cuttings
H/C - petroleum hydrocarbon

02-13-2001 E:\COMPANY FILES\CHEVRON\CDU TRACT 19\BORING LOGS\BH-1.BOR

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LOG OF BORING BH-10

(Page 1 of 1)

Chevron USA
Site Assessment
CDU Tract 19
Eunice, New Mexico
(Section 29, T 21 S, R 37 E, Lea County)

Date Completed	: 12/15/00, 1/3/00	Company Rep.	: R. Massey
Drilling Method	: H.S.A.	Boring Location	:
Driller	: D. Whatley	Logged By	: D. Whatley
Hole Diameter	: 7.0 in.		
Sampling Method	: Thin Wall Sampling Tube		

Depth in Feet	USCS	GRAPHIC	DESCRIPTION	Samples	Lab No.	TPH (mg/Kg)	Benzene (mg/Kg)	Toluene (mg/Kg)	Ethyl Benzene (mg/Kg)	Total Xylenes (mg/Kg)	Chlorides (mg/L)
0	SW		0-3 ft. SAND, well graded, red, no H/C odor	1	H5468-6	<10	<0.200	<0.200	<0.200	<0.600	116
5	FL		5- 7 ft. Fill material, black-gray, sticky								
10	SW		10-11 ft. SAND, poorly graded, black-gray, strong H/C odor	2	H5468-7	18,400	1.43	0.634	0.574	19.6	66
15	CA		15-16 ft. CALICHE, hard, white, strong H/C odor								
20			20-21 ft. CALICHE, white, medium H/C odor. (See note below)	3	H5468-8	11,800	0.060	0.061	0.139	0.385	116
25			25-26 ft. CALICHE, white, slight H/C odor	4	H5493-1	9,500	0.009	0.039	0.020	0.131	248
30			30-31 ft. CALICHE, pinkish-white, slight H/C odor								
35	SP		35-36 ft. SAND, poorly graded, light brown	5	H5493-2	3,430	<0.200	<0.200	<0.200	<0.600	99
40			40-41 ft. SAND, poorly graded, light brown								
45			45-46 ft. SAND, poorly graded, light brown	6	H5493-3	26.7	<0.200	<0.200	<0.200	<0.600	99
50											

Well: BH-10
Elev.: 0

See location map for boring placement.
On 12/15/00, hole caved in, auger stuck, pull out and move rig. Re-entered hole on 1/3/01for additonal sampling.
Backfilled hole with 10 ft. bentonite plug then cuttings.
H/C - petroleum hydrocarbon

02-13-2001 E:\COMPANY FILES\CHEVRON\CDU TRACT 19\BORING LOGS\BH-10.BOR

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LOG OF BORING BH-11

(Page 1 of 1)

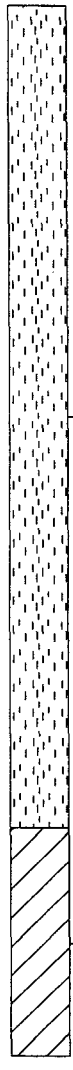
Chevron USA
Site Assessment
CDU Tract 19

Eunice, New Mexico
(Section 29, T 21 S, R 37 E, Lea County)

Date Completed	: 12/18/00	Company Rep.	: R. Massey
Drilling Method	: H.S.A.	Boring Location	:
Driller	: D. Whatley	Logged By	: D. Whatley
Hole Diameter	: 7.0 in.		
Sampling Method	: Thin Wall Sampling Tube		

Depth in Feet	USCS	GRAPHIC	DESCRIPTION	Samples	Lab No.	TPH (mg/Kg)	Benzene (mg/Kg)	Toluene (mg/Kg)	Ethyl Benzene (mg/Kg)	Total Xylenes (mg/Kg)	Chlorides (mg/L)
0	SW		0-3 ft. SAND, well graded, red	1	H5468-11	3,220	<0.200	<0.200	<0.200	<0.600	50
5	FL		5- 7 ft. Fill material, black-gray,								
10	SW		10-11 ft. SAND, well graded, brown, strong H/C odor	2	H5468-12	31,000	0.329	0.188	0.441	1.71	33
15	CA		15-16 ft. CALICHE, hard, white, strong H/C odor								
20	SP		20-21 ft. SAND, poorly graded, with caliche, medium H/C odor	3	H5468-13	22,600	0.070	0.094	0.323	1.090	66
25	CA		25-26 ft. CALICHE, white, slight H/C odor								
30	CA		30-31 ft. CALICHE, hard, white	4	H5468-14	14,300	0.030	0.030	0.045	0.220	50
35	SP		35-36 ft. SAND, poorly graded, brown, medium H/C odor								
40	SP		40-41 ft. SAND, poorly graded, light brown, slight H/C odor	5	H5468-15	14,626	0.033	0.024	<0.002	0.075	66
45				6	H5468-16	4,380	0.002	0.003	0.004	<0.006	66
50											

Well: BH-11
Elev.: 0



See location map for boring placement
Backfilled hole with 10 ft. bentonite plug then cuttings
H/C - petroleum hydrocarbon

02-13-2001 E:\COMPANY FILES\CHEVRON\CDU TRACT 19\BORING LOGS\BH-11.BOR

Safety & Environmental Solutions, Inc.

LOG OF BORING BH-12

Chevron USA
Site Assessment
CDU Tract 19
Eunice, New Mexico
(Section 29, T 21 S, R 37 E, Lea County)

Date Completed	: 12/22/00	Company Rep.	: R. Massey
Drilling Method	: H.S.A.	Boring Location	:
Driller	: D. Whatley	Logged By	: D. Whatley
Hole Diameter	: 7.0 in.		
Sampling Method	: Thin Wall Sampling Tube		

Depth in Feet	USCS	GRAPHIC	DESCRIPTION	Samples	Lab No.	TPH (mg/Kg)	Benzene (mg/Kg)	Toluene (mg/Kg)	Ethyl Benzene (mg/Kg)	Total Xylenes (mg/Kg)	Chlorides (mg/L)
0	SW		0-3 ft. SAND, well graded, red, no odor	1	H5468-9	5,860	0.002	0.006	<0.002	0.008	66
5	CA		5-7 ft. CALICHE, with brown poorly graded sand								
10	SP		10-11 ft. SAND, poorly graded, red, with caliche	2	H5468-10	1,900	<0.002	<0.002	<0.002	0.014	132
15											

Well: BH-2
Elev.: 0

See location map for boring placement
Backfilled hole with cuttings
H/C - petroleum hydrocarbon

02-13-2001 E:\COMPANY FILES\CHEVRON\CDU TRACT 19\BORING LOGS\BH-12.BOR

Safety & Environmental Solutions, Inc.

LOG OF BORING BH-13

Chevron USA
Site Assessment
CDU Tract 19
Eunice, New Mexico
(Section 29, T 21 S, R 37 E, Lea County)

Date Completed	: 1/2/01	Company Rep.	: R. Massey
Drilling Method	: H.S.A.	Boring Location	:
Driller	: D. Whatley	Logged By	: D. Whatley
Hole Diameter	: 7.0 in.		
Sampling Method	: Thin Wall Sampling Tube		

Depth in Feet	USCS	GRAPHIC	DESCRIPTION	Samples	Lab No.	TPH (mg/Kg)	Benzene (mg/Kg)	Toluene (mg/Kg)	Ethyl Benzene (mg/Kg)	Total Xylenes (mg/Kg)	Chlorides (mg/L)
0	SW		0-3 ft. SAND, well graded, red	1	H5493-4	<10	<0.002	<0.002	<0.002	<0.006	50
5	CA		5-7 ft. CALICHE, white								
10			10-11 ft. CALICHE, pink, slight H/C odor	2	H5493-5	6,890	<0.002	<0.002	<0.002	<0.006	50
15	SP		15-16 ft. SAND, poorly graded, with caliche	3	H5493-6	442	<0.002	<0.002	<0.002	<0.006	66
20	CA		20-21 ft. CALICHE, white	4	H5493-7	105	<0.002	<0.002	<0.002	<0.006	50
25											

Well: BH-13
Elev.: 0

See location map for boring placement
Backfilled hole with cuttings
H/C - petroleum hydrocarbon

02-13-2001 E:\COMPANY FILES\CHEVRON\CDU TRACT 19\BORING LOGS\BH-13.BOR

Safety & Environmental Solutions, Inc.

LOG OF BORING BH-14

Chevron USA
Site Assessment
CDU Tract 19

Eunice, New Mexico
(Section 29, T 21 S, R 37 E, Lea County)

Date Completed	: 1/2/01	Company Rep.	: R. Massey
Drilling Method	: H.S.A.	Boring Location	:
Driller	: D. Whatley	Logged By	: D. Whatley
Hole Diameter	: 7.0 in.		
Sampling Method	: Thin Wall Sampling Tube		

Depth in Feet	USCS	GRAPHIC	DESCRIPTION	Samples	Lab No.	TPH (mg/Kg)	Benzene (mg/Kg)	Toluene (mg/Kg)	Ethyl Benzene (mg/Kg)	Total Xylenes (mg/Kg)	Chlorides (mg/L)
0	SW		0-3 ft. SAND, well graded, red	1	H5493-8	<10	<0.002	<0.002	<0.002	<0.006	83
5	SW		5-7 ft. SAND, well graded, red								
10	CA		10-11 ft. CALICHE, hard, white	2	H5493-9	10.7	<0.002	<0.002	<0.002	<0.006	331
15	CA		15-16 ft. CALICHE, white with poorly graded sand, red.								
20											

Well: BH-14
Elev.: 0

See location map for boring placement
Backfilled hole with cuttings
H/C - petroleum hydrocarbon

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Safety & Environmental Solutions, Inc.

LOG OF BORING BH-15

Chevron USA
Site Assessment
CDU Tract 19

Eunice, New Mexico
(Section 29, T 21 S, R 37 E, Lea County)

Date Completed	: 1/2/01	Company Rep.	: R. Massey
Drilling Method	: H.S.A.	Boring Location	:
Driller	: D. Whatley	Logged By	: D. Whatley
Hole Diameter	: 7.0 in.		
Sampling Method	: Thin Wall Sampling Tube		

Depth in Feet	USCS	GRAPHIC	DESCRIPTION	Samples	Lab No.	TPH (mg/Kg)	Benzene (mg/Kg)	Toluene (mg/Kg)	Ethyl Benzene (mg/Kg)	Total Xylenes (mg/Kg)	Chlorides (mg/L)
0	SW		0-3 ft. SAND, well graded, red	1	H5493-10	109	<0.002	<0.002	<0.002	<0.006	33
5	CA		5-7 ft. CALICHE, pink								
10			10-11 ft. CALICHE, hard, white	2	H5493-11	<10	<0.002	<0.002	<0.002	<0.006	596
15	CA		15-16 ft. CALICHE, with poorly graded sand, red.	3	H5493-12	<10	<0.002	<0.002	<0.002	<0.006	977
20											

Well: BH-15
Elev.: 0

Cuttings

See location map for boring placement
Backfilled hole with cuttings
H/C - petroleum hydrocarbon

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Safety & Environmental Solutions, Inc.

LOG OF BORING BH-16

Chevron USA
Site Assessment
CDU Tract 19
Eunice, New Mexico
(Section 29, T 21 S, R 37 E, Lea County)

Date Completed	: 1/2/01	Company Rep.	: R. Massey
Drilling Method	: H.S.A.	Boring Location	:
Driller	: D. Whatley	Logged By	: D. Whatley
Hole Diameter	: 7.0 in.		
Sampling Method	: Thin Wall Sampling Tube		

Depth in Feet	USCS	GRAPHIC	DESCRIPTION	Samples	Lab No.	TPH (mg/Kg)	Benzene (mg/Kg)	Toluene (mg/Kg)	Ethyl Benzene (mg/Kg)	Total Xylenes (mg/Kg)	Chlorides (mg/L)
0	FL		0-3 ft. FILL MATERIAL, black	1	H5493-13	28,500	<0.002	<0.002	<0.002	<0.006	132
5	CA		5-7 ft. CALICHE, gray								
10	CA		10-11 ft. CALICHE, pink, with poorly graded sand								
15			15-16 ft. CALICHE, pink, with poorly graded sand	2	H5493-14	<10	<0.002	<0.002	<0.002	<0.006	2,900
20											

Well: BH-16
Elev.: 0

Cuttings

See location map for boring placement
Backfilled hole with cuttings
H/C - petroleum hydrocarbon

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Safety & Environmental Solutions, Inc.

LOG OF BORING BH-2

Chevron USA
Site Assessment
CDU Tract 19
Eunice, New Mexico
(Section 29, T 21 S, R 37 E, Lea County)

Date Completed	: 12/6/00	Company Rep.	: R. Massey
Drilling Method	: H.S.A.	Boring Location	:
Driller	: D. Whatley	Logged By	: D. Whatley
Hole Diameter	: 7.0 in.		
Sampling Method	: Thin Wall Sampling Tube		

Depth in Feet	USCS	GRAPHIC	DESCRIPTION	Samples	Lab No.	TPH (mg/Kg)	Benzene (mg/Kg)	Toluene (mg/Kg)	Ethyl Benzene (mg/Kg)	Total Xylenes (mg/Kg)	Chlorides (mg/L)
0	SW		0-3 ft. SAND, well graded, red, no odor								
5	CA		5-7 ft. CALICHE, with poorly graded sand, no odor								
10			10-11 ft. CALICHE, pink with poorly graded sand	1	H5416-1	<10	<0.005	<0.005	<0.005	<0.015	99
15											

Well: BH-2
Elev.: 0

See location map for boring placement
Backfilled hole with cuttings
H/C - petroleum hydrocarbon

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Safety & Environmental Solutions, Inc.

LOG OF BORING BH-3

Chevron USA
Site Assessment
CDU Tract 19
Eunice, New Mexico
(Section 29, T 21 S, R 37 E, Lea County)

Date Completed	: 12/6/00	Company Rep.	: R. Massey
Drilling Method	: H.S.A.	Boring Location	:
Driller	: D. Whatley	Logged By	: D. Whatley
Hole Diameter	: 7.0 in.		
Sampling Method	: Thin Wall Sampling Tube		

Depth in Feet	USCS	GRAPHIC	DESCRIPTION	Samples	Lab No.	TPH (mg/Kg)	Benzene (mg/Kg)	Toluene (mg/Kg)	Ethyl Benzene (mg/Kg)	Total Xylenes (mg/Kg)	Chlorides (mg/L)
0	SW		0-3 ft. SAND, well graded, red, no odor								
5	CA		5-7 ft. CALICHE, with poorly graded sand, no odor								
10	SP		10-11 ft. SAND, poorly graded, red, with caliche, no odor	1	H5416-2	<10	<0.005	<0.005	<0.005	<0.015	83
15											

Well: BH-3
Elev.: 0

See location map for boring placement
Backfilled hole with cuttings
H/C - petroleum hydrocarbon

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Safety & Environmental Solutions, Inc.

LOG OF BORING BH-4

Chevron USA
Site Assessment
CDU Tract 19

Eunice, New Mexico
(Section 29, T 21 S, R 37 E, Lea County)

Date Completed	: 12/6/00	Company Rep.	: R. Massey
Drilling Method	: H.S.A.	Boring Location	:
Driller	: D. Whatley	Logged By	: D. Whatley
Hole Diameter	: 7.0 in.		
Sampling Method	: Thin Wall Sampling Tube		

Depth in Feet	USCS	GRAPHIC	DESCRIPTION	Samples	Lab No.	TPH (mg/Kg)	Benzene (mg/Kg)	Toluene (mg/Kg)	Ethyl Benzene (mg/Kg)	Total Xylenes (mg/Kg)	Chlorides (mg/L)
0	SW		0-3 ft. SAND, well graded, red, no odor								
5	CA		5-7 ft. CALICHE, hard white								
10	SP		10-11 ft. SAND, poorly graded, red, with caliche	1	H5416-3	31.4	<0.005	<0.005	<0.005	0.016	464
15											

Well: BH-4
Elev.: 0

See location map for boring placement
Backfilled hole with cuttings
H/C - petroleum hydrocarbon

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Safety & Environmental Solutions, Inc.

LOG OF BORING BH-5

Chevron USA
Site Assessment
CDU Tract 19
Eunice, New Mexico
(Section 29, T 21 S, R 37 E, Lea County)

Date Completed	: 12/6/00	Company Rep.	: R. Massey
Drilling Method	: H.S.A.	Boring Location	:
Driller	: D. Whatley	Logged By	: D. Whatley
Hole Diameter	: 7.0 in.		
Sampling Method	: Thin Wall Sampling Tube		

Depth in Feet	USCS	GRAPHIC	DESCRIPTION	Samples	Lab No.	TPH (mg/Kg)	Benzene (mg/Kg)	Toluene (mg/Kg)	Ethyl Benzene (mg/Kg)	Total Xylenes (mg/Kg)	Chlorides (mg/L)
0	SW		0-3 ft. SAND, well graded, red, no odor								
5	CA		5-7 ft. CALICHE, with poorly graded sand								
10	SP		10-11 ft. SAND, poorly graded, red, with caliche	1	H5416-4	<10	<0.005	<0.005	<0.005	0.016	265
15											

Well: BH-5
Elev.: 0

See location map for boring placement
Backfilled hole with cuttings
H/C - petroleum hydrocarbon

02-13-2001 E:\COMPANY FILES\CHEVRON\CDU TRACT 19\BORING LOGS\BH-5.BOR

Safety & Environmental Solutions, Inc.

LOG OF BORING BH-6

Chevron USA
Site Assessment
CDU Tract 19
Eunice, New Mexico
(Section 29, T 21 S, R 37 E, Lea County)

Date Completed	: 12/12/00	Company Rep.	: R. Massey
Drilling Method	: H.S.A.	Boring Location	:
Driller	: D. Whatley	Logged By	: D. Whatley
Hole Diameter	: 7.0 in.		
Sampling Method	: Thin Wall Sampling Tube		

Depth in Feet	USCS	GRAPHIC	DESCRIPTION	Samples	Lab No.	TPH (mg/Kg)	Benzene (mg/Kg)	Toluene (mg/Kg)	Ethyl Benzene (mg/Kg)	Total Xylenes (mg/Kg)	Chlorides (mg/L)
0	SW		0-3 ft. SAND, well graded, black, saturated								
5	CA		5-7 ft. CALICHE, with poorly graded sand, strong H/C odor	1	H5416-5	68,100	0.889	2.57	13.9	21.5	3,064
10			10-11 ft. CALICHE, white, with poorly graded sand								
15			15-16 ft. CALICHE, white, with poorly graded sand	2	H5416-6	58.2	<0.005	<0.005	<0.005	<0.015	3,230
20	CA		20-21 ft. CALICHE, white	3	H5416-7	<10	<0.005	<0.005	<0.005	0.020	3,975
25											

Well: BH-6
Elev.: 0

Cuttings

See location map for boring placement
Backfilled hole with cuttings
H/C - petroleum hydrocarbon

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Safety & Environmental Solutions, Inc.

LOG OF BORING BH-7

(Page 1 of 1)

Chevron USA
Site Assessment
CDU Tract 19
Eunice, New Mexico
(Section 29, T 21 S, R 37 E, Lea County)

Date Completed	: 12/12/00,1/25/01	Company Rep.	: R. Massey
Drilling Method	: H.S.A.	Boring Location	:
Driller	: D. Whatley	Logged By	: D. Whatley
Hole Diameter	: 7.0 in.		
Sampling Method	: Thin Wall Sampling Tube		

Depth in Feet	USCS	GRAPHIC	DESCRIPTION	Samples	Lab No.	TPH (mg/Kg)	Benzene (mg/Kg)	Toluene (mg/Kg)	Ethyl Benzene (mg/Kg)	Total Xylenes (mg/Kg)	Chlorides (mg/L)
0	SW		0-3 ft. SAND, well graded, red								
5	FL		5- 7 ft. Fill material, black-gray, sticky	1	H5416-8	41,100	<0.005	<0.005	<0.005	<0.015	86
10	SW		10-11 ft. SAND, poorly graded, red, strong H/C odor								
15			15-16 ft. SAND, poorly graded, with caliche, strong H/C odor	2	H5416-9	23,200	<0.005	0.010	0.161	0.323	99
20			20-21 ft. SAND, poorly graded, with caliche, medium H/C odor	3	H5416-10	32,300	0.006	0.013	0.055	<0.015	116
25	SP		25-26 ft. SAND, poorly graded, with caliche, slight H/C odor	4	H5430-1	17,900	<0.005	<0.005	0.007	0.532	99
30			30-31 ft. SAND, poorly graded, with caliche, medium H/C odor	5	H5430-2	16,600	<0.005	<0.005	<0.005	0.114	149
35			35-36 ft. SAND, poorly graded, medium H/C odor (see notes below)	6	H5430-3	14,900	<0.005	<0.005	0.011	0.017	99
40	SP										
45			Cuttings are sand with sandstone, tan, dry	7	H5557-1	10,100	<0.200	<0.200	<0.200	<0.600	129
50											
55											
60	SP/SS			8	H5557-2	6,860	<1.00	<1.00	<1.00	<3.00	81
65											
70				9	H5557-3	12,900	<0.500	<0.500	<0.500	<1.50	145
75											

Well: BH-7
Elev.: 0

Cuttings

Bentonite

See location map for boring placement. On 12/12/00, backfilled hole with 10 ft. bentonite plug (26-36 ft.) then cuttings. On 1/26/01 reentered hole for additional samples. Lithologic log from 45-70 ft. from Atkins Engineering. Backfilled with 5 ft. bentonite plug then cuttings.
H/C - petroleum hydrocarbon

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Safety & Environmental Solutions, Inc.

LOG OF BORING BH-8

Chevron USA
Site Assessment
CDU Tract 19
Eunice, New Mexico
(Section 29, T 21 S, R 37 E, Lea County)

Date Completed	: 12/14/00	Company Rep.	: R. Massey
Drilling Method	: H.S.A.	Boring Location	:
Driller	: D. Whatley	Logged By	: D. Whatley
Hole Diameter	: 7.0 in.		
Sampling Method	: Thin Wall Sampling Tube		

Depth in Feet	USCS	GRAPHIC	DESCRIPTION	Samples	Lab No.	TPH (mg/Kg)	Benzene (mg/Kg)	Toluene (mg/Kg)	Ethyl Benzene (mg/Kg)	Total Xylenes (mg/Kg)	Chlorides (mg/L)
0	SW		0-3 ft. SAND, well graded, red, no odor	1	H5468-1	397	<0.200	<0.200	<0.200	<0.600	166
5	CA		5-7 ft. CALICHE, with poorly graded sand, no odor								
10			10-11 ft. CALICHE, with poorly graded sand	2	H5468-2	149	<0.200	<0.200	<0.200	<0.600	132
15											

Well: BH-8
Elev.: 0

See location map for boring placement
Backfilled hole with cuttings
H/C - petroleum hydrocarbon

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Safety & Environmental Solutions, Inc.

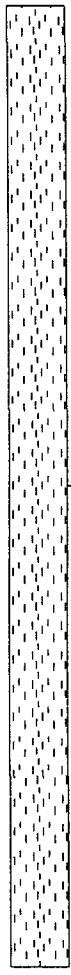
LOG OF BORING BH-9

Chevron USA
Site Assessment
CDU Tract 19
Eunice, New Mexico
(Section 29, T 21 S, R 37 E, Lea County)

Date Completed	: 12/14/00	Company Rep.	: R. Massey
Drilling Method	: H.S.A.	Boring Location	:
Driller	: D. Whatley	Logged By	: D. Whatley
Hole Diameter	: 7.0 in.		
Sampling Method	: Thin Wall Sampling Tube		

Depth in Feet	USCS	GRAPHIC	DESCRIPTION	Samples	Lab No.	TPH (mg/Kg)	Benzene (mg/Kg)	Toluene (mg/Kg)	Ethyl Benzene (mg/Kg)	Total Xylenes (mg/Kg)	Chlorides (mg/L)
0	SW		0-3 ft. SAND, well graded, red, no H/C odor	1	H5468-3	2,010	<0.200	<0.200	<0.200	<0.600	66
5	CA		5-7 ft. CALICHE, with poorly graded sand, slight H/C odor								
10			10-11 ft. CALICHE, with poorly graded sand, slight H/C odor	2	H5468-4	42,800	0.026	0.043	<0.050	<0.150	298
15	SP		15-16 ft. SAND, poorly graded, with caliche, slight H/C odor								
20	CA		20-21 ft. CALICHE, hard, white, no odor	3	H5468-5	5,980	0.003	0.11	0.007	0.029	994
25											

Well: BH-9
Elev.: 0



See location map for boring placement
Backfilled hole with cuttings
H/C - petroleum hydrocarbon

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Safety & Environmental Solutions, Inc.

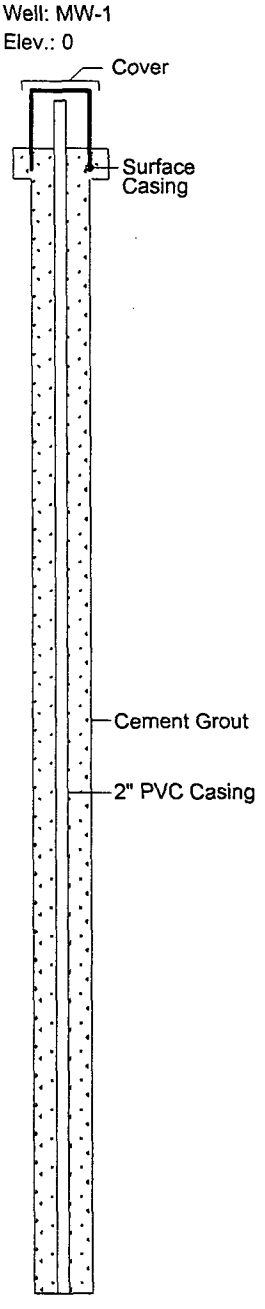
LOG OF BORING MW-1

Chevron USA
Site Assessment
CDU Tract 19

Eunice, New Mexico
(Section 29, T 21 S, R 37 E, Lea County)

Date Completed	: 1/3/01, 1/26/01	Company Rep.	: R. Massey
Drilling Method	: H.S.A., Air Rotary	Boring Location	:
Driller	: SESI, Eades, Atkins	Logged By	: D. Whatley
Hole Diameter	: 7.0 in., 11.5		
Sampling Method	: Thin Wall Sampling Tube		

Depth in Feet	USCS	GRAPHIC	DESCRIPTION
0	SW		0-5 ft. SAND, well graded, red
5	CA		5-10 ft. CALICHE, white, hard
10			10-13 ft. CALICHE, white, hard
15	CA		13-16 ft. CALICHE, pink, with poorly sorted sand
20	CA		16-25 ft. CALICHE, white, hard
25			
30			
35	SP		25-45 ft. SAND, poorly graded, light brown
40			
45	SS		45-50 ft. SANDSTONE, silty, hard
50			50-53 ft. SANDSTONE, silty, hard (see well construction notes)
55	SP		



Well Construction Information

WELL CONSTRUCTION

Date Compl.	: 1/26/01
Hole Diameter	: 7, 11.5 inch
Drill. Method	: HSA, Air rotary
Company Rep.	: R. Massey

WELL CASING

Material	: PVC
Diameter	: 2-inch
Joints	: Flush screw

WELL SCREEN

Material	: PVC
Diameter	: 2-inch
Joints	: Flush screw
Opening	: 10 slot (0.010 in.)
SAND PACK	: 10-20 silica sand
ANNULUS SEAL	: Bentonite & grout

SURFACE CASING

Material	: Steel protector box
Diameter	: 4-inch
Cap	: Locking

NOTES

1/3/01
At 53 ft. sheared pin on SESI Giddings auger downhole. Efforts to retrieve unsuccessful and left one 5-ft. section downhole. Plugged with 15 ft. bentonite and cuttings to surface.

1/25/01
Moved over and began air-rotary drilling using Eades Drilling of Hobbs. Difficulty in reaching location due to soft sediments in pit. Drilled from surface to 102 ft., but caved back to 94 ft. Water at 93.45 ft.

1/26/01
Hole caved in to 91 ft. Company rep. made decision to call for large HSA rig from Atkins Engineering of Hobbs. On-site at 1 p.m. Drilled to 102 ft. and completed well as described.

See location map for boring placement
H/C - petroleum hydrocarbon

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Safety & Environmental Solutions, Inc.

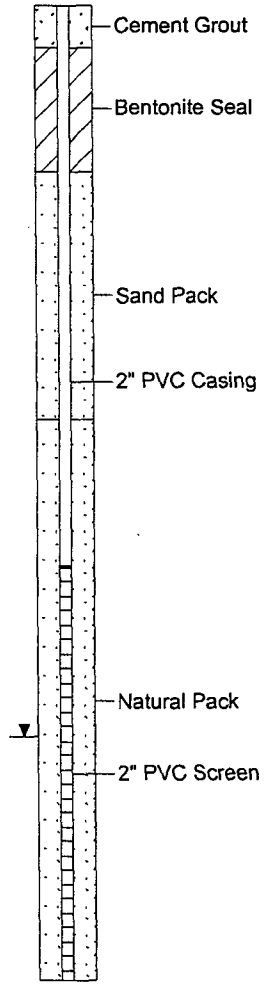
LOG OF BORING MW-1

Chevron USA
Site Assessment
CDU Tract 19

Eunice, New Mexico
(Section 29, T 21 S, R 37 E, Lea County)

Date Completed	: 1/3/01, 1/26/01	Company Rep.	: R. Massey
Drilling Method	: H.S.A., Air Rotary	Boring Location	:
Driller	: SESI, Eades, Atkins	Logged By	: D. Whatley
Hole Diameter	: 7.0 in., 11.5		
Sampling Method	: Thin Wall Sampling Tube		

Depth in Feet	USCS	GRAPHIC	DESCRIPTION
55			
60			
65	SP		Drill cuttings are sand, caliche, and sandstone
70			
75			
80			
85			Drill cuttings are sand with caliche and sandstone
90	SP		
95			
100			
105			
110			



Well Construction Information

WELL CONSTRUCTION

Date Compl.	: 1/26/01
Hole Diameter	: 7, 11.5 inch
Drill. Method	: HSA, Air rotary
Company Rep.	: R. Massey

WELL CASING

Material	: PVC
Diameter	: 2-inch
Joints	: Flush screw

WELL SCREEN

Material	: PVC
Diameter	: 2-inch
Joints	: Flush screw
Opening	: 10 slot (0.010 in.)
SAND PACK	: 10-20 silica sand
ANNULUS SEAL	: Bentonite & grout

SURFACE CASING

Material	: Steel protector box
Diameter	: 4-inch
Cap	: Locking

NOTES

1/3/01
At 53 ft. sheared pin on SESI Giddings auger downhole. Efforts to retrieve unsuccessful and left one 5-ft. section downhole. Plugged with 15 ft. bentonite and cuttings to surface.

1/25/01
Moved over and began air-rotary drilling using Eades Drilling of Hobbs. Difficulty in reaching location due to soft sediments in pit. Drilled from surface to 102 ft., but caved back to 94 ft. Water at 93.45 ft.

1/26/01
Hole caved in to 91 ft. Company rep. made decision to call for large HSA rig from Atkins Engineering of Hobbs. On-site at 1 p.m. Drilled to 102 ft. and completed well as described.

See location map for boring placement
H/C - petroleum hydrocarbon

02-14-2001 E:\COMPANY FILES\CHEVRON\CDU TRACT 19\BORING LOGS\MW-1.BOR

Appendix B
Laboratory Analytical Reports

CARDINAL LABORATORIES

PHONE (915) 673-7001 • 2111 BEECHWOOD • ABILENE, TX 79603
PHONE (505) 393-2326 • 101 E. MARLAND • HOBBS, NM 88240

ANALYTICAL RESULTS FOR:
SAFETY AND ENVIRONMENTAL SOLUTIONS, INC.
ATTN: BOB ALLEN
703 E. CLINTON, SUITE 103
HOBBS, NM 88240
FAX TO: 505-393-4308

Receiving Date: 01/29/01
Reporting Date: 01/30/01
Project Number: NOT GIVEN
Project Name: CDU TRACT 19
Project Location: NOT GIVEN

Sampling Date: 01/26/01
Sample Type: SOIL
Sample Condition: COOL, INTACT
Sample Received By: BC
Analyzed By: JA

LAB NUMBER	SAMPLE ID	BENZENE (mg/Kg)	TOLUENE (mg/Kg)	ETHYL BENZENE (mg/Kg)	TOTAL XYLENES (mg/Kg)
ANALYSIS DATE		01/30/01	01/30/01	01/30/01	01/30/01
H5557-1	BH#7 45'	<0.200*	<0.200*	<0.200*	<0.600*
H5557-2	BH#7 60'	<1.00*	<1.00*	<1.00*	<3.00*
H5557-3	BH#7 70'	<0.500*	<0.500*	<0.500*	<1.50*
Quality Control		0.099	0.114	0.103	0.315
True Value QC		0.100	0.100	0.100	0.300
% Accuracy		99	114	103	105
Relative Percent Difference		2.9	2.5	0.7	4.4

METHOD: EPA SW 846-8020, 5030, Gas Chromatography

* MATRIX INTERFERENCE--UNRESOLVED PEAKS IN THE BTEX RANGE.

Chemist

1-30-01
Date

H5557SSESIHOBBSBTEXONLY

CARDINAL LABORATORIES

PHONE (915) 673-7001 • 2111 BEECHWOOD • ABILENE, TX 79603
PHONE (505) 393-2326 • 101 E. MARLAND • HOBBS, NM 88240

ANALYTICAL RESULTS FOR
SAFETY & ENVIRONMENTAL SOLUTIONS, INC.
ATTN: BOB ALLEN
703 E. CLINTON, SUITE #103
HOBBS, NM 88240
FAX TO: (505) 393-4388

Receiving Date: 01/29/01
Reporting Date: 01/30/01
Project Number: NOT GIVEN
Project Name: CDU TRACT 19
Project Location: NOT GIVEN

Sampling Date: 01/26/01
Sample Type: SOIL
Sample Condition: COOL & INTACT
Sample Received By: BC
Analyzed By: BC/AH

LAB NUMBER	SAMPLE ID	TPH (mg/Kg)	Cl* (mg/Kg)
ANALYSIS DATE:		01/29/01	01/30/01
H5557-1	BH #7 45'	10100	129
H5557-2	BH #7 60'	6860	81
H5557-3	BH #7 70'	12900	145
Quality Control		241	1051
True Value QC		240	1000
% Recovery		100	105
Relative Percent Difference		3.9	3.9

METHODS: TPH-EPA 600/4-79-020 418.1; Cl-Std. Methods 4500-Cl B
*Analyses performed on 1:4 w:v aqueous extracts.

Chemist

1/30/01
Date

H5557A.XLS

CARDINAL LABORATORIES, INC.

2111 Beechwood, Abilene, TX 79603 (915) 673-7001 Fax (915) 673-7020
101 East Marland, Hobbs, NM 88240 (505) 393-2326 Fax (505) 393-2476

CHAIN-OF-CUSTODY AND ANALYSIS REQUEST

Page 1 of 1

Company Name: SESI	BILL TO PO #:
Project Manager: Ana	Company: SAME
Address: 703 E. CLINTON, #103	Attn:
City: HOBBS State: NM Zip: 88240	Address:
Phone #: (505) 397-0510	City:
Fax #: (505) 393-4388	State: Zip:
Project #: Project Owner:	Phone #:
Project Name: CONTRACT 19	Fax #:
Project Location:	

FOR LAB USE ONLY				MATRIX						PRES.			SAMPLING		ANALYSIS REQUEST		
LAB I.D.	Sample I.D.	(G)RAB OR (C)OMP.	# CONTAINERS	GROUNDWATER	WASTEWATER	SOIL	OIL	SLUDGE	OTHER:	ACID:	ICE / COOL	OTHER:	DATE	TIME	TPH (418.1)	BTEX	Cl -
H5557-1	BH #7 45'	G	1			X					X		1-26-01	7:00 pm	X	X	X
-2	BH #7 60'	G	1			X					X		"	8:30 pm	X	X	X
-3	BH #7 70'	G	1			X					X		"	10:05 pm	X	X	X

PLEASE NOTE: Liability and Damages. Cardinal's liability and client's exclusive remedy for any claim arising whether based in contract or tort, shall be limited to the amount paid by the client for the analyses. All claims including those for negligence and any other cause whatsoever shall be deemed waived unless made in writing and received by Cardinal within 30 days after completion of the applicable service. In no event shall Cardinal be liable for incidental or consequential damages, including without limitation, business interruptions, loss of use, or loss of profits incurred by client, its subsidiaries, affiliates or successors arising out of or related to the performance of services hereunder by Cardinal, regardless of whether such claim is based upon any of the above stated reasons or otherwise.

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Sampler Relinquished:	Date: 1-29-01	Received By:	Phone Result ☐ Yes ☐ No Additional Fax #:
	Time: 11:00		Fax Result: ☐ Yes ☐ No
Relinquished By:	Date:	Received By: (Lab Staff)	REMARKS:
	Time:		
Delivered By: (Circle One)	Sample Condition: Cool ☒ Yes ☐ No; Intact ☒ Yes ☐ No	CHECKED BY: (Initials)	
Sampler - UPS - Bus - Other:			

† Cardinal cannot accept verbal changes. Please fax written changes to 915-673-7020.

CARDINAL LABORATORIES, INC.

CHAIN-OF-CUSTODY AND ANALYSIS REQUEST

2111 Beechwood, Abilene, TX 79603 (915) 673-7001 Fax (915) 673-7020
101 East Marland, Hobbs, NM 88240 (505) 393-2326 Fax (505) 393-2476

Page 1 of 1

Company Name: SESI	BILL TO PO #:
Project Manager: Ana	Company: SAME
Address: 703 E. CLINTON, #103	Attn:
City: HOBBS State: NM Zip: 88240	Address:
Phone #: (505) 397-0510	City:
Fax #: (505) 393-4388	State: Zip:
Project #: Project Owner:	Phone #:
Project Name: CDU TRACT 19	Fax #:
Project Location:	

ANALYSIS REQUEST

FOR LAB USE ONLY LAB I.D.	Sample I.D.	(G)RAB OR (C)OMP.	# CONTAINERS	MATRIX: GROUNDWATER	WASTEWATER	SOIL	OIL	SLUDGE	OTHER:	PRES.: ACID:	ICE / COOL	OTHER:	SAMPLING: DATE	TIME	TPH (418.1)	BTEX	Cl -
H5557-1	BH #7 45'	G	1			X					X		1-26-01	7:00 pm	X	X	X
-2	BH #7 60'	G	1			X					X		"	8:30 pm	X	X	X
-3	BH #7 70'	G	1			X					X		"	10:05 pm	X	X	X

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Sampler Relinquished:	Date: 1-29-01	Received By:	Phone Result ☐ Yes ☐ No Additional Fax #:
	Time: 11:00		Fax Result: ☐ Yes ☐ No
Relinquished By:	Date:	Received By: (Lab Staff)	REMARKS:
	Time:		
Delivered By: (Circle One)	Sample Condition: Cool ☒ Yes ☐ No; Intact ☒ Yes ☐ No	CHECKED BY: (Initials)	
Sampler - UPS - Bus - Other:			

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PHONE (505) 393-2326 • 101 E. MARLAND • HOBBS, NM 88240

ANALYTICAL RESULTS FOR
SAFETY & ENVIRONMENTAL SOLUTIONS, INC.
ATTN: BOB ALLEN
703 E. CLINTON, STE 103
HOBBS, NM 88240
FAX TO: (505) 393-4388

Receiving Date: 01/29/01
Reporting Date: 01/31/01
Project Number: NOT GIVEN
Project Name: CHEVRON CDU TRACT 19
Project Location: CDU TRACT 19

Sampling Date: 01/29/01
Sample Type: GROUNDWATER
Sample Condition: COOL & INTACT
Sample Received By: BC
Analyzed By: JA

LAB NO.	SAMPLE ID	BENZENE (mg/Kg)	TOLUENE (mg/Kg)	ETHYL BENZENE (mg/Kg)	TOTAL XYLENES (mg/Kg)
ANALYSIS DATE		01/31/01	01/31/01	01/31/01	01/31/01
H5563-1	MONITER WELL	<0.002	<0.002	<0.002	<0.002
Quality Control		0.099	0.114	0.103	0.315
True Value QC		0.100	0.100	0.100	0.300
% Recovery		99	114	103	105
Relative Percent Difference		2.9	2.5	0.7	4.4

METHOD: EPA SW-846 8260

Chemist

01/31/2001
Date

BTEX XLS

CARDINAL LABORATORIES

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ANALYTICAL RESULTS FOR
SAFETY & ENVIRONMENTAL SOLUTIONS, INC.
ATTN: DEE WHATLEY
703 E. CLINTON, SUITE #103
HOBBS, NM 88240
FAX TO: (505) 393-4388

Receiving Date: 01/29/01
Reporting Date: 01/30/01
Project Number: NOT GIVEN
Project Name: CHEVRON CDU TRACT 19
Project Location: CDU TRACT #19
Lab Number: H5563-1
Sample ID: MONITOR WELL

Analysis Date: 01/29/01
Sampling Date: 01/29/01
Sample Type: GROUNDWATER
Sample Condition: COOL & INTACT
Sample Received By: BC
Analyzed By: BC

POLYNUCLEAR AROMATIC HYDROCARBONS - 625 (mg/L)	Sample Result	Method Blank	QC	% Recov.	True Value QC
1 Naphthalene	<0.002	<0.002	0.028	56	0.050
2 2-Methylnaphthalene	<0.002	<0.002	0.029	58	0.050
3 1-Methylnaphthalene	<0.002	<0.002	NR	NR	NR
4 Acenaphthylene	<0.002	<0.002	0.030	60	0.050
5 Acenaphthene	<0.002	<0.002	0.029	58	0.050
6 Fluorene	<0.002	<0.002	0.026	52	0.050
7 Phenanthrene	0.002	<0.002	0.025	50	0.050
8 Anthracene	<0.002	<0.002	0.024	48	0.050
9 Fluoranthene	<0.002	<0.002	0.026	52	0.050
10 Pyrene	<0.002	<0.002	0.027	54	0.050
11 Benzo(a)anthracene	<0.002	<0.002	0.026	52	0.050
12 Chrysene	<0.002	<0.002	0.029	58	0.050
13 Benzo(b)fluoranthene	<0.002	<0.002	0.030	60	0.050
14 Benzo(k)fluoranthene	<0.002	<0.002	0.031	62	0.050
15 Benzo(a)pyrene	<0.002	<0.002	0.039	78	0.050
16 Indeno(1,2,3-cd)pyrene	<0.002	<0.002	0.030	60	0.050
17 Dibenzo(a,h,)anthracene	<0.002	<0.002	0.037	74	0.050
18 Benzo(g,h,i)perylene	<0.002	<0.002	0.034	68	0.050

	% Recovery
19 Nitrobenzene-d5	54
20 2-Fluorobiphenyl	64
21 Terphenyl-d14	100

METHODS: EPA 625

Burgess J.A. Cooke, Ph. D.

1/30/01
Date

CARDINAL LABORATORIES

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PHONE (505) 393-2326 • 101 E. MARLAND • HOBBS, NM 88240

ANALYTICAL RESULTS FOR
SAFETY & ENVIRONMENTAL SOLUTIONS, INC.
ATTN: BOB ALLEN
703 E. CLINTON, STE 103
HOBBS, NM 88240
FAX TO: (505) 393-4388

Receiving Date: 01/29/01
Reporting Date: 01/31/01
Project Number: NOT GIVEN
Project Name: CHEVRON CDU TRACT 19
Project Location: CDU TRACT 19

Sampling Date: 01/29/01
Sample Type: GROUNDWATER
Sample Condition: COOL & INTACT
Sample Received By: BC
Analyzed By: AH

LAB NUMBER SAMPLE ID	Na (mg/L)	Ca (mg/L)	Mg (mg/L)	K (mg/L)	Conductivity (mS/cm)	T-Alkalinity ($mgCaCO_3/L$)
ANALYSIS DATE:	01/31/01	01/30/01	01/30/01	01/30/01	01/30/01	01/30/01
H5563-1 MONITER WELL	643	377	127	17.98	4890	172
Quality Control	1.051	51	52	4.94	1489	NR
True Value QC	1.000	50	50	5.00	1413	NR
% Accuracy	105	102	104	98.8	105	NR
Relative Percent Difference	0.6	0	1.9	1.6	0.3	NR
METHODS:	273.1	3500-Ca-D	3500-Mg E	8049	120.1	310.1

LAB NUMBER SAMPLE ID	Cl^- (mg/L)	SO_4 (mg/L)	CO_3 (mg/L)	HCO_3 (mg/L)	pH (s.u.)	TDS (mg/L)
ANALYSIS DATE:	01/30/01	01/30/01	01/30/01	01/30/01	01/30/01	01/31/01
H5563-1 MONITER WELL	1344	294	0	210	7.28	3182
Quality Control	1051	53.19	NR	995	7.38	NR
True Value QC	1000	50.00	NR	1000	7.00	NR
% Accuracy	105	106	NR	99.5	105	NR
Relative Percent Difference	3.9	0.3	NR	0	4.6	0
METHODS:	SM4500-Cl-B	375.4	310.1	310.1	150.1	160.1

Gayle A. Potter, Chemist

01/31/2001
Date

CARDINAL LABORATORIES, INC.

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101 East Marland, Hobbs, NM 88240 (505) 393-2326 Fax (505) 393-2476

CHAIN-OF-CUSTODY AND ANALYSIS REQUEST

Page 1 of 1

Company Name: SESI	BILL TO PO #:
Project Manager:	Company: SAME
Address: 703 E. CLINTON, #103	Attn:
City: HOBBS State: NM Zip: 88240	Address:
Phone #: (505) 397-0510	City:
Fax #: (505) 393-4388	State: Zip:
Project #: Project Owner:	Phone #:
Project Name: Chevron CDU Tract 19	Fax #:
Project Location: CDU Tract #19	

FOR LAB USE ONLY				MATRIX							PRES.			SAMPLING		ANALYSIS REQUEST												
LAB I.D.	Sample I.D.	(G)RAB OR (C)OMP.	# CONTAINERS	GROUNDWATER	WASTEWATER	SOIL	OIL	SLUDGE	OTHER:	ACID:	ICE / COOL	OTHER:	DATE	TIME	PAH (Oil & Grease, Chloride, Sulfate, pH)	BTEX	Major Cations	Major Anions										
H5563-1	Monitor Well		4	✓							✓		1-29-01	2:00pm	✓	✓	✓	✓										

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Sampler Relinquished:	Date: 1-29-01	Received By:	Phone Result ☐ Yes ☐ No Additional Fax #:
	Time: 2:00pm		Fax Result: ☐ Yes ☐ No
Relinquished By:	Date: 1-29-01	Received By: (Lab Staff)	REMARKS:
	Time: 4:30pm		
Delivered By: (Circle One)		Sample Condition Cool ☑ Yes ☐ No Intact ☑ Yes ☐ No	CHECKED BY! (Initials)
Sampler - UPS - Bus - Other:			

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CARDINAL LABORATORIES

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PHONE (505) 393-2326 • 101 E. MARLAND • HOBBS, NM 88240

ANALYTICAL RESULTS FOR
SAFETY AND ENVIRONMENTAL SOLUTIONS, INC.
ATTN: BOB ALLEN
703 E. CLINTON, SUITE 103
HOBBS, NM 88240
FAX TO:

Receiving Date: 01/04/01
Reporting Date: 01/05/01
Project Number: NOT GIVEN
Project Name: CDU
Project Location: EUNICE

Sampling Date: 01/03/01
Sample Type: SOIL
Sample Condition: COOL, INTACT
Sample Received By: AH
Analyzed By: JA

LAB NUMBER	SAMPLE ID	BENZENE (mg/Kg)	TOLUENE (mg/Kg)	ETHYL BENZENE (mg/Kg)	TOTAL XYLENES (mg/Kg)
ANALYSIS DATE		01/05/01	01/05/01	01/05/01	01/05/01
H5493-1	BH #10 25'	0.009	0.039	0.020	0.131
H5493-2	BH #10 35'	<0.200*	<0.200*	<0.200*	<0.600*
H5493-3	BH #10 45'	<0.020*	<0.020*	<0.020*	<0.060*
H5493-4	BH #13 0-3'	<0.002	<0.002	<0.002	<0.006
H5493-5	BH #13 10'	<0.002	<0.002	<0.002	<0.006
H5493-6	BH #13 15'	<0.002	<0.002	<0.002	<0.006
H5493-7	BH #13 20'	<0.002	<0.002	<0.002	<0.006
H5493-8	BH#14 0-3'	<0.002	<0.002	<0.002	<0.006
H5493-9	BH#14 10'	<0.002	<0.002	<0.002	<0.006
H5493-10	BH#15 0-3'	<0.002	<0.002	<0.002	<0.006
H5493-11	BH#15 10'	<0.002	<0.002	<0.002	<0.006
H5493-12	BH#15 15'	<0.002	<0.002	<0.002	<0.006
H5493-13	BH #16 0-3'	<0.002	<0.002	<0.002	<0.006
H5493-14	BH #16 15'	<0.002	<0.002	<0.002	<0.006
H5493-15	MW-1 15'	<0.002	<0.002	<0.002	<0.006
Quality Control		0.094	0.104	0.090	0.283
True Value QC		0.100	0.100	0.100	0.300
% Accuracy		94	104	90	94
Relative Percent Difference		7.1	1.4	0.8	1.3

METHOD: EPA SW 846-8020, 5030, Gas Chromatography

* MATRIX INTERFERENCE DUE TO HIGH CONCENTRATIONS OF PETROLEUM HYDROCARBONS.

Chemist

1-5-01
Date

H5493SHOBBSBTEXONLY

CARDINAL LABORATORIES

PHONE (915) 673-7001 • 2111 BEECHWOOD • ABILENE, TX 79603
PHONE (505) 393-2326 • 101 E. MARLAND • HOBBS, NM 88240

ANALYTICAL RESULTS FOR
SAFETY & ENVIRONMENTAL SOLUTIONS, INC.
ATTN: BOB ALLEN
703 E. CLINTON, SUITE 103
HOBBS, NM 88240
FAX TO: (505) 393-4388

Receiving Date: 01/04/01
Reporting Date: 01/05/01
Project Number: NOT GIVEN
Project Name: CDU
Project Location: EUNICE, NM

Sampling Date: 01/03/01
Sample Type: SOIL
Sample Condition: COOL & INTACT
Sample Received By: AH
Analyzed By: AH/BC

LAB NUMBER	SAMPLE ID	TPH (mg/Kg)	Cl* (mg/Kg)
ANALYSIS DATE:		01/04/01	01/05/01
H5493-1	B.H. #10-25'	9500	248
H5493-2	B.H. #10-35'	3430	99
H5493-3	B.H. #10-45'	26.7	99
H5493-4	B.H. #13-0-3'	<10	50
H5493-5	B.H. #13-10'	6890	50
H5493-6	B.H. #13-15'	442	66
H5493-7	B.H. #13-20'	105	50
H5493-8	B.H. #14-0-3'	<10	83
H5493-9	B.H. #14-10'	10.7	331
H5493-10	B.H. #15-0-3'	109	33
H5493-11	B.H. #15-10'	<10	596
H5493-12	B.H. #15-15'	<10	977
H5493-13	B.H. #16-0-3'	28500	132
H5493-14	B.H. #16-15'	<10	2900
H5493-15	MW-1 15'	<10	911
Quality Control		240	1004
True Value QC		240	1000
% Recovery		100	100
Relative Percent Difference		1.7	7.2

METHODS: TPH-EPA 600/4-79-020 418.1; Cl-Std. Methods 4500-Cl-B
*Analyses performed on 1:4 w:v aqueous extracts.

Chemist

1/5/01
Date

H5493A.XLS

CARDINAL LABORATORIES, INC.

CHAIN-OF-CUSTODY AND ANALYSIS REQUEST

2111 Beechwood, Abilene, TX 79603 (915) 673-7001 Fax (915) 673-7020
101 East Marland, Hobbs, NM 88240 (505) 393-2326 Fax (505) 393-2476

Company Name: SESI	BILL TO PO #:
Project Manager: Bob Allen	Company: SAME
Address: 703 E Clinton Ste 103	Attn:
City: Hobbs State: NM Zip: 88240	Address:
Phone #: (505) 397-0510	City:
Fax #: (505) 393-4388	State: Zip:
Project #: Project Owner:	Phone #:
Project Name: CDU	Fax #:
Project Location: EUNICE	

ANALYSIS REQUEST: TPH 418.1; Chlorides; BTEX

FOR LAB USE ONLY LAB I.D.	Sample I.D.	(G)RAB OR (C)OMP.	# CONTAINERS	MATRIX: GROUNDWATER	WASTEWATER	SOIL	OIL	SLUDGE	OTHER:	PRES.: ACID:	ICE / COOL	OTHER:	SAMPLING: DATE	TIME
H5493-1	B.H. #10 - 25'		1			X					X		1-3-01	
-2	B.H. #10 - 35'		1			X					X			
-3	B.H. #10 - 45'		1			X					X			
-4	B.H. #13 - 0-3'		1			X					X			
-5	B.H. #13 - 10'		1			X					X			
-6	B.H. #13 - 15'		1			X					X			
-7	B.H. #13 - 20'		1			X					X			
-8	B.H. #14 - 0-3'		1			X					X			
-9	B.H. #14 - 10'		1			X					X			
-10	B.H. #15 - 0-3'		1			X					X		↓	

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Sampler Relinquished:	Date: / Time:	Received By:	Phone Result ☐ Yes ☐ No Additional Fax #: / Fax Result: ☐ Yes ☐ No / REMARKS:
Relinquished By:	Date: 01-04-00 / Time: 8:05	Received By: (Lab Staff)	
Delivered By: (Circle One) Sampler - UPS - Bus - Other:		Sample Condition Cool Intact ☑ Yes ☑ Yes ☐ No ☐ No	CHECKED BY: (Initials)

† Cardinal cannot accept verbal changes. Please fax written changes to 915-673-7020.

CARDINAL LABORATORIES, INC.

2111 Beechwood, Abilene, TX 79603 (915) 673-7001 Fax (915) 673-7020
101 East Marland, Hobbs, NM 88240 (505) 393-2326 Fax (505) 393-2476

CHAIN-OF-CUSTODY AND ANALYSIS REQUEST

Company Name: SESI	BILL TO PO #:
Project Manager: Bob Allen	Company: SAME
Address: 703 E Clinton Ste 103	Attn:
City: Hobbs State: NM Zip: 88240	Address:
Phone #: (505) 397-0510	City:
Fax #: (505) 393-4388	State: Zip:
Project #: Project Owner:	Phone #:
Project Name: CDM	Fax #:
Project Location: EUNICE	

FOR LAB USE ONLY				MATRIX							PRES.			SAMPLING		ANALYSIS REQUEST												
LAB I.D.	Sample I.D.	(G)RAB OR (C)OMP.	# CONTAINERS	GROUNDWATER	WASTEWATER	SOIL	OIL	SLUDGE	OTHER:		ACID:	ICE / COOL	OTHER:	DATE	TIME	TPH 418.1	Chlorides	BTEX											
H5493-11	B.H. #15 - 10'		1			X						X		1-3-01		X	X	X										
-12	B.H. #15 - 15'		1			X						X				X	X	X										
-13	B.H #16 - 0-3'		1			X						X				X	X	X										
-14	B.H #16 - 15'		1			X						X				X	X	X										
-15	MW-1 15'		1			X						X				X	X	X										

Sampler Relinquished:	Date:	Received By:	Phone Result ☐ Yes ☐ No Additional Fax #:
	Time:		Fax Result: ☐ Yes ☐ No
Relinquished By:	Date: 01-04-00	Received By: (Lab Staff)	REMARKS:
	Time: 8:05		
Delivered By: (Circle One)	Sample Condition Cool ☐ Yes ☐ No Intact ☐ Yes ☐ No	CHECKED BY: (Initials)	
Sampler - UPS - Bus - Other:			

† Cardinal cannot accept verbal changes. Please fax written changes to 915-673-7020.

CARDINAL LABORATORIES

PHONE (915) 673-7001 • 2111 BEECHWOOD • ABILENE, TX 79603
PHONE (505) 393-2326 • 101 E. MARLAND • HOBBS, NM 88240

ANALYTICAL RESULTS FOR
SAFETY & ENVIRONMENTAL SOLUTIONS, INC.
ATTN: BOB ALLEN
703 E. CLINTON, STE. #103
HOBBS, NM 88240
FAX TO:

Receiving Date: 12/22/00
Reporting Date: 01/02/01
Project Owner: CHEVRON
Project Name: CDU ASSESSMENT
Project Location: CDU TRACT 19

Sampling Date: 12/22/00
Sample Type: SOIL
Sample Condition: COOL & INTACT
Sample Received By: BC
Analyzed By: BC/AH

LAB NUMBER	SAMPLE ID	TPH (mg/Kg)	Cl* (mg/Kg)
ANALYSIS DATE:		12/28/00	12/28/00
H5468-1	B.H.#8 0-3'	397	166
H5468-2	B.H.#8 10'-11'	149	132
H5468-3	B.H.#9 0-3'	2010	66
H5468-4	B.H.#9 10'-11'	42800	298
H5468-5	B.H.#9 20'-21'	5980	994
H5468-6	B.H.#10 0-3'	<10	116
H5468-7	B.H.#10 10'-11'	18400	66
H5468-8	B.H.#10 20'-21'	11800	116
H5468-9	B.H.#12 0-3'	5860	66
H5468-10	B.H.#12 10'-11'	1900	132
H5468-11	B.H.#11 0-3'	3220	50
H5468-12	B.H.#11 10'-11'	31000	33
H5468-13	B.H.#11 20'-21'	22600	66
H5468-14	B.H.#11 30'-31'	14300	50
H5468-15	B.H.#11 40'-41'	14626	66
H5468-16	B.H.#11 45'-46'	4380	66
Quality Control		241	932
True Value QC		240	1000
% Recovery		101	93.2
Relative Percent Difference		5.4	6.7

METHODS: TPH-EPA 600/4-79-020 418.1; Cl-Std. Methods 4500-Cl B
*Analyses performed on 1:4 w:v aqueous extracts.

Chemist

1/2/01
Date

H5468A.XLS

CARDINAL LABORATORIES

PHONE (915) 673-7001 • 2111 BEECHWOOD • ABILENE, TX 79603
PHONE (505) 393-2326 • 101 E. MARLAND • HOBBS, NM 88240

ANALYTICAL RESULTS FOR
SAFETY & ENVIRONMENTAL SOLUTIONS, INC.
ATTN: BOB ALLEN
703 E. CLINTON, STE. #103
HOBBS, NM 88240
FAX TO:

Receiving Date: 12/22/00
Reporting Date: 01/03/01
Project Owner: CHEVRON
Project Name: CDU ASSESSMENT
Project Location: CDU TRACT 19

Sampling Date: 12/22/00
Sample Type: SOIL
Sample Condition: COOL & INTACT
Sample Received By: BC
Analyzed By: JA

LAB NO.	SAMPLE ID	BENZENE (mg/Kg)	TOLUENE (mg/Kg)	ETHYL BENZENE (mg/Kg)	TOTAL XYLENES (mg/Kg)
ANALYSIS DATE		12/29/00	12/29/00	12/29/00	12/29/00
H5468-1	B.H.#8 0-3'	<0.002	<0.002	<0.002	<0.006
H5468-2	B.H.#8 10'-11'	<0.002	<0.002	<0.002	<0.006
H5468-3	B.H.#9 0-3'	<0.002	<0.002	<0.002	<0.006
H5468-4	B.H.#9 10'-11'	0.026	0.043	<0.050*	<0.150*
H5468-5	B.H.#9 20'-21'	0.003	0.011	0.007	0.029
H5468-6	B.H.#10 0-3'	<0.002	<0.002	<0.002	<0.006
H5468-7	B.H.#10 10'-11'	1.43	0.634	0.574	19.6
H5468-8	B.H.#10 20'-21'	0.060	0.061	0.139	0.385
H5468-9	B.H.#12 0-3'	0.002	0.006	<0.002	0.008
H5468-10	B.H.#12 10'-11'	<0.002	<0.002	<0.002	0.014
H5468-11	B.H.#11 0-3'	<0.002	<0.002	<0.002	<0.006
H5468-12	B.H.#11 10'-11'	0.329	0.188	0.441	1.71
H5468-13	B.H.#11 20'-21'	0.070	0.094	0.323	1.09
H5468-14	B.H.#11 30'-31'	0.030	0.030	0.045	0.220
H5468-15	B.H.#11 40'-41'	0.033	0.024	<0.002	0.075
H5468-16	B.H.#11 45'-46'	0.002	0.003	0.004	<0.006
Quality Control		0.094	0.104	0.090	0.277
True Value QC		0.100	0.100	0.100	0.300
% Recovery		94.4	104	89.7	92.3
Relative Percent Difference		0.4	4.1	2.0	2.6

*Matrix interference noted.

METHOD: EPA SW-846 8021B, 5030B

Chemist

1/3/01
Date

H5468B.XLS

CHAIN-OF-CUSTODY AND ANALYSIS REQUEST

CARDINAL LABORATORIES, INC.

2111 Beechwood, Abilene, TX 79603 (915) 673-7001 Fax (915) 673-7020

101 East Marland, Hobbs, NM 88240 (505) 393-2326 Fax (505) 393-2476

Company Name:	SESI	**BILL TO**	
Project Manager:	Bob Allen	P.O. #:	
Address:		Company:	
City:	State: Zip:	Attn:	
Phone #:	Fax #:	Address:	
Project #:	Project Owner: Chevron	City:	
Project Name:	CDU Assessment	State: Zip:	
Project Location:	CDU Tract 19	Phone #:	
Sampler Name:	Dee Wheeler	Fax #:	

FOR LAB USE ONLY				MATRIX						PRESERV.			SAMPLING		ANALYSIS REQUEST										
Lab I.D.	Sample I.D.	(G)RAB OR (C)OMP.	# CONTAINERS	GROUNDWATER	WASTEWATER	SOIL	CRUDE OIL	SLUDGE	OTHER:	ACID/BASE:	ICE / COOL	OTHER:	DATE	TIME	Chlorides	BTEX	TPH 418.1								
H5468-1	B.H. #8	0-3'	G	1			✓				✓		12-22-00	11:00 Am	✓	✓	✓								
-2	B.H. #8	10'-11'	G	1			✓				✓				✓	✓	✓								
-3	B.H. #9	0-3	G	1			✓				✓				✓	✓	✓								
-4	B.H. #9	10'-11'	G	1			✓				✓				✓	✓	✓								
-5	B.H. #9	20'-21'	G	1			✓				✓				✓	✓	✓								
-6	B.H. #10	0-3'	G	1			✓				✓				✓	✓	✓								
-7	B.H. #10	10'-11'	G	1			✓				✓				✓	✓	✓								
-8	B.H. #10	20'-21'	G	1			✓				✓				✓	✓	✓								
-9	B.H. #12	0-3'	G	1			✓				✓				✓	✓	✓								
-10	B.H. #12	10'-11'	G	1			✓				✓				✓	✓	✓								

Sampler Relinquished:	Date: 12-22-00	Received By:	Phone Result: ☐ Yes ☐ No Add'l Phone #:
	Time: 11:00 Am		Fax Result: ☐ Yes ☐ No Add'l Fax #:
Relinquished By:	Date:	Received By: (Lab Staff)	REMARKS:
	Time:		

Delivered By: (Circle One)

Sampler - UPS - Bus - Other:

Sample Condition: Cool / Intact — ☑ Yes ☑ Yes / ☐ No ☐ No

CHECKED BY: (Initials)

† Cardinal cannot accept verbal changes. Please fax written changes to 505-393-2476.

CHAIN-OF-CUSTODY AND ANALYSIS REQUEST

CARDINAL LABORATORIES, INC.

2111 Beechwood, Abilene, TX 79603 (915) 673-7001 Fax (915) 673-7020

101 East Marland, Hobbs, NM 88240 (505) 393-2326 Fax (505) 393-2476

Company Name:	SESF	**BILL TO**	
Project Manager:	Bob Allen	P.O. #:	
Address:		Company:	
City:	State: Zip:	Attn:	
Phone #:	Fax #:	Address:	
Project #:	Project Owner: Chevron	City:	
Project Name:	CPU Assessment	State: Zip:	
Project Location:	CPU Tract 19	Phone #:	
Sampler Name:	Dee Whitley	Fax #:	

FOR LAB USE ONLY Lab I.D.	Sample I.D.	(G)RAB OR (C)OMP.	# CONTAINERS	MATRIX: GROUNDWATER	WASTEWATER	SOIL	CRUDE OIL	SLUDGE	OTHER:	PRESERV: ACID/BASE:	ICE / COOL	OTHER:	SAMPLING DATE	SAMPLING TIME	ANALYSIS REQUEST: Chlorides	BTEX	TPH 418.1
H5468-11	B.H.#11 0-3'	G	1			✓					✓		12-22-00	11:00 AM	✓	✓	✓
-12	B.H.#11 10-11'	G	1			✓					✓				✓	✓	✓
-13	B.H.#11 20-21'	G	1			✓					✓				✓	✓	✓
-14	B.H.#11 30-31'	G	1			✓					✓				✓	✓	✓
-15	B.H.#11 40-41'	G	1			✓					✓				✓	✓	✓
-16	B.H.#11 45-46'	G	1			✓					✓				✓	✓	✓

Sampler Relinquished:	Date: 12-22-00 Time: 11:00 AM	Received By:	Phone Result: ☐ Yes ☐ No Add'l Phone #:
			Fax Result: ☐ Yes ☐ No Add'l Fax #:
Relinquished By:	Date: Time:	Received By: (Lab Staff)	REMARKS:

Delivered By: (Circle One)	Sample Condition	CHECKED BY:
Sampler - UPS - Bus - Other:	Cool: ☐ Yes ☐ No Intact: ☐ Yes ☐ No	(Initials)

† Cardinal cannot accept verbal changes. Please fax written changes to 505-393-2476.

CARDINAL LABORATORIES

PHONE (915) 673-7001 • 2111 BEECHWOOD • ABILENE, TX 79603
PHONE (505) 393-2326 • 101 E. MARLAND • HOBBS, NM 88240

ANALYTICAL RESULTS FOR
SAFETY & ENVIRONMENTAL SOLUTIONS, INC.
ATTN: DEE WHATLEY
703 E. CLINTON, STE. 103
HOBBS, NM 88240
FAX TO: (505) 393-4388

Receiving Date: 12/12/00
Reporting Date: 12/15/00
Project Owner: CHEVRON
Project Name: NOT GIVEN
Project Location: NOT GIVEN

Sampling Date: 12/12/00
Sample Type: SOIL
Sample Condition: COOL & INTACT
Sample Received By: AH
Analyzed By: BC

LAB NUMBER	SAMPLE ID	BENZENE (mg/Kg)	TOLUENE (mg/Kg)	ETHYL BENZENE (mg/Kg)	TOTAL XYLENES (mg/Kg)
ANALYSIS DATE		12/14/00	12/14/00	12/14/00	12/14/00
H5430-1	B.H.#7 25'	<0.005	<0.005	0.007	0.532
H5430-2	B.H.#7 30'	<0.005	<0.005	<0.005	0.114
H5430-3	B.H.#7 35'	<0.005	0.011	0.017	0.779
Quality Control		0.088	0.092	0.094	0.284
True Value QC		0.100	0.100	0.100	0.300
% Recovery		88.0	91.8	94.4	94.8
Relative Percent Difference		2.3	3.5	1.5	1.7

METHOD: EPA SW-846 8260

Chemist

12/15/00
Date

H5430BNS

CARDINAL LABORATORIES

PHONE (915) 673-7001 • 2111 BEECHWOOD • ABILENE, TX 79603
PHONE (505) 393-2326 • 101 E. MARLAND • HOBBS, NM 88240

ANALYTICAL RESULTS FOR
SAFETY & ENVIRONMENTAL SOLUTIONS, INC.
ATTN: DEE WHATLEY
703 E. CLINTON, STE. 103
HOBBS, NM 88240
FAX TO: (505) 393-4388

Receiving Date: 12/12/00
Reporting Date: 12/14/00
Project Owner: CHEVRON
Project Name: NOT GIVEN
Project Location: NOT GIVEN

Sampling Date: 12/12/00
Sample Type: SOIL
Sample Condition: COOL & INTACT
Sample Received By: AH
Analyzed By: AH/BC

LAB NUMBER	SAMPLE ID	TPH (mg/Kg)	Cl* (mg/Kg)
ANALYSIS DATE:		12/13/00	12/13/00
H5430-1	B.H.#7 25'	17900	99
H5430-2	B.H.#7 30'	16600	149
H5430-3	B.H.#7 35'	14900	99
Quality Control		228	994
True Value QC		240	1000
% Recovery		95.0	99.4
Relative Percent Difference		4.0	4.1

METHODS: TPH-EPA 600/4-79-020 418.1; Cl-Std. Methods 4500-Cl B
*Analyses performed on 1:4 w:v aqueous extracts.

Chemist

12/14/00
Date

H5430A.XLS

CHAIN-OF-CUSTODY AND ANALYSIS REQUEST

CARDINAL LABORATORIES, INC.

2111 Beechwood, Abilene, TX 79603 (915) 673-7001 Fax (915) 673-7020
101 East Marland, Hobbs, NM 88240 (505) 393-2326 Fax (505) 393-2476

Page ____ of ____

Company Name:	SESI	BILL TO	PO #:
Project Manager:	Dee Wlaffer	Company:	
Address:	703 E. Clinton Ste 103	Attn:	
City:	State: Zip:	Address:	
Phone #:		City:	
Fax #:		State:	Zip:
Project #:	Project Owner: Chevron	Phone #:	
Project Name:		Fax #:	
Project Location:			

ANALYSIS REQUEST: BTEX 418.1 TPH Chlorides

FOR LAB USE ONLY LAB I.D.	Sample I.D.	(G)RAB OR (C)OMP.	# CONTAINERS	MATRIX: GROUNDWATER	WASTEWATER	SOIL	OIL	SLUDGE	OTHER:	PRES.: ACID:	ICE / COOL	OTHER:	SAMPLING: DATE	TIME
H5430-1	B.H. #7 25'	6	1			✓					✓		12-12	4:00pm
-2	B.H. #7 30'	6	1			✓					✓		12/12	
-3	B.H. #7 35'	6	1			✓					✓		12/12	5

PLEASE NOTE: Liability and Damages. Cardinal's liability and client's exclusive remedy for any claim arising whether based in contract or tort, shall be limited to the amount paid by the client for the analyses. All claims including those for negligence and any other cause whatsoever shall be deemed waived unless made in writing and received by Cardinal within 30 days after completion of the applicable service. In no event shall Cardinal be liable for incidental or consequential damages, including without limitation, business interruptions, loss of use, or loss of profits incurred by client, its subsidiaries, affiliates or successors arising out of or related to the performance of services hereunder by Cardinal, regardless of whether such claim is based upon any of the above stated reasons or otherwise.

Terms and Conditions: Interest will be charged on all accounts more than 30 days past due at the rate of 24% per annum from the original date of invoice, and all costs of collections, including attorney's fees.

Sampler Relinquished:	Date: 12-12-12	Received By:	Phone Result ☐ Yes ☐ No Additional Fax #:
	Time: 4:00pm		Fax Result: ☐ Yes ☐ No
Relinquished By:	Date:	Received By: (Lab Staff)	REMARKS:
	Time:		
Delivered By: (Circle One) Sampler - UPS - Bus - Other:		Sample Condition: Cool ☑ Yes ☐ No; Intact ☐ Yes ☐ No	CHECKED BY: (Initials)

† Cardinal cannot accept verbal changes. Please fax written changes to 915-673-7020.

CARDINAL LABORATORIES

PHONE (915) 673-7001 • 2111 BEECHWOOD • ABILENE, TX 79603
PHONE (505) 393-2326 • 101 E. MARLAND • HOBBS, NM 88240

ANALYTICAL RESULTS FOR
SAFETY & ENVIRONMENTAL SOLUTIONS, INC.
ATTN: BOB ALLEN
703 E. CLINTON, STE. 103
HOBBS, NM 88240
FAX TO: (505) 393-4388

Receiving Date: 12/11/00
Reporting Date: 12/14/00
Project Owner: CHEVRON
Project Name: CDU ASSESSMENT
Project Location: CDU TRACT 19

Sampling Date: 12/08/00
Sample Type: SOIL
Sample Condition: COOL & INTACT
Sample Received By: BC
Analyzed By: BC

LAB NUMBER	SAMPLE ID	BENZENE (mg/Kg)	TOLUENE (mg/Kg)	ETHYL BENZENE (mg/Kg)	TOTAL XYLENES (mg/Kg)
ANALYSIS DATE		12/13/00	12/13/00	12/13/00	12/13/00
H5416-1	#2 10'-11'	<0.005	<0.005	<0.005	<0.015
H5416-2	#3 10'-11'	<0.005	<0.005	<0.005	<0.015
H5416-3	#4 10'-11'	<0.005	<0.005	<0.005	0.016
H5416-4	#5 10'-11'	<0.005	<0.005	<0.005	0.016
H5416-5	#6 5'-6'	0.889	2.57	13.9	21.5
H5416-6	#6 15'-16'	<0.005	<0.005	<0.005	<0.015
H5416-7	#6 20'-21'	<0.005	<0.005	<0.005	0.020
H5416-8	#7 5'-6'	<0.005	<0.005	<0.005	<0.015
H5416-9	#7 15'-16'	<0.005	0.010	0.161	0.323
H5416-10	#7 20'-21'	0.006	0.013	0.055	<0.015
Quality Control		0.090	0.095	0.093	0.280
True Value QC		0.100	0.100	0.100	0.300
% Recovery		90.0	95.0	93.0	93.2
Relative Percent Difference		14.6	6.3	7.4	5.9

METHOD: EPA SW-846 8260

Chemist

12/14/00
Date

CARDINAL LABORATORIES

PHONE (915) 673-7001 • 2111 BEECHWOOD • ABILENE, TX 79603
PHONE (505) 393-2326 • 101 E. MARLAND • HOBBS, NM 88240

ANALYTICAL RESULTS FOR
SAFETY & ENVIRONMENTAL SOLUTIONS, INC.
ATTN: BOB ALLEN
703 E. CLINTON, STE. 103
HOBBS, NM 88240
FAX TO: (505) 393-4388

Receiving Date: 12/11/00
Reporting Date: 12/12/00
Project Owner: CHEVRON
Project Name: CDU ASSESSMENT
Project Location: CDU TRACT 19

Sampling Date: 12/08/00
Sample Type: SOIL
Sample Condition: COOL & INTACT
Sample Received By: BC
Analyzed By: AH/BC

LAB NUMBER	SAMPLE ID	TPH (mg/Kg)	Cl (mg/Kg)
ANALYSIS DATE:		12/11/00	12/12/00
H5416-1	#2 10'-11'	<10	99
H5416-2	#3 10'-11'	<10	83
H5416-3	#4 10'-11'	31.4	464
H5416-4	#5 10'-11'	<10	265
H5416-5	#6 5'-6'	68100	3064
H5416-6	#6 15'-16'	58.2	3230
H5416-7	#6 20'-21'	<10	3975
H5416-8	#7 5'-6'	41100	66
H5416-9	#7 15'-16'	23200	99
H5416-10	#7 20'-21'	32300	116
Quality Control		252	994
True Value QC		240	1000
% Recovery		105	99.4
Relative Percent Difference		0.8	4.1

METHODS: TPH-EPA 600/4-79-020 418.1; Cl-Std. Methods 4500-Cl B

Burgess J. Cooke
Chemist

12/12/00
Date

H5416A.XLS

CHAIN-OF-CUSTODY AND ANALYSIS REQUEST

CARDINAL LABORATORIES, INC.

2111 Beechwood, Abilene, TX 79603 (915) 673-7001 Fax (915) 673-7020
101 East Marland, Hobbs, NM 88240 (505) 393-2326 Fax (505) 393-2476

Page 1 of 1

Company Name:	SESI
Project Manager:	Allen
Address:	703 Eclinton Suite 101
City:	Hobbs State: NM Zip: 88240
Phone #:	397-0510
Fax #:	393-4388
Project #:	Project Owner: Chevron
Project Name:	CDU Assessment
Project Location:	CDU TRACT 101

BILL TO PO #:

Company:	
Attn:	
Address:	
City:	
State:	Zip:
Phone #:	
Fax #:	

FOR LAB USE ONLY LAB I.D.	Sample I.D.	(G)RAB OR (C)OMP.	# CONTAINERS	MATRIX: GROUNDWATER	WASTEWATER	SOIL	OIL	SLUDGE	OTHER:	PRES.: ACID:	ICE / COOL	OTHER:	SAMPLING: DATE	TIME	BTEX	CHLORIDES	TPH 418.1
H5416-1	#2 10'-11'	G	1			✓					✓		12-8-00	8:45	X	X	X
-2	#3 10'-11'	G	1			✓					✓		12-8-00	9:40	X	X	X
-3	#4 10'-11'	G	1			✓					✓		12-8-00	10:52	X	X	X
-4	#5 10'-11'	G	1			✓					✓		12-8-00	11:50	X	X	X
-5	#6 5'-6'	G	1			✓					✓		12-8-00	12:55	X	X	X
-6	#6 15-16'	G	1			✓					✓		12-8-00	1:45	X	X	X
-7	#6 20'-21'	G	1			✓					✓		12-8-00	4:10	X	X	X
-8	#7 - 5'-6'	G	1			✓					✓		12-8-00	10:22	X	X	X
-9	#7 - 15'-16'	G	1			✓					✓		12-10-00	11:13	X	X	X
-10	#7 - 20'-21'	G	1			✓					✓		12-10-00	11:55	X	X	X

ANALYSIS REQUEST

Sampler Relinquished:	Date: 12-11-00	Received By:	Phone Result ☐ Yes ☐ No Additional Fax #:
	Time: 8:54		Fax Result: ☐ Yes ☐ No
Relinquished By:	Date:	Received By: (Lab Staff)	REMARKS:
	Time:		
Delivered By: (Circle One)		Sample Condition Cool ☒ Yes ☐ No Intact ☒ Yes ☐ No	CHECKED BY: (Initials)
Sampler - UPS - Bus - Other:			

† Cardinal cannot accept verbal changes. Please fax written changes to 915-673-7020.

CARDINAL LABORATORIES

PHONE (915) 673-7001 • 2111 BEECHWOOD • ABILENE, TX 79603
PHONE (505) 393-2326 • 101 E. MARLAND • HOBBS, NM 88240

ANALYTICAL RESULTS FOR
SAFETY & ENVIRONMENTAL SOLUTIONS, INC.
ATTN: DEE WHATLEY
703 E. CLINTON, STE. 103
HOBBS, NM 88240
FAX TO: (505) 393-4388

Receiving Date: 12/07/00
Reporting Date: 12/08/00
Project Owner: CHEVRON
Project Name: CDU ASSESSMENT
Project Location: CDU TRACT 19

Sampling Date: 12/06/00
Sample Type: SOIL
Sample Condition: COOL & INTACT
Sample Received By: GP
Analyzed By: BC/AH

LAB NUMBER	SAMPLE ID	GRO (C_6-C_{10}) (mg/Kg)	DRO (>C_{10}-C_{28}) (mg/Kg)	Cl* (mg/Kg)
ANALYSIS DATE		12/07/00	12/07/00	12/08/00
H5410-1	B.H. 1 0-3'	525	23800	83
H5410-2	B.H. 1 5-7'	279	3990	66
H5410-3	B.H. 1 10-11'	168	6840	149
H5410-4	B.H. 1 15-16'	<50	196	397
H5410-5	B.H. 1 20-21'	<50	618	348
Quality Control		777	798	1035
True Value QC		800	800	1000
% Recovery		97.1	99.7	104
Relative Percent Difference		9.4	4.0	0.9

METHODS: TPH GRO & DRO: EPA SW-846 8015 M; Cl^-: Std. Methods 4500-Cl^-B
*Analyses performed on 1:4 w:v aqueous extracts.

Chemist

12/8/00
Date

H5410A.XLS

CARDINAL LABORATORIES

PHONE (915) 673-7001 • 2111 BEECHWOOD • ABILENE, TX 79603
PHONE (505) 393-2326 • 101 E. MARLAND • HOBBS, NM 88240

ANALYTICAL RESULTS FOR
SAFETY & ENVIRONMENTAL SOLUTIONS, INC.
ATTN: DEE WHATLEY
703 E. CLINTON, STE. 103
HOBBS, NM 88240
FAX TO: (505) 393-4388

Receiving Date: 12/07/00
Reporting Date: 12/08/00
Project Owner: CHEVRON
Project Name: CDU ASSESSMENT
Project Location: CDU TRACT 19

Sampling Date: 12/06/00
Sample Type: SOIL
Sample Condition: COOL & INTACT
Sample Received By: GP
Analyzed By: BC

LAB NUMBER	SAMPLE ID	BENZENE (mg/Kg)	TOLUENE (mg/Kg)	ETHYL BENZENE (mg/Kg)	TOTAL XYLENES (mg/Kg)
ANALYSIS DATE		12/07/00	12/07/00	12/07/00	12/07/00
H5410-1	B.H. 1 0-3'	<0.005	0.010	0.008	0.028
H5410-2	B.H. 1 5-7'	<0.005	0.008	0.055	0.193
H5410-3	B.H. 1 10-11'	<0.005	<0.005	<0.005	<0.015
H5410-4	B.H. 1 15-16'	<0.005	<0.005	<0.005	0.016
H5410-5	B.H. 1 20-21'	<0.005	<0.005	<0.005	0.016
Quality Control		0.093	0.089	0.094	0.282
True Value QC		0.100	0.100	0.100	0.300
% Recovery		92.7	88.9	93.9	94.0
Relative Percent Difference		2.8	1.2	6.3	5.6

METHOD: EPA SW-846 8260

Burgess J. Cooke
Chemist

12/8/00
Date

H5410BXLS

CARDINAL LABORATORIES, INC.

CHAIN-OF-CUSTODY AND ANALYSIS REQUEST

2111 Beechwood, Abilene, TX 79603 (915) 673-7001 Fax (915) 673-7020
101 East Marland, Hobbs, NM 88240 (505) 393-2326 Fax (505) 393-2476

#5410

Page 1 of 1

Company Name:	Safety & Environmental Solutions
Project Manager:	Dee Whatley
Address:	PO Box 1613
City:	Hobbs State: NM Zip: 88241
Phone #:	397-0510
Fax #:	393-4388
Project #:	Project Owner: Chevron
Project Name:	CDU Assessment
Project Location:	CDU Tract 19

BILL TO	PO #:
Company:	
Attn:	
Address:	
City:	
State:	Zip:
Phone #:	
Fax #:	

FOR LAB USE ONLY				MATRIX						PRES.			SAMPLING		ANALYSIS REQUEST															
LAB I.D.	Sample I.D.	(G)RAB OR (C)OMP.	# CONTAINERS	GROUNDWATER	WASTEWATER	SOIL	OIL	SLUDGE	OTHER:	ACID:	ICE / COOL	OTHER:	DATE	TIME	BTEX	Chlorides	TPH - 8015M - GRO -													
H5410-1	B.H.1 0-3'	G	1			✓					✓		12-6-00	4:00 pm	✓	✓	✓													
-2	B.H.1 5-7'	G	1			✓					✓				✓	✓	✓													
-3	B.H.1 10-11'	G	1			✓					✓				✓	✓	✓													
-4	B.H.1 15-16'	G	1			✓					✓				✓	✓	✓													
-5	B.H.1 20-21'	G	1			✓					✓				✓	✓	✓													

PLEASE NOTE: Liability and Damages. Cardinal's liability and client's exclusive remedy for any claim arising whether based in contract or tort, shall be limited to the amount paid by the client for the analyses. All claims including those for negligence and any other cause whatsoever shall be deemed waived unless made in writing and received by Cardinal within 30 days after completion of the applicable service. In no event shall Cardinal be liable for incidental or consequential damages, including without limitation, business interruptions, loss of use, or loss of profits incurred by client, its subsidiaries, affiliates or successors arising out of or related to the performance of services hereunder by Cardinal, regardless of whether such claim is based upon any of the above stated reasons or otherwise.

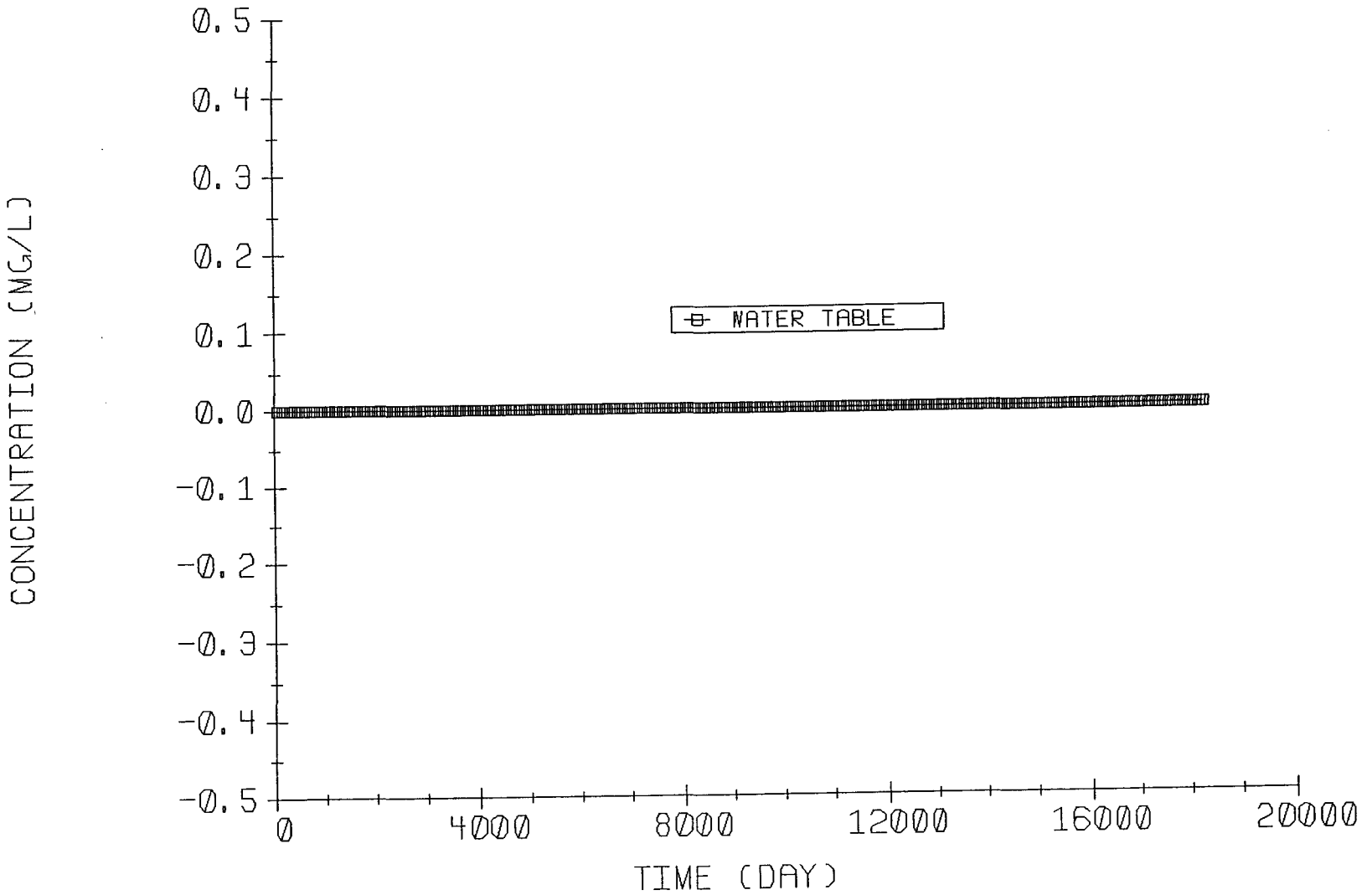
Terms and Conditions: Interest will be charged on all accounts more than 30 days past due at the rate of 24% per annum from the original date of invoice, and all costs of collections, including attorney's fees.

Sampler Relinquished:	Date: 12/6/00	Received By:	Phone Result ☐ Yes ☐ No Additional Fax #:
	Time: 7:30		Fax Result: ☐ Yes ☐ No
Relinquished By:	Date: 12/07/2000	Received By: (Lab Staff)	REMARKS:
	Time: 11:25 A.		
Delivered By: (Circle One)	Sample Condition Cool: ☒ Yes ☐ No Intact: ☒ Yes ☐ No	CHECKED BY: (Initials)	
Sampler - UPS - Bus / Other:			

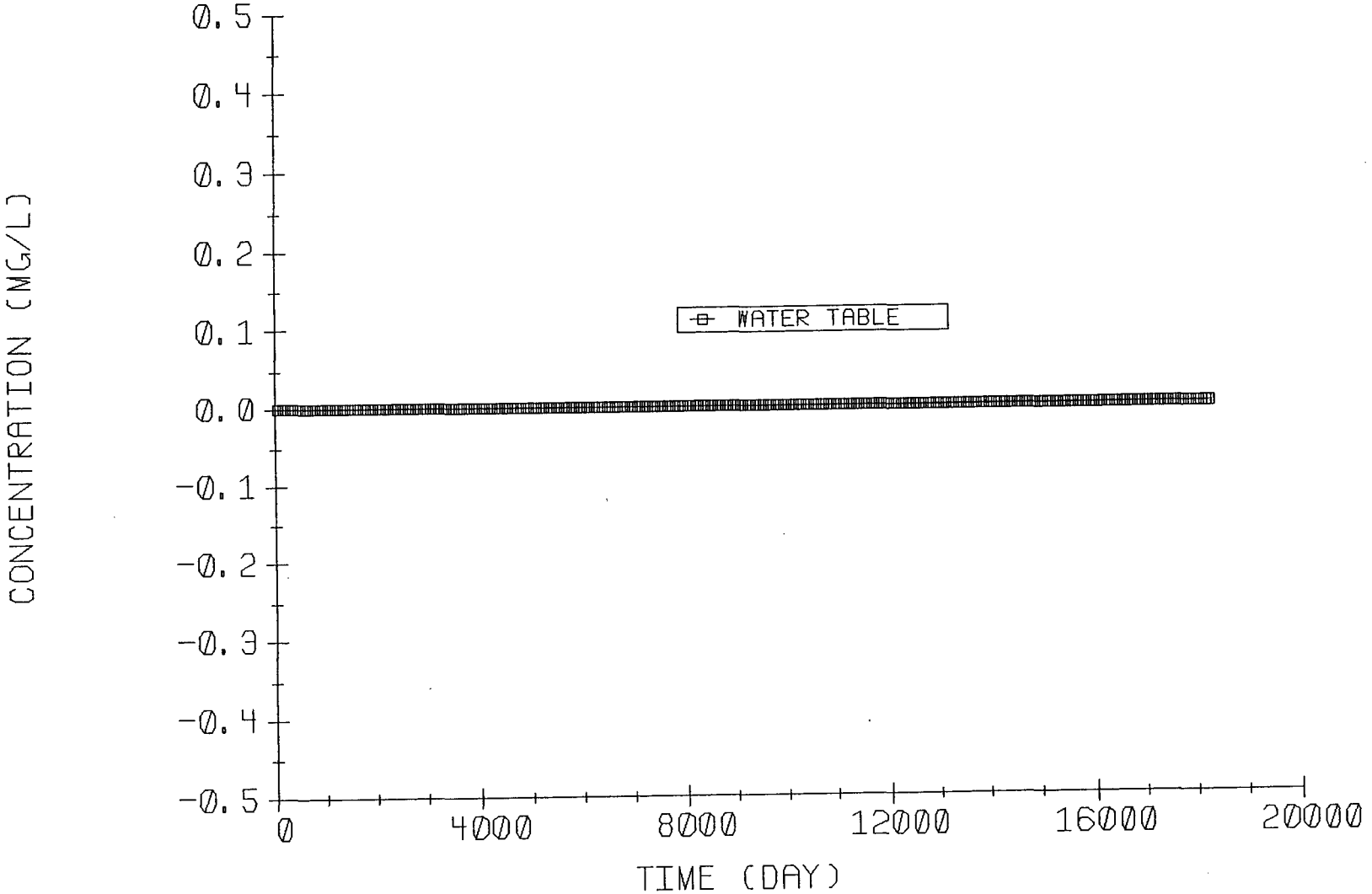
† Cardinal cannot accept verbal changes. Please fax written changes to 915-673-7020.

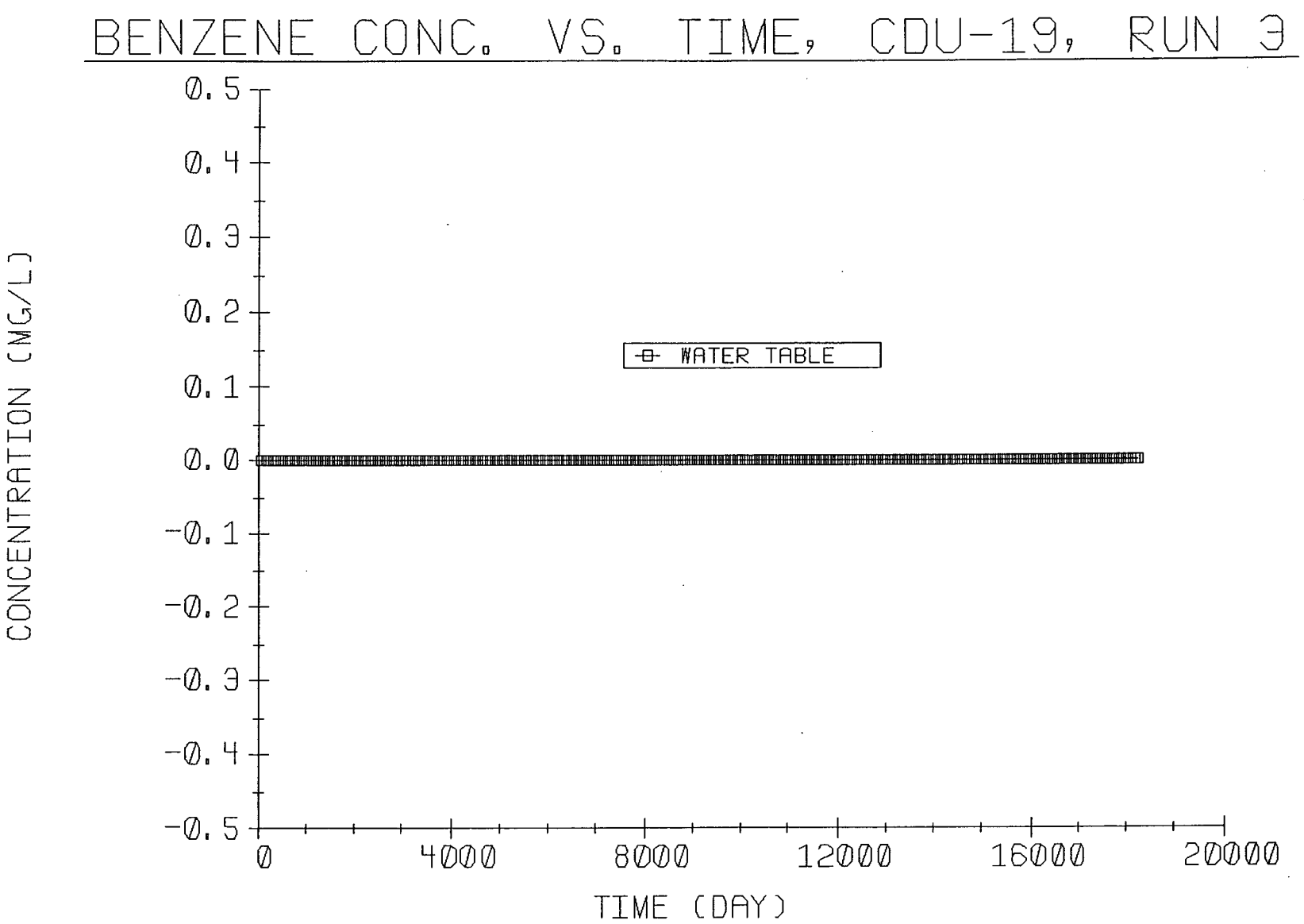
Appendix C
VADSAT Model Simulation Results

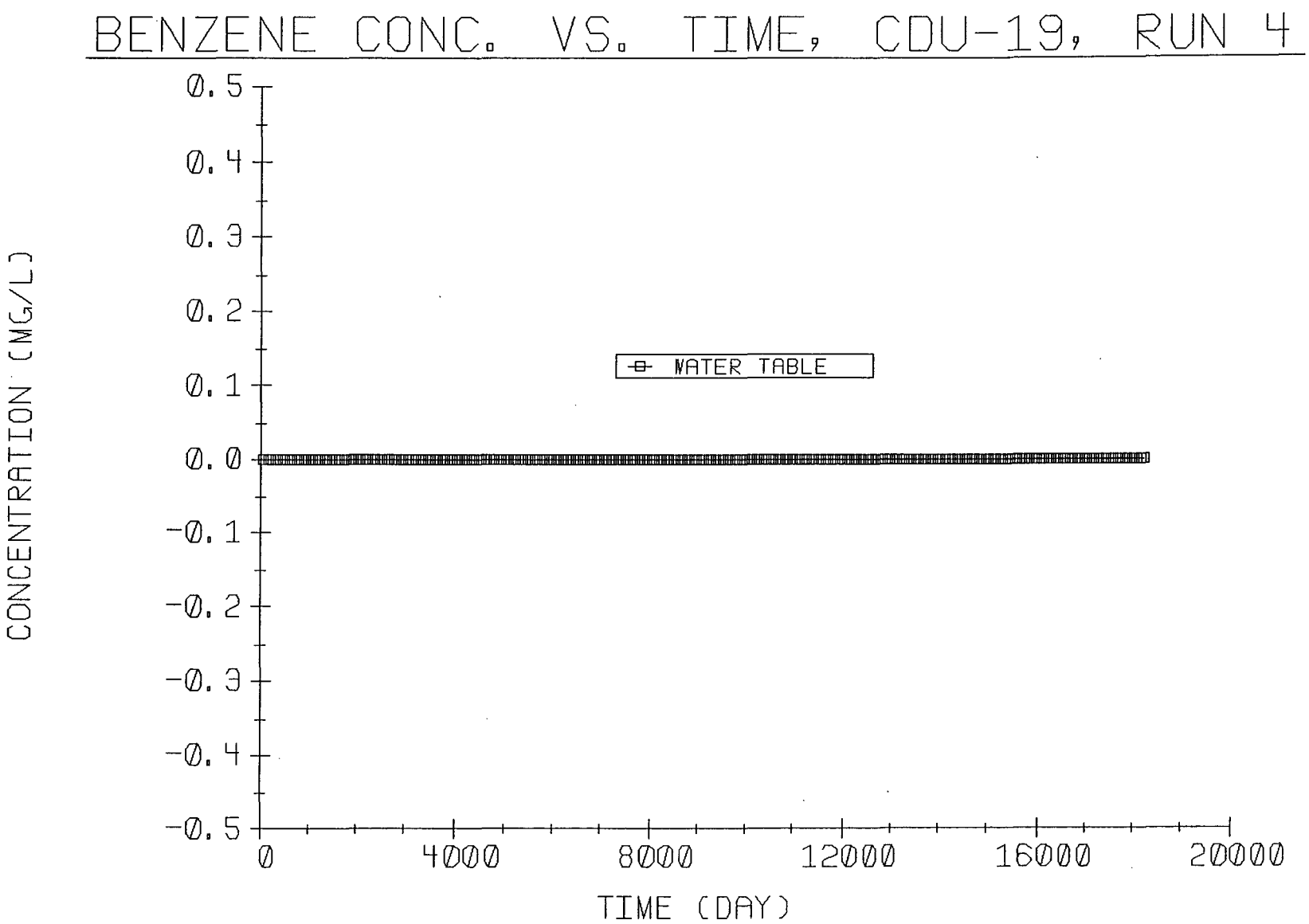
BENZENE CONC. VS. TIME, CDU-19, RUN 1



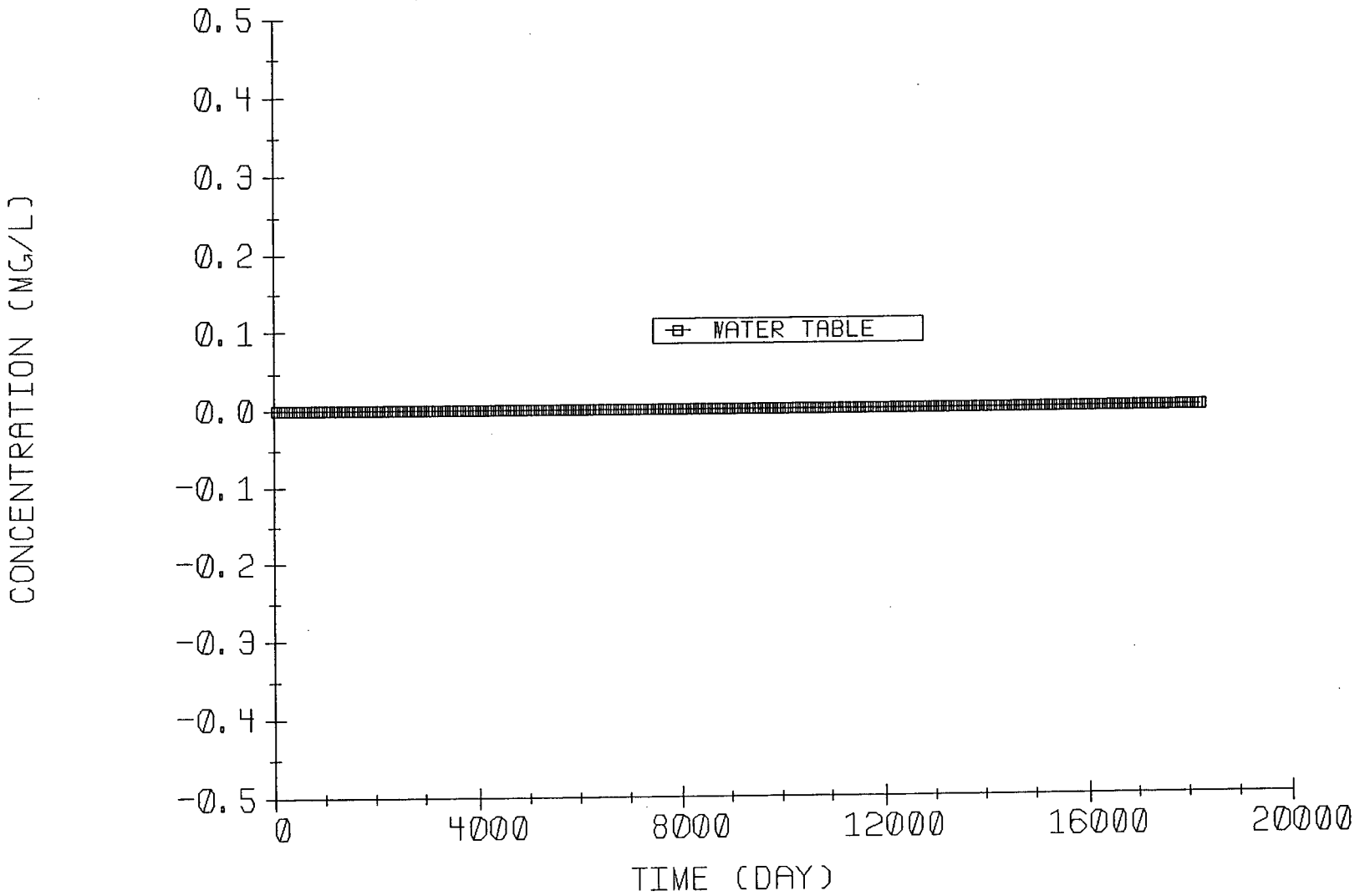
BENZENE CONC. VS. TIME, CDU-19, RUN 2

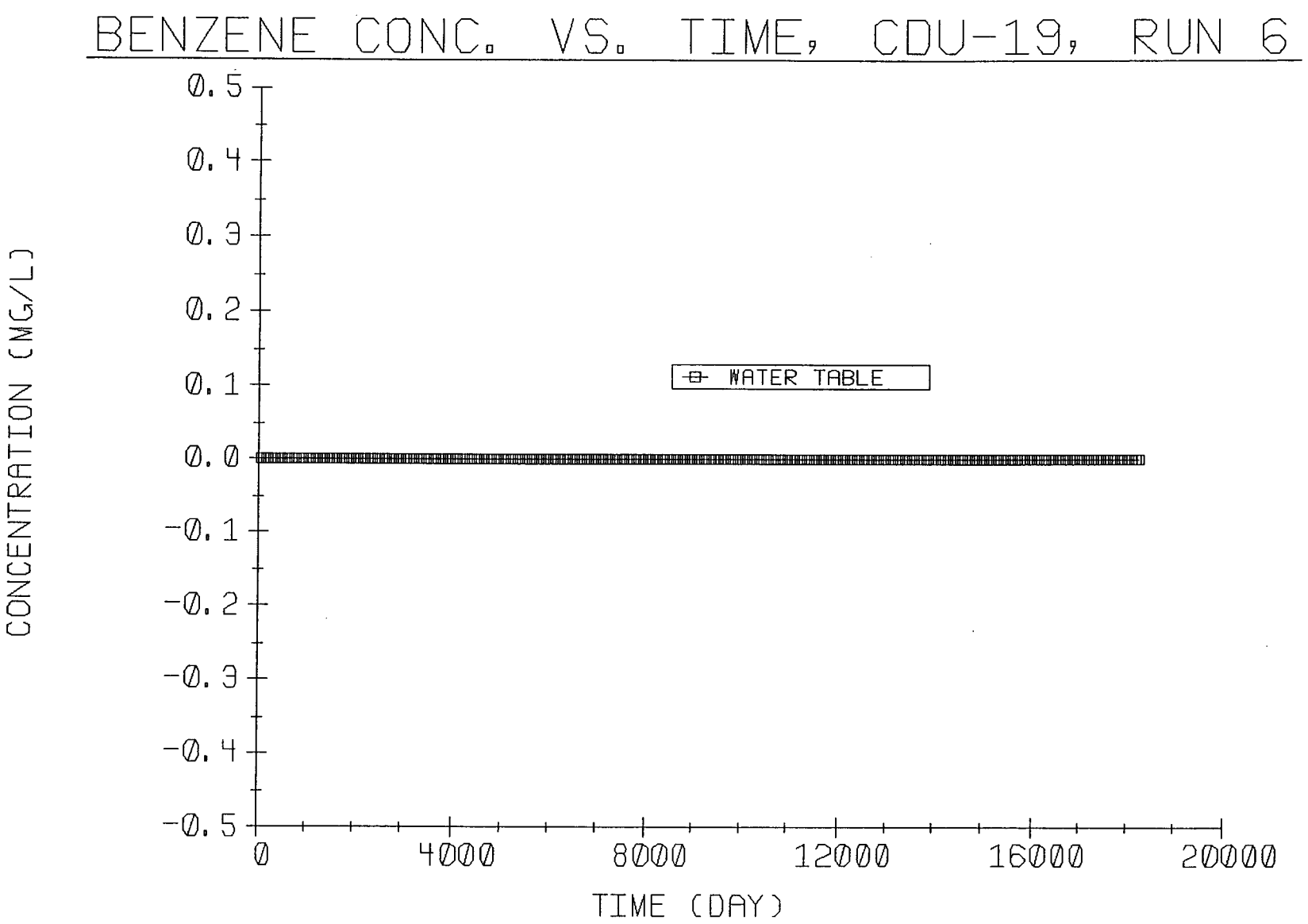



BENZENE CONC. VS. TIME, CDU-19, RUN 3
CONCENTRATION (MG/L)
0.5
0.4
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
-0.4
-0.5
WATER TABLE
0
4000
8000
12000
16000
20000
TIME (DAY)

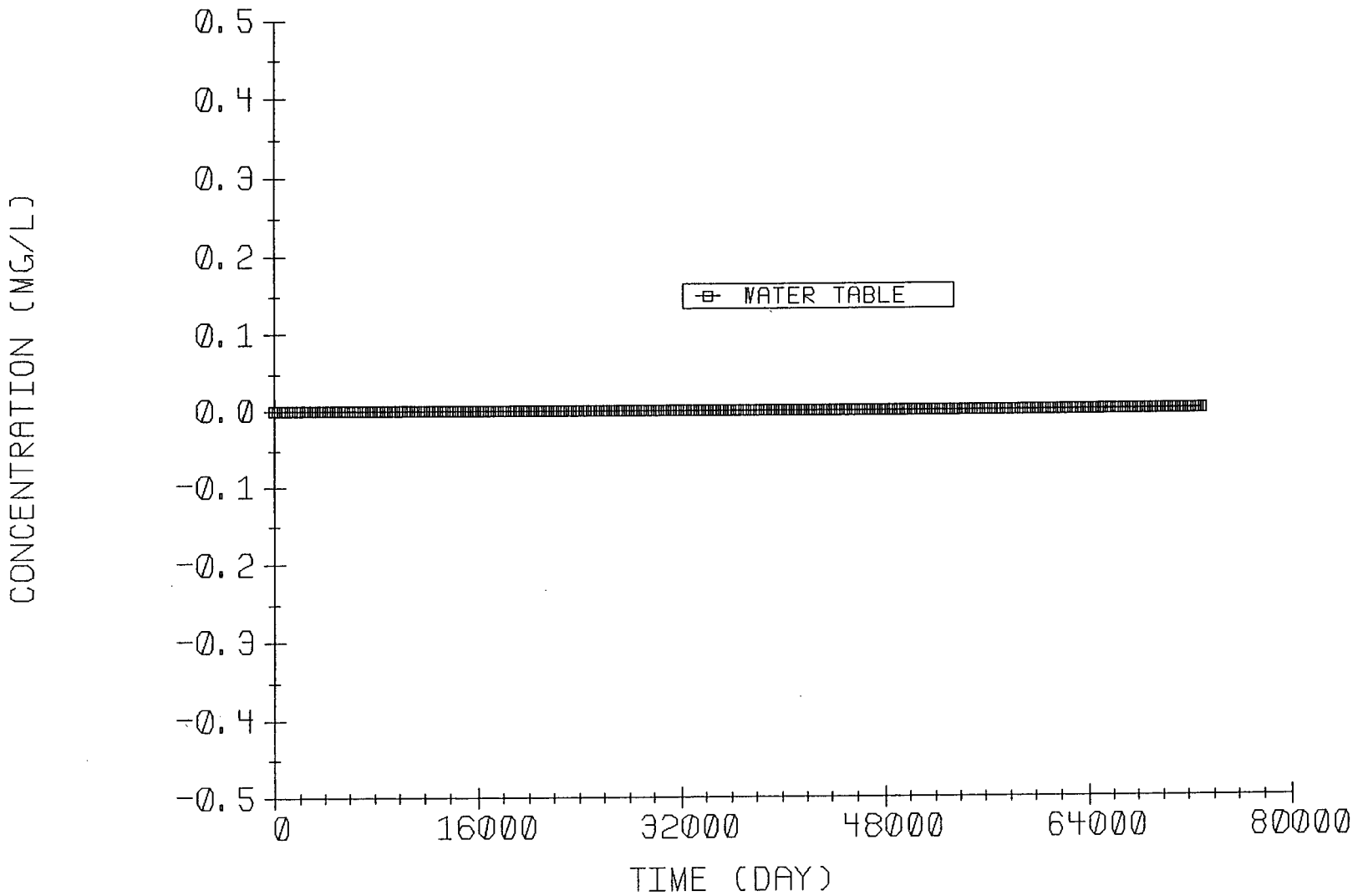

BENZENE CONC. VS. TIME, CDU-19, RUN 4
CONCENTRATION (MG/L)
0.5
0.4
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
-0.4
-0.5
WATER TABLE
0
4000
8000
12000
16000
20000
TIME (DAY)

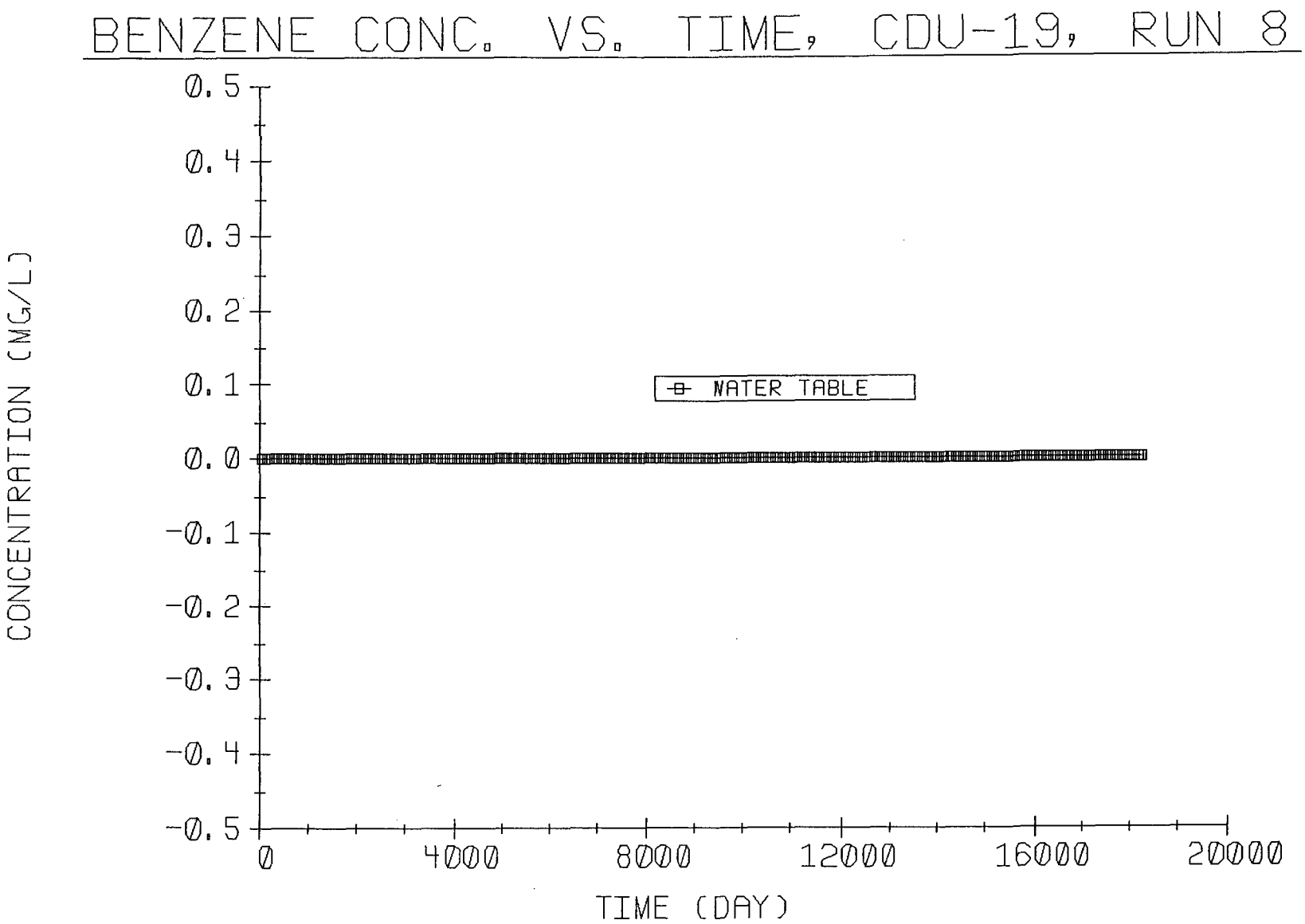
BENZENE CONC. VS. TIME, CDU-19, RUN 5



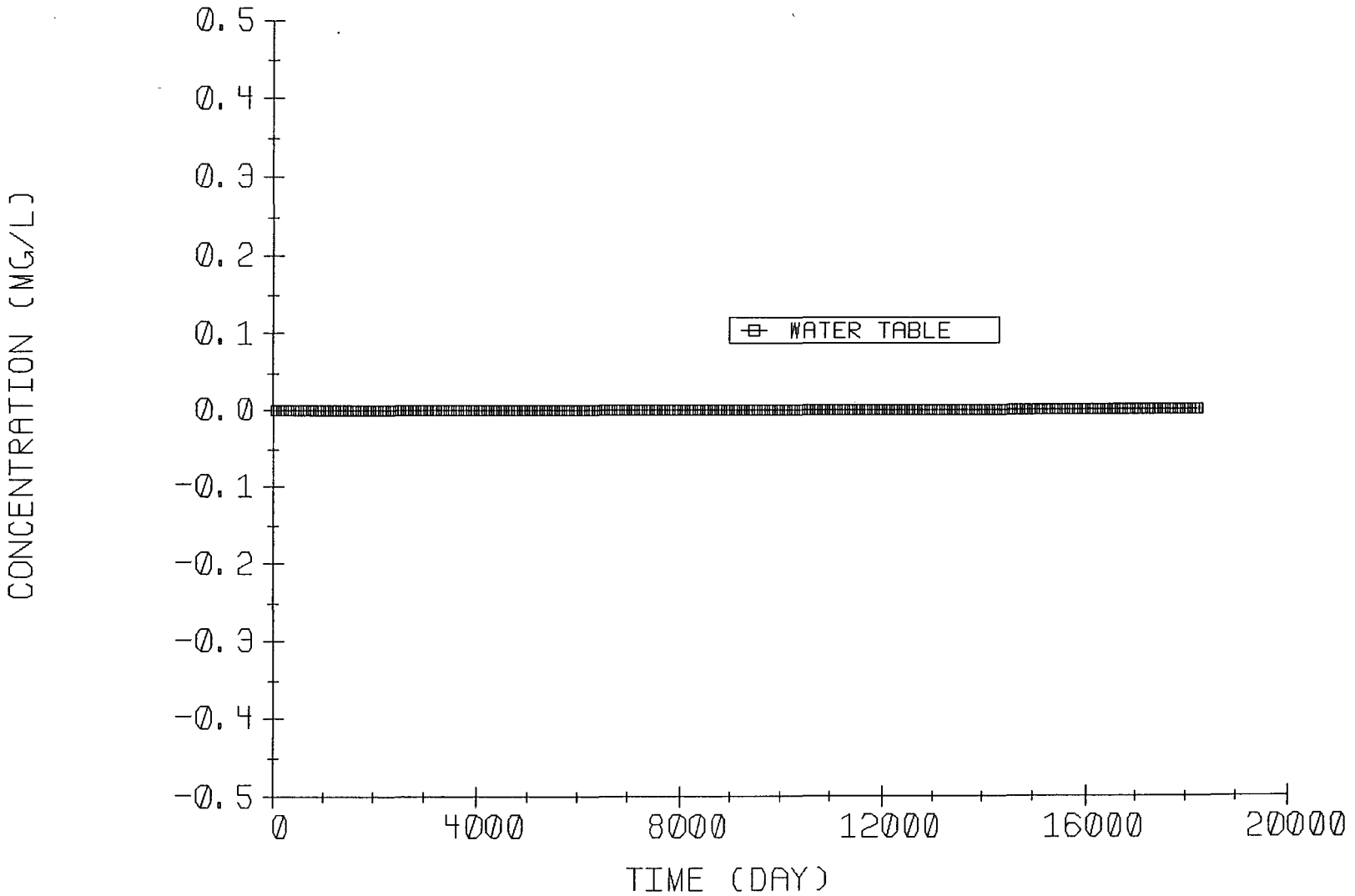

BENZENE CONC. VS. TIME, CDU-19, RUN 6
CONCENTRATION (MG/L)
0.5
0.4
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
-0.4
-0.5
WATER TABLE
0
4000
8000
12000
16000
20000
TIME (DAY)

BENZENE CONC. VS. TIME, CDU-19, RUN 7

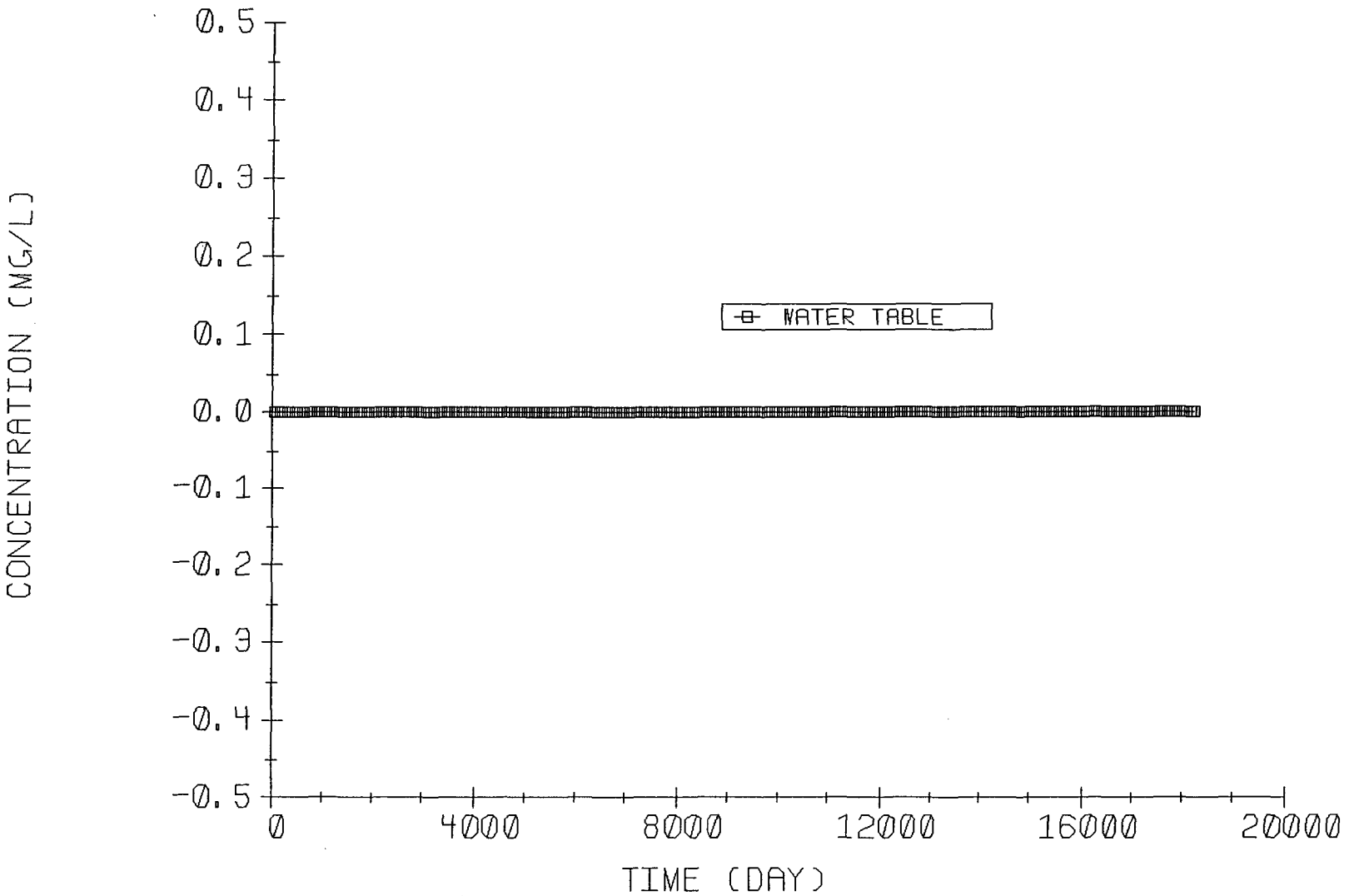



BENZENE CONC. VS. TIME, CDU-19, RUN 8
CONCENTRATION (MG/L)
0.5
0.4
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
-0.4
-0.5
WATER TABLE
0
4000
8000
12000
16000
20000
TIME (DAY)

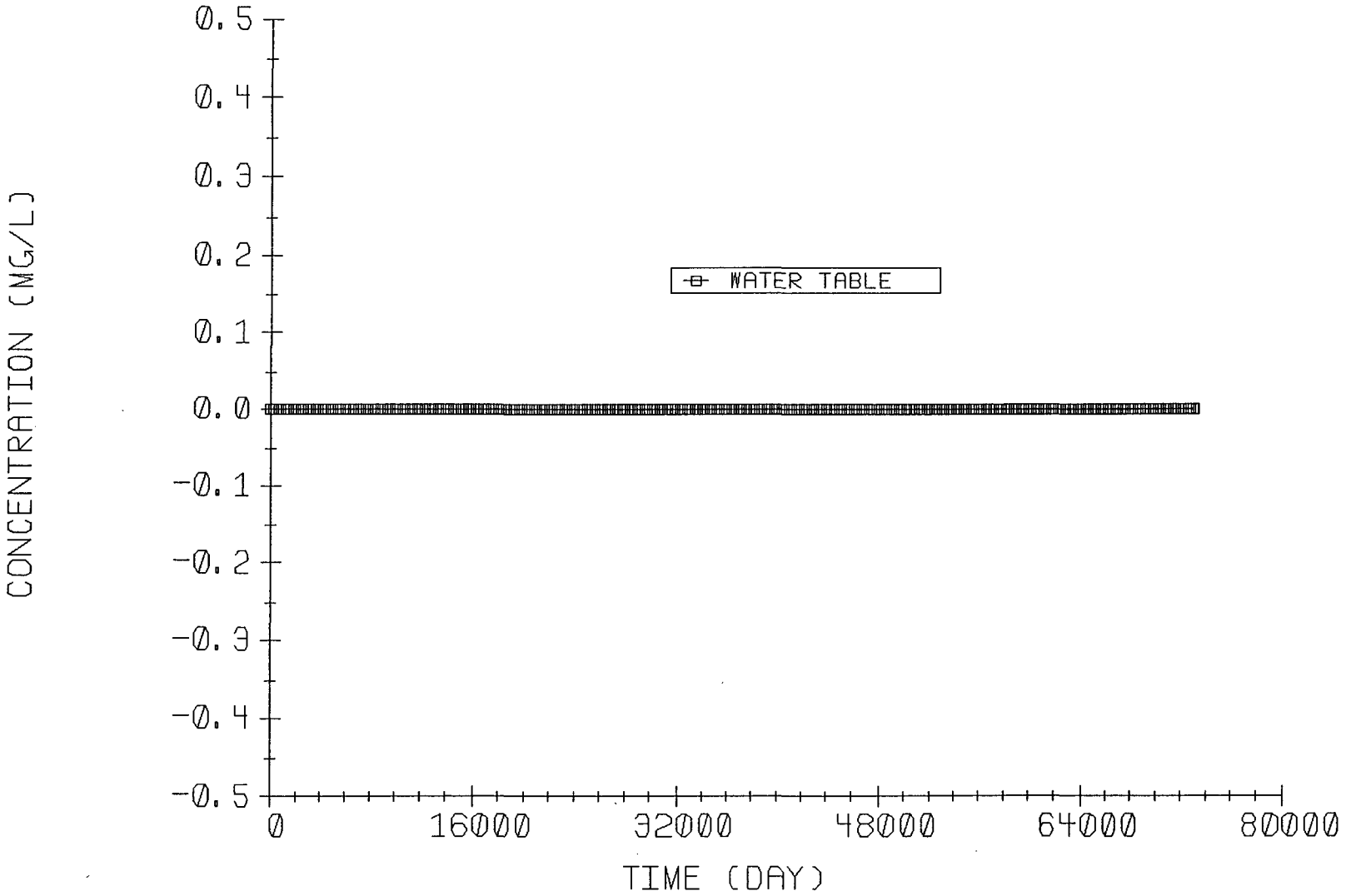
BENZENE CONC. VS. TIME, CDU-19, RUN 9

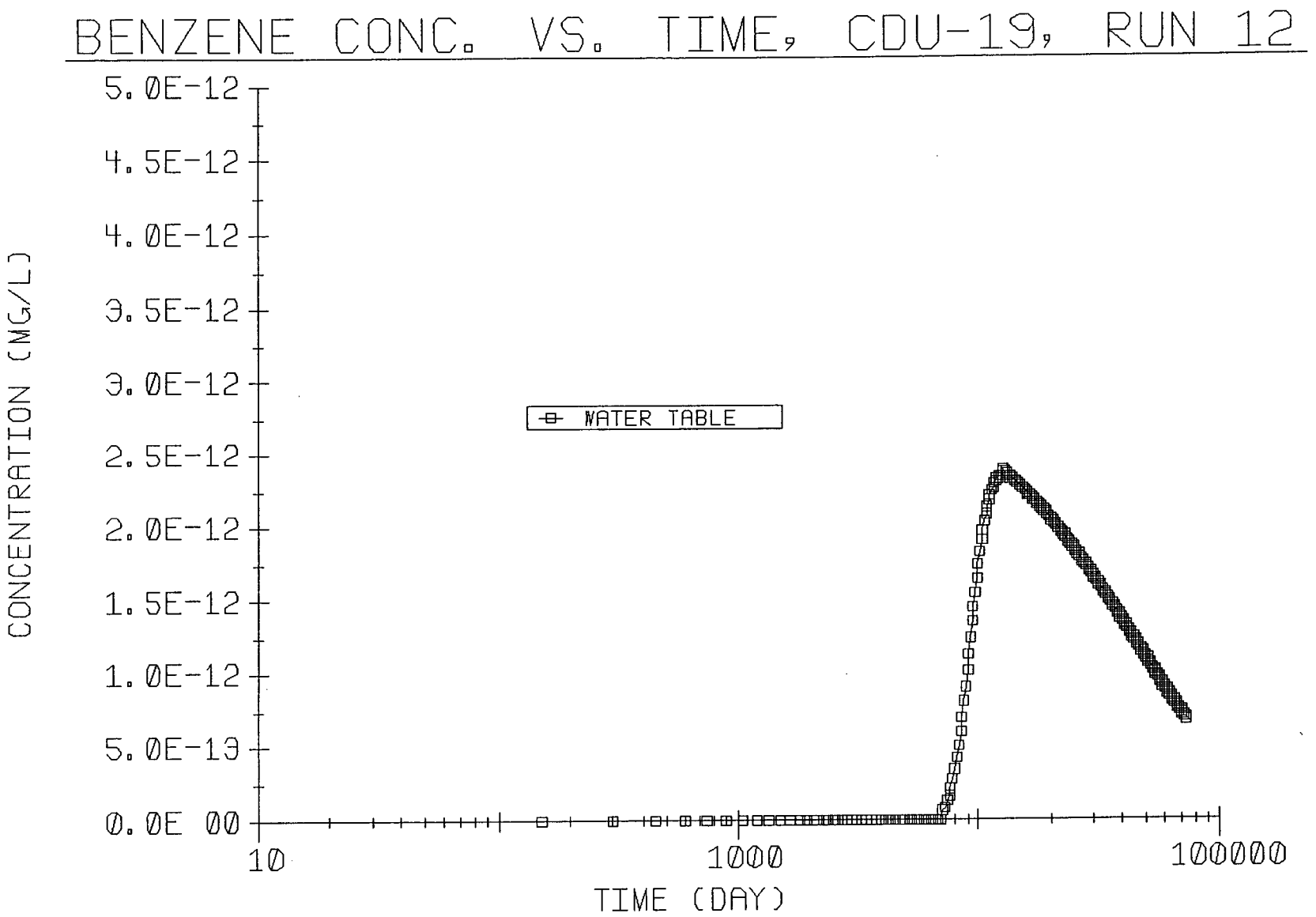


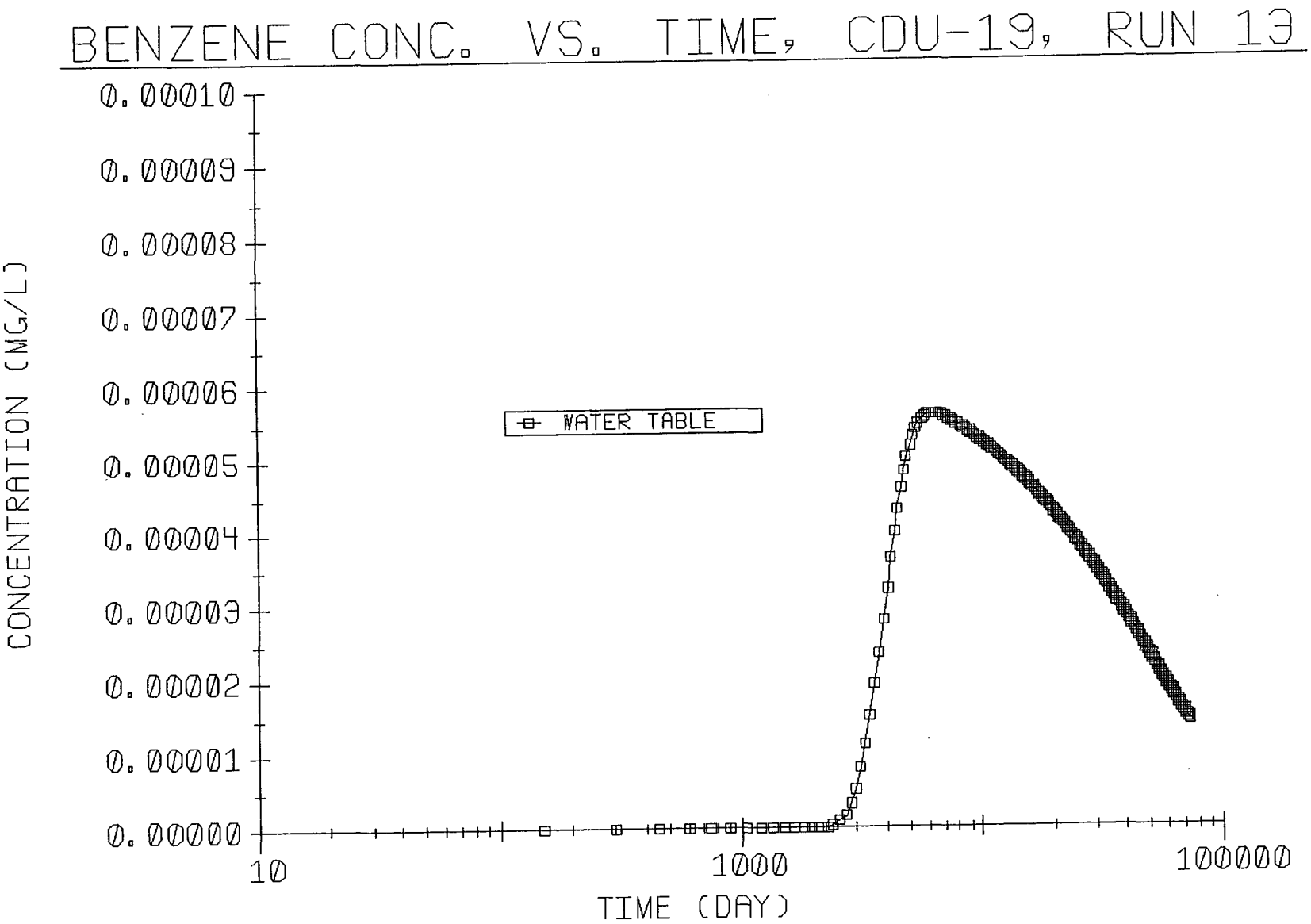
BENZENE CONC. VS. TIME, CDU-19, RUN 10



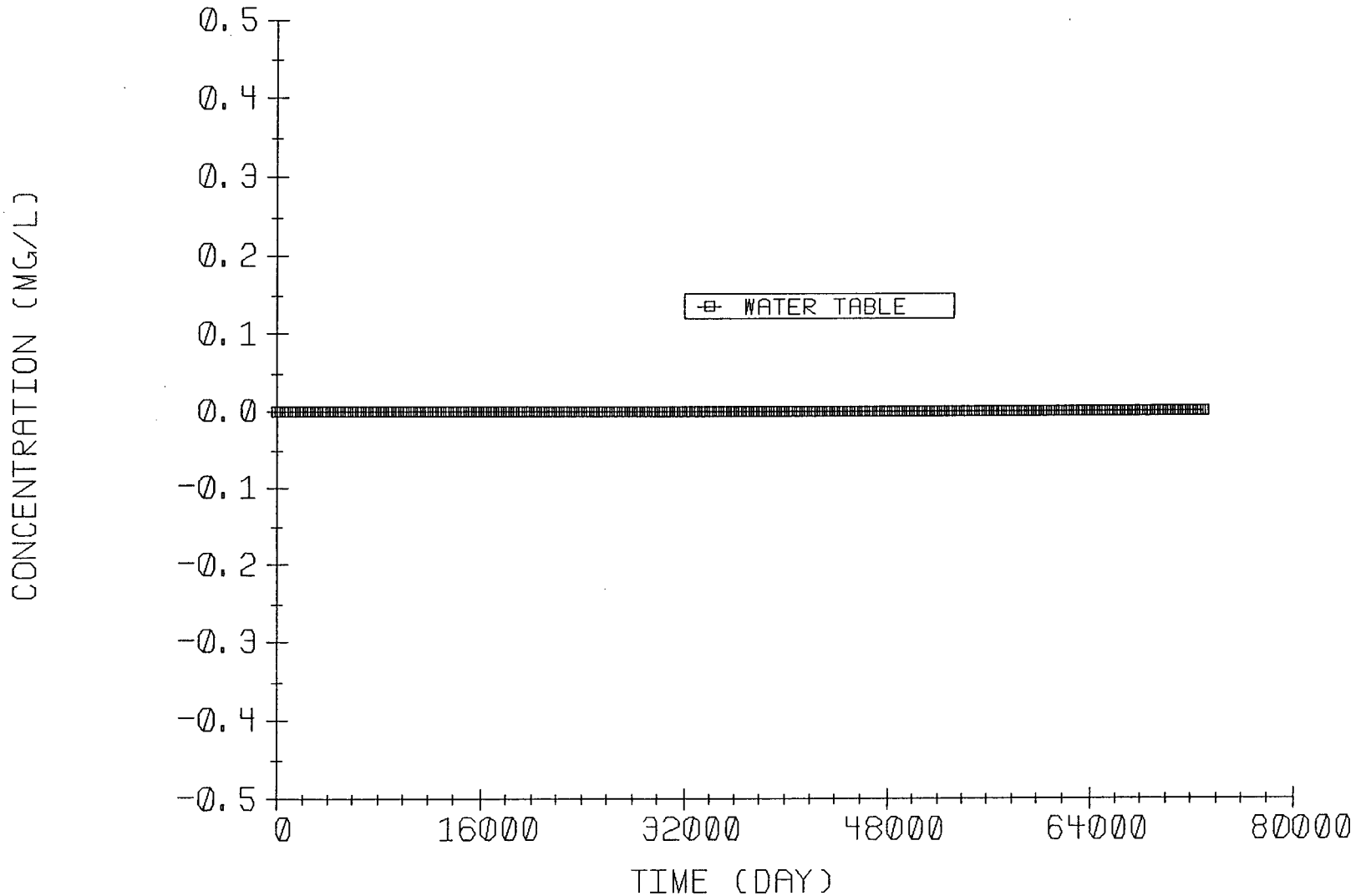
BENZENE CONC. VS. TIME, CDU-19, RUN 11




BENZENE CONC. VS. TIME, CDU-19, RUN 12
5.0E-12
4.5E-12
4.0E-12
3.5E-12
3.0E-12
2.5E-12
2.0E-12
1.5E-12
1.0E-12
5.0E-13
0.0E 00
CONCENTRATION (MG/L)
WATER TABLE
10
1000
100000
TIME (DAY)


BENZENE CONC. VS. TIME, CDU-19, RUN 13
CONCENTRATION (MG/L)
0.00010
0.00009
0.00008
0.00007
0.00006
0.00005
0.00004
0.00003
0.00002
0.00001
0.00000
WATER TABLE
10
1000
100000
TIME (DAY)

BENZENE CONC. VS. TIME, CDU-19, RUN 14



VADSAT Version 3.0

A Monte Carlo Model for Assessing the Effects of Soil Contamination on Groundwater Quality

Developed by:
Environmental Systems and Technologies Inc.
Blacksburg, Virginia
Tel: 703-552-0685, Fax: 703-951-5307

For
The American Petroleum Institute
1995

PROJECT TITLE:Chevron CDU 19, Benzene Run 14(Benz.15mg/Kg,7.1 m/d,5.3"/yr,200yrs,wt=70

SOURCE AND CHEMICAL DATA ****

DEPTHM, MEAN THICKNESS OF WASTE ZONE (m)	=	6.09600
DEPSTD, STD.DEV. OF THICKNESS OF WASTE ZONE	=	0.00000
AREAM, MEAN WASTE ZONE AREA (m^2)	=	956.44000
STDA, STD.DEV. OF WASTE ZONE AREA	=	0.00000
RLWM, MEAN L/W RATIO (-)	=	1.33000
STDRLW, STD.DEV. OF L/W RATIO	=	0.00000
CVRTHM, MEAN VALUE OF COVER THICKNESS (m)	=	0.00000
CVRTHS, STD.DEV. OF COVER THICKNESS	=	0.00000
KOCM, MEAN ORG. CARBON PARTITION COEF (cm^3/g)	=	83.20000
STDKOC, STD.DEV. OF ORG.CARBON PARTITION COEF	=	0.00000
FMOLM, MEAN INIT.VOL.FRAC. OF CONTAMINANT(-)	=	0.00022
FMOLSTD, STD.DEV. OF VOL.FRAC. OF CONTAMINANT	=	0.00000
CMFM, MASS OF CONTAMINANT PER MASS OF WASTE(mg/kg)	=	15.00000
CMFSD, STD.DEV. OF MASS CONTAMINANT PER MASS WASTE	=	0.00000
HCCONM, HYDCARBON MASS FRAC. IN WASTE (mg/kg)	=	68100.00000
HCCONS, STD OF HYDCARBON MASS FRAC. IN WASTE	=	0.00000

CHEMICAL SPECIES	benzene
MOLW, MOLECULAR WT. OF CONTAMINANT (g/mole)	= 78.10000
AVERMW, AVG. MOL. WT. OF OILY WASTE (g/mole)	= 800.00000

RHO, DENSITY OF CONTAMINANT (g/cm^3) = 0.87600

RHOG, AVERAGE DENSITY OF HYDROCARBON (g/cm^3) = 0.88000

SOL, AQUEOUS SOLUB. OF CONTAMINANT (g/m^3) = 1790.00000

HENRYC, HENRY'S CONSTANT (-) = 0.23000

DIFFA, DIFFUSION COEF. IN FREE AIR (m^2/day) = 0.77000

HYDROGEOLOGICAL PROPERTIES

** UNSATURATED ZONE INPUT PARAMETERS **

GAMMAM, MEAN UNSAT ZONE DECAY COEF (1/day) = 0.00210

STDGAM, STD.DEV. OF UNSAT ZONE DECAY COEF = 0.00000

UNFOCM, MEAN UNSAT ZONE ORGANIC CARBON FRACTION (-) = 0.00650

UNFOCS, STD.DEV. OF UNSAT ZONE ORGANIC CARBON FRAC. = 0.00000

FKSW, MEAN SAT. CONDUCTIVITY (m/day) = 7.12800

STDFKS, STD.DEV. OF SAT. CONDUCTIVITY = 0.000

DISTM, MEAN DEPTH TO GROUNDWATER (m) = 21.33500

STDDST, STD.DEV. OF DEPTH TO GROUNDWATER = 0.00000

UNPORM, MEAN VADOSE ZONE POROSITY (-) = 0.40000

SUNPOR, STD.DEV. OF VADOSE ZONE POROSITY = 0.00000

PARNM, MEAN VALUE OF VG PARAMETER N (-) = 2.68000

SDPARN, STD.DEV. OF VG PARAMETER N = 0.00000

RESWCM, MEAN RESIDUAL WATER CONTENT (-) = 0.03000

RESWCS, STD.DEV. OF RESIDUAL WATER CONTENT = 0.00000

ALFINM = 0, UNSAT DISPERSIVITY CALCULATED INTERNALLY

** SATURATED ZONE INPUT PARAMETERS **

LAMBW, MEAN SAT. ZONE DECAY COEFF. (1/day) = 0.00210

SLAMB, STD.DEV. OF SAT. ZONE DECAY COEFF. = 0.00000

PORM, MEAN SAT. ZONE POROSITY (-) = 0.20000

STDPOR, STD.DEV. OF SAT. ZONE POROSITY = 0.00000

FOCM, MEAN SAT. ZONE ORG. CARBON FRAC. (-) = 0.00300

STDFOC, STD.DEV. SAT. ZONE ORG. CARBON FRAC.= 0.00000

ALRLTM, MEAN DISPERS, RATIO LONG/TRANSV. (-) = 3.00000

SALRLT, STD.DEV. OF DISP. RATIO LONG/TRANSV. = 0.00000

ALRTVM, MEAN DISPERS. RATIO TRANSV/VERT. (-) = 100.00000

SALRTV, STD.DEV. OF DISP. RATIO TRANSV/VERT. = 0.00000

CONDS, SAT. HYDRAULIC COND. (m/day) = 1.90000

SCONDS, STD.DEV. OF SAT HYDRAULIC COND. = 0.00000

GRADS, HYDRAULIC GRADIENT (m/m) = 0.00500

SGRADS, STD.DEV. OF HYDRAULIC GRADIENT = 0.00000

HMEAN, MEAN AQUIFER THICKNESS (m) = 12.19200
STDH, STD.DEV. OF AQUIFER THICKNESS = 0.00000

QINM, MEAN INFILTRATION RATE (m/day) = 0.00037
QINSTD, STD.DEV. OF INFILTRATION RATE = 0.00000

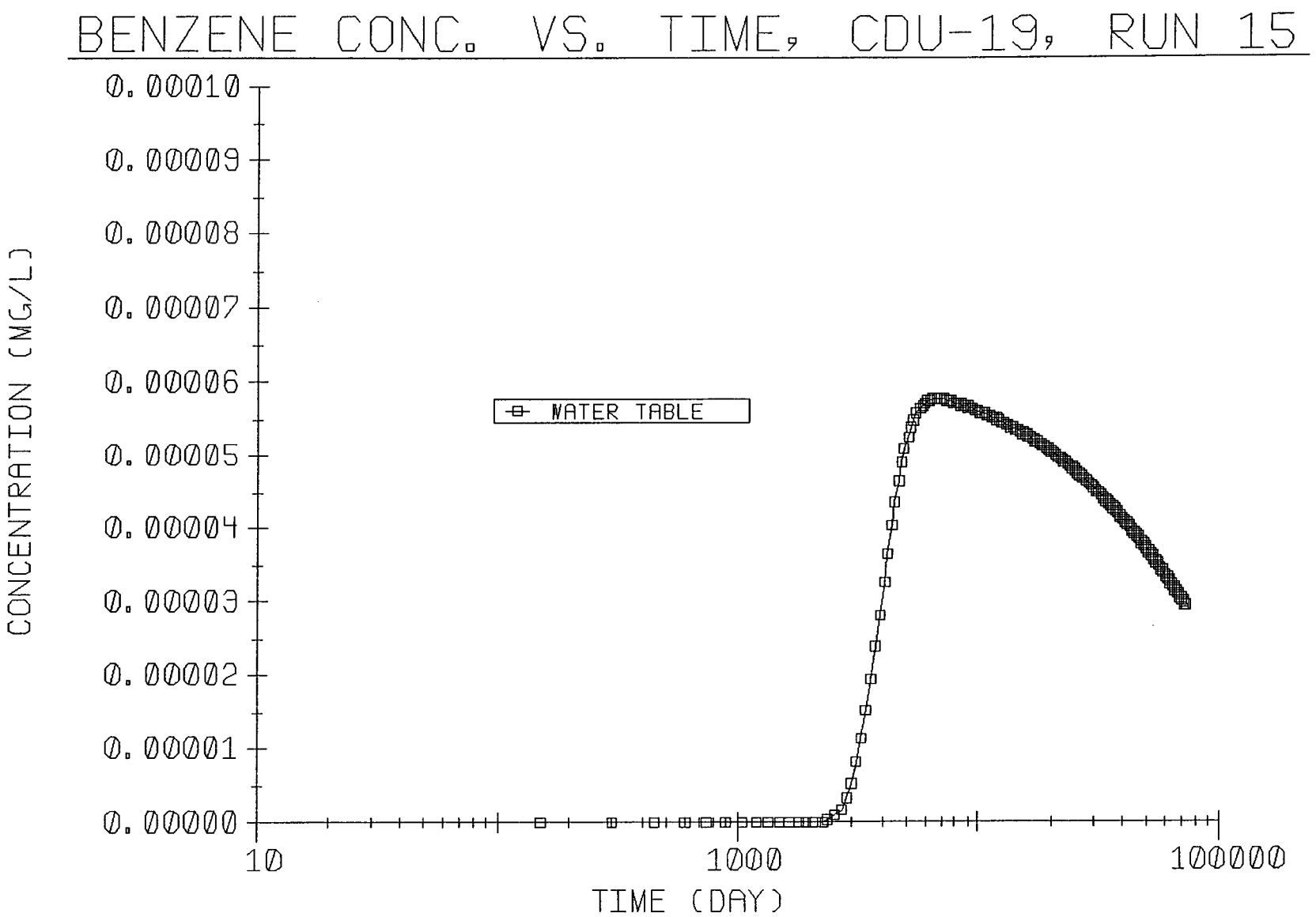
LOCATION OF RECEPTORS:

	X (M)	Y (M)	Z (M)
RECEPTOR(1)	8.2	0.0	0.2

BREAKTHROUGH CURVES

CONCENTRATIONS (MG/L) AT:

TIME (DAYS)	WATER TABLE BELOW THE SOURCE	RECEPTORS (in order)
150.0000	0.0000E+00	0.0000E+00
300.0000	0.0000E+00	0.0000E+00
450.0000	0.0000E+00	0.0000E+00
600.0000	0.0000E+00	0.0000E+00
750.0000	0.0000E+00	0.0000E+00
900.0000	0.0000E+00	0.0000E+00
1050.0000	0.0000E+00	0.0000E+00
1200.0000	0.0000E+00	0.0000E+00
1350.0000	0.0000E+00	0.0000E+00
1500.0000	0.0000E+00	0.0000E+00
1650.0000	0.0000E+00	0.0000E+00
1800.0000	0.0000E+00	0.0000E+00
1950.0000	0.0000E+00	0.0000E+00
2100.0000	0.0000E+00	0.0000E+00
2250.0000	0.0000E+00	0.0000E+00
2400.0000	0.0000E+00	0.0000E+00
2550.0000	0.0000E+00	0.0000E+00
2700.0000	0.0000E+00	0.0000E+00
2850.0000	0.0000E+00	0.0000E+00
3000.0000	0.0000E+00	0.0000E+00
3150.0000	0.0000E+00	0.0000E+00
3300.0000	0.0000E+00	0.0000E+00
3450.0000	0.0000E+00	0.0000E+00
3600.0000	0.0000E+00	0.0000E+00
3750.0000	0.0000E+00	0.0000E+00
3900.0000	0.0000E+00	0.0000E+00
4050.0000	0.0000E+00	0.0000E+00
4200.0000	0.0000E+00	0.0000E+00
4350.0000	0.0000E+00	0.0000E+00
4500.0000	0.0000E+00	0.0000E+00
4650.0000	0.0000E+00	0.0000E+00
4800.0000	0.0000E+00	0.0000E+00
4950.0000	0.0000E+00	0.0000E+00
5100.0000	0.0000E+00	0.0000E+00
5250.0000	0.0000E+00	0.0000E+00
5400.0000	0.0000E+00	0.0000E+00


BENZENE CONC. VS. TIME, CDU-19, RUN 15
CONCENTRATION (MG/L)
0.00010
0.00009
0.00008
0.00007
0.00006
0.00005
0.00004
0.00003
0.00002
0.00001
0.00000
WATER TABLE
10
1000
100000
TIME (DAY)

VADSAT Version 3.0

A Monte Carlo Model for Assessing the Effects of Soil Contamination on Groundwater Quality

Developed by:
Environmental Systems and Technologies Inc.
Blacksburg, Virginia
Tel: 703-552-0685, Fax: 703-951-5307

For
The American Petroleum Institute
1995

PROJECT TITLE:Chevron CDU 19, Benzene Run 15(Benz.15mg/Kg,7.1 m/d,5.3"/yr,200yrs,wt=10

SOURCE AND CHEMICAL DATA ****

DEPTHM, MEAN THICKNESS OF WASTE ZONE (m)	=	6.09600
DEPSTD, STD.DEV. OF THICKNESS OF WASTE ZONE	=	0.00000
AREAM, MEAN WASTE ZONE AREA (m^2)	=	956.44000
STDA, STD.DEV. OF WASTE ZONE AREA	=	0.00000
RLWM, MEAN L/W RATIO (-)	=	1.33000
STDRLW, STD.DEV. OF L/W RATIO	=	0.00000
CVRTHM, MEAN VALUE OF COVER THICKNESS (m)	=	0.00000
CVRTHS, STD.DEV. OF COVER THICKNESS	=	0.00000
KOCM, MEAN ORG. CARBON PARTITION COEF (cm^3/g)	=	83.20000
STDKOC, STD.DEV. OF ORG.CARBON PARTITION COEF	=	0.00000
FMOLM, MEAN INIT.VOL.FRAC. OF CONTAMINANT(-)	=	0.00022
FMOLSTD, STD.DEV. OF VOL.FRAC. OF CONTAMINANT	=	0.00000
CMFM, MASS OF CONTAMINANT PER MASS OF WASTE(mg/kg)	=	15.00000
CMFSD, STD.DEV. OF MASS CONTAMINANT PER MASS WASTE	=	0.00000
HCCONM, HYDCARBON MASS FRAC. IN WASTE (mg/kg)	=	68100.00000
HCCONS, STD OF HYDCARBON MASS FRAC. IN WASTE	=	0.00000

CHEMICAL SPECIES	benzene
MOLW, MOLECULAR WT. OF CONTAMINANT (g/mole)	= 78.10000
AVERMW, AVG. MOL. WT. OF OILY WASTE (g/mole)	= 800.00000

RHO, DENSITY OF CONTAMINANT (g/cm^3) = 0.87600

RHOG, AVERAGE DENSITY OF HYDROCARBON (g/cm^3) = 0.88000

SOL, AQUEOUS SOLUB. OF CONTAMINANT (g/m^3) = 1790.00000

HENRYC, HENRY'S CONSTANT (-) = 0.23000

DIFFA, DIFFUSION COEF. IN FREE AIR (m^2/day) = 0.77000

HYDROGEOLOGICAL PROPERTIES

** UNSATURATED ZONE INPUT PARAMETERS **

GAMMAM, MEAN UNSAT ZONE DECAY COEF (1/day) = 0.00210

STDGAM, STD.DEV. OF UNSAT ZONE DECAY COEF = 0.00000

UNFOCM, MEAN UNSAT ZONE ORGANIC CARBON FRACTION (-) = 0.00650

UNFOCS, STD.DEV. OF UNSAT ZONE ORGANIC CARBON FRAC. = 0.00000

FKSW, MEAN SAT. CONDUCTIVITY (m/day) = 7.12800

STDFKS, STD.DEV. OF SAT. CONDUCTIVITY = 0.000

DISTM, MEAN DEPTH TO GROUNDWATER (m) = 3.04790

STDDST, STD.DEV. OF DEPTH TO GROUNDWATER = 0.00000

UNPORM, MEAN VADOSE ZONE POROSITY (-) = 0.40000

SUNPOR, STD.DEV. OF VADOSE ZONE POROSITY = 0.00000

PARNM, MEAN VALUE OF VG PARAMETER N (-) = 2.68000

SDPARN, STD.DEV. OF VG PARAMETER N = 0.00000

RESWCM, MEAN RESIDUAL WATER CONTENT (-) = 0.03000

RESWCS, STD.DEV. OF RESIDUAL WATER CONTENT = 0.00000

ALFINM = 0, UNSAT DISPERSIVITY CALCULATED INTERNALLY

** SATURATED ZONE INPUT PARAMETERS **

LAMBW, MEAN SAT. ZONE DECAY COEFF. (1/day) = 0.00210

SLAMB, STD.DEV. OF SAT. ZONE DECAY COEFF. = 0.00000

PORM, MEAN SAT. ZONE POROSITY (-) = 0.20000

STDPOR, STD.DEV. OF SAT. ZONE POROSITY = 0.00000

FOCM, MEAN SAT. ZONE ORG. CARBON FRAC. (-) = 0.00300

STDFOC, STD.DEV. SAT. ZONE ORG. CARBON FRAC.= 0.00000

ALRLTM, MEAN DISPERS, RATIO LONG/TRANSV. (-) = 3.00000

SALRLT, STD.DEV. OF DISP. RATIO LONG/TRANSV. = 0.00000

ALRTVM, MEAN DISPERS. RATIO TRANSV/VERT. (-) = 100.00000

SALRTV, STD.DEV. OF DISP. RATIO TRANSV/VERT. = 0.00000

CONDS, SAT. HYDRAULIC COND. (m/day) = 1.90000

SCONDS, STD.DEV. OF SAT HYDRAULIC COND. = 0.00000

GRADS, HYDRAULIC GRADIENT (m/m) = 0.00500

SGRADS, STD.DEV. OF HYDRAULIC GRADIENT = 0.00000

HMEAN, MEAN AQUIFER THICKNESS (m) = 12.19200
STDH, STD.DEV. OF AQUIFER THICKNESS = 0.00000

QINM, MEAN INFILTRATION RATE (m/day) = 0.00037
QINSTD, STD.DEV. OF INFILTRATION RATE = 0.00000

LOCATION OF RECEPTORS:

	X (M)	Y (M)	Z (M)
RECEPTOR(1)	8.2	0.0	0.3
RECEPTOR(2)	8.2	0.0	3.4

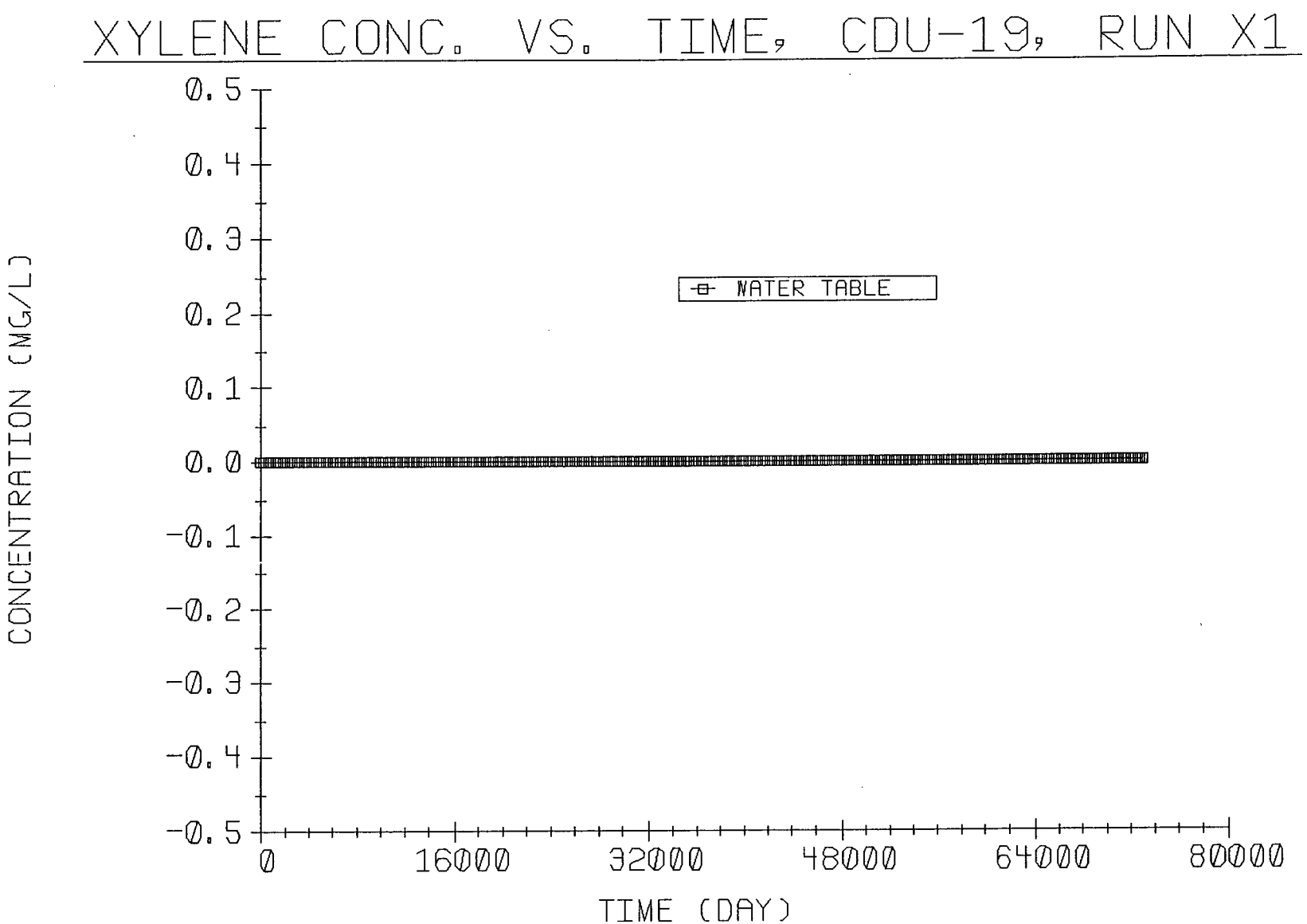
BREAKTHROUGH CURVES

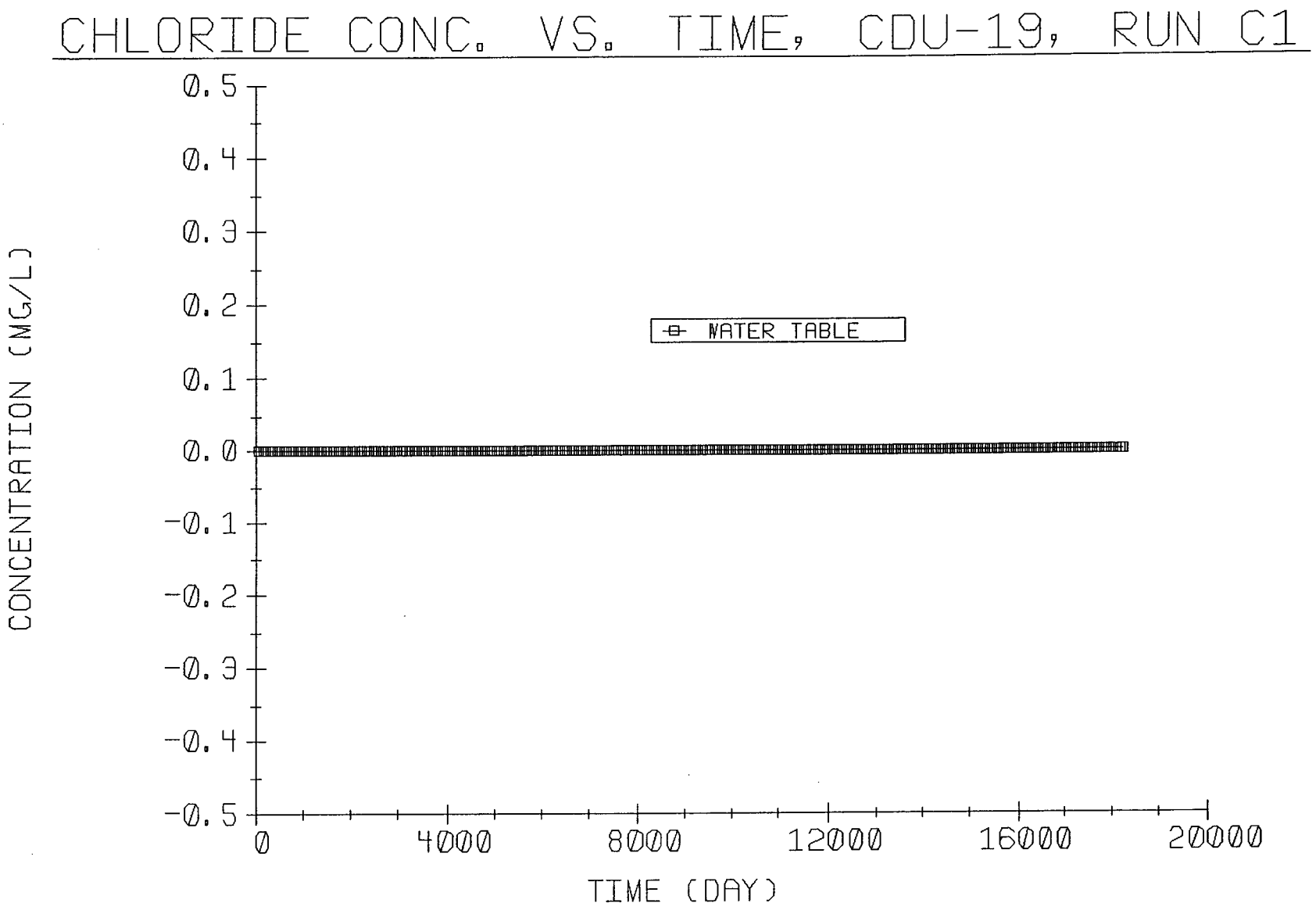
CONCENTRATIONS (MG/L) AT:

TIME (DAYS)	WATER TABLE BELOW THE SOURCE	RECEPTORS (in order)	
150.0000	0.0000E+00	0.0000E+00	0.0000E+00
300.0000	0.0000E+00	0.0000E+00	0.0000E+00
450.0000	0.0000E+00	0.0000E+00	0.0000E+00
600.0000	0.0000E+00	0.0000E+00	0.0000E+00
750.0000	0.0000E+00	0.0000E+00	0.0000E+00
900.0000	0.0000E+00	0.0000E+00	0.0000E+00
1050.0000	0.0000E+00	0.0000E+00	0.0000E+00
1200.0000	0.0000E+00	0.0000E+00	0.0000E+00
1350.0000	0.1328E-11	0.6551E-16	0.2430E-26
1500.0000	0.3006E-10	0.5194E-14	0.7222E-22
1650.0000	0.3610E-09	0.1233E-12	0.4757E-19
1800.0000	0.2698E-08	0.1625E-11	0.2822E-17
1950.0000	0.1400E-07	0.1375E-10	0.6904E-16
2100.0000	0.5455E-07	0.8206E-10	0.1000E-14
2250.0000	0.1693E-06	0.3708E-09	0.9709E-14
2400.0000	0.4371E-06	0.1336E-08	0.6816E-13
2550.0000	0.9701E-06	0.3994E-08	0.3667E-12
2700.0000	0.1900E-05	0.1023E-07	0.1580E-11
2850.0000	0.3353E-05	0.2300E-07	0.5648E-11
3000.0000	0.5420E-05	0.4631E-07	0.1723E-10
3150.0000	0.8134E-05	0.8487E-07	0.4587E-10
3300.0000	0.1146E-04	0.1435E-06	0.1086E-09
3450.0000	0.1530E-04	0.2261E-06	0.2324E-09
3600.0000	0.1952E-04	0.3355E-06	0.4549E-09
3750.0000	0.2393E-04	0.4723E-06	0.8238E-09
3900.0000	0.2837E-04	0.6350E-06	0.1393E-08
4050.0000	0.3268E-04	0.8200E-06	0.2217E-08
4200.0000	0.3673E-04	0.1022E-05	0.3343E-08
4350.0000	0.4044E-04	0.1236E-05	0.4806E-08
4500.0000	0.4373E-04	0.1454E-05	0.6621E-08
4650.0000	0.4660E-04	0.1670E-05	0.8780E-08
4800.0000	0.4904E-04	0.1880E-05	0.1125E-07
4950.0000	0.5108E-04	0.2077E-05	0.1399E-07
5100.0000	0.5274E-04	0.2259E-05	0.1693E-07
5250.0000	0.5408E-04	0.2424E-05	0.1999E-07

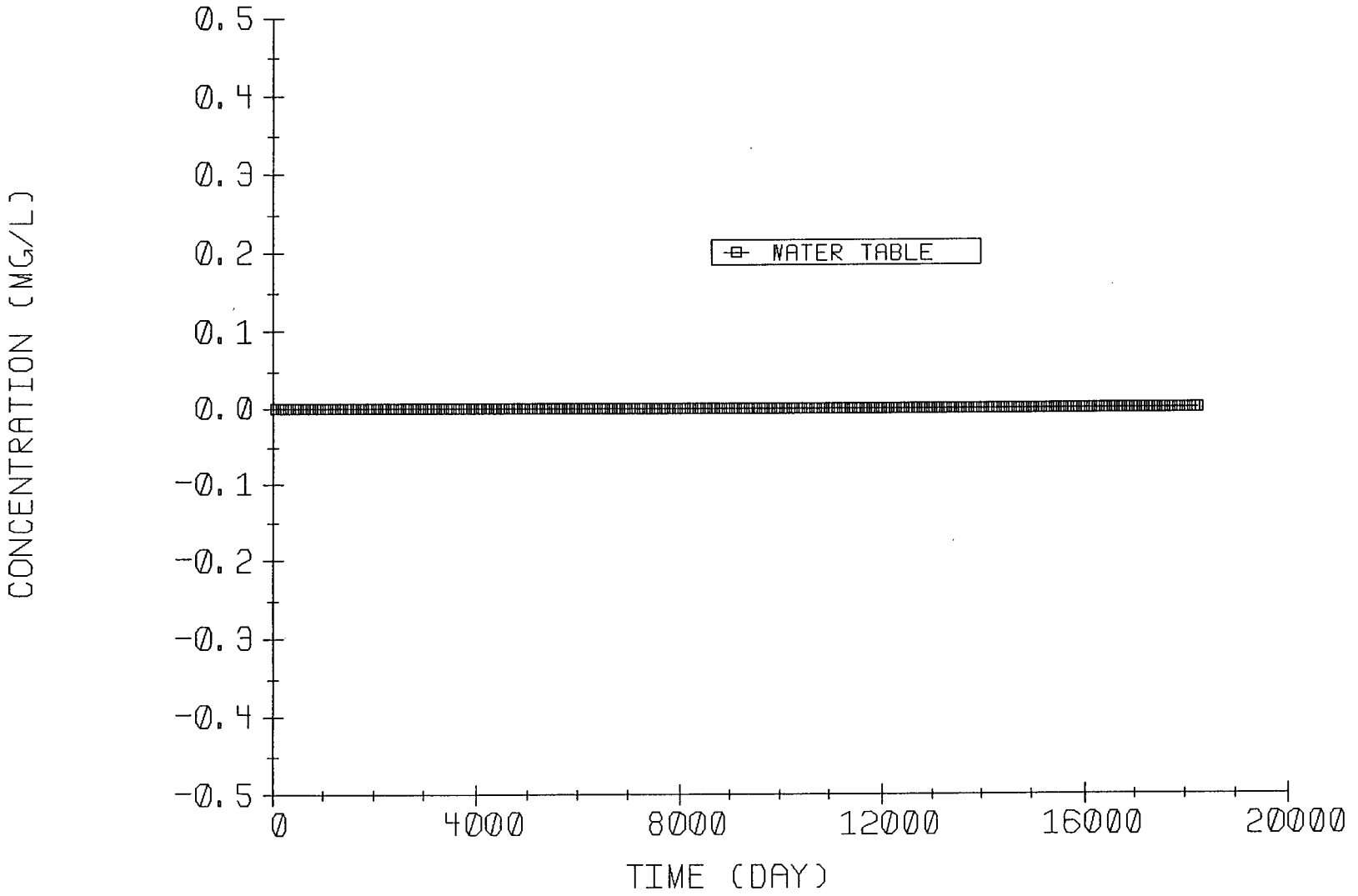
5400.0000	0.5513E-04	0.2571E-05	0.2310E-07
5550.0000	0.5595E-04	0.2699E-05	0.2617E-07
5700.0000	0.5657E-04	0.2808E-05	0.2915E-07
5850.0000	0.5703E-04	0.2901E-05	0.3197E-07
6000.0000	0.5736E-04	0.2978E-05	0.3460E-07
6150.0000	0.5759E-04	0.3041E-05	0.3699E-07
6300.0000	0.5774E-04	0.3091E-05	0.3914E-07
6450.0000	0.5783E-04	0.3132E-05	0.4103E-07
6600.0000	0.5787E-04	0.3163E-05	0.4268E-07
6750.0000	0.5788E-04	0.3187E-05	0.4409E-07
6900.0000	0.5787E-04	0.3205E-05	0.4528E-07
7050.0000	0.5783E-04	0.3218E-05	0.4626E-07
7200.0000	0.5778E-04	0.3227E-05	0.4707E-07
7350.0000	0.5772E-04	0.3233E-05	0.4773E-07
7500.0000	0.5765E-04	0.3236E-05	0.4824E-07
7650.0000	0.5757E-04	0.3237E-05	0.4865E-07
7800.0000	0.5749E-04	0.3237E-05	0.4896E-07
7950.0000	0.5741E-04	0.3236E-05	0.4919E-07
8100.0000	0.5733E-04	0.3233E-05	0.4935E-07
8250.0000	0.5724E-04	0.3230E-05	0.4946E-07
8400.0000	0.5716E-04	0.3227E-05	0.4953E-07
8550.0000	0.5707E-04	0.3223E-05	0.4957E-07
8700.0000	0.5698E-04	0.3219E-05	0.4958E-07
8850.0000	0.5690E-04	0.3214E-05	0.4957E-07
9000.0000	0.5681E-04	0.3210E-05	0.4954E-07
9150.0000	0.5672E-04	0.3205E-05	0.4950E-07
9300.0000	0.5664E-04	0.3201E-05	0.4946E-07
9450.0000	0.5655E-04	0.3196E-05	0.4940E-07
9600.0000	0.5646E-04	0.3191E-05	0.4934E-07
9750.0000	0.5637E-04	0.3186E-05	0.4928E-07
9900.0000	0.5629E-04	0.3181E-05	0.4921E-07
10050.0000	0.5620E-04	0.3176E-05	0.4914E-07
10200.0000	0.5611E-04	0.3172E-05	0.4907E-07
10350.0000	0.5603E-04	0.3167E-05	0.4900E-07
10500.0000	0.5594E-04	0.3162E-05	0.4892E-07
10650.0000	0.5586E-04	0.3157E-05	0.4885E-07
10800.0000	0.5577E-04	0.3152E-05	0.4878E-07
10950.0000	0.5568E-04	0.3147E-05	0.4870E-07
11100.0000	0.5560E-04	0.3142E-05	0.4863E-07
11250.0000	0.5551E-04	0.3138E-05	0.4855E-07
11400.0000	0.5543E-04	0.3133E-05	0.4848E-07
11550.0000	0.5534E-04	0.3128E-05	0.4840E-07
11700.0000	0.5526E-04	0.3123E-05	0.4833E-07
11850.0000	0.5517E-04	0.3118E-05	0.4826E-07
12000.0000	0.5509E-04	0.3113E-05	0.4818E-07
12150.0000	0.5500E-04	0.3109E-05	0.4811E-07
12300.0000	0.5492E-04	0.3104E-05	0.4803E-07
12450.0000	0.5483E-04	0.3099E-05	0.4796E-07
12600.0000	0.5475E-04	0.3094E-05	0.4789E-07
12750.0000	0.5466E-04	0.3090E-05	0.4781E-07
12900.0000	0.5458E-04	0.3085E-05	0.4774E-07
13050.0000	0.5449E-04	0.3080E-05	0.4766E-07
13200.0000	0.5441E-04	0.3075E-05	0.4759E-07
13350.0000	0.5433E-04	0.3071E-05	0.4752E-07
13500.0000	0.5424E-04	0.3066E-05	0.4744E-07
13650.0000	0.5416E-04	0.3061E-05	0.4737E-07
13800.0000	0.5408E-04	0.3056E-05	0.4730E-07

18.5 yrs

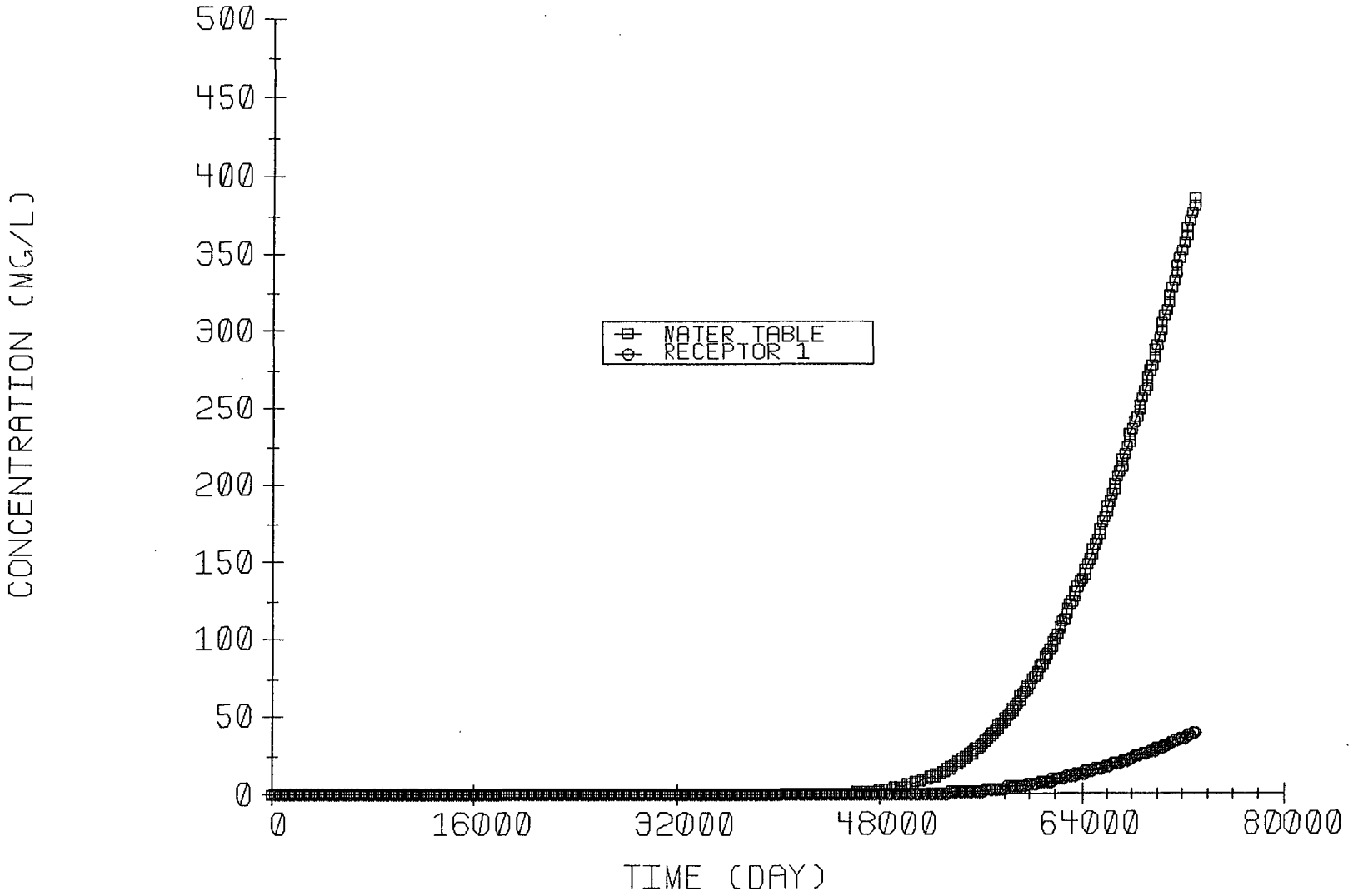

XYLENE CONC. VS. TIME, CDU-19, RUN X1
CONCENTRATION (MG/L)
0.5
0.4
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
-0.4
-0.5
WATER TABLE
0
16000
32000
48000
64000
80000
TIME (DAY)

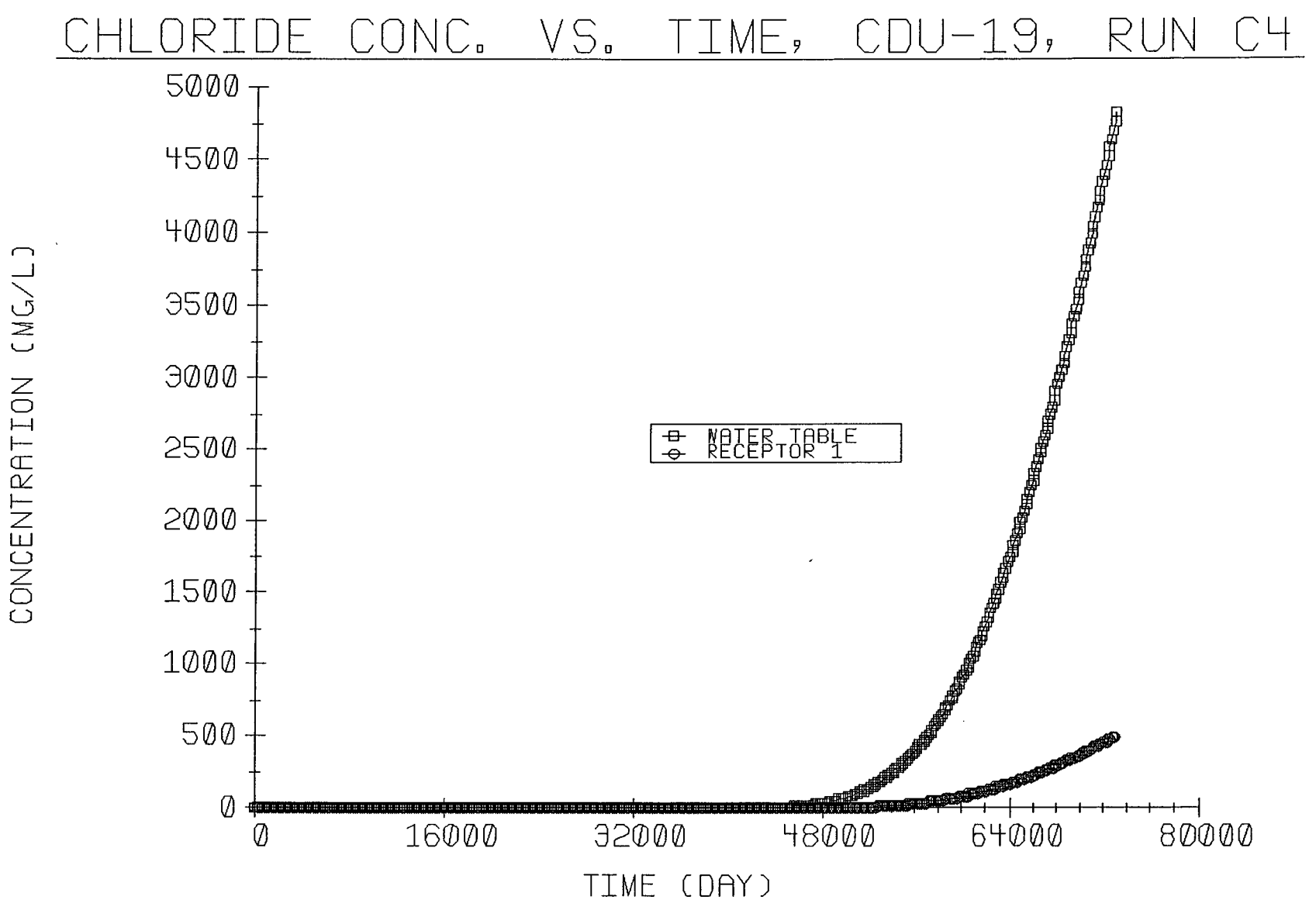

CHLORIDE CONC. VS. TIME, CDU-19, RUN C1
CONCENTRATION (MG/L)
0.5
0.4
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
-0.4
-0.5
WATER TABLE
0
4000
8000
12000
16000
20000
TIME (DAY)

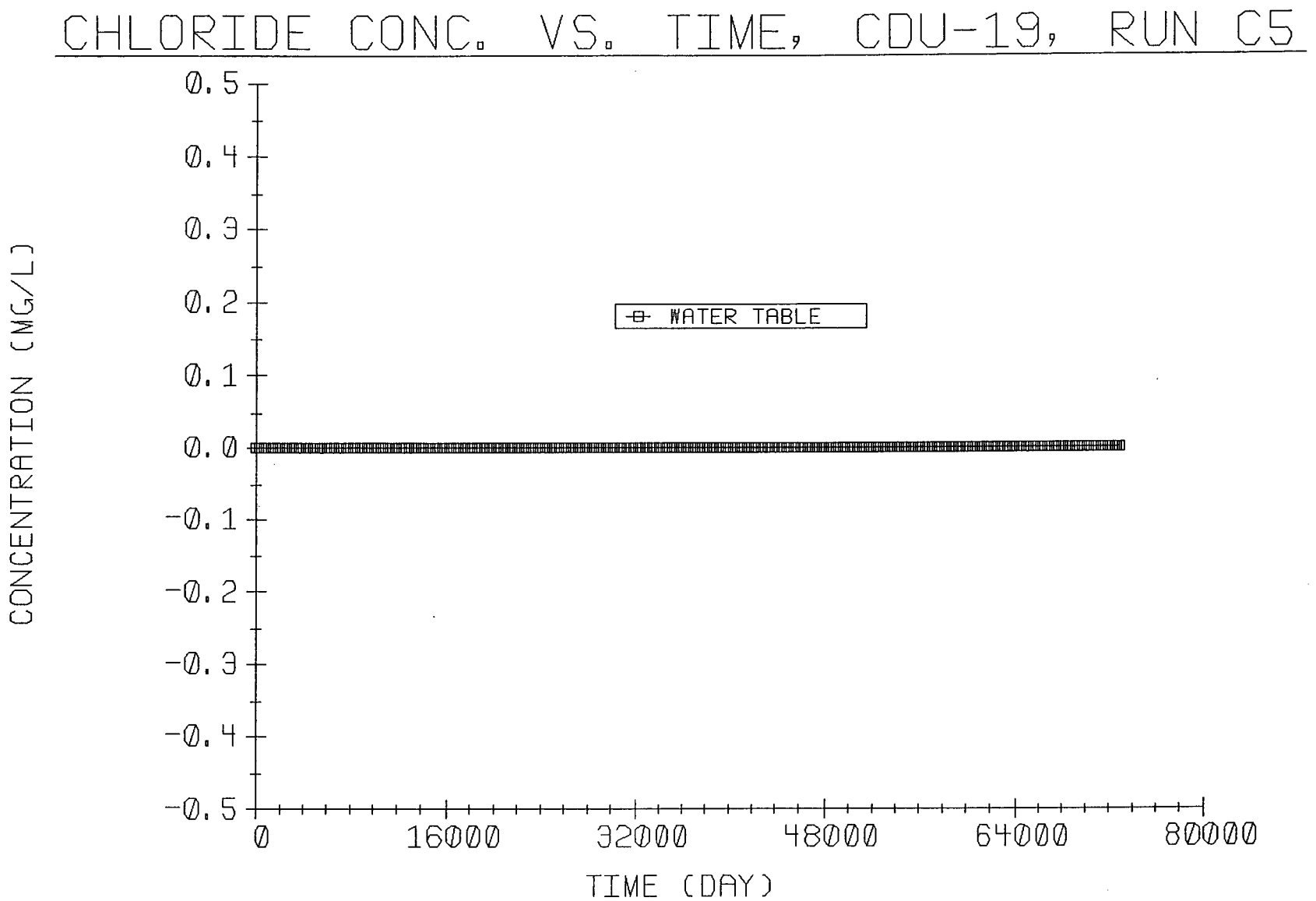
CHLORIDE CONC. VS. TIME, CDU-19, RUN C2

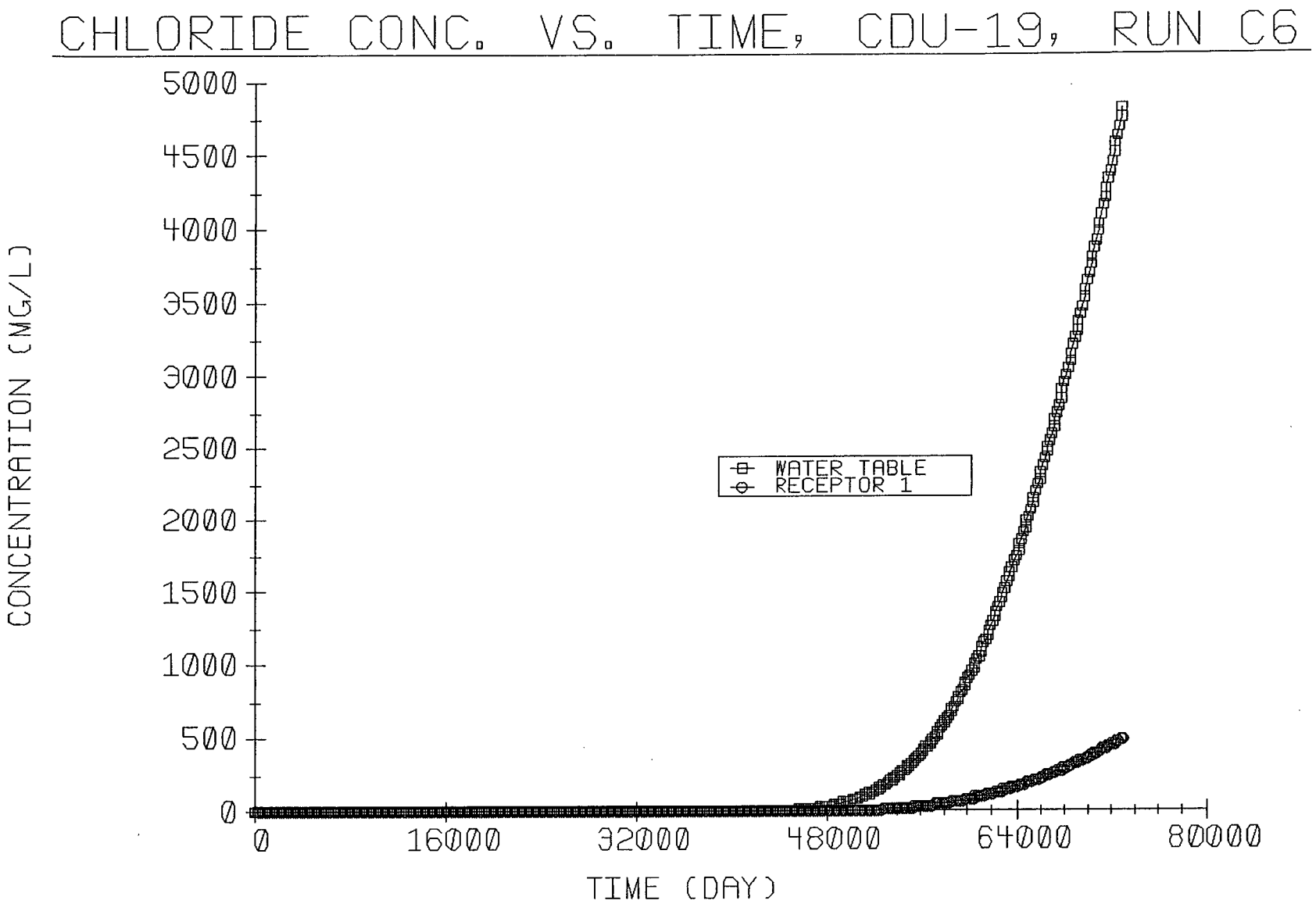


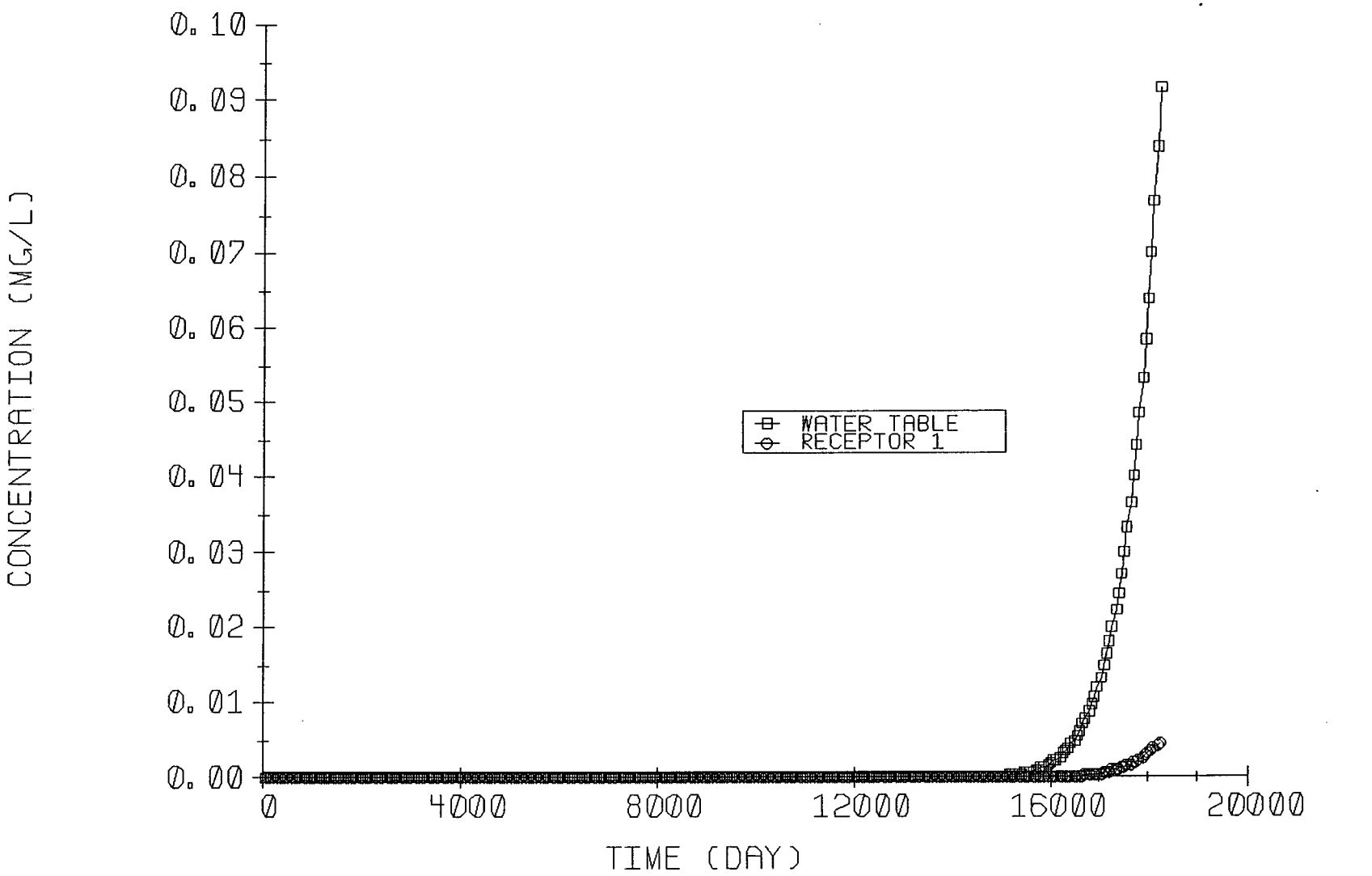
CHLORIDE CONC. VS. TIME, CDU-19, RUN C3



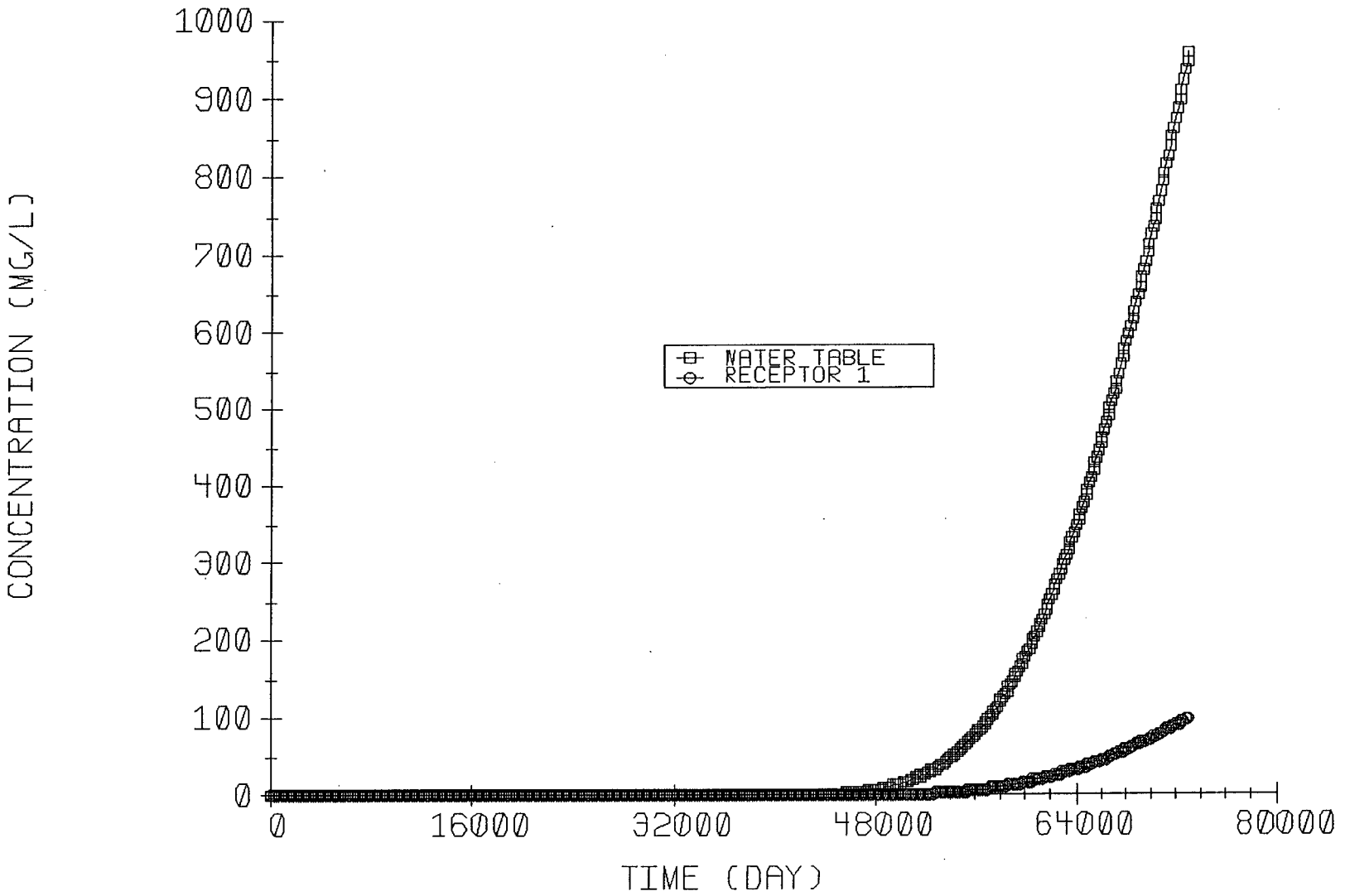

CHLORIDE CONC. VS. TIME, CDU-19, RUN C4
CONCENTRATION (MG/L)
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
WATER TABLE
RECEPTOR 1
0
16000
32000
48000
64000
80000
TIME (DAY)


CHLORIDE CONC. VS. TIME, CDU-19, RUN C5
CONCENTRATION (MG/L)
0.5
0.4
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
-0.4
-0.5
WATER TABLE
0
16000
32000
48000
64000
80000
TIME (DAY)

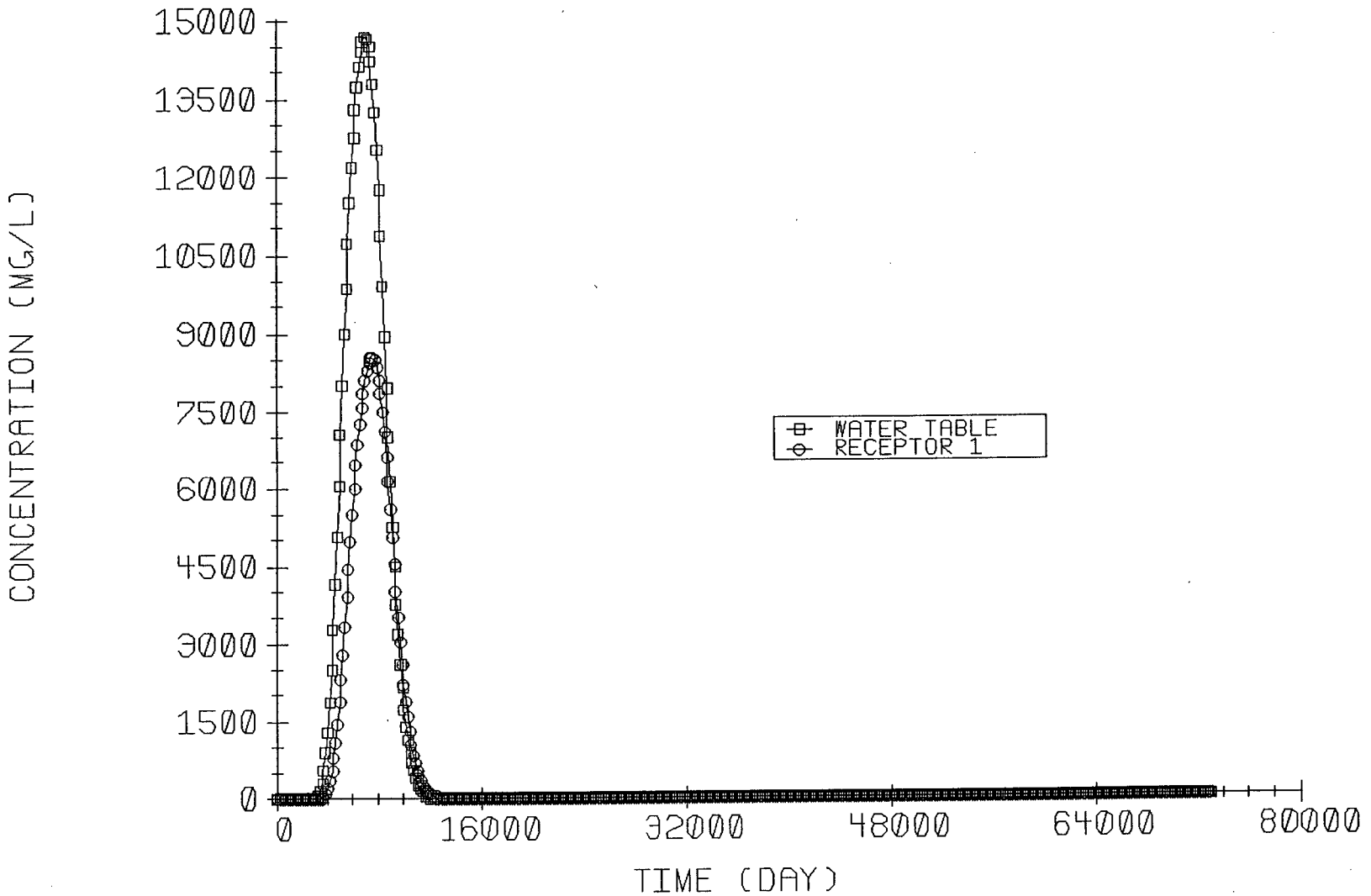

CHLORIDE CONC. VS. TIME, CDU-19, RUN C6
CONCENTRATION (MG/L)
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
0
16000
32000
48000
64000
80000
TIME (DAY)
WATER TABLE
RECEPTOR 1


CHLORIDE CONC. VS. TIME, CDU-19, RUN C7
CONCENTRATION (MG/L)
0.10
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
WATER TABLE
RECEPTOR 1
0
4000
8000
12000
16000
20000
TIME (DAY)

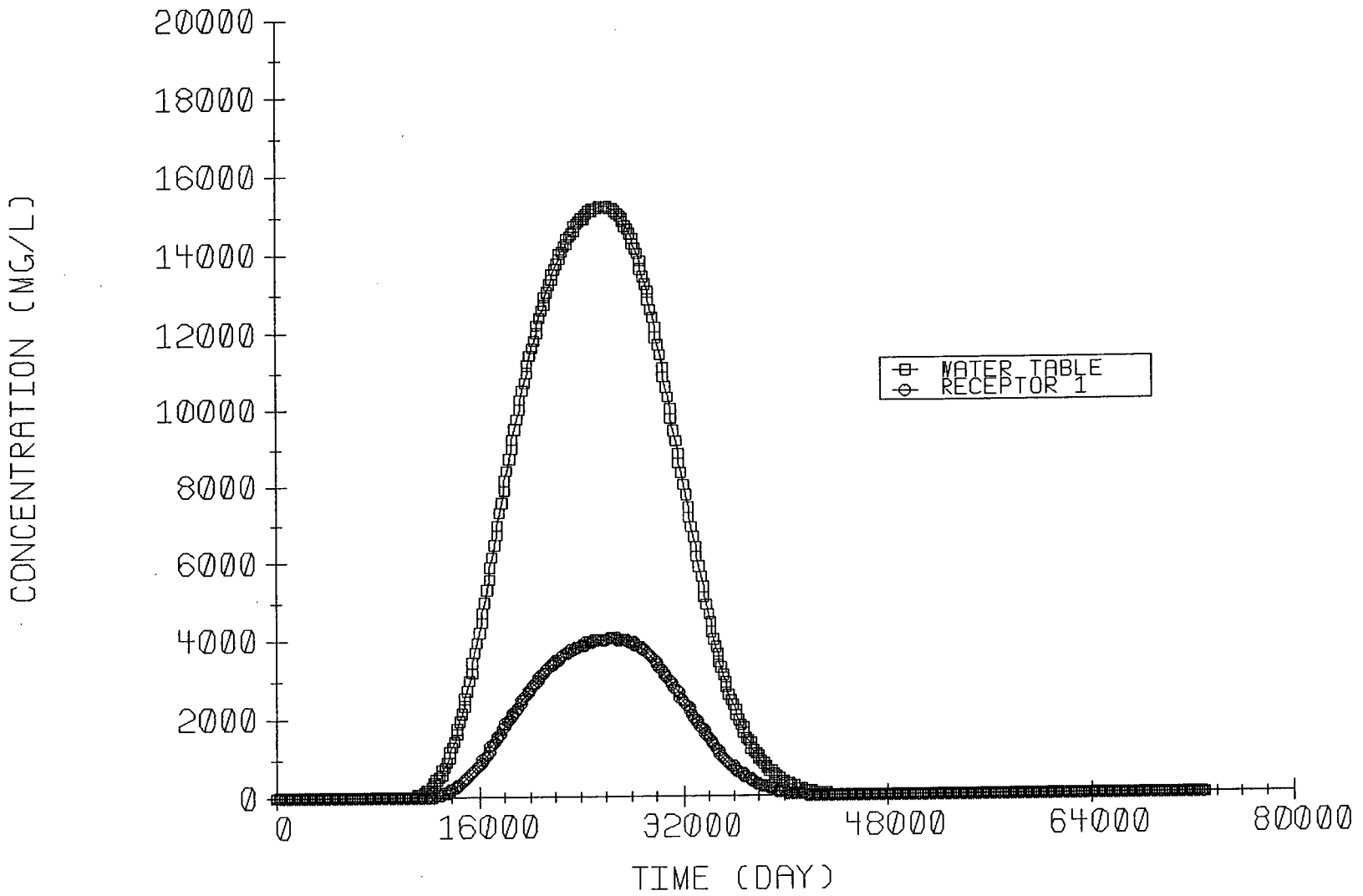
CHLORIDE CONC. VS. TIME, CDU-19, RUN C8



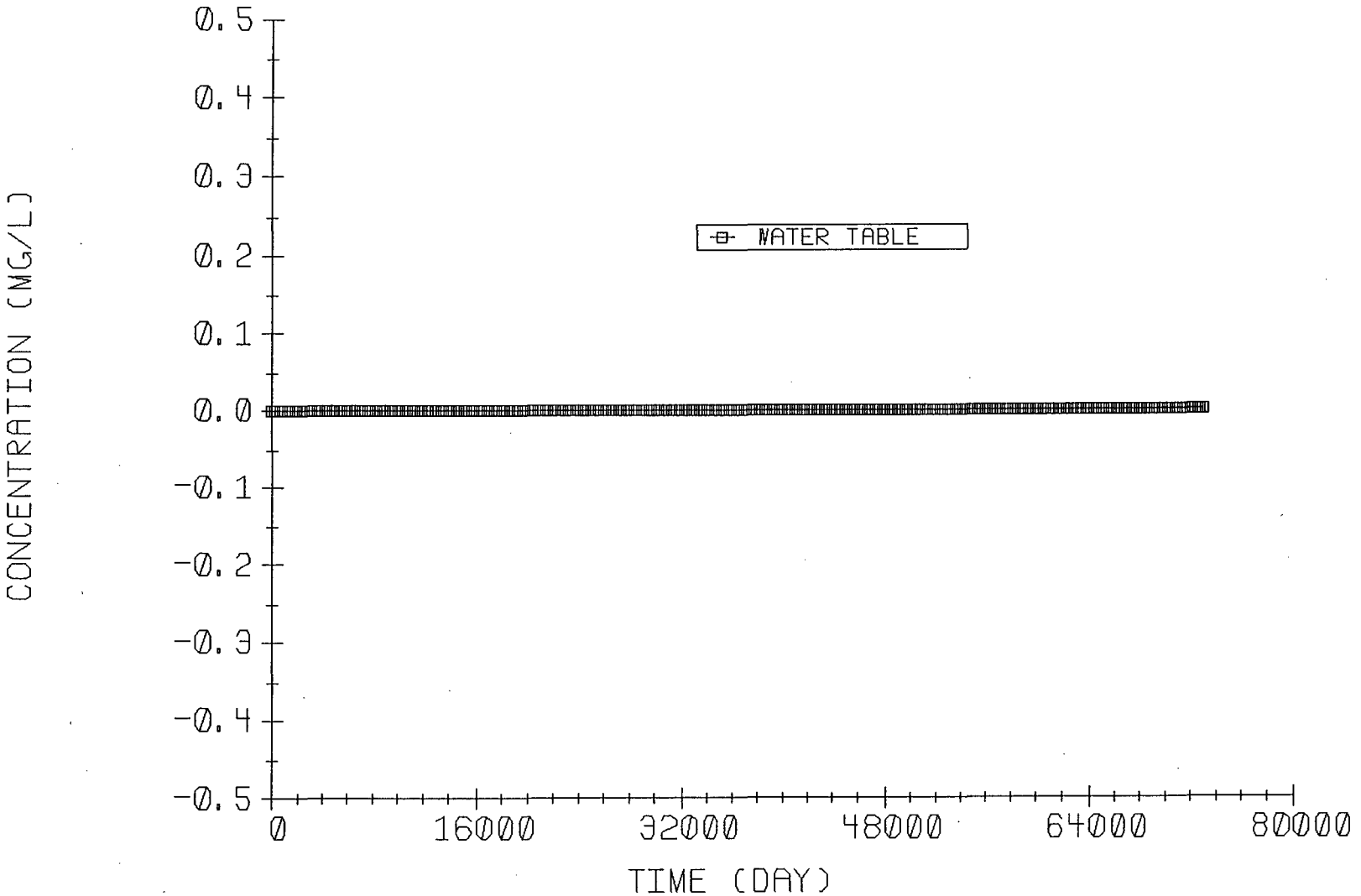
CHLORIDE CONC. VS. TIME, CDU-19, RUN C9



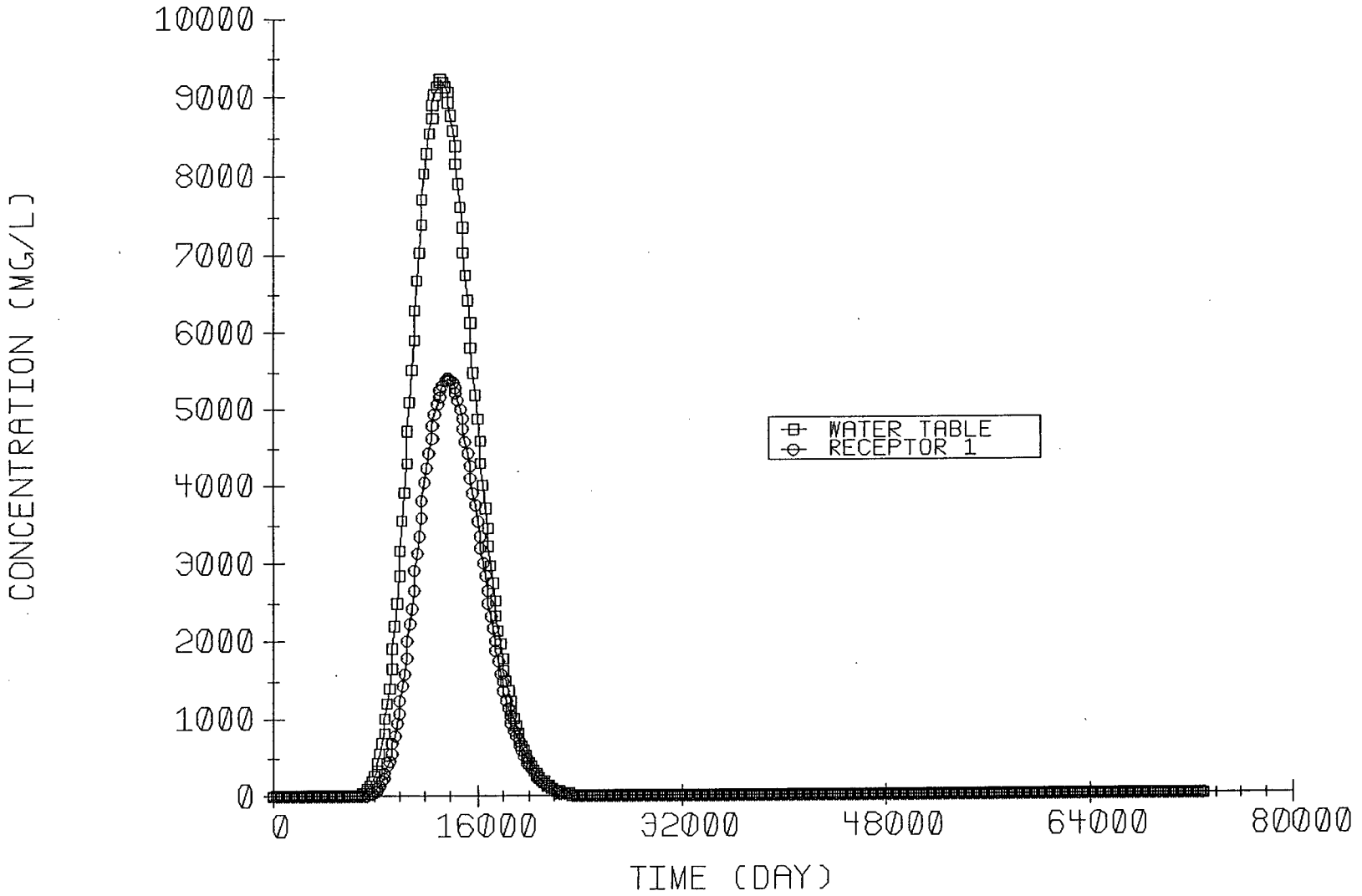
CHLORIDE CONC. VS. TIME, CDU-19, RUN C10



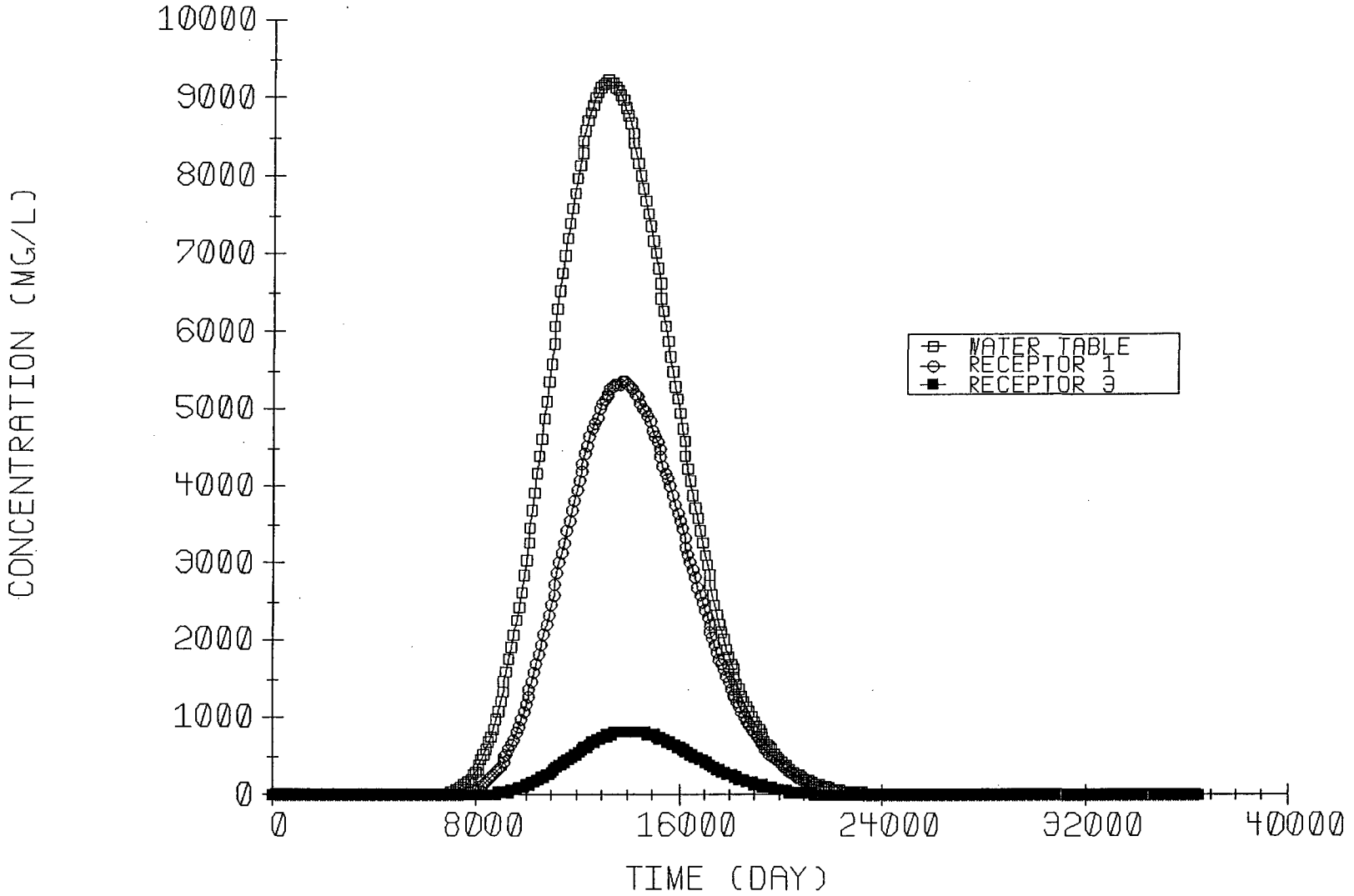
CHLORIDE CONC. VS. TIME, CDU-19, RUN C11



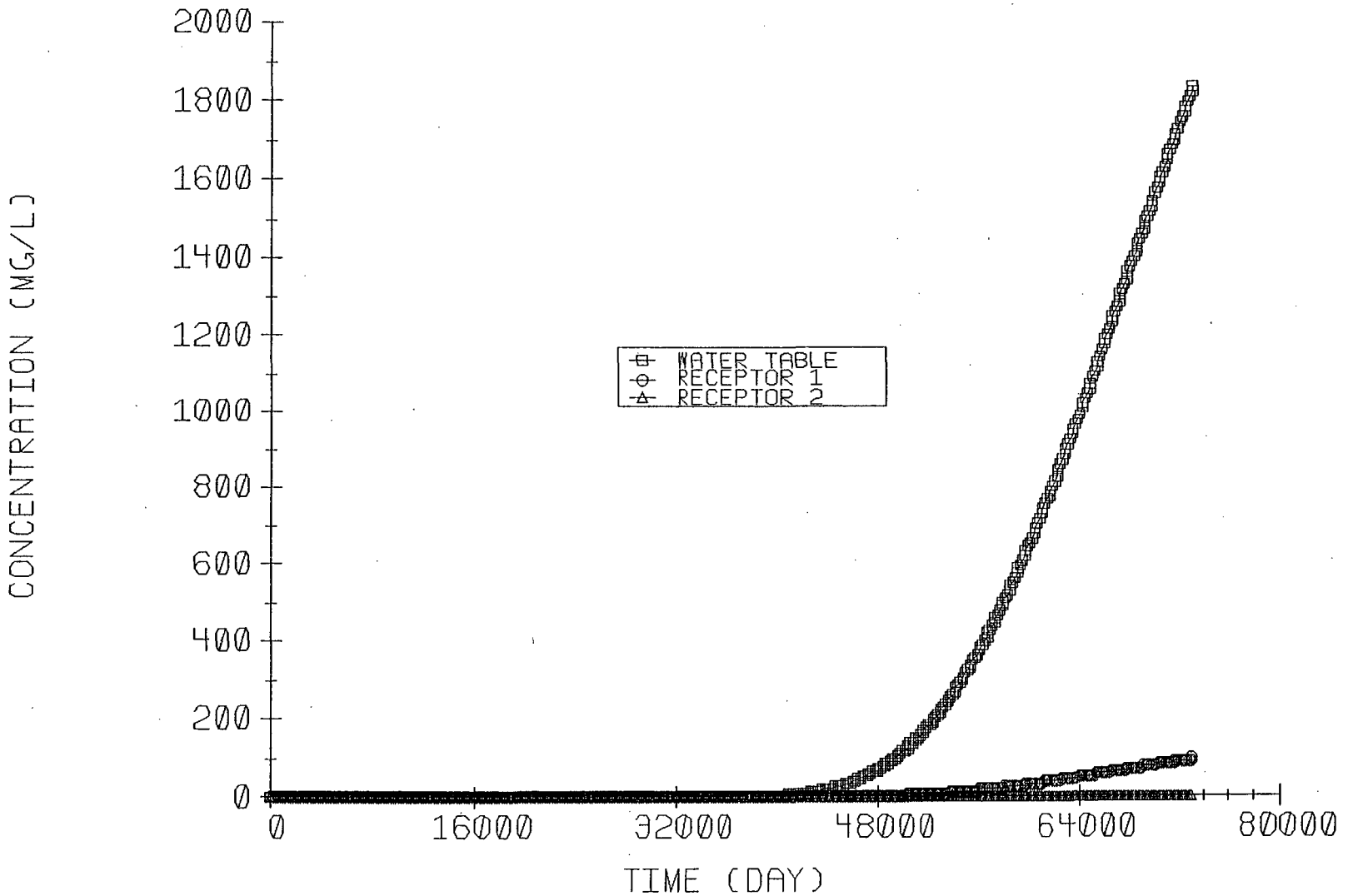
CHLORIDE CONC. VS. TIME, CDU-19, RUN C12



CHLORIDE CONC. VS. TIME, CDU-19, RUN C13



CHLORIDE CONC. VS. TIME, CDU-19, RUN C14



VADSAT Version 3.0

A Monte Carlo Model for Assessing the Effects of Soil Contamination on Groundwater Quality

Developed by:
Environmental Systems and Technologies Inc.
Blacksburg, Virginia
Tel: 703-552-0685, Fax: 703-951-5307

For
The American Petroleum Institute
1995

PROJECT TITLE:Chevron CDU 19, Cl Run 14(Cl avg.mean, 0.035m/d, 200yrs, WT=70 ft.)

SOURCE AND CHEMICAL DATA ****

DEPTHM, MEAN THICKNESS OF WASTE ZONE (m)	=	6.09600
DEPSTD, STD.DEV. OF THICKNESS OF WASTE ZONE	=	0.00000
AREAM, MEAN WASTE ZONE AREA (m^2)	=	116.73000
STDA, STD.DEV. OF WASTE ZONE AREA	=	0.00000
RLWM, MEAN L/W RATIO (-)	=	1.33000
STDRLW, STD.DEV. OF L/W RATIO	=	0.00000
CVRTHM, MEAN VALUE OF COVER THICKNESS (m)	=	0.00000
CVRTHS, STD.DEV. OF COVER THICKNESS	=	0.00000
MEAN MASS FRACTION OF SALT IN WASTE (mg/kg)	=	790.99371
STD OF MASS FRACTION OF SALT IN WASTE	=	0.00000
CZEROM, MEAN AQU. PHASE CONC OF SALT (g/m^3)	=	3144.19995
CZEROS, STD.DEV. OF AQU. PHASE CONC. OF SALT	=	0.00000

CHEMICAL SPECIES Sodium Chloride

HYDROGEOLOGICAL PROPERTIES

** UNSATURATED ZONE INPUT PARAMETERS **

GAMMAM, MEAN UNSAT ZONE DECAY COEF (1/day)	=	0.00210
STDGAM, STD.DEV. OF UNSAT ZONE DECAY COEF	=	0.00000
UNFOCM, MEAN UNSAT ZONE ORGANIC CARBON FRACTION (-)	=	0.00000
UNFOCS, STD.DEV. OF UNSAT ZONE ORGANIC CARBON FRAC.	=	0.00000

FKSW, MEAN SAT. CONDUCTIVITY (m/day) = 0.03500
STDFKS, STD.DEV. OF SAT. CONDUCTIVITY = 0.000

DISTM, MEAN DEPTH TO GROUNDWATER (m) = 21.33500
STDDST, STD.DEV. OF DEPTH TO GROUNDWATER = 0.00000

UNPORM, MEAN VADOSE ZONE POROSITY (-) = 0.40000
SUNPOR, STD.DEV. OF VADOSE ZONE POROSITY = 0.00000

PARNM, MEAN VALUE OF VG PARAMETER N (-) = 2.68000
SDPARN, STD.DEV. OF VG PARAMETER N = 0.00000

RESWCM, MEAN RESIDUAL WATER CONTENT (-) = 0.03000
RESWCS, STD.DEV. OF RESIDUAL WATER CONTENT = 0.00000

ALFINM = 0, UNSAT DISPERSIVITY CALCULATED INTERNALLY

** SATURATED ZONE INPUT PARAMETERS **

LAMBW, MEAN SAT. ZONE DECAY COEFF. (1/day) = 0.00210
SLAMB, STD.DEV. OF SAT. ZONE DECAY COEFF. = 0.00000

PORM, MEAN SAT. ZONE POROSITY (-) = 0.20000
STDPOR, STD.DEV. OF SAT. ZONE POROSITY = 0.00000

FOCM, MEAN SAT. ZONE ORG. CARBON FRAC. (-) = 0.00000
STDFOC, STD.DEV. SAT. ZONE ORG. CARBON FRAC.= 0.00000

ALRLTM, MEAN DISPERS, RATIO LONG/TRANSV. (-) = 3.00000
SALRLT, STD.DEV. OF DISP. RATIO LONG/TRANSV. = 0.00000

ALRTVM, MEAN DISPERS. RATIO TRANSV/VERT. (-) = 100.00000
SALRTV, STD.DEV. OF DISP. RATIO TRANSV/VERT. = 0.00000

CONDS, SAT. HYDRAULIC COND. (m/day) = 1.90000
SCONDS, STD.DEV. OF SAT HYDRAULIC COND. = 0.00000

GRADS, HYDRAULIC GRADIENT (m/m) = 0.00500
SGRADS, STD.DEV. OF HYDRAULIC GRADIENT = 0.00000

HMEAN, MEAN AQUIFER THICKNESS (m) = 12.19200
STDH, STD.DEV. OF AQUIFER THICKNESS = 0.00000

QINM, MEAN INFILTRATION RATE (m/day) = 0.00004
QINSTD, STD.DEV. OF INFILTRATION RATE = 0.00000

LOCATION OF RECEPTORS:

	X (M)	Y (M)	Z (M)
RECEPTOR(1)	8.2	0.0	0.3
RECEPTOR(2)	8.2	0.0	3.4

BREAKTHROUGH CURVES

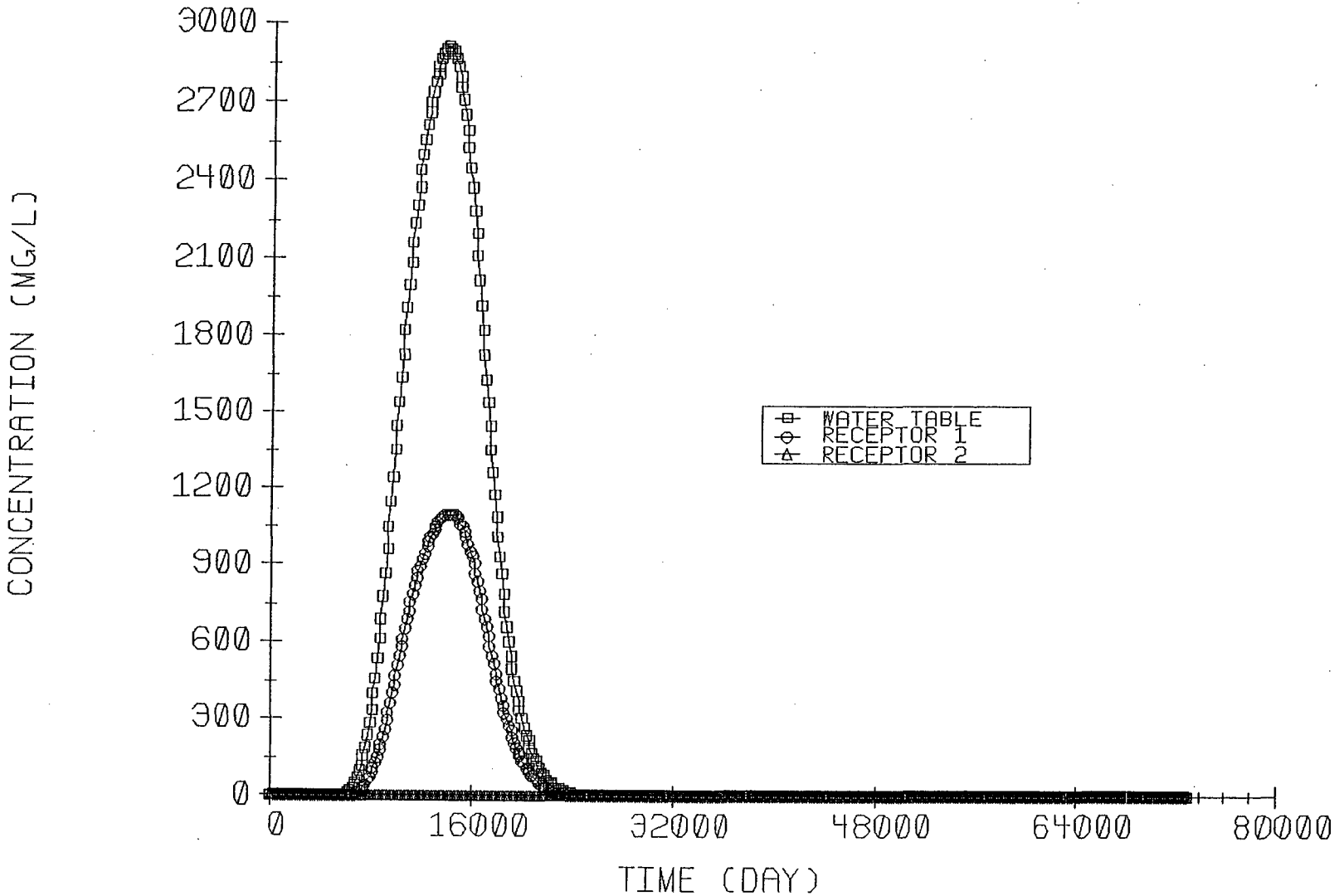
CONCENTRATIONS (MG/L) AT:

TIME WATER TABLE RECEPTORS (in order)

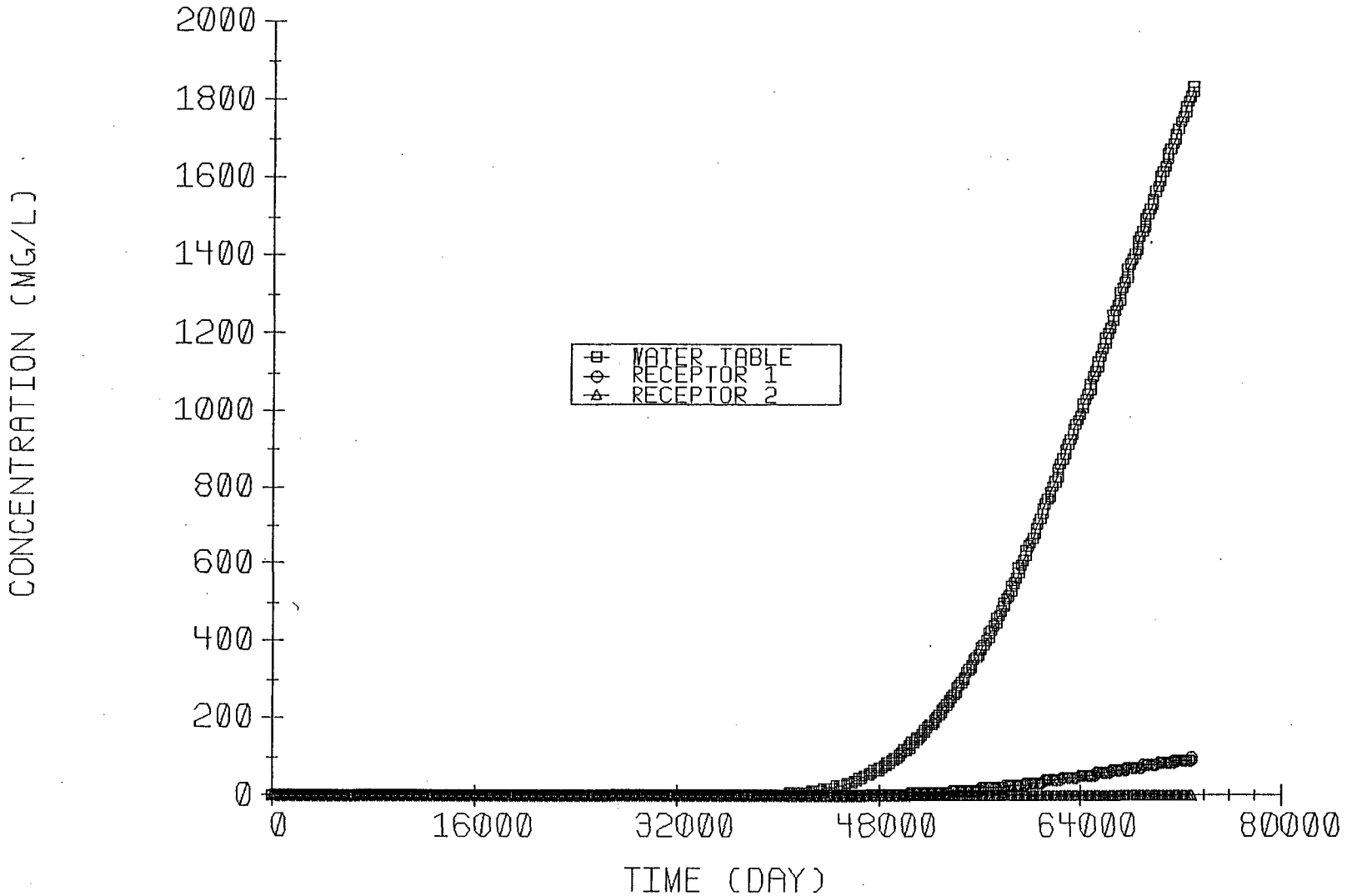
(DAYS) BELOW THE SOURCE

150.0000	0.0000E+00	0.0000E+00	0.0000E+00
300.0000	0.0000E+00	0.0000E+00	0.0000E+00
450.0000	0.0000E+00	0.0000E+00	0.0000E+00
600.0000	0.0000E+00	0.0000E+00	0.0000E+00
750.0000	0.0000E+00	0.0000E+00	0.0000E+00
900.0000	0.0000E+00	0.0000E+00	0.0000E+00
1050.0000	0.0000E+00	0.0000E+00	0.0000E+00
1200.0000	0.0000E+00	0.0000E+00	0.0000E+00
1350.0000	0.0000E+00	0.0000E+00	0.0000E+00
1500.0000	0.0000E+00	0.0000E+00	0.0000E+00
1650.0000	0.0000E+00	0.0000E+00	0.0000E+00
1800.0000	0.0000E+00	0.0000E+00	0.0000E+00
1950.0000	0.0000E+00	0.0000E+00	0.0000E+00
2100.0000	0.0000E+00	0.0000E+00	0.0000E+00
2250.0000	0.0000E+00	0.0000E+00	0.0000E+00
2400.0000	0.0000E+00	0.0000E+00	0.0000E+00
2550.0000	0.0000E+00	0.0000E+00	0.0000E+00
2700.0000	0.0000E+00	0.0000E+00	0.0000E+00
2850.0000	0.0000E+00	0.0000E+00	0.0000E+00
3000.0000	0.0000E+00	0.0000E+00	0.0000E+00
3150.0000	0.0000E+00	0.0000E+00	0.0000E+00
3300.0000	0.0000E+00	0.0000E+00	0.0000E+00
3450.0000	0.0000E+00	0.0000E+00	0.0000E+00
3600.0000	0.0000E+00	0.0000E+00	0.0000E+00
3750.0000	0.0000E+00	0.0000E+00	0.0000E+00
3900.0000	0.0000E+00	0.0000E+00	0.0000E+00
4050.0000	0.0000E+00	0.0000E+00	0.0000E+00
4200.0000	0.0000E+00	0.0000E+00	0.0000E+00
4350.0000	0.0000E+00	0.0000E+00	0.0000E+00
4500.0000	0.0000E+00	0.0000E+00	0.0000E+00
4650.0000	0.0000E+00	0.0000E+00	0.0000E+00
4800.0000	0.0000E+00	0.0000E+00	0.0000E+00
4950.0000	0.0000E+00	0.0000E+00	0.0000E+00
5100.0000	0.0000E+00	0.0000E+00	0.0000E+00
5250.0000	0.0000E+00	0.0000E+00	0.0000E+00
5400.0000	0.0000E+00	0.0000E+00	0.0000E+00
5550.0000	0.0000E+00	0.0000E+00	0.0000E+00
5700.0000	0.0000E+00	0.0000E+00	0.0000E+00
5850.0000	0.0000E+00	0.0000E+00	0.0000E+00
6000.0000	0.0000E+00	0.0000E+00	0.0000E+00
6150.0000	0.0000E+00	0.0000E+00	0.0000E+00
6300.0000	0.0000E+00	0.0000E+00	0.0000E+00
6450.0000	0.0000E+00	0.0000E+00	0.0000E+00
6600.0000	0.0000E+00	0.0000E+00	0.0000E+00
6750.0000	0.0000E+00	0.0000E+00	0.0000E+00
6900.0000	0.0000E+00	0.0000E+00	0.0000E+00
7050.0000	0.0000E+00	0.0000E+00	0.0000E+00
7200.0000	0.0000E+00	0.0000E+00	0.0000E+00
7350.0000	0.0000E+00	0.0000E+00	0.0000E+00
7500.0000	0.0000E+00	0.0000E+00	0.0000E+00
7650.0000	0.0000E+00	0.0000E+00	0.0000E+00
7800.0000	0.0000E+00	0.0000E+00	0.0000E+00
7950.0000	0.0000E+00	0.0000E+00	0.0000E+00
8100.0000	0.0000E+00	0.0000E+00	0.0000E+00
8250.0000	0.0000E+00	0.0000E+00	0.0000E+00

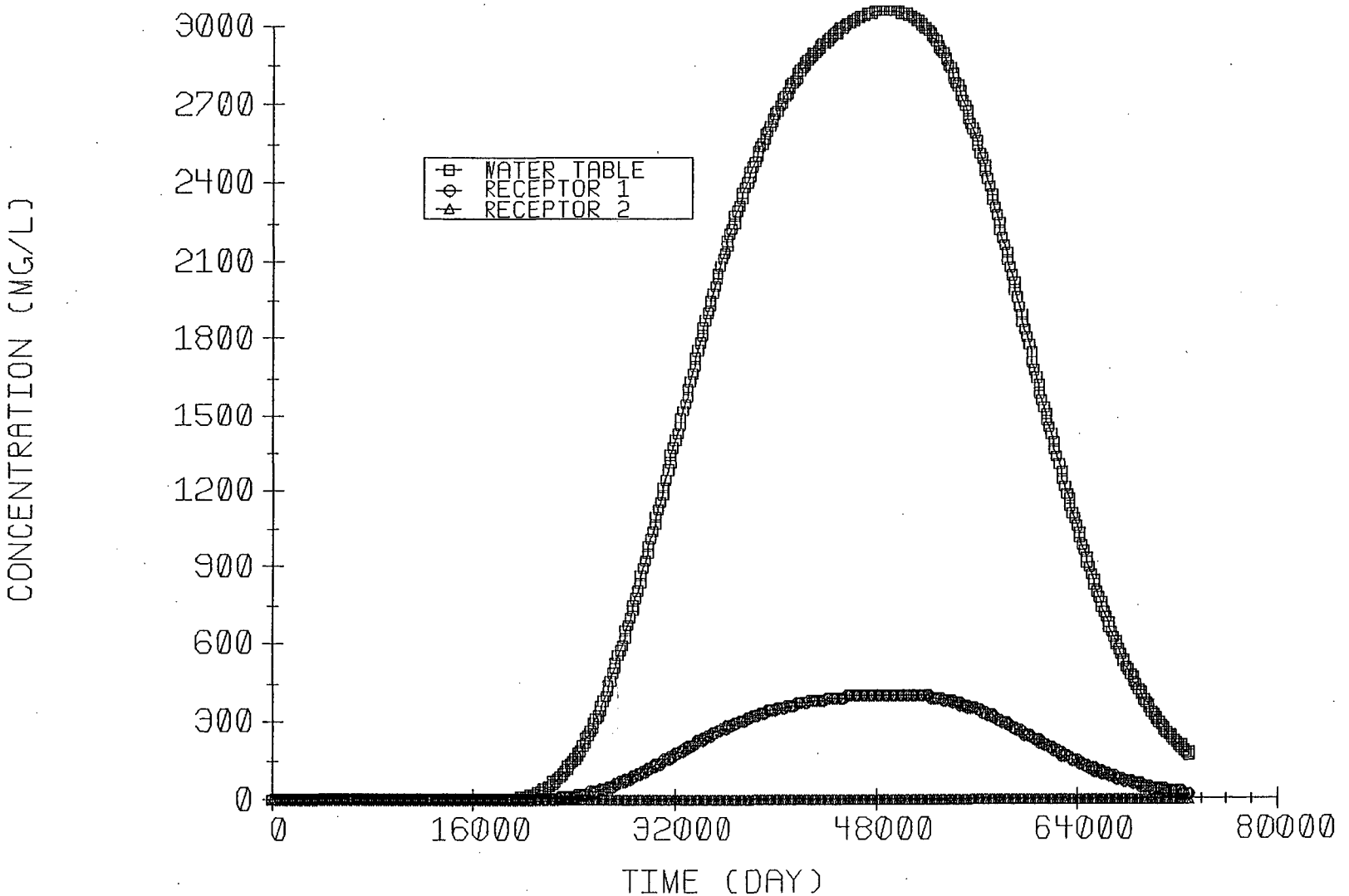
CHLORIDE CONC. VS. TIME, CDU-19, RUN C15



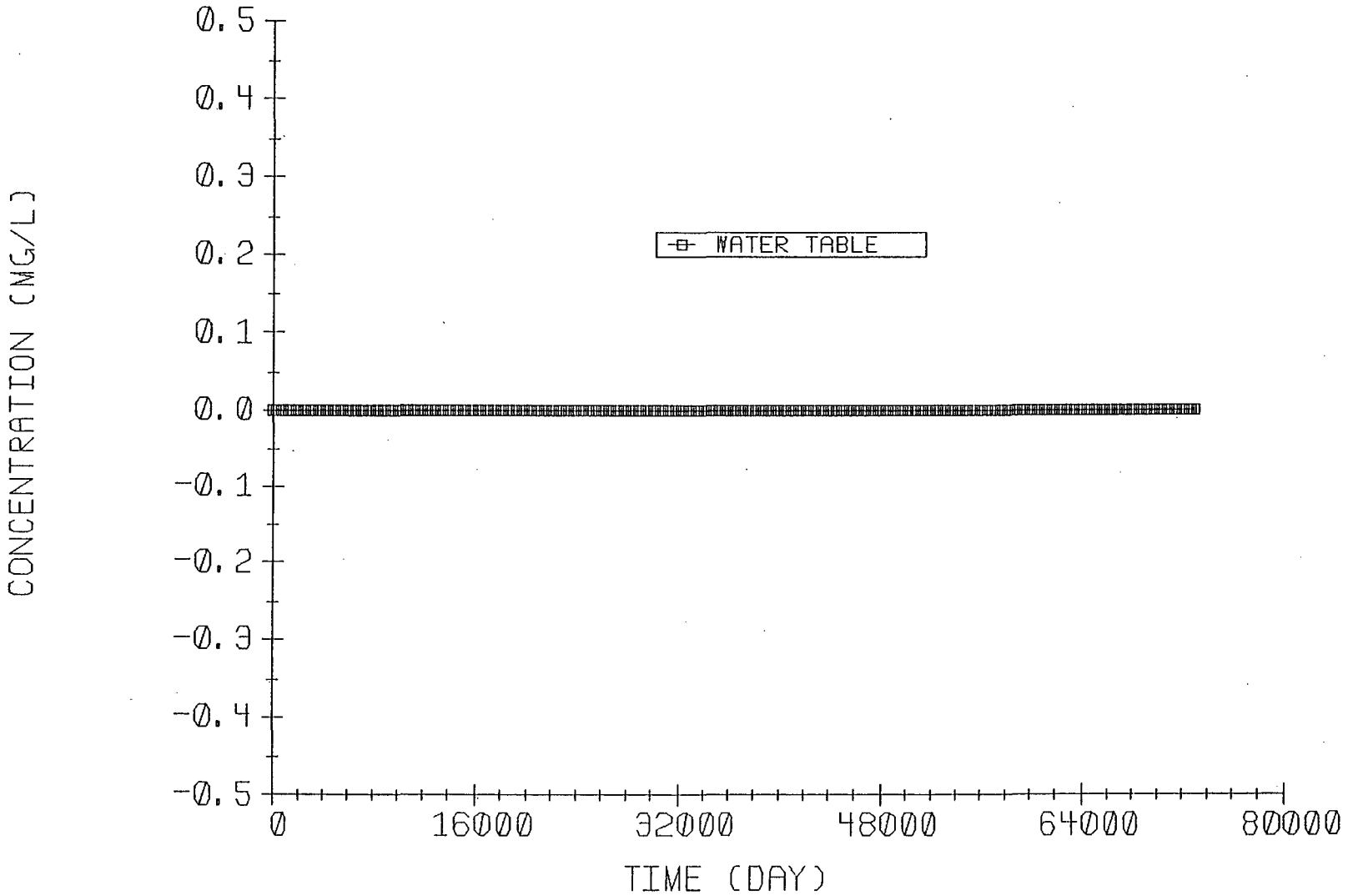
CHLORIDE CONC. VS TIME, CDU-19, RUN C16



CHLORIDE CONC. VS. TIME, CDU-17, RUN 17



CHLORIDE CONC. VS. TIME, CDU-19, RUN 18



VADSAT Version 3.0

A Monte Carlo Model for Assessing the Effects of Soil Contamination on Groundwater Quality

Developed by:
Environmental Systems and Technologies Inc.
Blacksburg, Virginia
Tel: 703-552-0685, Fax: 703-951-5307

For
The American Petroleum Institute
1995

PROJECT TITLE:Chevron CDU 19, Chloride Run 18(Cl max,7.1 m/d,5"/yr infil,liner,200 yrs

SOURCE AND CHEMICAL DATA ****

FKSWM, MEAN WASTE ZONE SAT. CONDUC. (m/day)	=	0.00000
SDFKSW, STD.DEV. OF WASTE ZONE SAT. CONDUC.	=	0.00000
DEPTHM, MEAN THICKNESS OF WASTE ZONE (m)	=	6.09600
DEPSTD, STD.DEV. OF THICKNESS OF WASTE ZONE	=	0.00000
AREAM, MEAN WASTE ZONE AREA (m^2)	=	116.73000
STDA, STD.DEV. OF WASTE ZONE AREA	=	0.00000
RLWM, MEAN L/W RATIO (-)	=	1.33000
STDRLW, STD.DEV. OF L/W RATIO	=	0.00000
CVRTHM, MEAN VALUE OF COVER THICKNESS (m)	=	0.00000
CVRTHS, STD.DEV. OF COVER THICKNESS	=	0.00000
MEAN MASS FRACTION OF SALT IN WASTE (mg/kg)	=	790.99371
STD OF MASS FRACTION OF SALT IN WASTE	=	0.00000
CZEROM, MEAN AQU. PHASE CONC OF SALT (g/m^3)	=	3144.19995
CZEROS, STD.DEV. OF AQU. PHASE CONC. OF SALT	=	0.00000

CHEMICAL SPECIES Sodium Chloride

HYDROGEOLOGICAL PROPERTIES

** UNSATURATED ZONE INPUT PARAMETERS **

GAMMAM, MEAN UNSAT ZONE DECAY COEF (1/day)	=	0.00210
STDGAM, STD.DEV. OF UNSAT ZONE DECAY COEF	=	0.00000

UNFOCM, MEAN UNSAT ZONE ORGANIC CARBON FRACTION (-) = 0.00000
UNFOCS, STD.DEV. OF UNSAT ZONE ORGANIC CARBON FRAC. = 0.00000

FKSW, MEAN SAT. CONDUCTIVITY (m/day) = 7.12800
STDFKS, STD.DEV. OF SAT. CONDUCTIVITY = 0.000

DISTM, MEAN DEPTH TO GROUNDWATER (m) = 21.33500
STDDST, STD.DEV. OF DEPTH TO GROUNDWATER = 0.00000

UNPORM, MEAN VADOSE ZONE POROSITY (-) = 0.40000
SUNPOR, STD.DEV. OF VADOSE ZONE POROSITY = 0.00000

PARNM, MEAN VALUE OF VG PARAMETER N (-) = 2.68000
SDPARN, STD.DEV. OF VG PARAMETER N = 0.00000

RESWCM, MEAN RESIDUAL WATER CONTENT (-) = 0.03000
RESWCS, STD.DEV. OF RESIDUAL WATER CONTENT = 0.00000

ALFINM = 0, UNSAT DISPERSIVITY CALCULATED INTERNALLY
** SATURATED ZONE INPUT PARAMETERS **

LAMBW, MEAN SAT. ZONE DECAY COEFF. (1/day) = 0.00210
SLAMB, STD.DEV. OF SAT. ZONE DECAY COEFF. = 0.00000

PORM, MEAN SAT. ZONE POROSITY (-) = 0.20000
STDPOR, STD.DEV. OF SAT. ZONE POROSITY = 0.00000

FOCM, MEAN SAT. ZONE ORG. CARBON FRAC. (-) = 0.00000
STDFOC, STD.DEV. SAT. ZONE ORG. CARBON FRAC.= 0.00000

ALRLTM, MEAN DISPERS, RATIO LONG/TRANSV. (-) = 3.00000
SALRLT, STD.DEV. OF DISP. RATIO LONG/TRANSV. = 0.00000

ALRTVM, MEAN DISPERS. RATIO TRANSV/VERT. (-) = 100.00000
SALRTV, STD.DEV. OF DISP. RATIO TRANSV/VERT. = 0.00000

CONDS, SAT. HYDRAULIC COND. (m/day) = 1.90000
SCONDS, STD.DEV. OF SAT HYDRAULIC COND. = 0.00000

GRADS, HYDRAULIC GRADIENT (m/m) = 0.00500
SGRADS, STD.DEV. OF HYDRAULIC GRADIENT = 0.00000

HMEAN, MEAN AQUIFER THICKNESS (m) = 12.19200
STDH, STD.DEV. OF AQUIFER THICKNESS = 0.00000

QINM, MEAN INFILTRATION RATE (m/day) = 0.00035
QINSTD, STD.DEV. OF INFILTRATION RATE = 0.00000

LOCATION OF RECEPTORS:

	X (M)	Y (M)	Z (M)
RECEPTOR(1)	8.2	0.0	0.3
RECEPTOR(2)	8.2	0.0	3.4

BREAKTHROUGH CURVES

CONCENTRATIONS (MG/L) AT:

TIME (DAYS)	WATER TABLE BELOW THE SOURCE	RECEPTORS (in order)	
150.0000	0.0000E+00	0.0000E+00	0.0000E+00
300.0000	0.0000E+00	0.0000E+00	0.0000E+00
450.0000	0.0000E+00	0.0000E+00	0.0000E+00
600.0000	0.0000E+00	0.0000E+00	0.0000E+00
750.0000	0.0000E+00	0.0000E+00	0.0000E+00
900.0000	0.0000E+00	0.0000E+00	0.0000E+00
1050.0000	0.0000E+00	0.0000E+00	0.0000E+00
1200.0000	0.0000E+00	0.0000E+00	0.0000E+00
1350.0000	0.0000E+00	0.0000E+00	0.0000E+00
1500.0000	0.0000E+00	0.0000E+00	0.0000E+00
1650.0000	0.0000E+00	0.0000E+00	0.0000E+00
1800.0000	0.0000E+00	0.0000E+00	0.0000E+00
1950.0000	0.0000E+00	0.0000E+00	0.0000E+00
2100.0000	0.0000E+00	0.0000E+00	0.0000E+00
2250.0000	0.0000E+00	0.0000E+00	0.0000E+00
2400.0000	0.0000E+00	0.0000E+00	0.0000E+00
2550.0000	0.0000E+00	0.0000E+00	0.0000E+00
2700.0000	0.0000E+00	0.0000E+00	0.0000E+00
2850.0000	0.0000E+00	0.0000E+00	0.0000E+00
3000.0000	0.0000E+00	0.0000E+00	0.0000E+00
3150.0000	0.0000E+00	0.0000E+00	0.0000E+00
3300.0000	0.0000E+00	0.0000E+00	0.0000E+00
3450.0000	0.0000E+00	0.0000E+00	0.0000E+00
3600.0000	0.0000E+00	0.0000E+00	0.0000E+00
3750.0000	0.0000E+00	0.0000E+00	0.0000E+00
3900.0000	0.0000E+00	0.0000E+00	0.0000E+00
4050.0000	0.0000E+00	0.0000E+00	0.0000E+00
4200.0000	0.0000E+00	0.0000E+00	0.0000E+00
4350.0000	0.0000E+00	0.0000E+00	0.0000E+00
4500.0000	0.0000E+00	0.0000E+00	0.0000E+00
4650.0000	0.0000E+00	0.0000E+00	0.0000E+00
4800.0000	0.0000E+00	0.0000E+00	0.0000E+00
4950.0000	0.0000E+00	0.0000E+00	0.0000E+00
5100.0000	0.0000E+00	0.0000E+00	0.0000E+00
5250.0000	0.0000E+00	0.0000E+00	0.0000E+00
5400.0000	0.0000E+00	0.0000E+00	0.0000E+00
5550.0000	0.0000E+00	0.0000E+00	0.0000E+00
5700.0000	0.0000E+00	0.0000E+00	0.0000E+00
5850.0000	0.0000E+00	0.0000E+00	0.0000E+00
6000.0000	0.0000E+00	0.0000E+00	0.0000E+00
6150.0000	0.0000E+00	0.0000E+00	0.0000E+00
6300.0000	0.0000E+00	0.0000E+00	0.0000E+00
6450.0000	0.0000E+00	0.0000E+00	0.0000E+00
6600.0000	0.0000E+00	0.0000E+00	0.0000E+00
6750.0000	0.0000E+00	0.0000E+00	0.0000E+00
6900.0000	0.0000E+00	0.0000E+00	0.0000E+00
7050.0000	0.0000E+00	0.0000E+00	0.0000E+00
7200.0000	0.0000E+00	0.0000E+00	0.0000E+00
7350.0000	0.0000E+00	0.0000E+00	0.0000E+00
7500.0000	0.0000E+00	0.0000E+00	0.0000E+00
7650.0000	0.0000E+00	0.0000E+00	0.0000E+00
7800.0000	0.0000E+00	0.0000E+00	0.0000E+00