3R - 77

REPORTS

DATE:

April 26, 1993

REPORT
GROUND WATER QUALITY MONITORING RESULTS
MAVERIK REFINERY TANK FARM
KIRTLAND, NEW MEXICO
MAVERIK COUNTRY STORES, INC.

RECEIVED

MAY 0 4 1993

OIL CONSERVATION DIV.
SANTA FE

April 26, 1993

Prepared by:

GeoWest Golden, Inc.
Salt Lake City, Utah

Job No. 9131.01

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1.0 INTRODUCTION

This is to report the results of ground water quality monitoring and water level measurements at the former Maverik Country Stores Refinery and Tank Farm, Kirtland, New Mexico. A previous report dated March 16, 1992 presented results of the First Quarter 1992 monitoring conducted during January 1992 and a letter report dated July 15, 1992 presented results of the Second Quarter sampling conducted in early June. Numerous earlier reports present results of site investigations dating back to 1987.

This report presents the findings of the Third and Fourth Quarter 1992 and First Quarter 1993 investigations. These were conducted during the periods August 19 and 20, 1992, December 16, 1992 and March 30, 1993, respectively.

2.0 SCOPE OF WORK

The work which was performed was similar to that conducted during the first two quarters of 1992. This had been agreed to by the New Mexico Oil Conservation Division (OCD) in a letter from W.C. Olsen dated May 14, 1992. The work essentially consisted of obtaining water level measurements in 14 existing shallow monitor wells and 4 piezometers and obtaining samples for water quality analysis from 12 of the wells.

The samples were analyzed by Mountain States Analytical Laboratory, Salt Lake City, Utah, for benzene, toluene, ethylbenzene and xylenes (BTEX) as well as for 1,2-dichloroethane (DCA) by EPA Methods 601/602. Sulfate concentrations were determined in samples from the two wells within the confines of the slurry wall. Field measurements of ground water pH, specific conductance and temperature were also made.

Three casing volumes were purged from each well by bailing with an HDPE disposable bailer prior to sampling. A separate disposable bailer was used to collect samples. A Hydac pH, conductivity and temperature meter was used to make field measurements of these parameters and a Keck ET-89 electric tape was employed to measure water levels.

As noted in our previous report, wells MW-17 and 18 were found to be missing during the January 1992 sampling; it is assumed that they had been destroyed during the piping and tankage removal operations of the previous fall. These were replaced in June 1992 with wells having the same construction and at the same locations. Four piezometers extending to eight feet below grade were installed at the same time inside the slurry wall and near each of the four corners. The installation report, including drilling and completion logs for these wells and piezometers, has not been previously submitted to the OCD and is included as Appendix A.

3.0 RESULTS

3.1 Ground Water Level Elevations, Fluctuations, Direction and Gradients

Water levels measurements taken during the August and December 1992 and March 1993 sampling events are recorded on Tables 1, 2, and 3, respectively. Table 4 summarizes the depths of ground water below ground surface during these three and the two prior sampling events. Figure 1 shows the locations of each well and piezometer. Note that the base map for Figure 1 is a 1987 aerial photograph; all tankage and pipelines shown have since been removed.

The water level data illustrates the same pattern which has been evident during several years of investigations at this site. The direction of flow is toward the southwest, the water table is typically 1-4 feet below grade, and the ground water level normally fluctuates 2-3 feet over an annual cycle reaching its maximum elevation in mid-winter. The shallow ground water has been shown in the past to be significantly influenced by the operation of the Farmers' Mutual Irrigation Ditch located along the northern property boundary.

The water level data during the most recent and previous monitoring periods indicates an overall shallow ground water gradient to the southwest of about 1 ft/100 ft between the north and south property boundaries, steepening somewhat adjacent to and downgradient of the slurry wall. Previous measurements indicated the presence of a gradient within the slurry wall confines not too dissimilar to that outside the slurry wall. The four piezometers installed within the slurry wall boundaries were installed specifically to provide further insight into this observation.

Distances between various pairs of wells/piezometers were measured in the field or determined from the surveyed co-ordinates and the gradients determined for the last four

measuring events. This data is summarized in Table 5. The water level data was analyzed to determine the magnitude and timing of changes in elevations in wells located inside vs. outside the slurry wall.

With regard to the latter issue, there was no apparent difference in the magnitude and timing of water level changes in wells/piezometers located inside vs. outside of the slurry wall.

Using the data in Table 5, the average gradient between wells/piezometers located inside the slurry wall during the four comparison periods has been 0.662 ft/100 ft while the gradient between wells located outside the slurry wall has been 0.989 ft/100. ft. The trends of the seasonal changes in gradients are similar in both groups of wells/piezometers but there is a continuing trend toward a flatter gradient between the inside wells when compared to the average gradient between wells outside the slurry wall.

The ground surface inside the slurry wall slopes to the southwest from the upgradient piezometers (P-1 and P-4) to the downgradient piezometers (P-2 and P-3) at a gradient of between 1.3 and 1.8 ft/100 ft. It will be noted from Table 4 that the depth to ground water below ground surface is typically 2-4 ft shallower at the downgradient piezometers than at the upgradient ones. This would foster greater evaporation from the ground surface (and transpiration of water through plants located here) at the downgradient portion of the area within the slurry wall. We believe it is this mechanism of differential evapotranspiration that explains the maintenance of a shallow ground water gradient within the confines of the slurry wall. Support for this hypothesis is provided by the observations that the gradients between all the paired wells/piezometers inside the slurry wall peaked during August when evaporation is at or near its maximum and the gradients are at a minimum during the periods when evaporation and transpiration are minimal.

Pan evaporation data has been collected from April through September for the years 1978 to 1992 at the New Mexico State University Farmington Experimental Station located about 10 miles southeast of the Maverik site. This data shows that pan evaporation rates average about 3 inches per month except during the June through August period, coinciding with the warmest three months, when it averages 4 inches per month.

It had been originally anticipated that the ground water within the slurry wall confines would eventually come into equilibrium and be without significant gradient. However, this did not consider the effects of the differential depths to ground water and resultant differential effects of evaporation over the area. It is likely that the presence of a gradient within the confines of the slurry wall will continue on a permanent basis since it appears to be the result of natural climatic phenomena.

It is safe to conclude that the slurry wall does have integrity and is performing its function of containing contaminated ground water. The water quality data in wells downgradient of the slurry wall provides proof of this.

3.2 Water Quality Analyses

Water quality monitoring results for the August and December, 1992 and the March, 1993 sampling events are summarized on Table 6 along with results from the five previous sampling events which have taken place since the slurry wall was installed in June, 1990. The laboratory's report forms for the three most recent events are included as Appendix B. Samples could not be obtained from MW-13 or MW-15 during the December, 1992 sampling period due to the fact that the water in the wells was frozen.

The samples from the 5 off-site monitor wells (MW-9, 13, 14, 15, and 16) did not yield detections of BTEX components or DCA above EPA or New Mexico drinking water

quality standards during any of the three sampling periods. The only reportable organic compound detected at all in these wells was the report of DCA at 1.5 ug/l (detection limit of 1 ug/l) in MW-9 during March, 1993.

In samples from the three on-site wells located downgradient of the slurry wall (MW-10, 19 and 20) no detections of target organics were made during any of the three sampling events which were in excess of New Mexico drinking water quality standards. No detections of any BTEX components were made in samples from these wells but low and declining concentrations of DCA were reported in MW-19 and on one occasion in MW-20.

MW-18 is located upgradient of the slurry wall and the area where the old gasoline spill occurred but is downgradient of where many of the former tank farm's activities were conducted. The original MW-18 was apparently destroyed during tank removal operations and was replaced during June, 1992. Samples taken from the replacement well were significantly higher in BTEX components than those taken from the original well. No DCA has ever been detected in samples from either the original or replacement well. BTEX component concentrations have declined during the last three sampling events to the point that during the March 1993 sampling, benzene, at 117 ug/l was the only organic compound in excess of New Mexico drinking water standards.

The last on-site monitor well outside the slurry wall is MW-21, located just outside the eastern slurry wall and downgradient of MW-18. No BTEX components have been detected in this well for two years. It appears that BTEX constituents in ground water such as that sampled by MW-18 are attenuated or biodegraded in transit around the east side of the slurry wall before they reach the area sampled by MW-21. DCA in MW-21, at 6-8 ug/l during the most recent three sampling events, has declined by an order of magnitude since the slurry wall was installed. Since no DCA has been detected in MW-

18, it is assumed the MW-21 DCA is residual from the old gasoline spill area now enclosed by the slurry wall.

The two monitor wells located within the confines of the slurry wall (MW-17 and 22) are designed primarily to assess the progress of biodegradation taking place within the highly contaminated portion of the site. As noted, the original MW-17 was apparently destroyed during removal of the tankage during the fall of 1991 and was replaced by an identical well during June 1992.

The concentrations of BTEX components and DCA have been very high in both of these wells. Biodegradation has been ongoing in the vicinity of both wells as evidenced by the very low levels of sulfate observed in the water samples (approximately 2 orders of magnitude lower than in wells outside the slurry wall). However, this is not immediately evident from cursory examination of the concentrations of the various organic constituents, as summarized in Table 6. We believe, however, that some of these figures may be distorted due to the difficulty of obtaining samples uncontaminated by free phase hydrocarbon in these two wells.

This problem had been previously recognized and measures were taken to prevent such contamination. One-inch diameter PVC piping ("drop-pipes") were installed in each of these two wells just prior to the June 1992 sampling event in a manner to preclude entry of floating free hydrocarbon into the one-inch pipe; purging was conducted through this pipe taking care not to allow the well water to be drawn down below the lower portion of the drop-pipe. Sampling was conducted through the drop-pipe by using a 0.75 inch diameter teflon bailer.

These two wells have long exhibited a strong hydrocarbon/septic odor and a sheen of free hydrocarbon on the water level probe when it was inserted between the casing and drop pipe. During the March 1993 sampling, a slight sheen was detected on the

water purged from the drop-pipe in both wells; this would have also been included in the samples taken for laboratory analysis. We believe this is the cause of the dramatic increase in the organic concentrations reported for both MW-17 and 22 during the March 1993 sampling relative to the December 1992 sampling. The analytical data and field observations also suggest that this type of sample contamination may have occurred during the January 1992 sampling of MW-22 when very high organic concentrations were reported in this well; drop-pipes were not in use at that time.

In future samplings of these two wells, we will either install new drop-pipes or utilize other methods such as using a separatory funnel in the field to increase the probability of excluding free-phase hydrocarbon from the samples.

Semi-logarithmic plots of the concentrations of total BTEX and benzene in each of the two wells within the slurry wall confines during each of the sampling periods since slurry wall installation were made and are shown as Figures 2 and 3. The January 1992 values in MW-22 have been excluded since, as just noted, we believe these samples are not representative of dissolved contaminant concentrations. We believe the same to be true of the March 1993 samples but these have been plotted to graphically illustrate the effects of free-phase hydrocarbon in the samples.

Regression lines were fitted to the plots excluding the non-representative data and calculations made to determine average rate of decline of the organics in the two wells over the 2.2 year time span since the first sampling following slurry wall installation through and including the December 1993 sampling results. The annual rate of decrease in BTEX concentration in MW-17 was 11.7 mg/l and in MW-22 was 8.4 mg/l. Annual rates of decrease for benzene were lower, between 1 and 1.5 mg/l in the two wells. Rates of decline for xylenes and toluene were significantly greater than for benzene. The annual rates of decline for DCA were much more rapid, in the range of 200 mg/l in MW-17 and

2,200 mg/l in MW-22. The calculated annual rates of decline in the two wells were 26 to 40 percent for total BTEX, 6.5 to 16 percent for benzene, and 73 to 92 percent for DCA.

4.0 PROPOSED PROGRAM MODIFICATIONS

The slurry wall has been in place for nearly three years as of this writing and the eight sampling periods of data collected since installation has demonstrated containment of the gasoline-related organics associated with the original spill. The monitoring data has also demonstrated that biodegradation of the organic contaminants is taking place and that the concentrations of these organics in off-site wells are either below drinking water standards or below detection limits. Given these findings, Maverik requests that OCD consider the following proposed modifications to the monitoring program at the facility.

1. Eliminate the requirement for water level and water quality monitoring in the off-site monitoring wells, i.e., MW-9, 13, 14, 15 and 16.

2. Continue monitoring for BTEX, DCA and the field parameters of pH, conductivity and temperature in on-site wells MW-10, 19, and 20 downgradient of the slurry wall, MW-18 upgradient of the slurry wall, MW-21 outside the slurry wall and downgradient of MW-18, and MW-17 and 22 within the confines of the slurry wall.

3. Obtain water level measurements in all wells monitored for water quality plus the four piezometers located within the slurry wall confines.

4. Reduce the frequency of water quality and water level measurements to two times per year, once at the beginning of the primary biodegradation season (in May or June) and once at the end of the season (in October or November).

Maverik proposes that results of the first sampling of the year (May-June) be transmitted to OCD within 4 weeks of receipt of final laboratory results via a transmittal letter and a summary table in the format of Table 6. The results of the second (October-November) sampling will be transmitted in a more formal interpretive report by the last day of the year; this will also include the previously collected data. Maverik will notify OCD at least one week in advance of sampling activities.

TABLE 1

WATER LEVEL ELEVATIONS
AUGUST 1992

Location	Datum (ft, msl)	Water Level (ft, msl)	Change in Water Level Since 6/92 (ft)	Depth to Water Below Ground Surface (ft)
MW-1	5207.24	5199.80	2.42	6.0
MW-2	5196.93	5191.46	0.58	3.8
MW-9	5191.22	5187.70	0.45	1.8
MW-10	5189.30	5184.59	-0.15	2.9
MW-13	5187.76	5184.83	0.09	2.7
MW-14	5194.47	5186.48	-0.12	4.2
MW-15	5188.80	5182.99	-0.20	2.4
MW-16	5194.98	5190.40	1.15	3.3
MW-17	5195.91	5188.77	0.30	3.4
MW-18	5201.75	5192.90	2.06	5.0
MW-19	5189.54	5186.47	0.10	1.9
MW-20	5191.05	5186.53	-0.04	3.5
MW-21	5194.81	5188.98	-0.34	4.6
MW-22	5195.86	5189.88	0.60	4.7
P-1	5197.66	5191.57	1.20	4.2
P-2	5192.32	5188.20	0.80	2.3
P-3	5193.21	5187.81	-0.23	3.6
P-4	5198.82	5190.89	0.83	6.2

TABLE 2

WATER LEVEL ELEVATIONS
DECEMBER 1992

Location	Datum (ft, msl)	Water Level (ft, msl)	Change in Water Level Since 8/92 (ft)	Depth to Water Below Ground Surface (ft)
MW-1	5207.24	5197.81	-1.99	8.0
MW-2	5196.93	5192.73	1.27	2.5
MW-9	5191.22	5188.87	1.17	0.6
MW-10	5189.30	5186.63	2.04	0.9
MW-13	5187.76	5186.45	1.62	1.1
MW-14	5194.47	5189.99	3.51	0.7
MW-15	5188.80	5185.26	2.27	0.1
MW-16	5194.98	5191.79	1.39	1.9
MW-17	5195.91	5190.05	1.28	2.1
MW-18	5201.75	5193.44	0.54	4.5
MW-19	5189.54	5188.07	1.60	0.3
MW-20	5191.05	5188.22	1.69	1.8
MW-21	5194.81	5191.36	2.38	2.2
MW-22	5195.86	5191.06	1.18	3.5
P-1	5197.66	5192.48	0.91	3.3
P-2	5192.32	5189.47	1.27	1.0
P-3	5193.21	5189.78	1.97	1.6
P-4	5198.82	5191.99	1.10	5.1

TABLE 3

WATER LEVEL ELEVATIONS
MARCH 1993

Location	Datum (ft, msl)	Water Level (ft, msl)	Change in Water Level Since 12/92 (ft)	Depth to Water Below Ground Surface (ft)
MW-1	5207.24	5193.54	-4.27	12.3
MW-2	5196.93	5190.75	-1.98	4.5
MW-9	5191.22	5187.64	-1.23	1.8
MW-10	5189.30	5185.94	-0.69	1.6
MW-13	5187.76	5185.88	-0.57	1.7
MW-14	5194.47	5188.49	-1.50	2.2
MW-15	5188.80	5184.73	-0.53	0.6
MW-16	5194.98	5189.69	-2.10	4.0
MW-17	5195.91	5189.06	-0.99	3.1
MW-18	5201.75	5191.25	-2.19	6.7
MW-19	5189.54	5187.12	-0.95	1.2
MW-20	5191.05	5187.33	-0.89	2.7
MW-21	5194.81	5190.34	-1.02	3.2
MW-22	5195.86	5189.56	-1.50	5.0
P-1	5197.66	5190.31	-2.17	5.5
P-2	5192.32	5188.27	-1.20	2.2
P-3	5193.21	5188.75	-1.03	2.6
P-4	5198.82	5190.01	-1.98	7.1

TABLE 4

DEPTH TO GROUND WATER BELOW SURFACE (FT.)

Location	Jan. 1992	June 1992	Aug. 1992	Dec. 1992	Mar. 1993
Inside Slurry Wall					
MW-17		3.7	3.4	2.1	3.1
MW-22	4.5	5.3	4.7	3.5	5.0
P-1		5.4	4.2	3.3	5.5
P-2		3.1	2.3	1.0	2.2
P-3		3.4	3.6	1.6	2.6
P-4		7.0	6.2	5.1	7.1
Outside Slurry Wall					
MW-1	10.9	8.4	6.0	8.0	12.3
MW-2	3.8	4.4	3.8	2.5	4.5
MW-9	1.5	2.3	1.8	0.6	1.8
MW-10	1.6	2.7	2.9	0.9	1.6
MW-13		2.8	2.7	1.1	1.7
MW-14	2.1	4.1	4.2	0.7	2.2
MW-15	0.8	2.2	2.4	0.1	0.6
MW-16	3.4	4.5	3.3	1.9	4.0
MW-18		7.1	5.0	4.5	6.7
MW-19	1.0	2.0	1.9	0.3	1.2
MW-20	2.6	3.5	3.5	1.8	2.7
MW-21	2.8	4.3	4.6	2.2	3.2

TABLE 5

GROUND WATER GRADIENTS

Wells and Date	Distance (ft)	Elevation Difference (ft)	Gradient (ft/100 ft)	Mean Gradient (ft/100 ft)
Inside Slurry Wall				
P4 → P3	338			
June '92		2.02	0.598	
Aug. '92		3.08	0.911	
Dec. '92		2.21	0.654	
Mar. '93		1.26	0.372	0.634
P4 → P2	360			
June '92		2.66	0.739	
Aug. '92		2.69	0.747	
Dec. '92		2.52	0.700	
Mar. '93		1.74	0.483	0.667
P1 → P2	393			
June '92		2.96	0.753	
Aug. '92		3.36	0.855	
Dec. '92		3.01	0.766	
Mar. '93		2.04	0.519	0.723
P4 → MW22	106			
June '92		0.78	0.736	
Aug. '92		1.01	0.953	
Dec. '92		0.93	0.877	
Mar. '93		0.45	0.424	0.748
MW22 → MW17	153			
June '92		0.81	0.529	
Aug. '92		1.11	0.725	
Dec. '92		1.01	0.660	
Mar. '93		0.50	0.326	0.560
MW-17 → P2	118			
June '92		1.07	0.906	
Aug. '92		0.57	0.483	
Dec. '92		0.58	0.491	
Mar. '93		0.79	0.669	0.637

TABLE 5 (Continued)

GROUND WATER GRADIENTS

Wells and Date	Distance (ft)	Elevation Difference (ft)	Gradient (ft/100 ft)	Mean Gradient (ft/100 ft)
Outside Slurry Wall				
MW21 → MW20	300			
June '92		2.75	0.917	
Aug. '92		2.45	0.817	
Dec. '92		3.14	1.047	
Mar. '93		3.01	1.003	0.946
MW16 → MW13	420			
June '92		4.51	1.070	
Aug. '92		5.57	1.326	
Dec. '92		5.34	1.271	
Mar. '93		3.81	0.907	1.144
MW16 → MW9	275			
June '92		2.88	1.047	
Aug. '92		2.70	0.982	
Dec. '92		2.92	1.062	
Mar. '93		2.05	0.745	0.959
MW21 → MW10	370			
June '92		4.58	1.238	
Aug. '92		4.39	1.186	
Dec. '92		4.73	1.278	
Mar. '93		4.40	1.189	1.228
MW18 → MW21	331			
June '92		1.52	0.459	
Aug. '92		3.92	1.184	
Dec. '92		2.58	0.779	
Mar. '93		0.91	0.275	0.674

TABLE 6

SUMMARY OF GROUND WATER QUALITY MONITORING RESULTS SINCE INSTALLATION OF SLURRY WALL

Location	Sampling Period	DCA	B	T	E	X	Total BTEX	pH	SC	Sulfate
Within Slurry Wall										
MW-17	1 (9/90)	360*	11,000*	15,000*	1,160*	13,000*	40,000	7.01	2,500	27
	2 (3/91)	400*	11,000*	10,000*	1,900*	15,000*	37,900	7.04	2,700	12
	3 (6/91)	420*	9,800*	6,300*	1,800*	16,000*	33,900	7.04	2,650	<5
	4 (1/92)	MSG	MSG	MSG	MSG	MSG	MSG	MSG	MSG	MSG
	5 (6/92)	45*	9,240*	7,580*	1,150*	7,190*	25,160	7.26	2,730	91
	6 (8/92)	27*	7,710*	1,920*	669*	5,130*	15,429	7.23	2,810	327
	7 (12/92)	17.3*	7,990*	4,740*	638*	4,600*	17,968	7.54	2,970	352
	8 (3/93)	16.8*	13,800*	6,830*	1,110*	6,930*	28,670	7.37	2,610	12
MW-22	1 (9/90)	7,200*	21,000*	20,000*	1,100*	8,300*	50,400	7.00	1,500	18
	2 (3/91)	2,200*	17,000*	9,500*	910*	6,600*	34,010	6.87	1,900	12
	3 (6/91)	3,600*	15,000*	3,200*	760*	3,000*	21,960	7.06	1,700	59
	4 (1/92)	5,400*	36,000*	27,000*	1,900*	13,500*	78,400	6.86	1,600	<1
	5 (6/92)	3,170*	21,200*	7,540*	1,040*	5,730*	35,510	7.13	1,690	7
	6 (8/92)	568*	20,500*	4,610*	588	3,280*	28,978	7.28	1,545	46
	7 (12/92)	908*	12,100*	4,220*	514	3,254*	20,088	7.43	1,508	6
	8 (3/93)	1,930*	29,800*	14,100*	1,170*	7,030*	52,100	7.26	1,408	<2
On-Site										
MW-10	1 (9/90)	1.4	<0.5	<0.5	<0.5	<1	<1	6.95	1,550	436
	2 (3/91)	<1	<0.5	<0.5	<0.5	<0.5	<0.5	7.29	1,700	5
	3 (6/91)	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4 (1/92)	<5	<5	<5	<5	<5	<5	7.31	1,840	422
	5 (6/92)	1.6	<1	<1	<1	<1	1.6	7.65	1,400	NA
	6 (8/92)	<1	<1	<1	<1	<1	<1	7.85	1,160	NA
	7 (12/92)	<1	<1	<1	<1	<1	<1	7.64	6,110	NA
	8 (3/93)	<1	<1	<1	<1	<1	<1	7.22	9,060	NA

TABLE 6 (continued)

SUMMARY OF GROUND WATER QUALITY MONITORING RESULTS SINCE INSTALLATION OF SLURRY WALL

Location	Sampling Period	DCA	B	T	E	X	Total BTEX	pH	SC	Sulfate
MW-18	1 (9/90)	<1	17*	<12	84	880*	981	7.00	1,500	67
	2 (3/91)	<1	26*	<12	85	770*	881	7.24	1,200	163
	3 (6/91)	<1	<25	<25	78	930*	1,008	6.77	1,200	181
	4 (1/92)	MSG	MSG	MSG	MSG	MSG	MSG	MSG	MSG	MSG
	5 (6/92)	<1	313*	1.1	200	1,710*	2,224	7.07	1,480	NA
	6 (8/92)	<1	527*	10.8	258	2,075*	2,871	7.26	2,100	NA
	7 (12/92)	<25	294*	<25	224	1,460*	1,978	7.31	1,930	NA
	8 (3/93)	<1	117*	8	96	226	447	7.07	2,780	NA
MW-19	1 (9/90)	45*	<0.5	<0.5	1.1	1.9	3	6.95	3,000	292
	2 (3/91)	35*	<0.5	<0.5	<0.5	<0.5	<0.5	7.22	2,500	354
	3 (6/91)	44*	<0.5	<0.5	5.9	<0.5	5.9	7.10	2,400	359
	4 (1/92)	14*	<5	<5	<5	<5	<5	7.66	460	457
	5 (6/92)	11.4*	<1	<1	<1	<1	<1	7.76	1,970	NA
	6 (8/92)	9.0	<1	<1	<1	<1	<1	7.72	1,320	NA
	7 (12/92)	6.6	<1	<1	<1	<1	<1	7.70	1,620	NA
	8 (3/93)	2.4	<1	<1	<1	<1	<1	7.74	1,750	NA
MW-20	1 (9/90)	<1	<0.5	<0.5	<0.5	<1	<1	7.01	1,350	650*
	2 (3/91)	2.0	<0.5	<0.5	<0.5	0.7	1	7.39	3,000	735*
	3 (6/91)	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4 (1/92)	<5	<5	<5	<5	<5	<5	7.54	3,750	427
	5 (6/92)	<1	<1	<1	<1	<1	<1	7.62	1,600	NA
	6 (8/92)	<1	<1	<1	<1	<1	<1	6.97	1,310	NA
	7 (12/92)	<1	<1	<1	<1	<1	<1	7.87	1,340	NA
	8 (3/93)	2.1	<1	<1	<1	<1	2	7.10	6,740	NA
MW-21	1 (9/90)	67*	<0.5	1.5	1.1	5	8	7.01	1,500	386
	2 (3/91)	44*	<0.5	<0.5	<0.5	<0.5	<0.5	7.62	1,700	342
	3 (6/91)	40*	<0.5	<0.5	<0.5	<0.5	<0.5	7.44	1,700	309
	4 (1/92)	8.8	<5	<5	<5	<5	<5	8.31	5,110	NA
	5 (6/92)	21.9*	<1	<1	<1	<1	<1	7.37	2,400	NA
	6 (8/92)	8.3	<1	<1	<1	<1	<1	6.96	1,730	NA
	7 (12/92)	1.7	<1	<1	<1	<1	<1	7.69	2,030	NA
	8 (3/93)	5.9	<1	<1	<1	<1	<1	7.58	1,590	NA

TABLE 6 (continued)

SUMMARY OF GROUND WATER QUALITY MONITORING RESULTS SINCE INSTALLATION OF SLURRY WALL

Location	Sampling Period	DCA	B	T	E	X	Total BTEX	pH	SC	Sulfate
Off-Site										
MW-9	1 (9/90)	2.1	<0.5	<0.5	<0.5	<1	<1	6.97	1,550	551
	2 (3/91)	1.8	<0.5	<0.5	<0.5	1.2	1.2	7.57	2,000	664*
	3 (6/91)	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4 (1/92)	<5	<5	<5	<5	<5	<5	7.31	4,360	638*
	5 (6/92)	1.5	<1	<1	<1	<1	<1	7.58	1,680	NA
	6 (8/92)	<1	<1	<1	<1	<1	<1	7.81	1,325	NA
	7 (12/92)	<1	<1	<1	<1	<1	<1	7.33	1,827	NA
	8 (3/93)	1.5	<1	<1	<1	<1	<1	7.63	1,640	NA
MW-13	1 (9/90)	<1	<0.5	1.5	<0.5	<1	1.5	7.02	2,950	1,630*
	2 (3/91)	<1	<0.5	<0.5	<0.5	<0.5	<0.5	7.84	3,250	1,540*
	3 (6/91)	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4 (1/92)	NA	NA	NA	NA	NA	NA	NA	NA	NA
	5 (6/92)	<1	<1	<1	<1	<1	<1	7.11	4,260	NA
	6 (8/92)	<1	<1	<1	<1	<1	<1	7.06	2,910	NA
	7 (12/92)	NA	NA	NA	NA	NA	NA	NA	NA	NA
	8 (3/93)	<1	<1	<1	<1	<1	<1	7.72	3,410	NA
MW-14	1 (9/90)	2.0	<0.5	<0.5	<0.5	<1	<1	6.97	5,450	2,080*
	2 (3/91)	<1	<0.5	<0.5	<0.5	1.7	<0.5	7.51	8,400	4,520*
	3 (6/91)	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4 (1/92)	<5	<5	<5	<5	<5	<5	7.20	19,380	6,840*
	5 (6/92)	2.3	<1	<1	<1	<1	<1	7.62	4,520	NA
	6 (8/92)	<1	<1	<1	<1	<1	<1	7.38	5,760	NA
	7 (12/92)	<1	<1	<1	<1	<1	<1	7.40	9,090	NA
	8 (3/93)	<1	<1	<1	<1	<1	<1	7.02	15,280	NA

TABLE 6 (continued)

SUMMARY OF GROUND WATER QUALITY MONITORING RESULTS SINCE INSTALLATION OF SLURRY WALL

Location	Sampling Period	DCA	B	T	E	X	Total BTEX	pH	SC	Sulfate
MW-15	1 (9/90)	<1	<0.5	<0.5	<0.5	<1	<1	7.00	3,250	1,380*
	2 (3/91)	<1	<0.5	<0.5	<0.5	<0.5	<0.5	7.02	8,500	3,890*
	3 (6/91)	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4 (1/92)	<5	<5	<5	<5	<5	<5	7.15	12,120	3,970*
	5 (6/92)	<1	<1	<1	<1	<1	<1	7.27	3,430	NA
	6 (8/92)	<1	<1	<1	<1	<1	<1	7.39	2,450	NA
	7 (12/92)	NA	NA	NA	NA	NA	NA	NA	NA	NA
	8 (3/93)	<1	<1	<1	<1	<1	<1	7.42	9,810	NA
MW-16	1 (9/90)	<1	<0.5	<0.5	<0.5	<1	<1	6.97	1,370	292
	2 (3/91)	<1	<0.5	<0.5	<0.5	<0.5	<0.5	7.57	1,200	230
	3 (6/91)	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4 (1/92)	<5	<5	<5	<5	<5	<5	7.30	2,050	345
	5 (6/92)	<1	<1	<1	<1	<1	<1	7.50	1,430	NA
	6 (8/92)	<1	<1	<1	<1	<1	<1	7.76	1,230	NA
	7 (12/92)	<1	<1	<1	<1	<1	<1	7.12	1,735	NA
	8 (3/93)	<1	<1	<1	<1	<1	<1	7.23	2,400	NA
Water Quality Stds.										
New Mexico		10	10	750	750	620		6-9	-----	600
EPA MCL		5	5	1,000	700	10,000		-----	-----	250

NOTES:

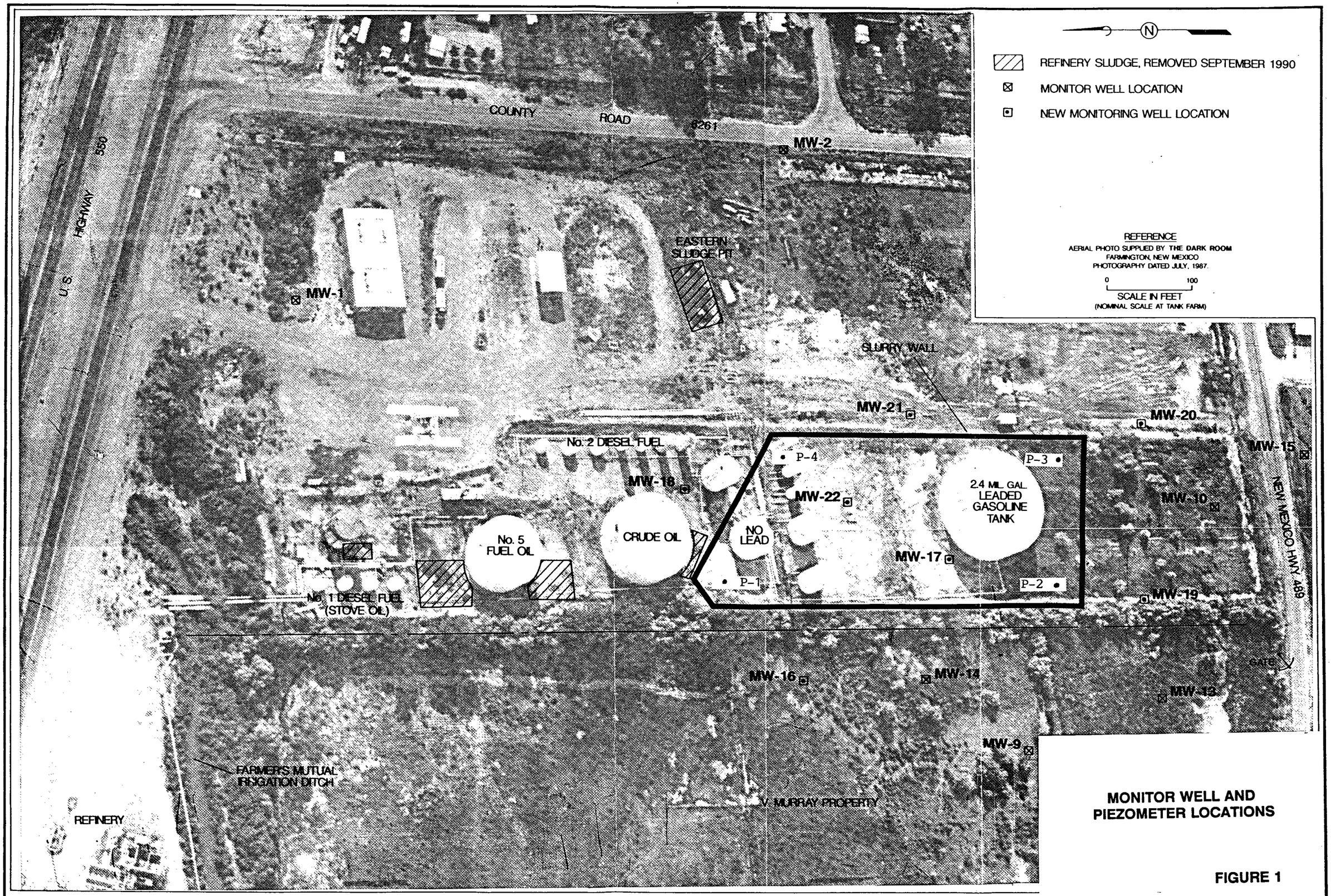
Abbreviations: DCA = 1,2-dichloroethane; B = benzene; T = toluene; E = ethylbenzene; X = xylenes; SC = specific conductivity; TDS = total dissolved solids; MSG = well missing; NA = not analyzed

Organic values in µg/l; pH in standard units; SC in µmhos/cm; sulfate in mg/l

Sampling dates: 1 = Sept. 13 & 14, 1990; 2 = March 18 & 19, 1991; 3 = June 13, 1991; 4 = January 20 & 21, 1992; 5 = June 9 & 12, 1992; 6 = August 19 & 20, 1992; 7 = December 16, 1992; 8 = March 30, 1993

* = exceeds New Mexico MCL for drinking water

From sampling period 5 onward, samples were obtained from replacement wells at MW-17 and MW-18



MONITOR WELL AND PIEZOMETER LOCATIONS

FIGURE 1

FILE 14819-005 BY ____ DATE ____ CHECKED BY ____ DATE ____

Concentrations of BTEX and Benzene in MW-17 Since Slurry Wall Installation

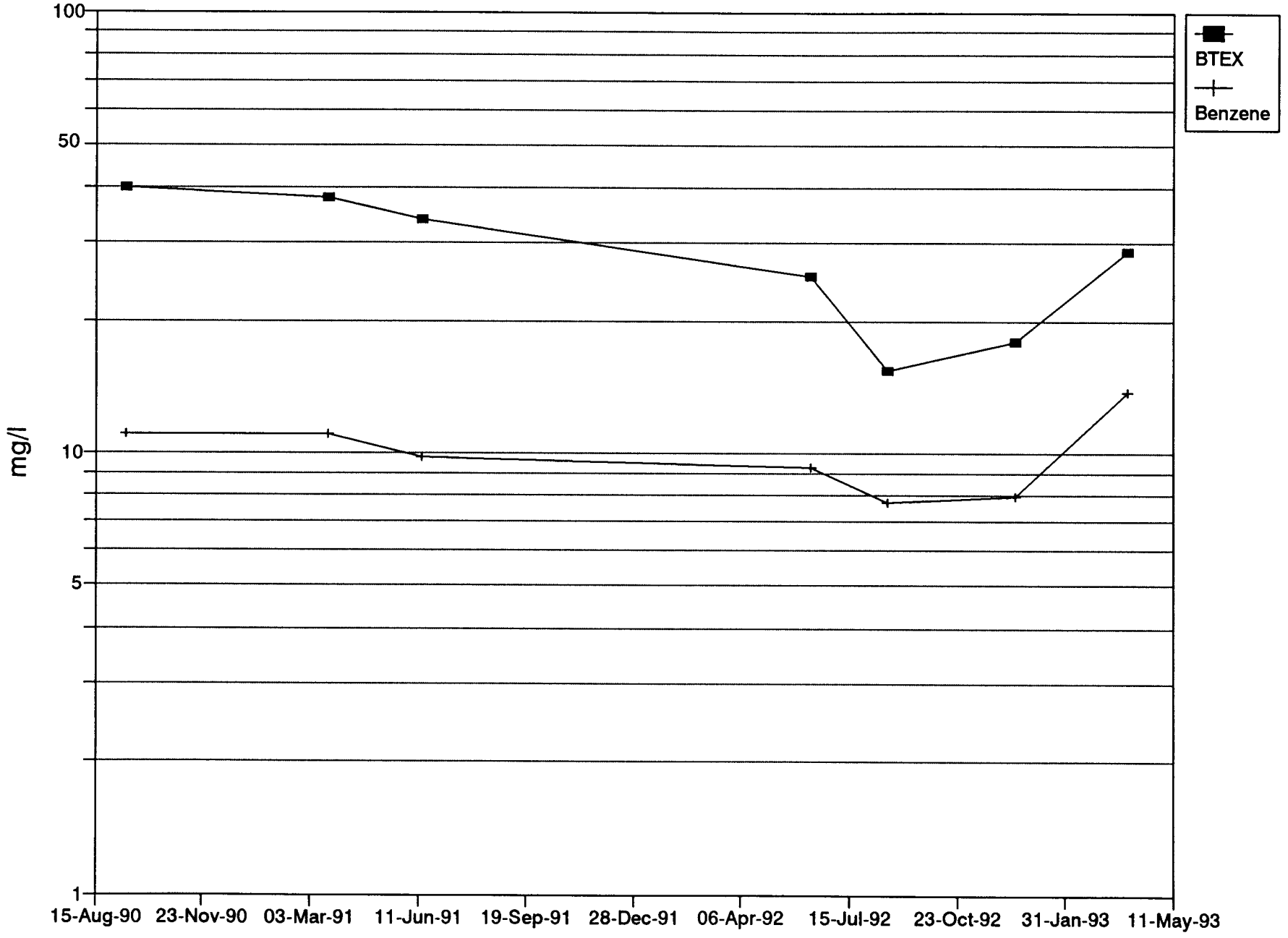


Figure 2

Concentrations of BTEX and Benzene in MW-22 Since Slurry Wall Installation

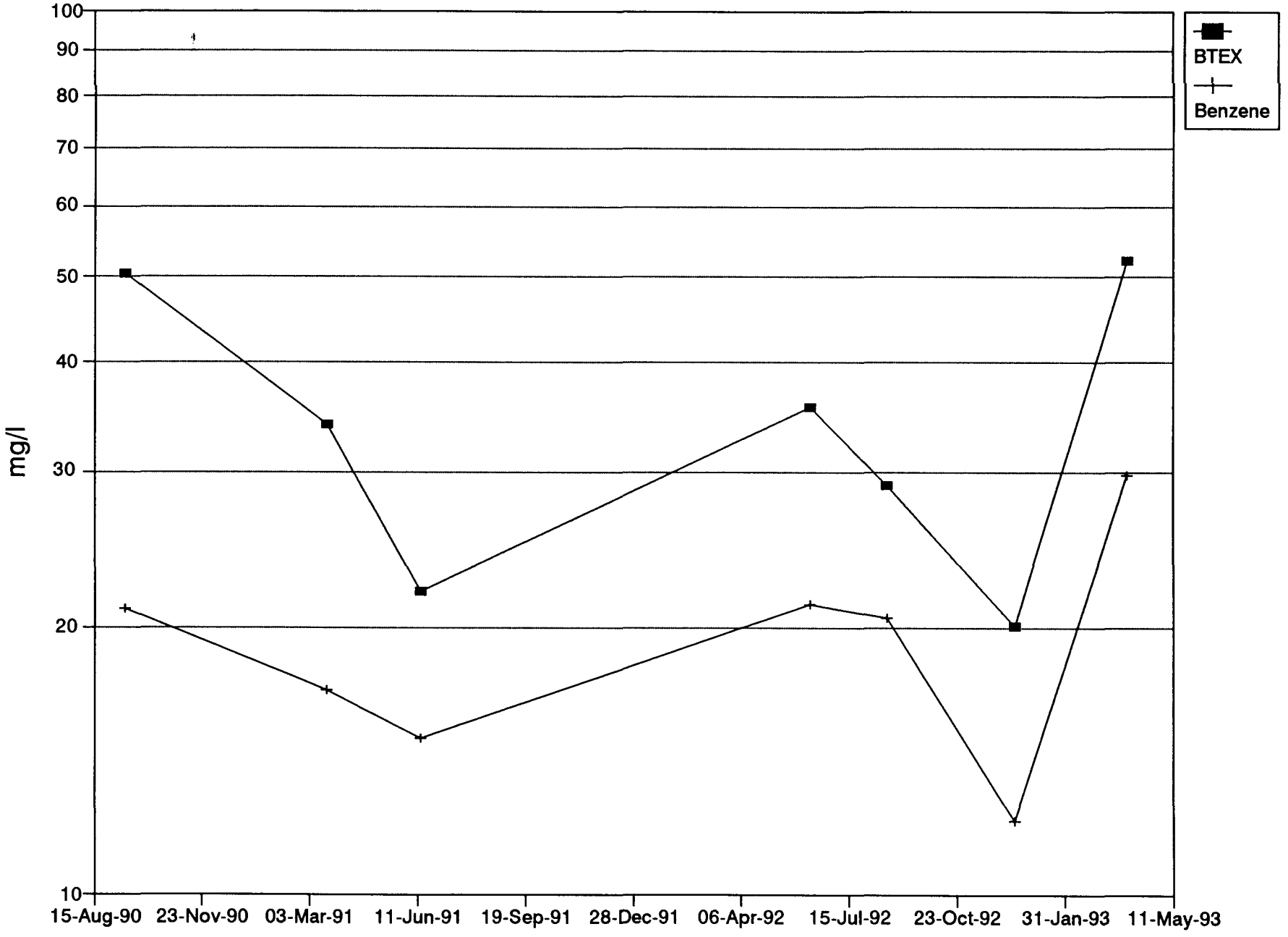


Figure 3

APPENDIX A

LABORATORY ANALYTICAL REPORTS

AUGUST 1992
DECEMBER 1992
MARCH 1993

Analytical Report

Mountain States Analytical

The Quality Solution

CLIENT: Geowest Golden Inc. SLC
175 West 200 South # 2006
Salt Lake City, UT 84101-
Phone: 801-359-3059 801-359-3307 (FAX)
ATTN: Mr. Paul Weissenborn
Project: 3rd Qtr 92/Maverick Kirt.

Date Samples Rec'd: 08/24/92
MSAI Group No.: 7586
Sample Matrix: Aqueous
Report Date: 09/09/92
P.O. Number: 9131.01

LAB NO.	SAMPLE DATE	SAMP TIME	SAMPLE DESCRIPTION	ANALYSES PERFORMED	RESULT
31178	08/19/92	1715	MW-9	VOL, Halo/Arom 601/602	See Attach ---
31179	08/19/92	1530	MW-10	VOL, Halo/Arom 601/602	See Attach ---
31180	08/19/92	1740	MW-13	VOL, Halo/Arom 601/602	See Attach ---
31181	08/19/92	1650	MW-14	VOL, Halo/Arom 601/602	See Attach ---
31182	08/19/92	1450	MW-15	VOL, Halo/Arom 601/602	See Attach ---
31183	08/19/92	1630	MW-16	VOL, Halo/Arom 601/602	See Attach ---
31184	08/20/92	930	MW-17	VOL, Halo/Arom 601/602	See Attach ---
				Sulfate, Turbidimetric	327 mg/l
				Sulfide w/ww	<1 mg/l
31185	08/20/92	1230	MW-18	VOL, Halo/Arom 601/602	See Attach ---
31186	08/19/92	1600	MW-19	VOL, Halo/Arom 601/602	See Attach ---
31187	08/18/92	1600	MW-20	VOL, Halo/Arom 601/602	See Attach ---
31188	08/18/92	1530	MW-21	VOL, Halo/Arom 601/602	See Attach ---
31189	08/20/92	1130	MW-22	VOL, Halo/Arom 601/602	See Attach ---
				Sulfate, Turbidimetric	46 mg/l
				Sulfide w/ww	<1 mg/l

Analytical Report

Mountain States Analytical

The Quality Solution

CLIENT: Geowest Golden Inc. SLC
175 West 200 South # 2006
Salt Lake City, UT 84101-
Phone: 801-359-3059 801-359-3307 (FAX)
ATTN: Mr. Paul Weissenborn
Project: 3rd Qtr 92/Maverick Kirt.

Date Samples Rec'd: 08/24/92
MSAI Group No.: 7586
Sample Matrix: Aqueous
Report Date: 09/09/92
P.O. Number: 9131.01

LAB SAMPLE NO.	SAMP DATE	SAMP TIME	SAMPLE DESCRIPTION	ANALYSES PERFORMED	RESULT
31190	08/18/92	1400	MW-26	VOL, Halo/Arom 601/602	See Attach ---
31191	08/13/92	900	Trip Blank	VOL, Halo/Arom 601/602	See Attach ---

Respectfully submitted,

Douglas W. Later

Douglas W. Later, Ph.D.
Laboratory Director

Glenn A. Sorensen

Glenn A. Sorensen, B.S.
Manager, Technical Operations

Mountain States Analytical
The Quality Solution

CLIENT:	Geowest Golden Inc. SLC 175 West 200 South # 2006 Salt Lake City, UT 84101-	LAB NO: GROUP NO: DATE SAMPLED: TIME SAMPLED:	31178 7586 08/19/92 1715
ATTN:	Mr. Paul Weissenborn	DATE RECEIVED: DATE REPORTED:	08/24/92 09/10/92
SAMPLE ID:	MW-9	DISPOSAL DATE:	10/10/92

ANALYSIS: Volatiles - Water Matrix [EPA 601/602] (Capillary)

COMPOUND(s)	RESULT	LIMIT OF QUANTITATION
Benzene	< 1.0 ug/l	1.0 ug/l
Toluene	< 1.0 ug/l	1.0 ug/l
Ethylbenzene	< 1.0 ug/l	1.0 ug/l
m,p-Xylene	< 1.0 ug/l	1.0 ug/l
o-Xylene/Styrene*	< 1.0 ug/l	1.0 ug/l
1,2-Dichloroethane	< 1.0 ug/l	1.0 ug/l

Date Analyzed: 09/01/92

*These compounds coelute under the conditions used. The result represents the total amount for these compounds.

Respectfully submitted,

Kenneth A. Roberts, B.S.
GC Group Leader

Analytical Report

Mountain States Analytical

The Quality Solution

CLIENT: Geowest Golden Inc. SLC
175 West 200 South # 2006
Salt Lake City, UT 84101-

ATTN: Mr. Paul Weissenborn

SAMPLE ID: MW-10

LAB NO: 31179
GROUP NO: 7586
DATE SAMPLED: 08/19/92
TIME SAMPLED: 1530
DATE RECEIVED: 08/24/92
DATE REPORTED: 09/10/92
DISPOSAL DATE: 10/10/92

ANALYSIS: Volatiles - Water Matrix [EPA 601/602] (Capillary)

COMPOUND(s)	RESULT	LIMIT OF QUANTITATION
Benzene	< 1.0 ug/l	1.0 ug/l
Toluene	< 1.0 ug/l	1.0 ug/l
Ethylbenzene	< 1.0 ug/l	1.0 ug/l
m,p-Xylene	< 1.0 ug/l	1.0 ug/l
o-Xylene/Styrene*	< 1.0 ug/l	1.0 ug/l
1,2-Dichloroethane	< 1.0 ug/l	1.0 ug/l

Date Analyzed: 09/01/92

*These compounds coelute under the conditions used. The result represents the total amount for these compounds.

Respectfully submitted,

Kenneth A. Roberts, B.S.
GC Group Leader

Analytical Report

Mountain States Analytical

The Quality Solution

CLIENT:	Geowest Golden Inc. SLC 175 West 200 South # 2006 Salt Lake City, UT 84101-	LAB NO:	31180
		GROUP NO:	7586
		DATE SAMPLED:	08/19/92
		TIME SAMPLED:	1740
ATTN:	Mr. Paul Weissenborn	DATE RECEIVED:	08/24/92
		DATE REPORTED:	09/10/92
SAMPLE ID:	MW-13	DISPOSAL DATE:	10/10/92

ANALYSIS: Volatiles - Water Matrix [EPA 601/602] (Capillary)

COMPOUND(s)	RESULT	LIMIT OF QUANTITATION
Benzene	< 1.0 ug/l	1.0 ug/l
Toluene	< 1.0 ug/l	1.0 ug/l
Ethylbenzene	< 1.0 ug/l	1.0 ug/l
m,p-Xylene	< 1.0 ug/l	1.0 ug/l
o-Xylene/Styrene*	< 1.0 ug/l	1.0 ug/l
1,2-Dichloroethane	< 1.0 ug/l	1.0 ug/l

Date Analyzed: 09/01/92

*These compounds coelute under the conditions used. The result represents the total amount for these compounds.

Respectfully submitted,

Kenneth A. Roberts

Kenneth A. Roberts, B.S.
GC Group Leader

1645 West 2200 South, Salt Lake City, Utah 84119 (801) 973-0050 FAX (801) 972-6278

Mountain States Analytical
The Quality Solution

CLIENT:	Geowest Golden Inc. SLC 175 West 200 South # 2006 Salt Lake City, UT 84101-	LAB NO: GROUP NO: DATE SAMPLED: TIME SAMPLED:	31181 7586 08/19/92 1650
ATTN:	Mr. Paul Weissenborn	DATE RECEIVED: DATE REPORTED:	08/24/92 09/10/92
SAMPLE ID:	MW-14	DISPOSAL DATE:	10/10/92

ANALYSIS: Volatiles - Water Matrix [EPA 601/602] (Capillary)

COMPOUND(s)		RESULT	LIMIT OF QUANTITATION
Benzene	<	1.0 ug/l	1.0 ug/l
Toluene	<	1.0 ug/l	1.0 ug/l
Ethylbenzene	<	1.0 ug/l	1.0 ug/l
m,p-Xylene	<	1.0 ug/l	1.0 ug/l
o-Xylene/Styrene*	<	1.0 ug/l	1.0 ug/l
1,2-Dichloroethane	<	1.0 ug/l	1.0 ug/l

Date Analyzed: 09/01/92

*These compounds coelute under the conditions used. The result represents the total amount for these compounds.

Respectfully submitted,

Kenneth A. Roberts, B.S.
GC Group Leader

Analytical Report

Mountain States Analytical

The Quality Solution

CLIENT:	Geowest Golden Inc. SLC 175 West 200 South # 2006 Salt Lake City, UT 84101-	LAB NO:	31182
		GROUP NO:	7586
		DATE SAMPLED:	08/19/92
		TIME SAMPLED:	1450
ATTN:	Mr. Paul Weissenborn	DATE RECEIVED:	08/24/92
		DATE REPORTED:	09/10/92
SAMPLE ID:	MW-15	DISPOSAL DATE:	10/10/92

ANALYSIS: Volatiles - Water Matrix [EPA 601/602] (Capillary)

COMPOUND(s)	RESULT	LIMIT OF QUANTITATION
Benzene	< 1.0 ug/l	1.0 ug/l
Toluene	< 1.0 ug/l	1.0 ug/l
Ethylbenzene	< 1.0 ug/l	1.0 ug/l
m,p-Xylene	< 1.0 ug/l	1.0 ug/l
o-Xylene/Styrene*	< 1.0 ug/l	1.0 ug/l
1,2-Dichloroethane	< 1.0 ug/l	1.0 ug/l

Date Analyzed: 09/01/92

*These compounds coelute under the conditions used. The result represents the total amount for these compounds.

Respectfully submitted,

Kenneth A. Roberts, B.S.
GC Group Leader

1645 West 2200 South, Salt Lake City, Utah 84119 (801) 973-0050 FAX (801) 972-6278

Mountain States Analytical
The Quality Solution

CLIENT:	Geowest Golden Inc. SLC 175 West 200 South # 2006 Salt Lake City, UT 84101-	LAB NO: GROUP NO: DATE SAMPLED: TIME SAMPLED:	31183 7586 08/19/92 1630
ATTN:	Mr. Paul Weissenborn	DATE RECEIVED: DATE REPORTED:	08/24/92 09/10/92
SAMPLE ID:	MW-16	DISPOSAL DATE:	10/10/92

ANALYSIS: Volatiles - Water Matrix [EPA 601/602] (Capillary)

COMPOUND(s)		RESULT	LIMIT OF QUANTITATION
Benzene	<	1.0 ug/l	1.0 ug/l
Toluene	<	1.0 ug/l	1.0 ug/l
Ethylbenzene	<	1.0 ug/l	1.0 ug/l
m,p-Xylene	<	1.0 ug/l	1.0 ug/l
o-Xylene/Styrene*	<	1.0 ug/l	1.0 ug/l
1,2-Dichloroethane	<	1.0 ug/l	1.0 ug/l

Date Analyzed: 09/01/92

*These compounds coelute under the conditions used. The result represents the total amount for these compounds.

Respectfully submitted,

Kenneth A. Roberts, B.S.
GC Group Leader

Analytical Report

Mountain States Analytical

The Quality Solution

CLIENT:	Geowest Golden Inc. SLC 175 West 200 South # 2006 Salt Lake City, UT 84101-	LAB NO:	31184
		GROUP NO:	7586
		DATE SAMPLED:	08/20/92
		TIME SAMPLED:	930
ATTN:	Mr. Paul Weissenborn	DATE RECEIVED:	08/24/92
		DATE REPORTED:	09/10/92
SAMPLE ID:	MW-17	DISPOSAL DATE:	10/10/92

ANALYSIS: Volatiles - Water Matrix [EPA 601/602] (Capillary)

COMPOUND(s)	RESULT	LIMIT OF QUANTITATION
Benzene	7,710 ug/l	100 ug/l
Toluene	1,920 ug/l	100 ug/l
Ethylbenzene	669 ug/l	100 ug/l
m,p-Xylene	3,610 ug/l	100 ug/l
o-Xylene/Styrene*	1,520 ug/l	100 ug/l
1,2-Dichloroethane	26.6 ug/l	1.0 ug/l

Date Analyzed: 09/01/92

*These compounds coelute under the conditions used. The result represents the total amount for these compounds.

Respectfully submitted,

Kenneth A. Roberts, B.S.
GC Group Leader

1645 West 2200 South, Salt Lake City, Utah 84119 (801) 973-0050 FAX (801) 972-6278

Mountain States Analytical
The Quality Solution

CLIENT: Geowest Golden Inc. SLC
175 West 200 South # 2006
Salt Lake City, UT 84101-

ATTN: Mr. Paul Weissenborn

SAMPLE ID: MW-18

LAB NO: 31185
GROUP NO: 7586
DATE SAMPLED: 08/20/92
TIME SAMPLED: 1230
DATE RECEIVED: 08/24/92
DATE REPORTED: 09/10/92
DISPOSAL DATE: 10/10/92

ANALYSIS: Volatiles - Water Matrix [EPA 601/602] (Capillary)

COMPOUND(s)	RESULT	LIMIT OF QUANTITATION
Benzene	527 ug/l	50.0 ug/l
Toluene	10.8 ug/l	1.0 ug/l
Ethylbenzene	258 ug/l	50.0 ug/l
m,p-Xylene	2,040 ug/l	50.0 ug/l
o-Xylene/Styrene*	35.1 ug/l	1.0 ug/l
1,2-Dichloroethane	< 1.0 ug/l	1.0 ug/l

Date Analyzed: 09/01/92

*These compounds coelute under the conditions used. The result represents the total amount for these compounds.

Respectfully submitted,

Kenneth A. Roberts, B.S.
GC Group Leader

Analytical Report

Mountain States Analytical

The Quality Solution

CLIENT: Geowest Golden Inc. SLC
175 West 200 South # 2006
Salt Lake City, UT 84101-

ATTN: Mr. Paul Weissenborn

SAMPLE ID: MW-19

LAB NO:	31186
GROUP NO:	7586
DATE SAMPLED:	08/19/92
TIME SAMPLED:	1600
DATE RECEIVED:	08/24/92
DATE REPORTED:	09/10/92
DISPOSAL DATE:	10/10/92

ANALYSIS: Volatiles - Water Matrix [EPA 601/602] (Capillary)

COMPOUND(s)		RESULT	LIMIT OF QUANTITATION
Benzene	<	1.0 ug/l	1.0 ug/l
Toluene	<	1.0 ug/l	1.0 ug/l
Ethylbenzene	<	1.0 ug/l	1.0 ug/l
m,p-Xylene	<	1.0 ug/l	1.0 ug/l
o-Xylene/Styrene*	<	1.0 ug/l	1.0 ug/l
1,2-Dichloroethane		9.0 ug/l	1.0 ug/l

Date Analyzed: 09/04/92

*These compounds coelute under the conditions used. The result represents the total amount for these compounds.

Respectfully submitted,

Kenneth A. Roberts, B.S.
GC Group Leader

1645 West 2200 South, Salt Lake City, Utah 84119 (801) 973-0050 FAX (801) 972-6278

Mountain States Analytical
The Quality Solution

CLIENT:	Geowest Golden Inc. SLC 175 West 200 South # 2006 Salt Lake City, UT 84101-	LAB NO: GROUP NO: DATE SAMPLED: TIME SAMPLED:	31187 7586 08/18/92 1600
ATTN:	Mr. Paul Weissenborn	DATE RECEIVED: DATE REPORTED:	08/24/92 09/10/92
SAMPLE ID:	MW-20	DISPOSAL DATE:	10/10/92

ANALYSIS: Volatiles - Water Matrix [EPA 601/602] (Capillary)

COMPOUND(s)	RESULT	LIMIT OF QUANTITATION
Benzene	< 1.0 ug/l	1.0 ug/l
Toluene	< 1.0 ug/l	1.0 ug/l
Ethylbenzene	< 1.0 ug/l	1.0 ug/l
m,p-Xylene	< 1.0 ug/l	1.0 ug/l
o-Xylene/Styrene*	< 1.0 ug/l	1.0 ug/l
1,2-Dichloroethane	< 1.0 ug/l	1.0 ug/l

Date Analyzed: 09/04/92

*These compounds coelute under the conditions used. The result represents the total amount for these compounds.

Respectfully submitted,

Kenneth A. Roberts, B.S.
GC Group Leader

Analytical Report

Mountain States Analytical

The Quality Solution

CLIENT:	Geowest Golden Inc. SLC 175 West 200 South # 2006 Salt Lake City, UT 84101-	LAB NO:	31188
		GROUP NO:	7586
		DATE SAMPLED:	08/18/92
		TIME SAMPLED:	1530
ATTN:	Mr. Paul Weissenborn	DATE RECEIVED:	08/24/92
		DATE REPORTED:	09/10/92
SAMPLE ID:	MW-21	DISPOSAL DATE:	10/10/92

ANALYSIS: Volatiles - Water Matrix [EPA 601/602] (Capillary)

COMPOUND(s)		RESULT	LIMIT OF QUANTITATION
Benzene	<	1.0 ug/l	1.0 ug/l
Toluene	<	1.0 ug/l	1.0 ug/l
Ethylbenzene	<	1.0 ug/l	1.0 ug/l
m,p-Xylene	<	1.0 ug/l	1.0 ug/l
o-Xylene/Styrene*	<	1.0 ug/l	1.0 ug/l
1,2-Dichloroethane		8.3 ug/l	1.0 ug/l

Date Analyzed: 09/04/92

*These compounds coelute under the conditions used. The result represents the total amount for these compounds.

Respectfully submitted,

Kenneth A. Roberts, B.S.
GC Group Leader

1645 West 2200 South, Salt Lake City, Utah 84119 (801) 973-0050 FAX (801) 972-6278

Mountain States Analytical
The Quality Solution

CLIENT:	Geowest Golden Inc. SLC 175 West 200 South # 2006 Salt Lake City, UT 84101-	LAB NO: GROUP NO: DATE SAMPLED: TIME SAMPLED:	31189 7586 08/20/92 1130
ATTN:	Mr. Paul Weissenborn	DATE RECEIVED: DATE REPORTED:	08/24/92 09/10/92
SAMPLE ID:	MW-22	DISPOSAL DATE:	10/10/92

ANALYSIS: Volatiles - Water Matrix [EPA 601/602] (Capillary)

COMPOUND(s)	RESULT	LIMIT OF QUANTITATION
Benzene	20,500 ug/l	1,000 ug/l
Toluene	4,610 ug/l	50.0 ug/l
Ethylbenzene	588 ug/l	50.0 ug/l
m,p-Xylene	2,210 ug/l	50.0 ug/l
o-Xylene/Styrene*	1,070 ug/l	50.0 ug/l
1,2-Dichloroethane	568 ug/l	50.0 ug/l

Date Analyzed: 09/01/92

*These compounds coelute under the conditions used. The result represents the total amount for these compounds.

Respectfully submitted,

Kenneth A. Roberts, B.S.
GC Group Leader

Analytical Report

Mountain States Analytical

The Quality Solution

CLIENT:	Geowest Golden Inc. SLC 175 West 200 South # 2006 Salt Lake City, UT 84101-	LAB NO:	31190
		GROUP NO:	7586
		DATE SAMPLED:	08/18/92
		TIME SAMPLED:	1400
ATTN:	Mr. Paul Weissenborn	DATE RECEIVED:	08/24/92
		DATE REPORTED:	09/10/92
SAMPLE ID:	MW-26	DISPOSAL DATE:	10/10/92

ANALYSIS: Volatiles - Water Matrix [EPA 601/602] (Capillary)

COMPOUND(s)	RESULT	LIMIT OF QUANTITATION
Benzene	< 1.0 ug/l	1.0 ug/l
Toluene	< 1.0 ug/l	1.0 ug/l
Ethylbenzene	< 1.0 ug/l	1.0 ug/l
m,p-Xylene	< 1.0 ug/l	1.0 ug/l
o-Xylene/Styrene*	< 1.0 ug/l	1.0 ug/l
1,2-Dichloroethane	9.3 ug/l	1.0 ug/l

Date Analyzed: 09/04/92

*These compounds coelute under the conditions used. The result represents the total amount for these compounds.

Respectfully submitted,

Kenneth A. Roberts, B.S.
GC Group Leader

1645 West 2200 South, Salt Lake City, Utah 84119 (801) 973-0050 FAX (801) 972-6278

Analytical Report

Mountain States Analytical

The Quality Solution

CLIENT:	Geowest Golden Inc. SLC 175 West 200 South # 2006 Salt Lake City, UT 84101-	LAB NO: GROUP NO: DATE SAMPLED: TIME SAMPLED:	31191 7586 08/13/92 900
ATTN:	Mr. Paul Weissenborn	DATE RECEIVED: DATE REPORTED:	08/24/92 09/10/92
SAMPLE ID:	Trip Blank	DISPOSAL DATE:	10/10/92

ANALYSIS: Volatiles - Water Matrix [EPA 601/602] (Capillary)

COMPOUND(s)	RESULT	LIMIT OF QUANTITATION
Benzene	< 1.0 ug/l	1.0 ug/l
Toluene	< 1.0 ug/l	1.0 ug/l
Ethylbenzene	< 1.0 ug/l	1.0 ug/l
m,p-Xylene	< 1.0 ug/l	1.0 ug/l
o-Xylene/Styrene*	< 1.0 ug/l	1.0 ug/l
1,2-Dichloroethane	< 1.0 ug/l	1.0 ug/l

Date Analyzed: 08/31/92

*These compounds coelute under the conditions used. The result represents the total amount for these compounds.

Respectfully submitted,

Kenneth A. Roberts, B.S.
GC Group Leader

1645 West 2200 South, Salt Lake City, Utah 84119 (801) 973-0050 FAX (801) 972-6278

CHAIN-OF-CUSTODY

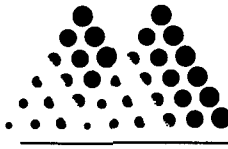
Project No.	Project Name: 3rd Qtr 1992 MAVERIK KIRTLAND REFINERY
913.01	
Samplers: (Signature)	

Sample No.	Date	Time	Sample Location	No. of Containers	Analysis Requested: BTEX	1,2 Dichloroethane	Sulfide	Sulfate			Remarks
MW-9	8/19	17:15	Mon well MW-9	3	✓	✓					*Trip Blank → BTEX only.
MW-10	8/19	15:30	" MW-10	3	✓	✓					
MW-13	8/19	17:40	MW-13	3	✓	✓					
MW-14	8/19	16:50	MW-14	3	✓	✓					
MW-15	8/19	14:50	MW-15	3	✓	✓					
MW-16	8/19	16:30	MW-16	3	✓	✓					
MW-17	8/20	0930	MW-17	6	✓	✓	✓	✓			
MW-18	8/20	12:30	MW-18	4	✓	✓					
MW-19	8/19	16:00	MW-19	3	✓	✓					
MW-20	8/18	16:00	MW-20	3	✓	✓					
MW-21	8/18	15:30	MW-21	3	✓	✓					
MW-22	8/20	11:30	MW-22	6	✓	✓	✓	✓			
MW-24	8/18	14:00	MW-24	3	✓	✓					
			Trip Blank*	3	✓						

Relinquished by: (Signature)	Date/Time	Recieved by: (Signature)	Relinquished by: (Signature)	Date/Time	Recieved by: (Signature)
[signature]	8/24/92 1545	[signature]		8/24 1545	
Relinquished by: (Signature)	Date/Time	Recieved by: (Signature)	Relinquished by: (Signature)	Date/Time	Recieved by: (Signature)
Relinquished by: (Signature)	Date/Time	Recieved for Laboratory by: (Signature)	Date/Time		

Remarks:

GeoWest Golden, Inc.
530 Commons Drive Golden, CO 80401 (303) 526-9838



Mountain States Analytical

The Quality Solution

CLIENT:	Geowest Golden, Inc. S.L. Office	SAMPLE NO:	0002989
	175 W. 200 S.	SAMPLE SET NO:	000644S
	Salt Lake City, UT 84101-	DATE SAMPLED:	12/16/92
		TIME SAMPLED:	1545
ATTN:	Mr. Paul Weisenborn	DATE RECEIVED:	12/18/92
		DATE REPORTED:	01/07/93
SAMPLE ID:	MW-9	DISPOSAL DATE:	02/06/93

ANALYSIS: Volatiles - Water Matrix [EPA 601/602] (Capillary)

COMPOUND(s)	RESULT	LIMIT OF QUANTITATION
Benzene	< 1.0 ug/l	1.0 ug/l
Toluene	< 1.0 ug/l	1.0 ug/l
Ethylbenzene	< 1.0 ug/l	1.0 ug/l
m,p-Xylene	< 1.0 ug/l	1.0 ug/l
o-Xylene/Styrene*	< 1.0 ug/l	1.0 ug/l
1,2-Dichloroethane	< 1.0 ug/l	1.0 ug/l

Respectfully submitted,

Kenneth A. Roberts

Kenneth A. Roberts, B.S.
GC Group Leader

Mountain States Analytical
The Quality Solution

CLIENT:	Geowest Golden, Inc. S.L. Office	SAMPLE NO:	0002990
	175 W. 200 S.	SAMPLE SET NO:	000644S
	Salt Lake City, UT 84101-	DATE SAMPLED:	12/16/92
		TIME SAMPLED:	1420
ATTN:	Mr. Paul Weisenborn	DATE RECEIVED:	12/18/92
		DATE REPORTED:	01/07/93
SAMPLE ID:	MW-10	DISPOSAL DATE:	02/06/93

ANALYSIS: Volatiles - Water Matrix [EPA 601/602] (Capillary)

COMPOUND(s)	RESULT	LIMIT OF QUANTITATION
Benzene	< 1.0 ug/l	1.0 ug/l
Toluene	< 1.0 ug/l	1.0 ug/l
Ethylbenzene	< 1.0 ug/l	1.0 ug/l
m,p-Xylene	< 1.0 ug/l	1.0 ug/l
o-Xylene/Styrene*	< 1.0 ug/l	1.0 ug/l
1,2-Dichloroethane	< 1.0 ug/l	1.0 ug/l

Respectfully submitted,

Kenneth A. Roberts, B.S.
GC Group Leader

Mountain States Analytical
The Quality Solution

CLIENT:	Geowest Golden, Inc. S.L. Office	SAMPLE NO:	0002991
	175 W. 200 S.	SAMPLE SET NO:	000644S
	Salt Lake City, UT 84101-	DATE SAMPLED:	12/16/92
		TIME SAMPLED:	1600
ATTN:	Mr. Paul Weisenborn	DATE RECEIVED:	12/18/92
		DATE REPORTED:	01/07/93
SAMPLE ID:	MW-14	DISPOSAL DATE:	02/06/93

ANALYSIS: Volatiles - Water Matrix [EPA 601/602] (Capillary)

COMPOUND(s)	RESULT	LIMIT OF QUANTITATION
Benzene	< 1.0 ug/l	1.0 ug/l
Toluene	< 1.0 ug/l	1.0 ug/l
Ethylbenzene	< 1.0 ug/l	1.0 ug/l
m,p-Xylene	< 1.0 ug/l	1.0 ug/l
o-Xylene/Styrene*	< 1.0 ug/l	1.0 ug/l
1,2-Dichloroethane	< 1.0 ug/l	1.0 ug/l

Respectfully submitted,

Kenneth A. Roberts, B.S.
GC Group Leader

Analytical Report

Mountain States Analytical

The Quality Solution

CLIENT:	Geowest Golden, Inc. S.L. Office	SAMPLE NO:	0002992
	175 W. 200 S.	SAMPLE SET NO:	000644S
	Salt Lake City, UT 84101-	DATE SAMPLED:	12/16/92
		TIME SAMPLED:	1630
ATTN:	Mr. Paul Weisenborn	DATE RECEIVED:	12/18/92
		DATE REPORTED:	01/07/93
SAMPLE ID:	MW-16	DISPOSAL DATE:	02/06/93

ANALYSIS: Volatiles - Water Matrix [EPA 601/602] (Capillary)

COMPOUND(s)	RESULT	LIMIT OF QUANTITATION
Benzene	< 1.0 ug/l	1.0 ug/l
Toluene	< 1.0 ug/l	1.0 ug/l
Ethylbenzene	< 1.0 ug/l	1.0 ug/l
m,p-Xylene	< 1.0 ug/l	1.0 ug/l
o-Xylene/Styrene*	< 1.0 ug/l	1.0 ug/l
1,2-Dichloroethane	< 1.0 ug/l	1.0 ug/l

Respectfully submitted,

Kenneth A. Roberts, B.S.
GC Group Leader

Mountain States Analytical

The Quality Solution

Geowest Golden, Inc. Salt Lake Office
175 West 200 South #2006
Salt Lake City, UT 84101
Telephone: (801) 359-3059
Facsimile: (801) 359-3307

Sample Number: 0002993
Sample Set: 000644S
Date Reported: 6 JAN 1993
Date Received: 18 DEC 1992
Disposal Date: 1 FEB 1993

Attention: Paul Weisenborn
Project: Maverick Kirtland
Case Number: 4th Qtr 1992
Purchase Order: 9131.01

Customer Number: MW-17
Date Sampled: 16 DEC 1992
Matrix: Wastewater
Containers: 5

Analysis	Catalog Number	Method	Result	Dry Result	Reporting Units
Chromatograms/Etc.	06159		Complete		
Volatile Aromatics/Halocarbons	05515	EPA 600 Series 601/ 602	See Attached		

2 Analyses for GC

Reviewed and approved by
Kenneth Roberts, B.S.
GC Group Leader

Sulfate, Turbidimetric	01125	EPA 600 Series 375.4	352		mg/l
Sulfide, Colorimetric	00230	EPA 427 EPA 376.1	1		mg/l

2 Analyses for Wet Chemistry

Reviewed and approved by
Glenn Sorensen, B.S.
Manager, Inorganics Department

4 Analyses for Sample Number 0002993

Mountain States Analytical
The Quality Solution

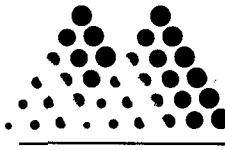
CLIENT:	Geowest Golden, Inc. S.L. Office	SAMPLE NO:	0002993
	175 W. 200 S.	SAMPLE SET NO:	000644S
	Salt Lake City, UT 84101-	DATE SAMPLED:	12/16/92
		TIME SAMPLED:	1045
ATTN:	Mr. Paul Weisenborn	DATE RECEIVED:	12/18/92
		DATE REPORTED:	01/07/93
SAMPLE ID:	MW-17	DISPOSAL DATE:	02/06/93

ANALYSIS: Volatiles - Water Matrix [EPA 601/602] (Capillary)

COMPOUND(s)	RESULT	LIMIT OF QUANTITATION
Benzene	7,990 ug/l	100 ug/l
Toluene	4,740 ug/l	100 ug/l
Ethylbenzene	638 ug/l	100 ug/l
m,p-Xylene	3,230 ug/l	100 ug/l
o-Xylene/Styrene*	1,370 ug/l	100 ug/l
1,2-Dichloroethane	17.3 ug/l	1.0 ug/l

Respectfully submitted,

Kenneth A. Roberts, B.S.
GC Group Leader



Mountain States Analytical

The Quality Solution

CLIENT:	Geowest Golden, Inc. S.L. Office	SAMPLE NO:	0002994
	175 W. 200 S.	SAMPLE SET NO:	000644S
	Salt Lake City, UT 84101-	DATE SAMPLED:	12/16/92
		TIME SAMPLED:	1205
ATTN:	Mr. Paul Weisenborn	DATE RECEIVED:	12/18/92
		DATE REPORTED:	01/07/93
SAMPLE ID:	MW-18	DISPOSAL DATE:	02/06/93

ANALYSIS: Volatiles - Water Matrix [EPA 601/602] (Capillary)

COMPOUND(s)		RESULT	LIMIT OF QUANTITATION
Benzene		294 ug/l	25.0 ug/l
Toluene	<	25.0 ug/l	25.0 ug/l
Ethylbenzene		224 ug/l	25.0 ug/l
m,p-Xylene		1,460 ug/l	25.0 ug/l
o-Xylene/Styrene*	<	25.0 ug/l	25.0 ug/l
1,2-Dichloroethane	<	25.0 ug/l	25.0 ug/l

Respectfully submitted,

Kenneth A. Roberts, B.S.
GC Group Leader

Mountain States Analytical
The Quality Solution

CLIENT:	Geowest Golden, Inc. S.L. Office	SAMPLE NO:	0002995
	175 W. 200 S.	SAMPLE SET NO:	000644S
	Salt Lake City, UT 84101-	DATE SAMPLED:	12/16/92
		TIME SAMPLED:	1450
ATTN:	Mr. Paul Weisenborn	DATE RECEIVED:	12/18/92
		DATE REPORTED:	01/07/93
SAMPLE ID:	MW-19	DISPOSAL DATE:	02/06/93

ANALYSIS: Volatiles - Water Matrix [EPA 601/602] (Capillary)

COMPOUND(s)	RESULT	LIMIT OF QUANTITATION
Benzene	< 1.0 ug/l	1.0 ug/l
Toluene	< 1.0 ug/l	1.0 ug/l
Ethylbenzene	< 1.0 ug/l	1.0 ug/l
m,p-Xylene	< 1.0 ug/l	1.0 ug/l
o-Xylene/Styrene*	< 1.0 ug/l	1.0 ug/l
1,2-Dichloroethane	6.6 ug/l	1.0 ug/l

Respectfully submitted,

Kenneth A. Roberts, B.S.
GC Group Leader

Mountain States Analytical

The Quality Solution

CLIENT:	Geowest Golden, Inc. S.L. Office	SAMPLE NO:	0002996
	175 W. 200 S.	SAMPLE SET NO:	000644S
	Salt Lake City, UT 84101-	DATE SAMPLED:	12/16/92
		TIME SAMPLED:	1320
ATTN:	Mr. Paul Weisenborn	DATE RECEIVED:	12/18/92
		DATE REPORTED:	01/07/93
SAMPLE ID:	MW-20	DISPOSAL DATE:	02/06/93

ANALYSIS: Volatiles - Water Matrix [EPA 601/602] (Capillary)

COMPOUND(s)	RESULT	LIMIT OF QUANTITATION
Benzene	< 1.0 ug/l	1.0 ug/l
Toluene	< 1.0 ug/l	1.0 ug/l
Ethylbenzene	< 1.0 ug/l	1.0 ug/l
m,p-Xylene	< 1.0 ug/l	1.0 ug/l
o-Xylene/Styrene*	< 1.0 ug/l	1.0 ug/l
1,2-Dichloroethane	< 1.0 ug/l	1.0 ug/l

Respectfully submitted,

Kenneth A. Roberts

Kenneth A. Roberts, B.S.
GC Group Leader

Mountain States Analytical

The Quality Solution

CLIENT:	Geowest Golden, Inc. S.L. Office	SAMPLE NO:	0002997
	175 W. 200 S.	SAMPLE SET NO:	000644S
	Salt Lake City, UT 84101-	DATE SAMPLED:	12/16/92
		TIME SAMPLED:	1245
ATTN:	Mr. Paul Weisenborn	DATE RECEIVED:	12/18/92
		DATE REPORTED:	01/07/93
SAMPLE ID:	MW-21	DISPOSAL DATE:	02/06/93

ANALYSIS: Volatiles - Water Matrix [EPA 601/602] (Capillary)

COMPOUND(s)		RESULT	LIMIT OF QUANTITATION
Benzene	<	1.0 ug/l	1.0 ug/l
Toluene	<	1.0 ug/l	1.0 ug/l
Ethylbenzene	<	1.0 ug/l	1.0 ug/l
m,p-Xylene	<	1.0 ug/l	1.0 ug/l
o-Xylene/Styrene*	<	1.0 ug/l	1.0 ug/l
1,2-Dichloroethane		1.7 ug/l	1.0 ug/l

Respectfully submitted,

Kenneth A. Roberts, B.S.
GC Group Leader

Mountain States Analytical

The Quality Solution

CLIENT: Geowest Golden, Inc. S.L. Office
175 W. 200 S.
Salt Lake City, UT 84101-

ATTN: Mr. Paul Weisenborn

SAMPLE ID: MW-24

SAMPLE NO: 0002999
SAMPLE SET NO: 000644S
DATE SAMPLED: 12/16/92
TIME SAMPLED: 830
DATE RECEIVED: 12/18/92
DATE REPORTED: 01/07/93
DISPOSAL DATE: 02/06/93

ANALYSIS: Volatiles - Water Matrix [EPA 601/602] (Capillary)

COMPOUND(s)	RESULT	LIMIT OF QUANTITATION
Benzene	< 1.0 ug/l	1.0 ug/l
Toluene	< 1.0 ug/l	1.0 ug/l
Ethylbenzene	< 1.0 ug/l	1.0 ug/l
m,p-Xylene	< 1.0 ug/l	1.0 ug/l
o-Xylene/Styrene*	< 1.0 ug/l	1.0 ug/l
1,2-Dichloroethane	1.6 ug/l	1.0 ug/l

(Dup of MW-21)

Respectfully submitted,

Kenneth A. Roberts, B.S.
GC Group Leader

Mountain States Analytical

The Quality Solution

Geowest Golden, Inc. Salt Lake Office
175 West 200 South #2006
Salt Lake City, UT 84101
Telephone: (801) 359-3059
Facsimile: (801) 359-3307

Sample Number: 0002998
Sample Set: 000644S
Date Reported: 6 JAN 1993
Date Received: 18 DEC 1992
Disposal Date: 1 FEB 1993

Attention: Paul Weisenborn
Project: Maverick Kirtland
Case Number: 4th Qtr 1992
Purchase Order: 9131.01

Customer Number: MW-22
Date Sampled: 16 DEC 1992
Matrix: Wastewater
Containers: 5

Analysis	Catalog Number	Method	Result	Dry Result	Reporting Units
Chromatograms/Etc.	06159		Complete		
Volatile Aromatics/Halocarbons	05515	EPA 600 Series 601/ 602	See Attached		

2 Analyses for GC

Reviewed and approved by
Kenneth Roberts, B.S.
GC Group Leader

Sulfate, Turbidimetric	01125	EPA 600 Series 375.4	6		mg/l
Sulfide, Colorimetric	00230	EPA 427 EPA 376.1	3		mg/l

2 Analyses for Wet Chemistry

Reviewed and approved by
Glenn Sorensen, B.S.
Manager, Inorganics Department

4 Analyses for Sample Number 0002998

Mountain States Analytical
The Quality Solution

CLIENT:	Geowest Golden, Inc. S.L. Office	SAMPLE NO:	0002998
	175 W. 200 S.	SAMPLE SET NO:	000644S
	Salt Lake City, UT 84101-	DATE SAMPLED:	12/16/92
		TIME SAMPLED:	915
ATTN:	Mr. Paul Weisenborn	DATE RECEIVED:	12/18/92
		DATE REPORTED:	01/07/93
SAMPLE ID:	MW-22	DISPOSAL DATE:	02/06/93

ANALYSIS: Volatiles - Water Matrix [EPA 601/602] (Capillary)

COMPOUND(s)	RESULT	LIMIT OF QUANTITATION
Benzene	12,100 ug/l	250 ug/l
Toluene	4,220 ug/l	250 ug/l
Ethylbenzene	514 ug/l	250 ug/l
m,p-Xylene	2,360 ug/l	250 ug/l
o-Xylene/Styrene*	894 ug/l	250 ug/l
1,2-Dichloroethane	908 ug/l	250 ug/l

Respectfully submitted,

Kenneth A. Roberts, B.S.
GC Group Leader

Mountain States Analytical
The Quality Solution

CLIENT:	Geowest Golden, Inc. S.L. Office	SAMPLE NO:	0003000
	175 W. 200 S.	SAMPLE SET NO:	000644S
	Salt Lake City, UT 84101-	DATE SAMPLED:	12/16/92
		TIME SAMPLED:	815
ATTN:	Mr. Paul Weisenborn	DATE RECEIVED:	12/18/92
		DATE REPORTED:	01/07/93
SAMPLE ID:	Trip Blank	DISPOSAL DATE:	02/06/93

ANALYSIS: Volatiles - Water Matrix [EPA 601/602] (Capillary)

COMPOUND(s)	RESULT	LIMIT OF QUANTITATION
Benzene	< 1.0 ug/l	1.0 ug/l
Toluene	< 1.0 ug/l	1.0 ug/l
Ethylbenzene	< 1.0 ug/l	1.0 ug/l
m,p-Xylene	< 1.0 ug/l	1.0 ug/l
o-Xylene/Styrene*	< 1.0 ug/l	1.0 ug/l
1,2-Dichloroethane	< 1.0 ug/l	1.0 ug/l

Respectfully submitted,

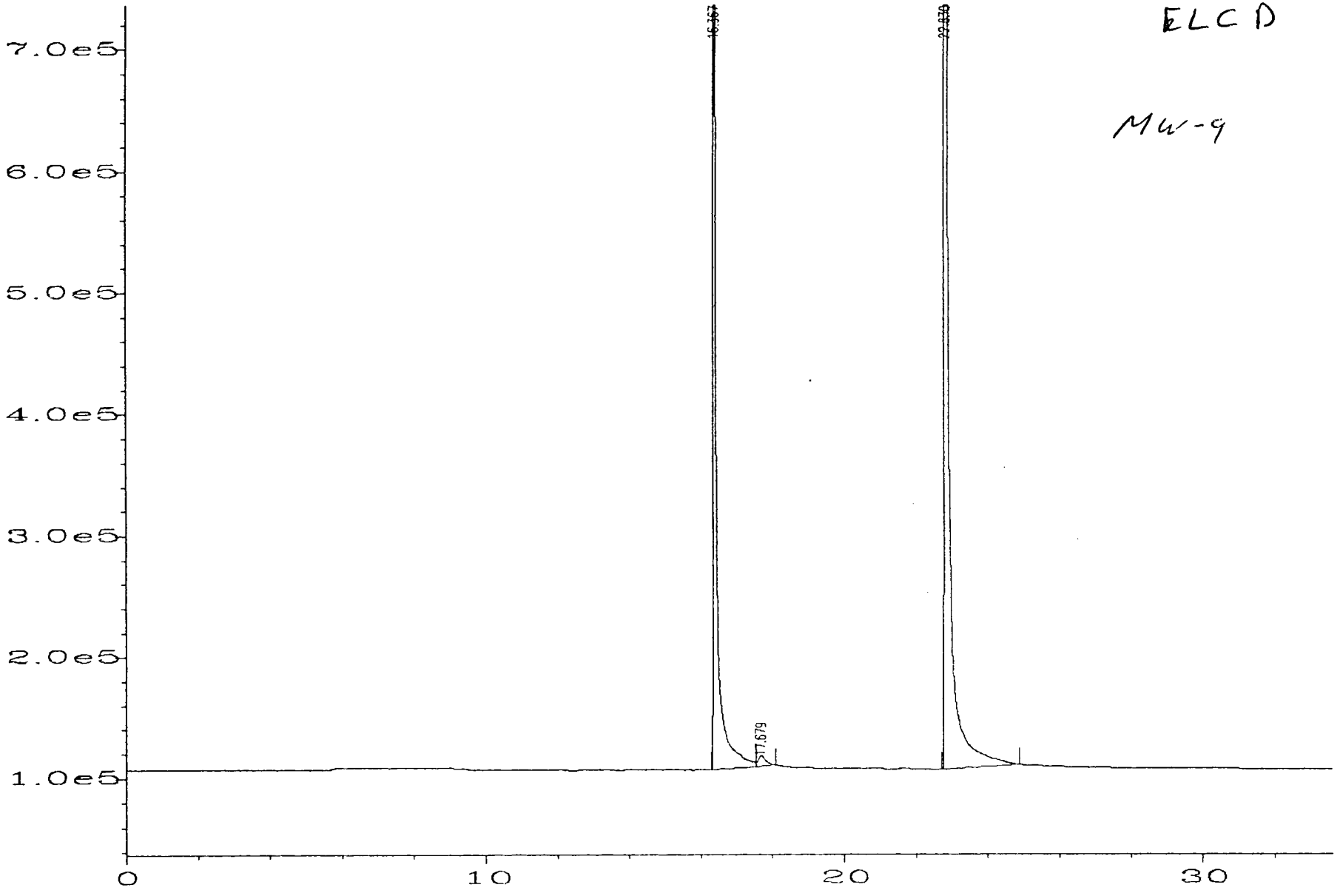
Kenneth A. Roberts, B.S.
GC Group Leader

Sample # 2989

DF 1

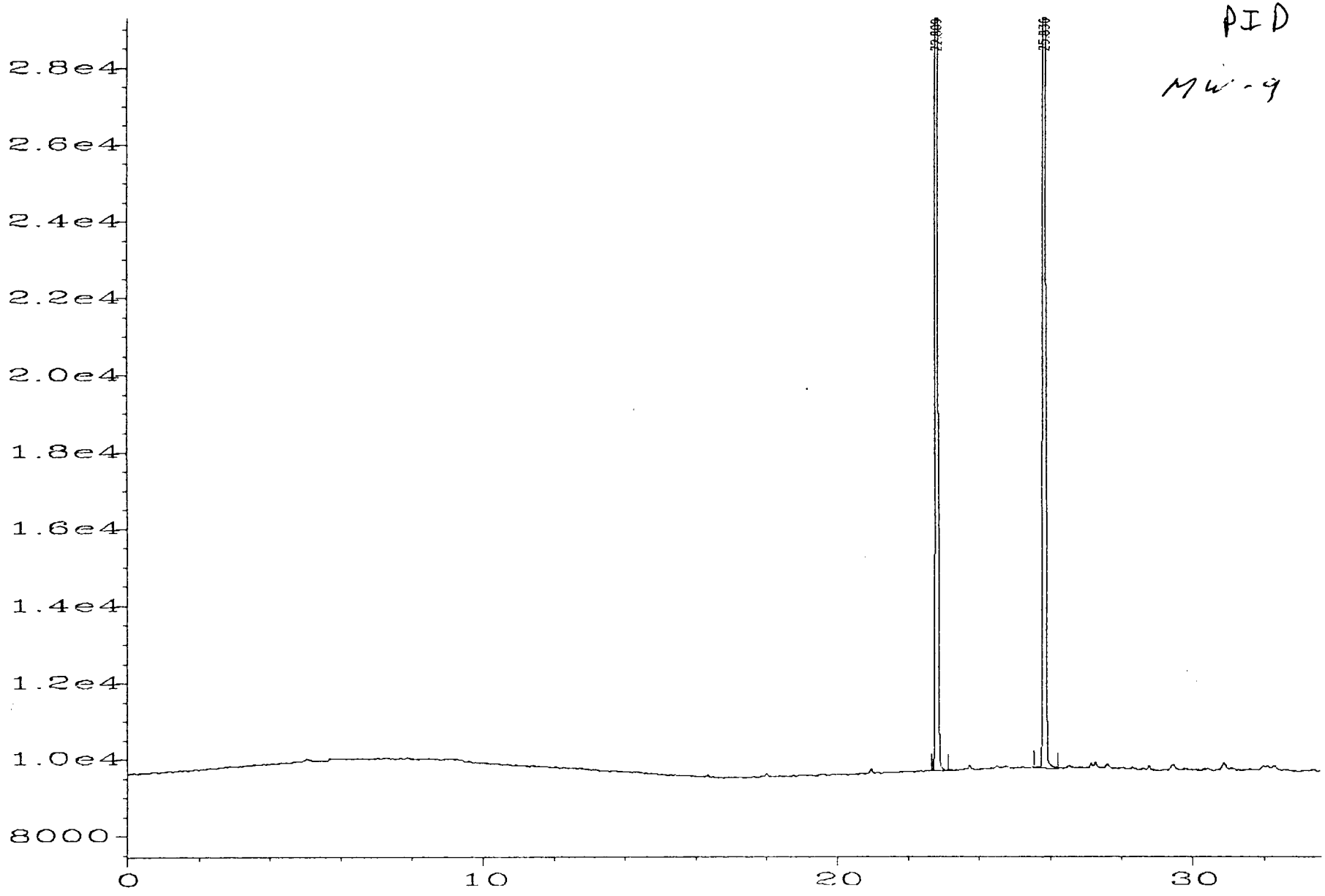
ELCD

Mw-9



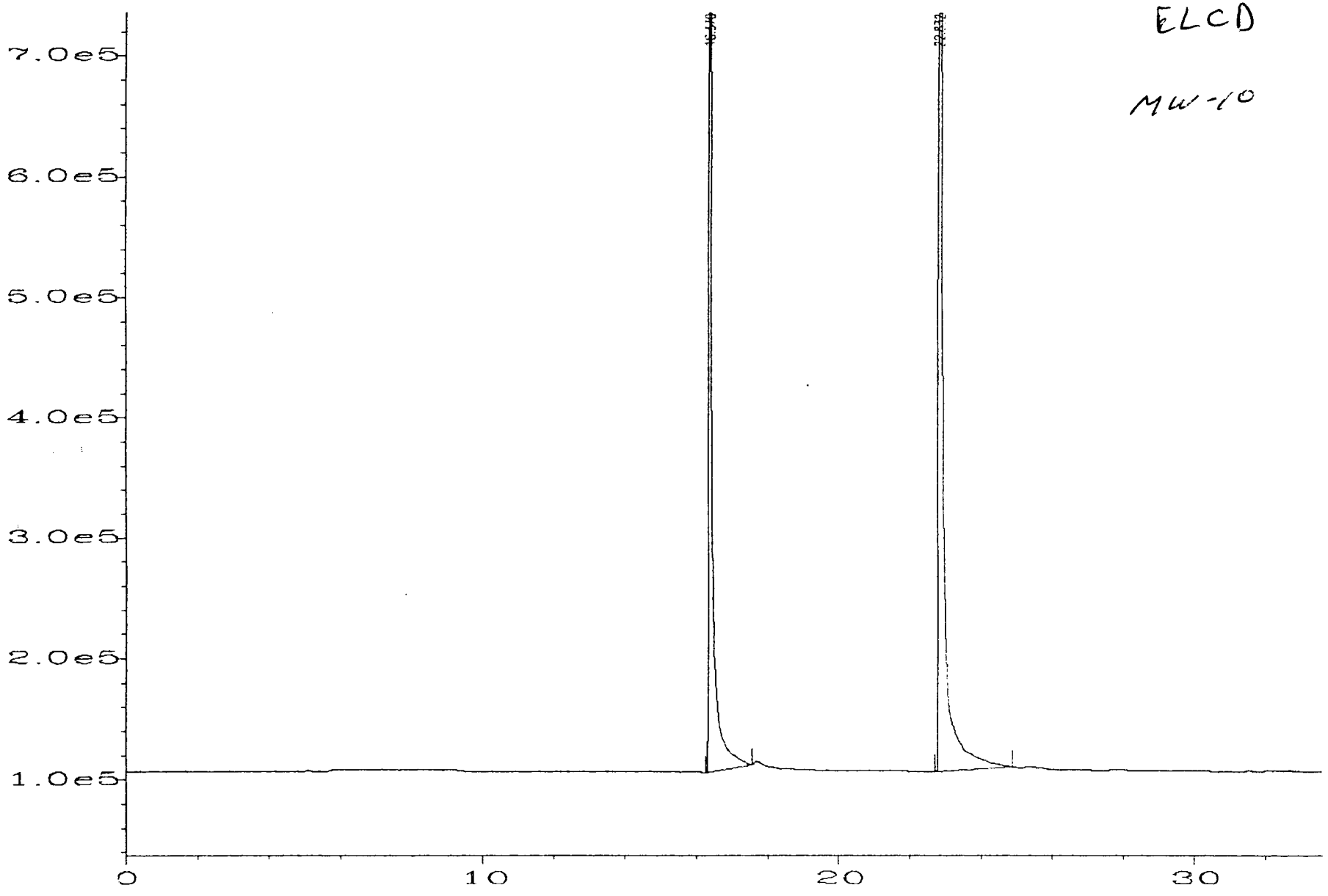
Sig. 1 in C:\HPCHEM\1\DATA\17DECVOL\035F0101.D

Sample # 2989
DF 1
PID
MW-9



Sig. 2 in C:\HPCHEM\1\DATA\17DECVOL\035R0101.D

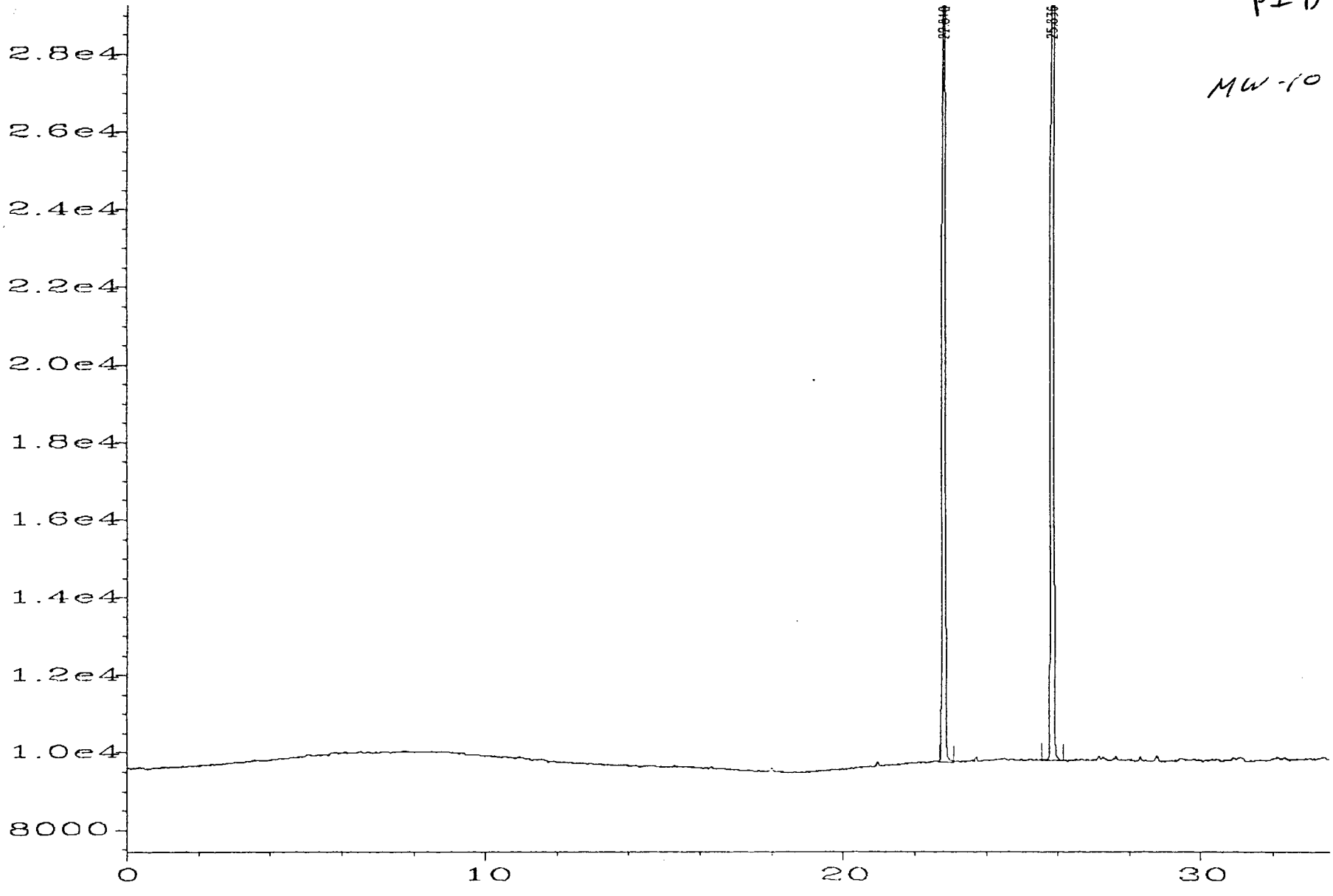
Sample # 2990
DF 1
ELCD
MW-10



Sig. 1 in C:\HPCHEM\1\DATA\17DECVOL\036F0101.D

Sample # 2990
DF 1
PID

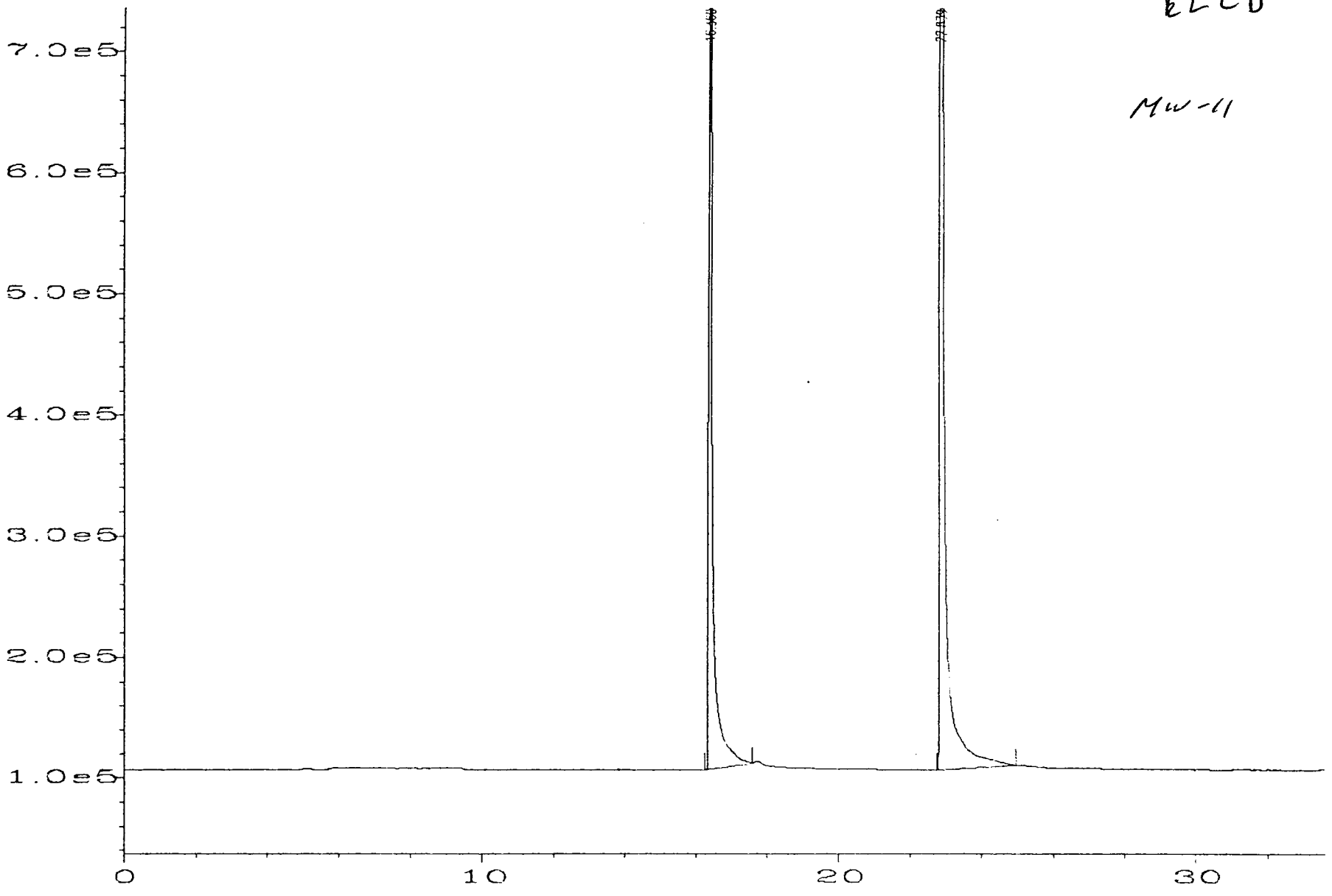
MW-10



Sig. 2 in C:\HPCHEM\1\DATA\17DECVOL\036R0101.D

Sample # 2997
DF 1
ELCD

MW-11



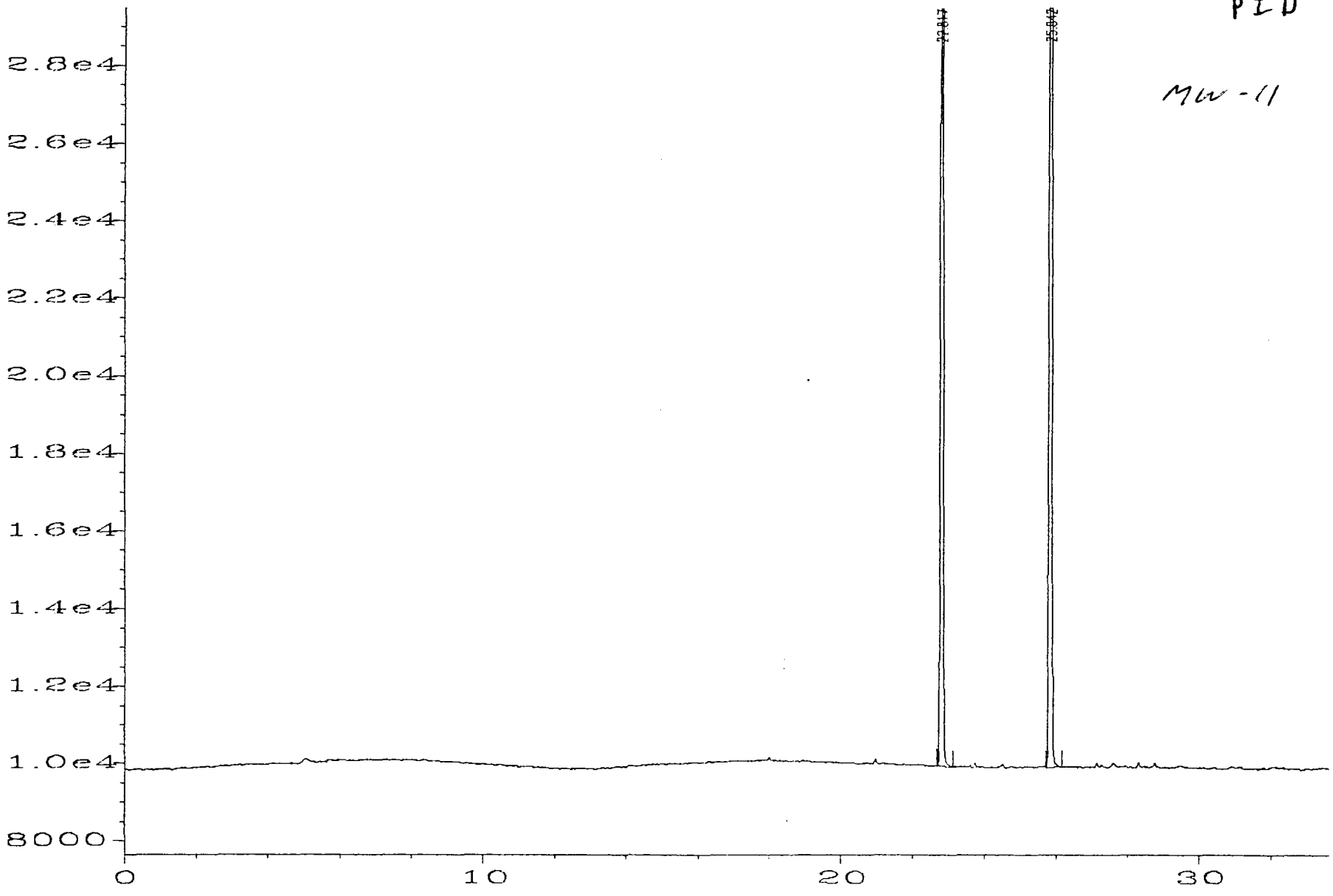
Sig. 1 in C:\HPCHEM\1\DATA\17DECVOL\037F0101.D

Sample # 2991

DF 1

PID

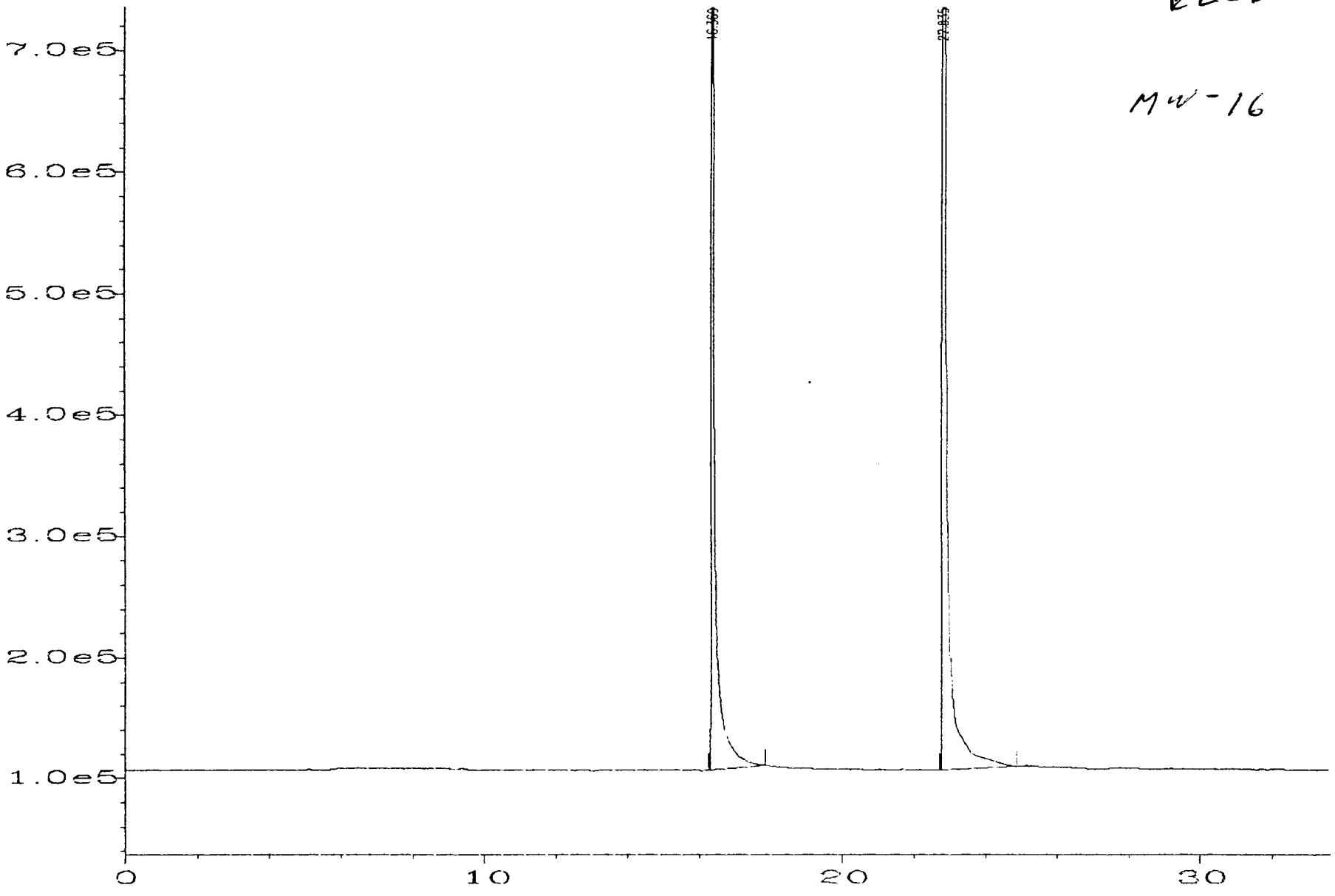
MW-11



Sig. 2 in C:\HPCHEM\1\DATA\17DECVOL\037R0101.D

Sample # 2992
DF 1
ELCD

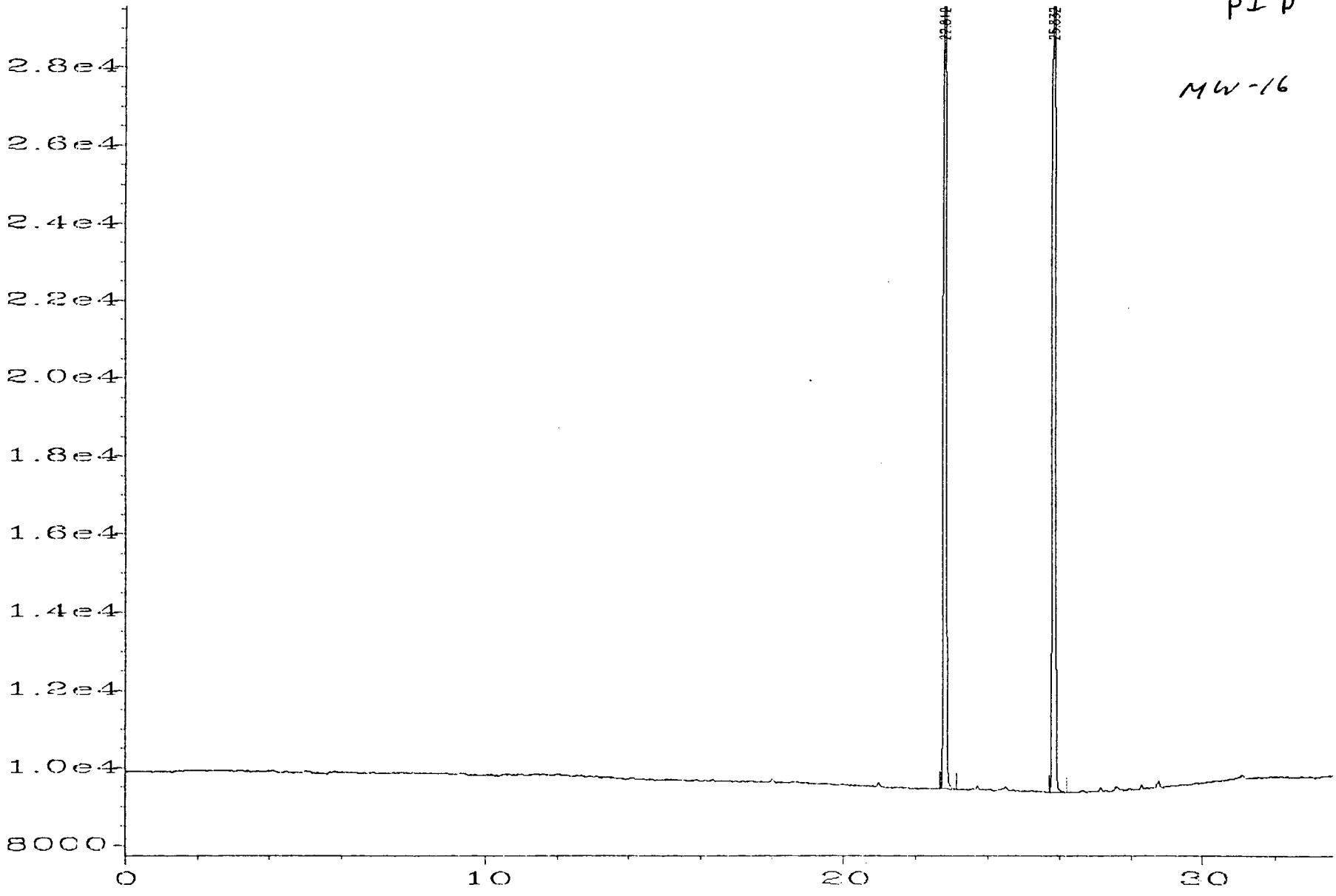
MW-16



Sig. 1 in C:\HPCHEM\1\DATA\17DECVOL\039F0101.D

Sample # 2992
OF 1
PID

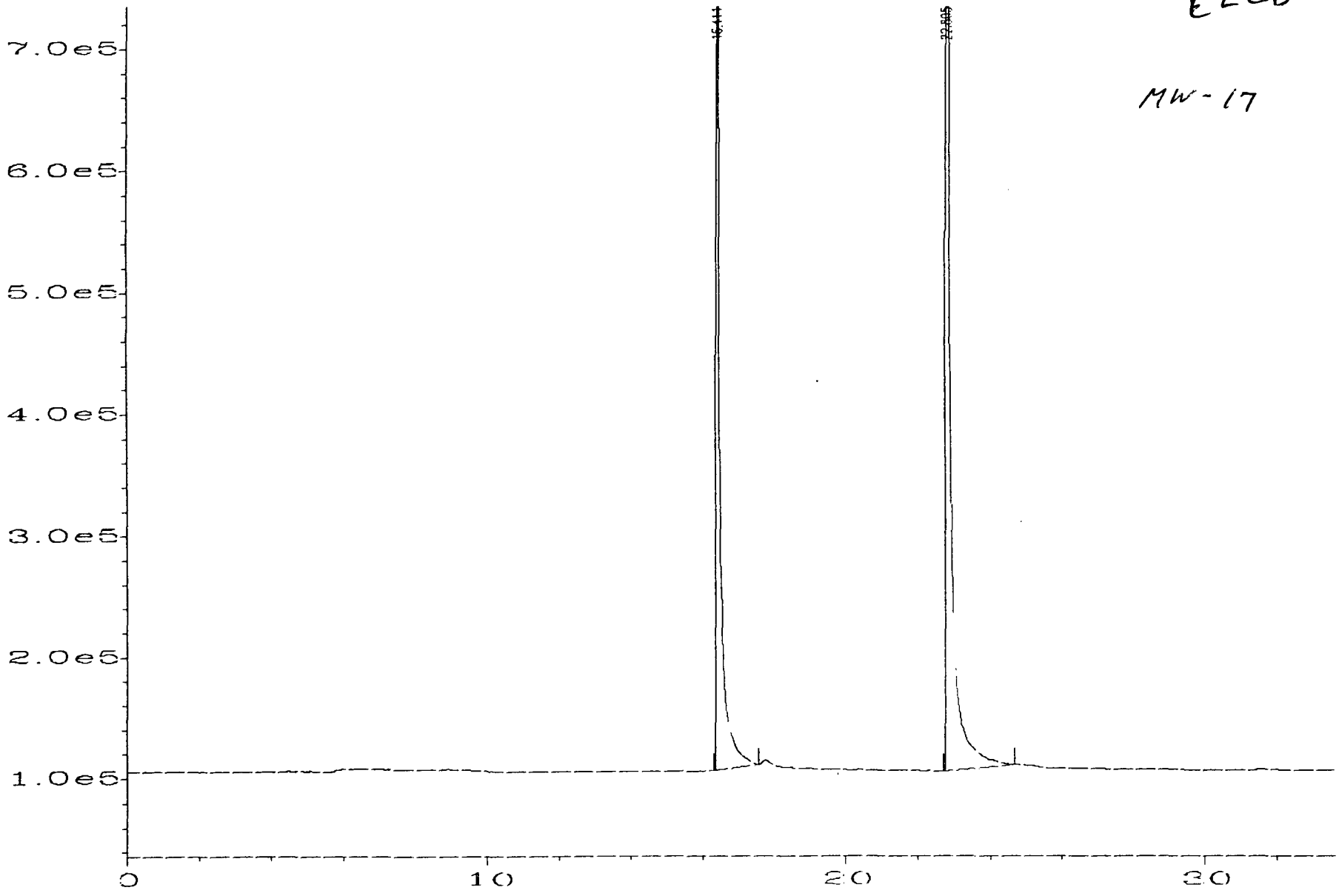
MW-16



Sig. 2 in C:\HPCHEM\1\DATA\17DECVOL\039R0101.D

Sample # 2993
DF 100
ELCD

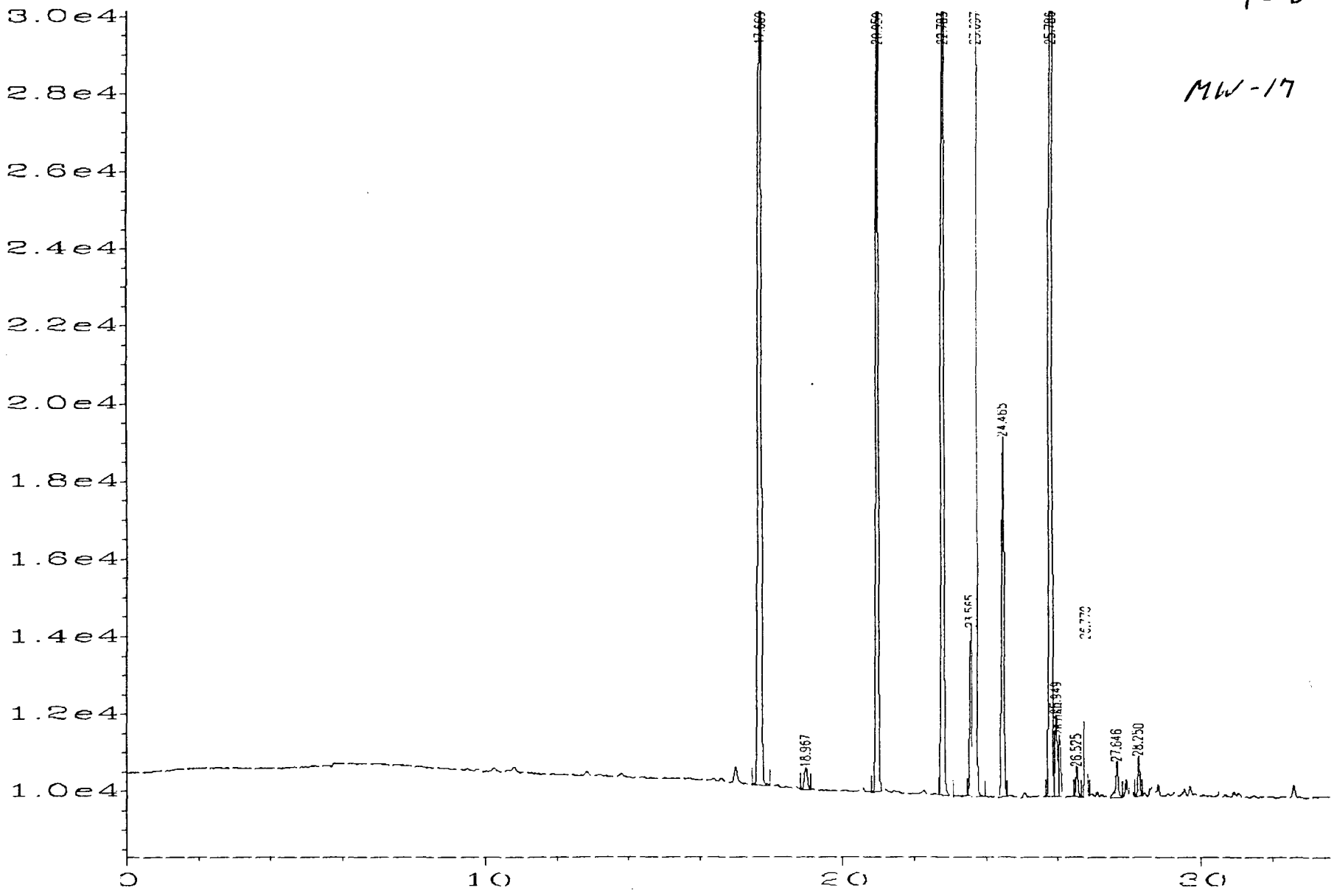
MW-17



Sig. 1 in C:\HPCHEM\1\DATA\17DEC\VOL\068F0101.D

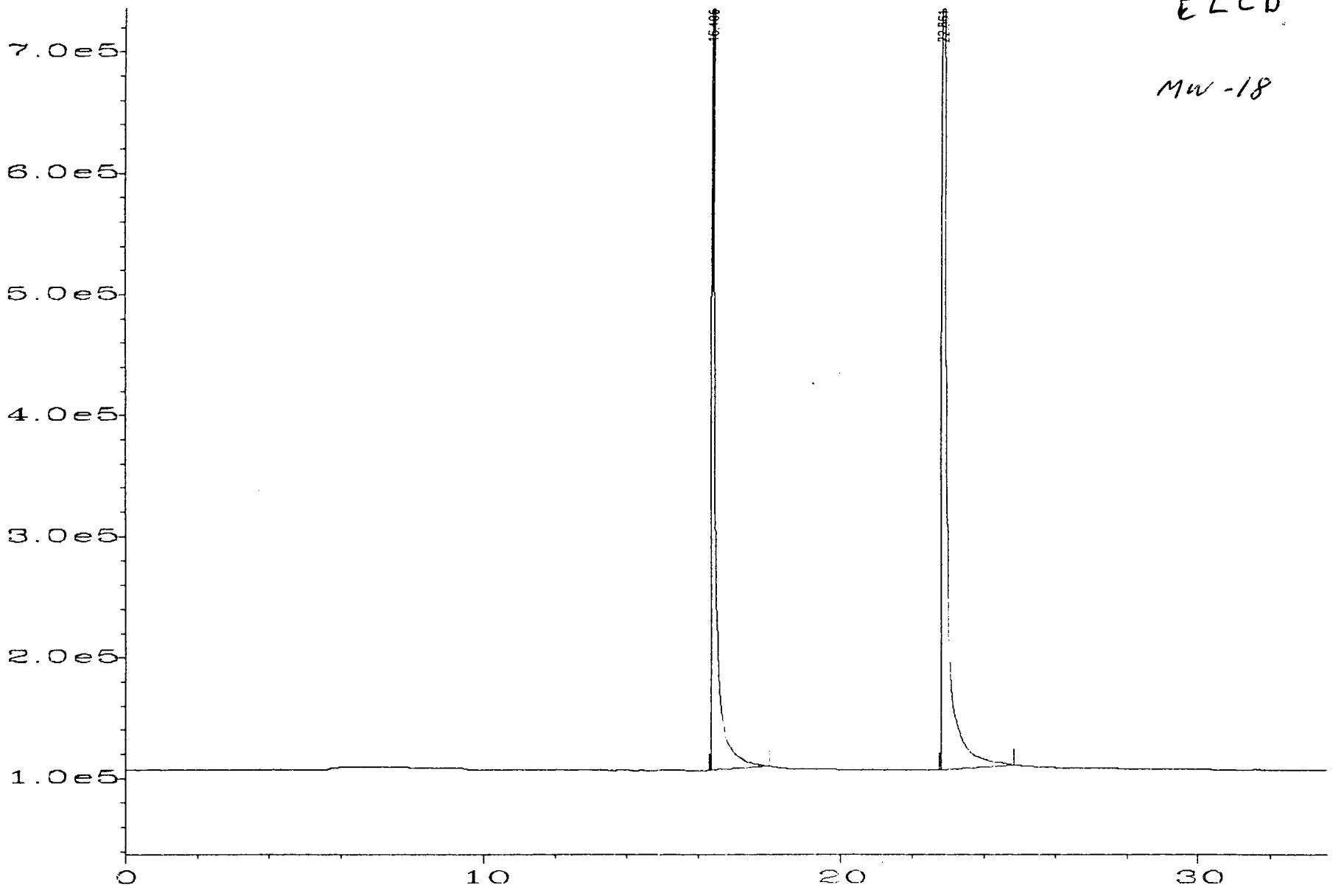
Sample # 2993
OF 100
PID

MW-17



Sigg. 2 in C:\HPCHEM\1\DATA\17DEC\VOL\068R0101.D

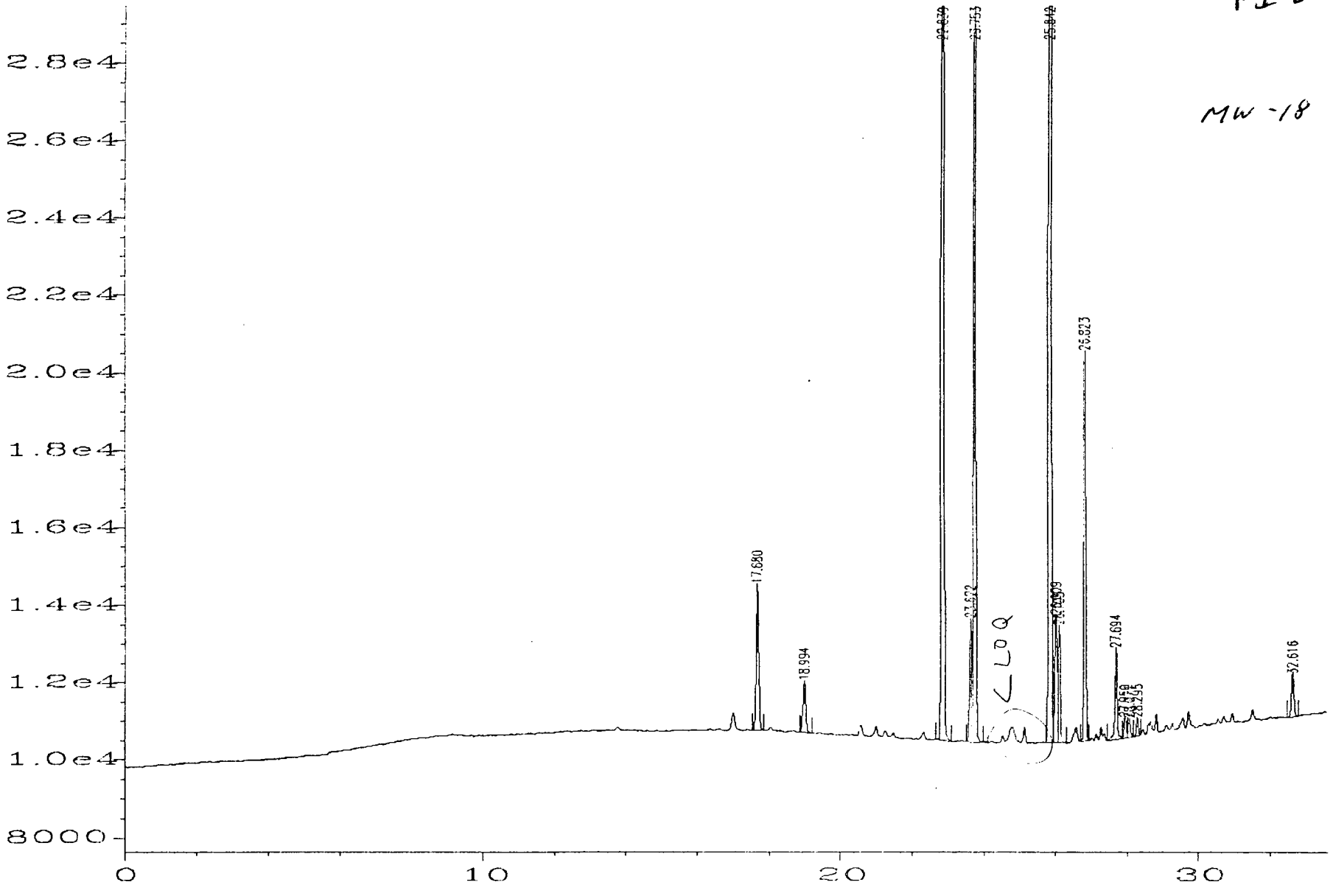
Sample # 4744
DF 50
ELCD
MW-18



Sig. 1 in C:\HPCHEM\1\DATA\17DECVOL\041F0101.D

Sample #2994
DF 50
PID

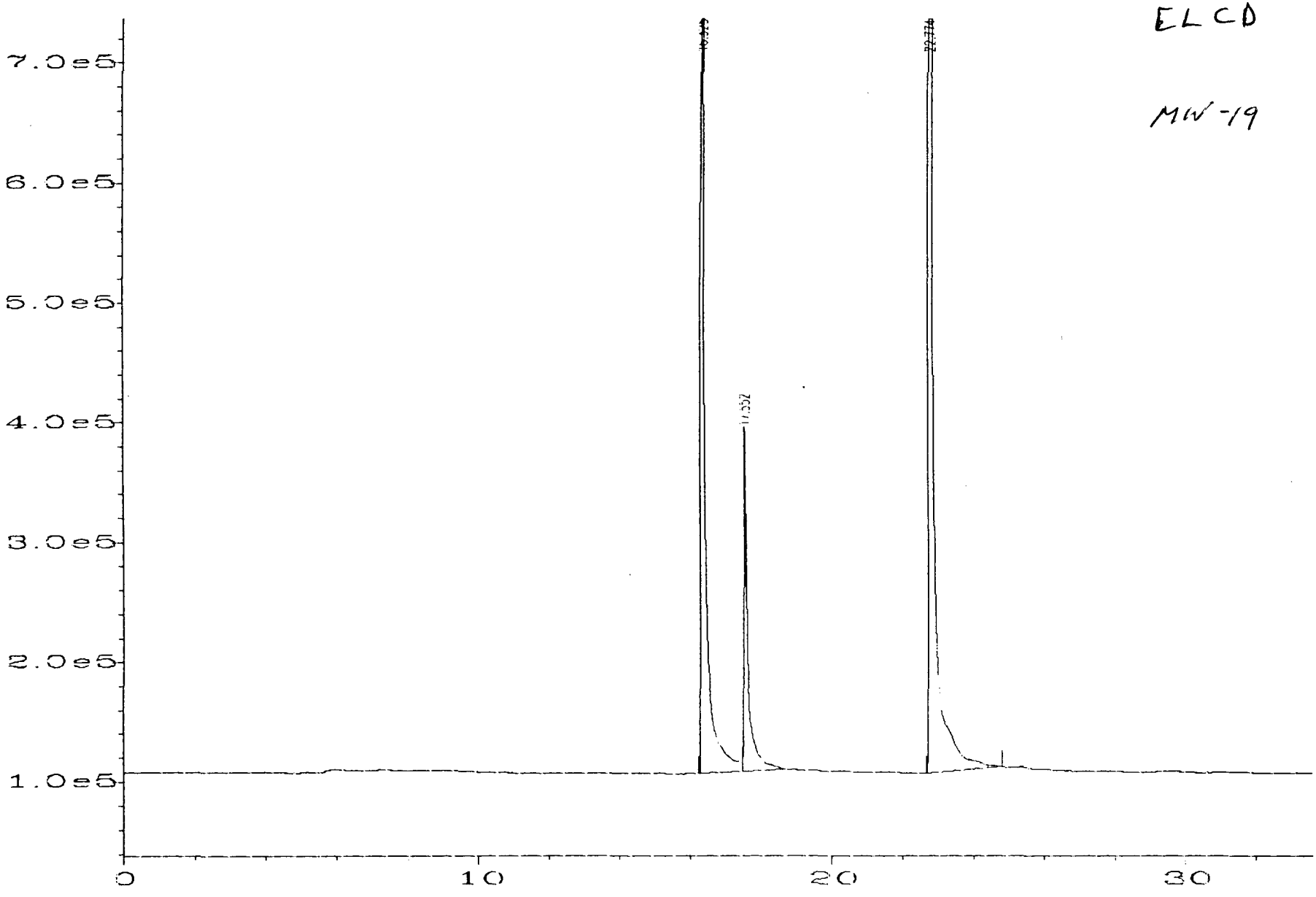
MW -18



Sig. 2 in C:\HPCHEM\1\DATA\17DECVOL\041R0101.D

Sample # 2995
DF 1
ELCD

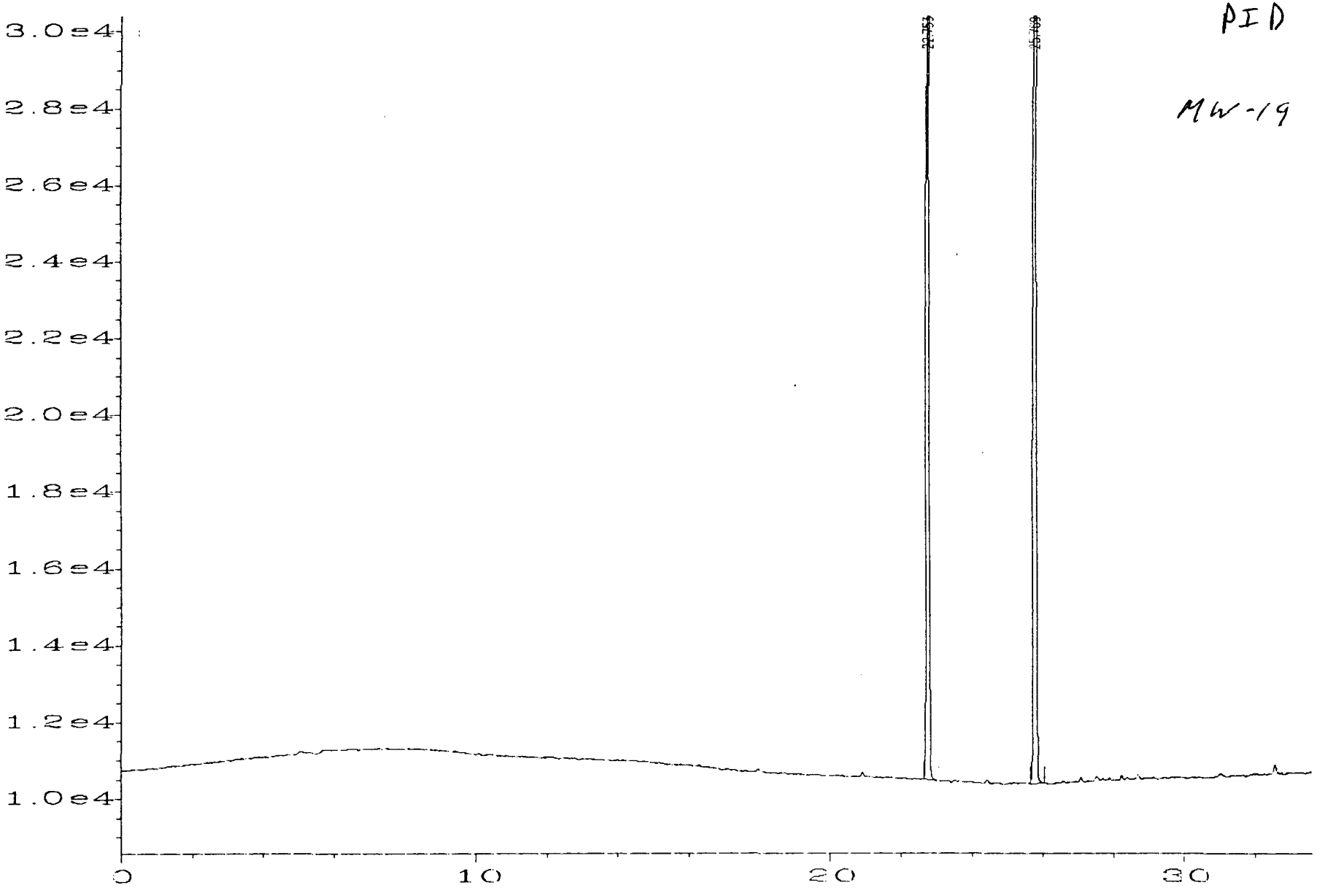
MW-19



Sig. 1 in C:\HPCHEM\1\DATA\17DEC98\LC48F0101.D

Sample # 2995
DF 1
PID

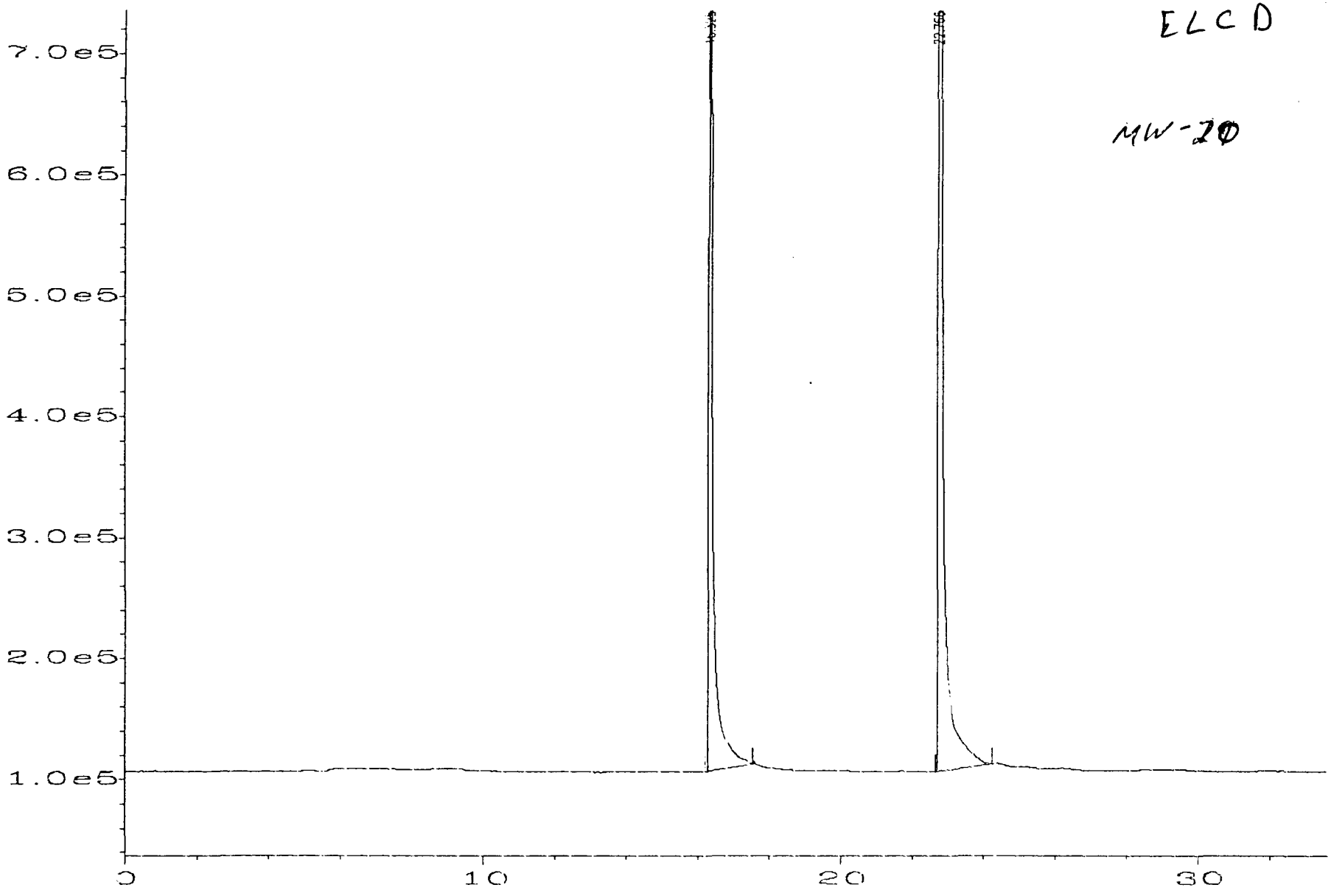
MW-19



Sig. 2 in C:\HPCHEM\1\DATA\17DEC\VOL\048R0101.D

Sample # 2996
OF 1
ELCD

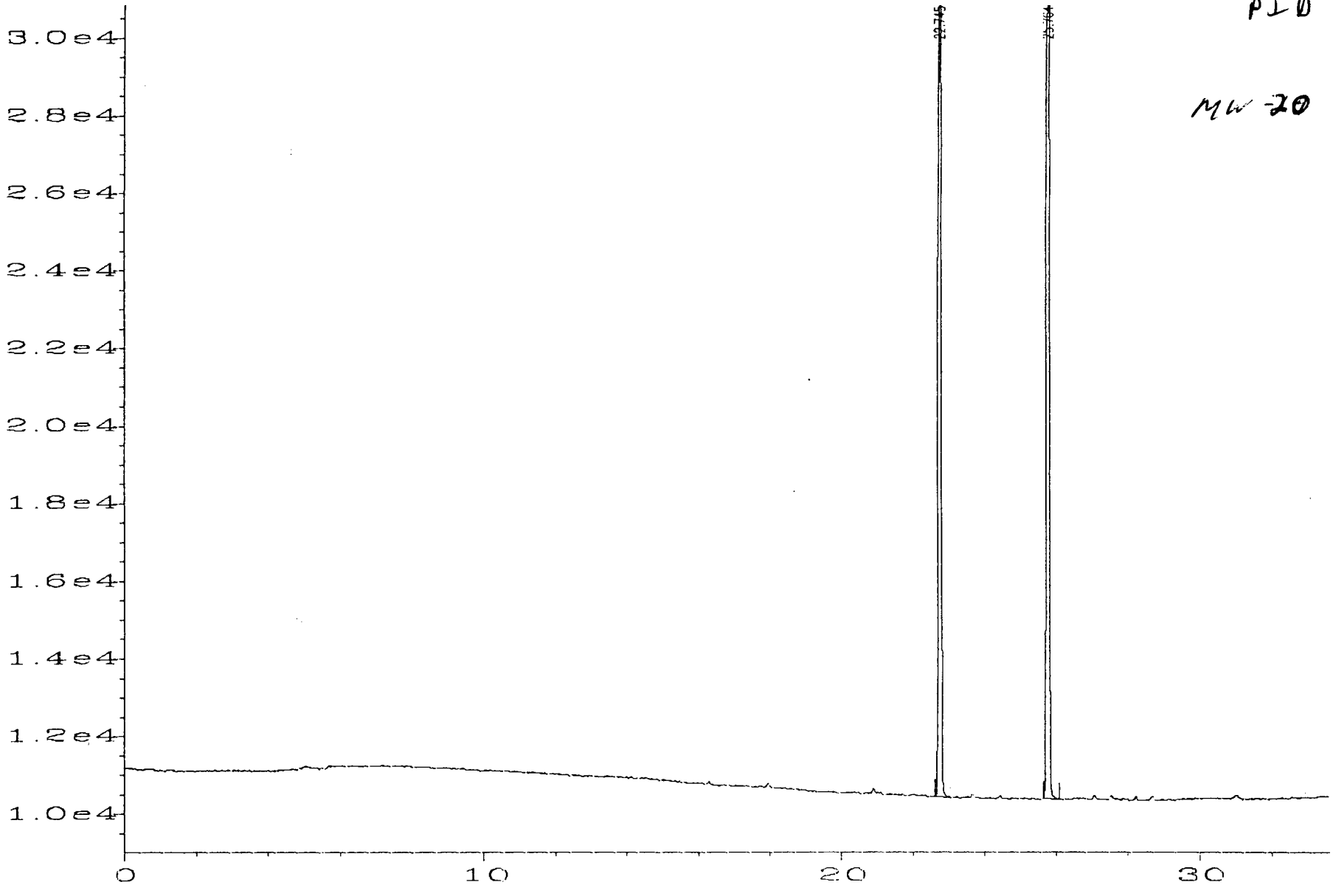
MW-20



Sig. 1 in C:\HPCHEM\1\DATA\17DECVOL\049F0101.D

Sample # 2996
OF 1
PID

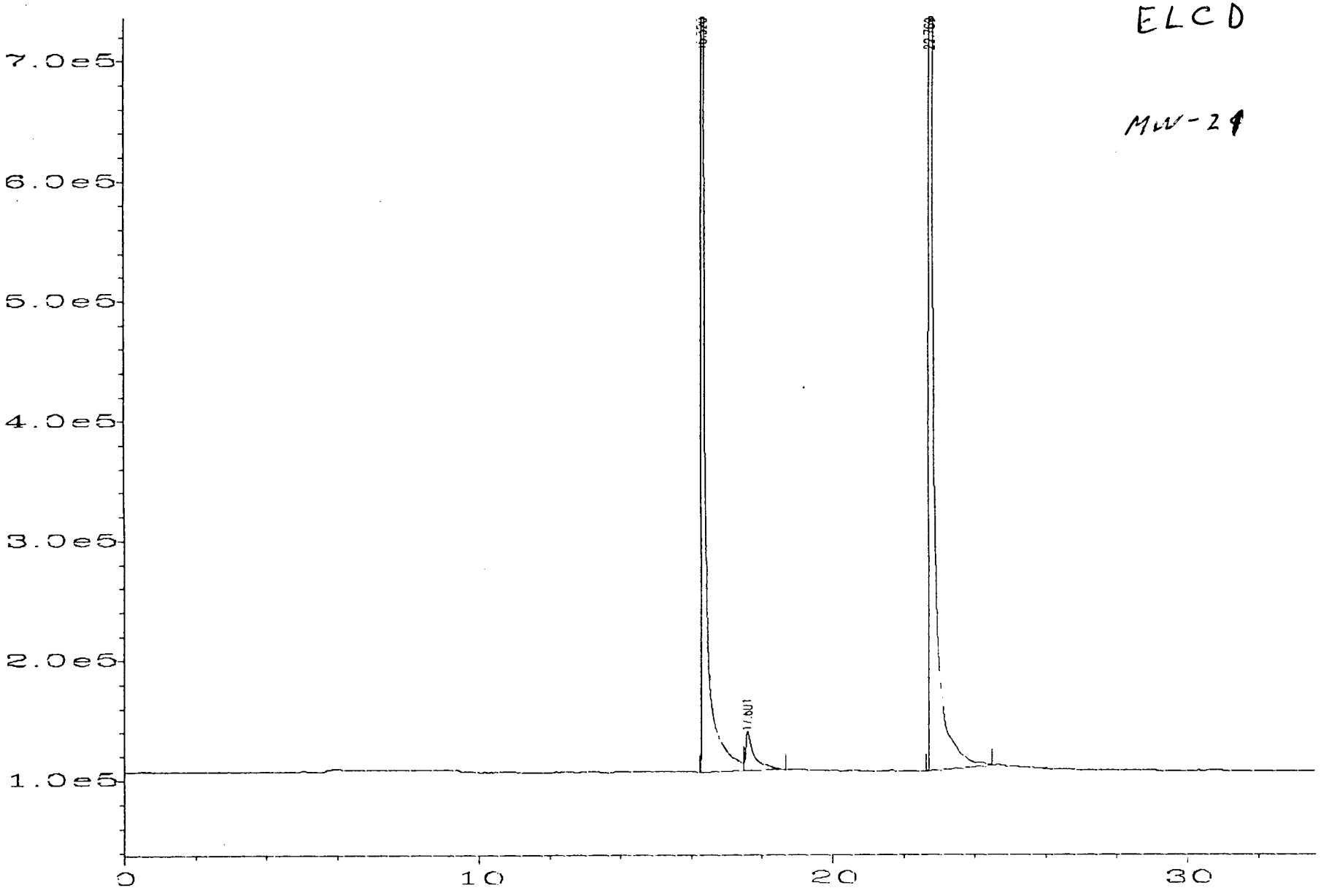
MW -20



Sig. 2 in C:\HPCHEM\1\DATA\17DECVOL\049R0101.D

Sample # 2997
DF 1
ELCD

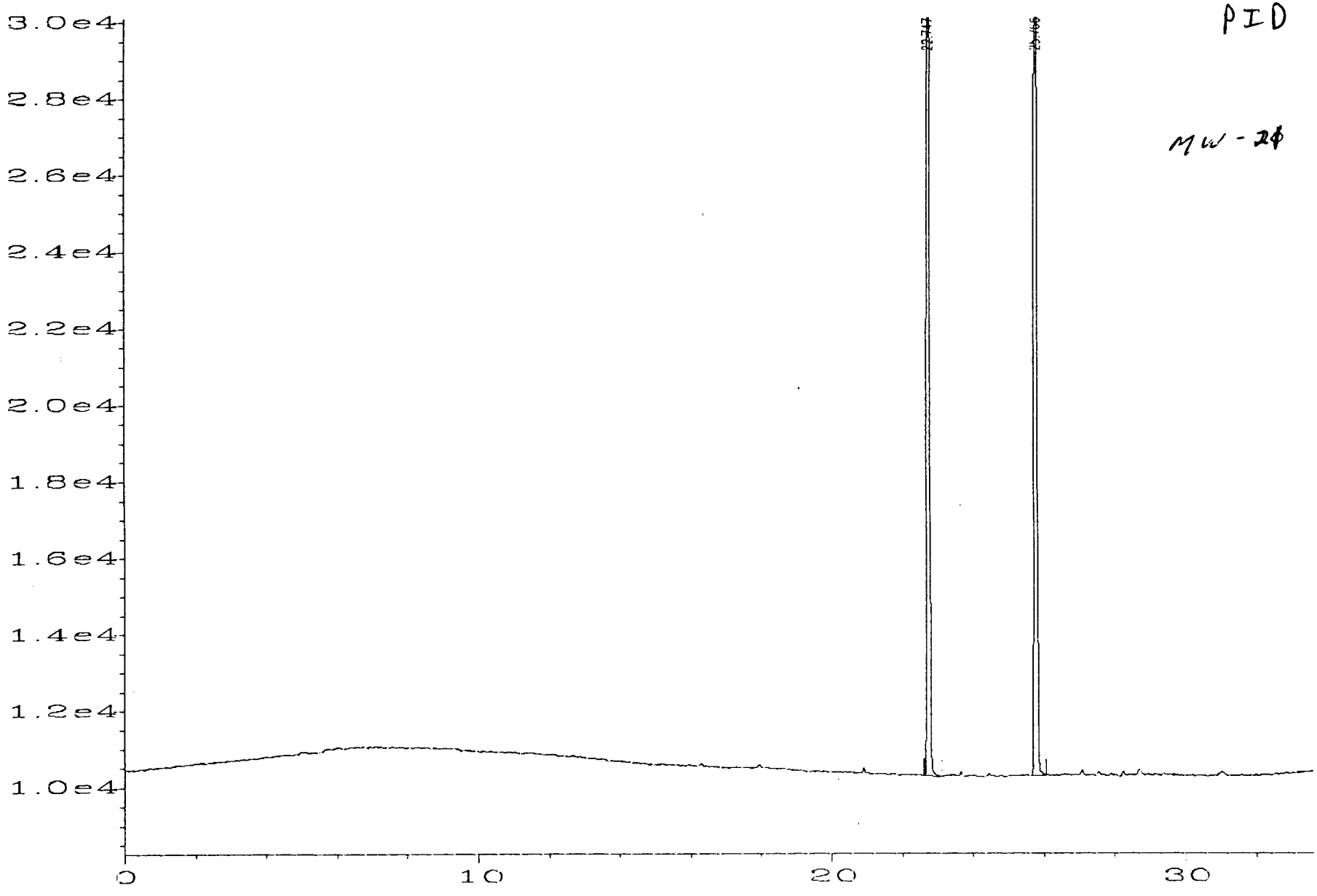
MW-29



Sig. 1 in C:\HPCHEM\1\DATA\17DEC\VOL\050F0101.D

Sample # 2997
OF 1
PID

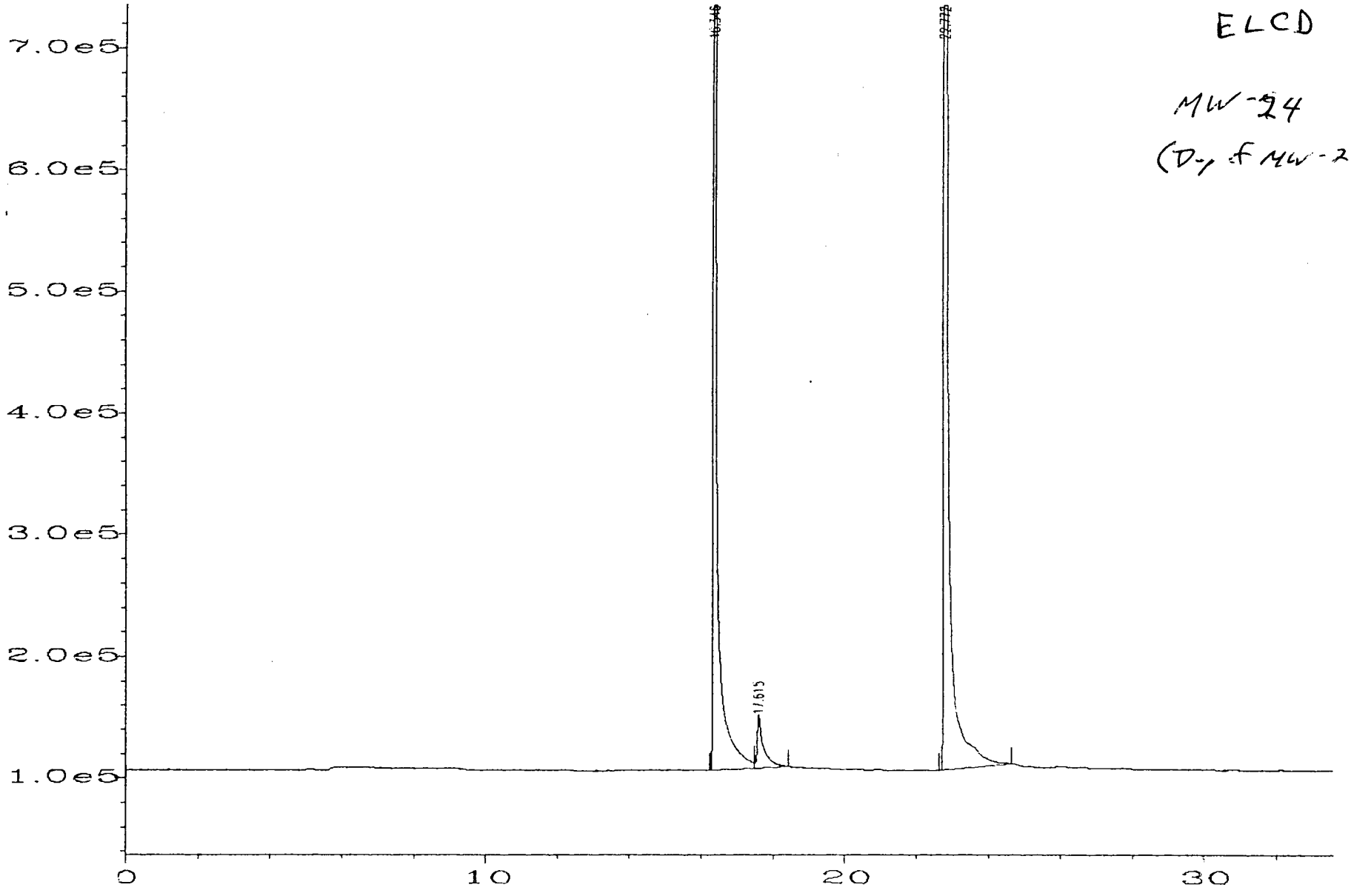
MW - 24



Sig. 2 in C:\HPCHEM\1\DATA\17DECVOL\050R0101.D

Sample # 2999
OF 1
ELCD

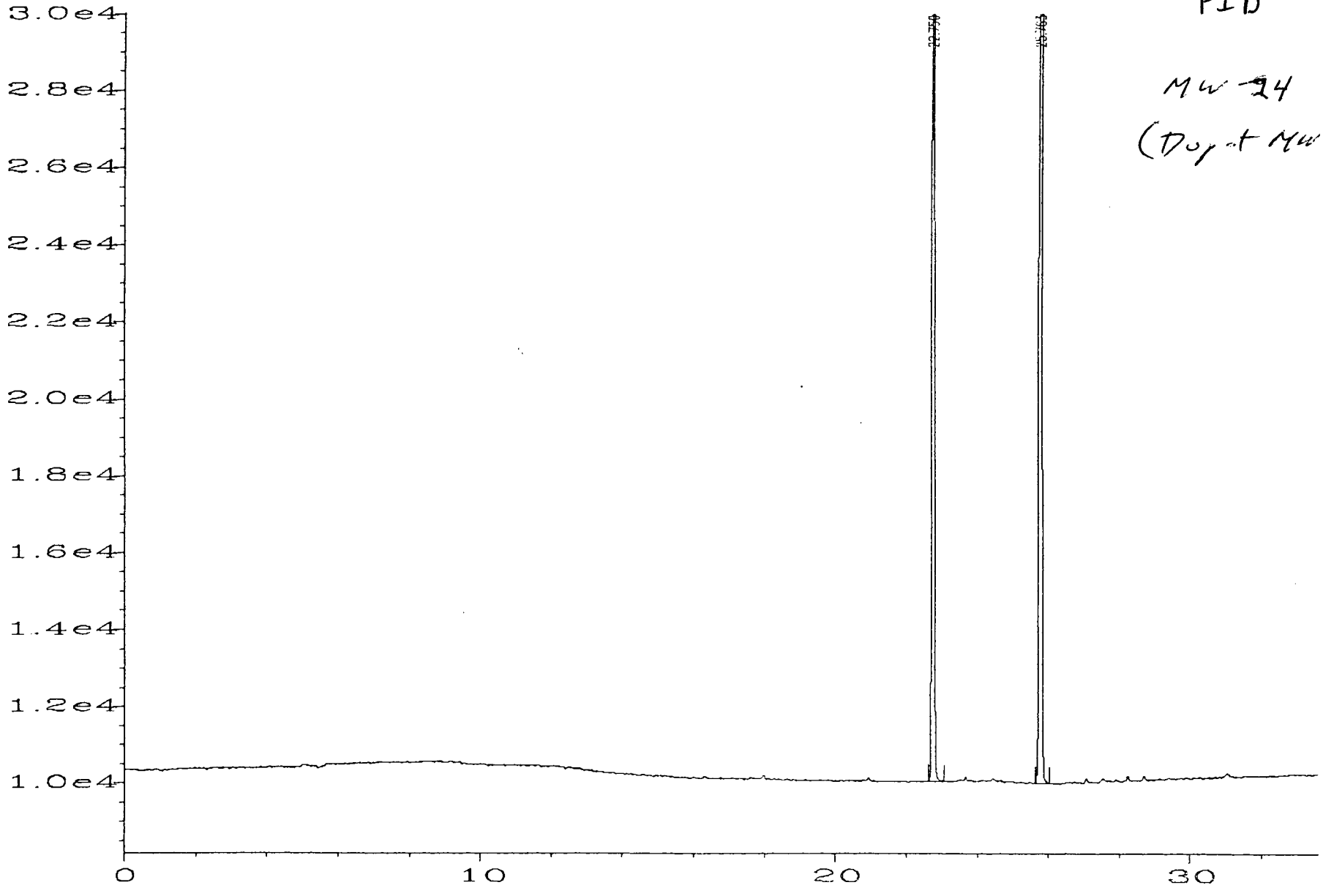
MW-24
(D-y of MW-21



Sig. 1 in C:\HPCHEM\1\DATA\17DECVOL\053F0101.D

Sample # 2999
DF 1
PID

MW-24
(Dup of MW-21)



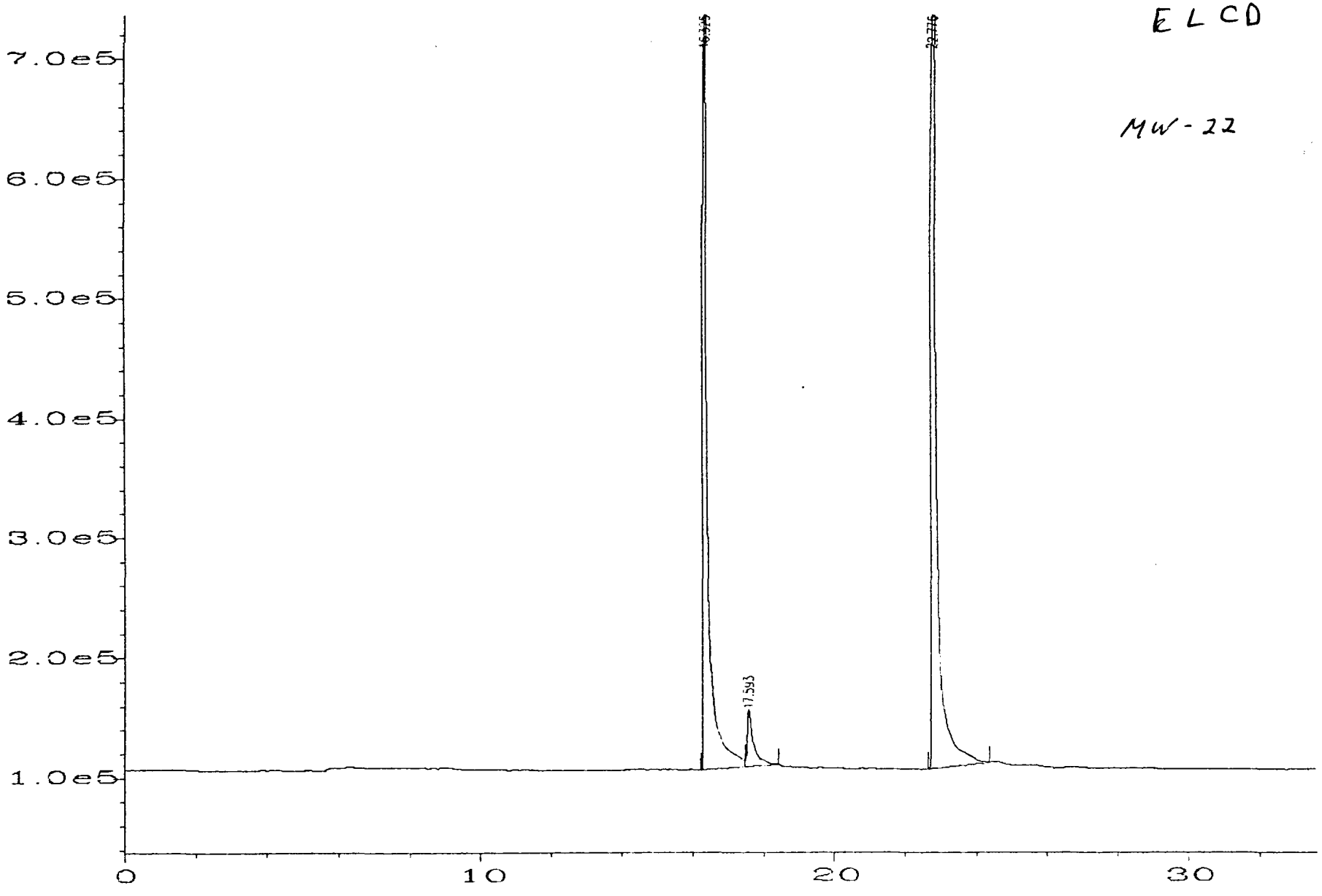
Sig. 2 in C:\HPCHEM\1\DATA\17DECVOL\053R0101.D

Sample # 2998

DF 500

ELCD

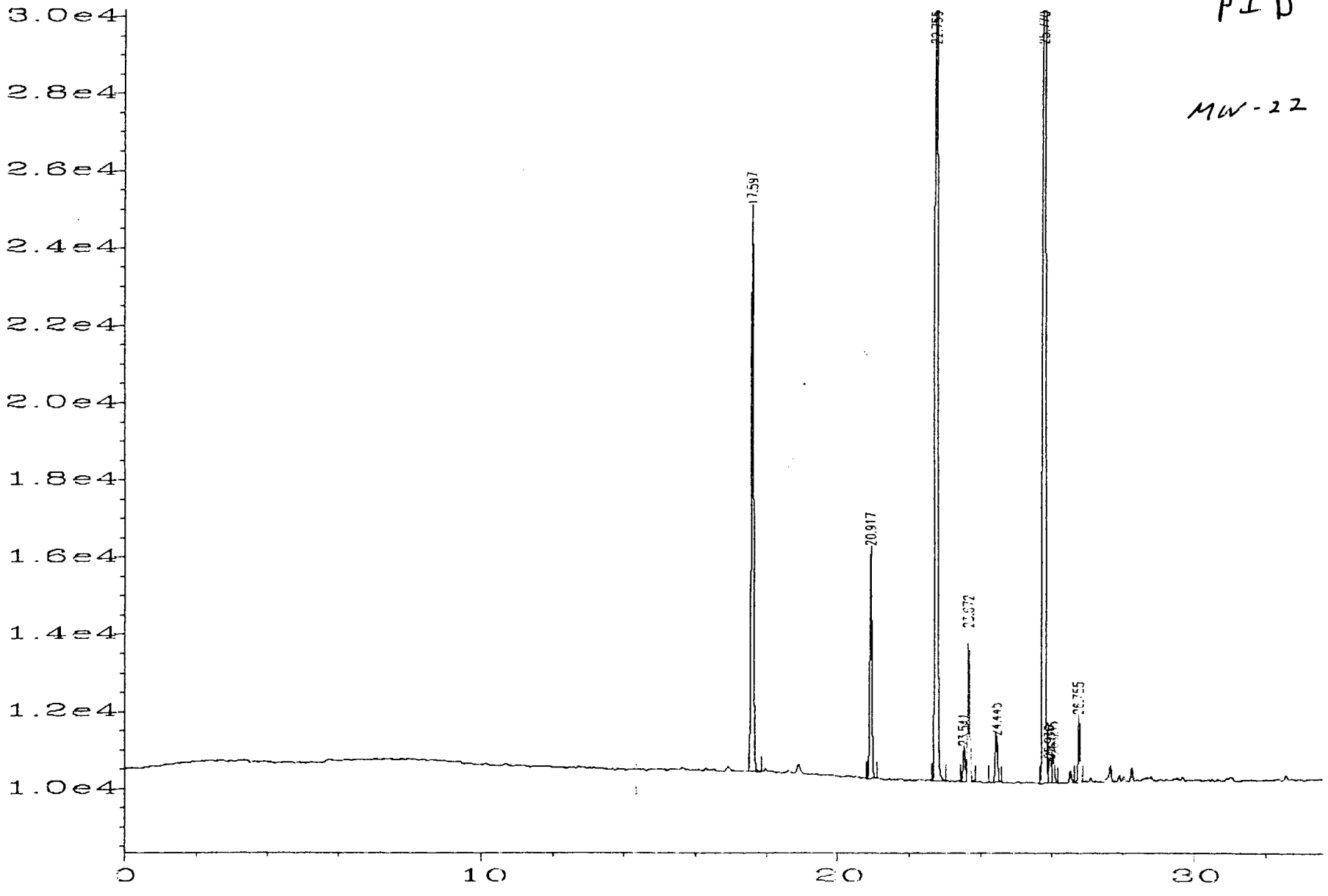
MW-22



Sig. 1 in C:\HPCHEM\1\DATA\17DECVOL\052F0101.D

Sample # 2998
DF 500
PID

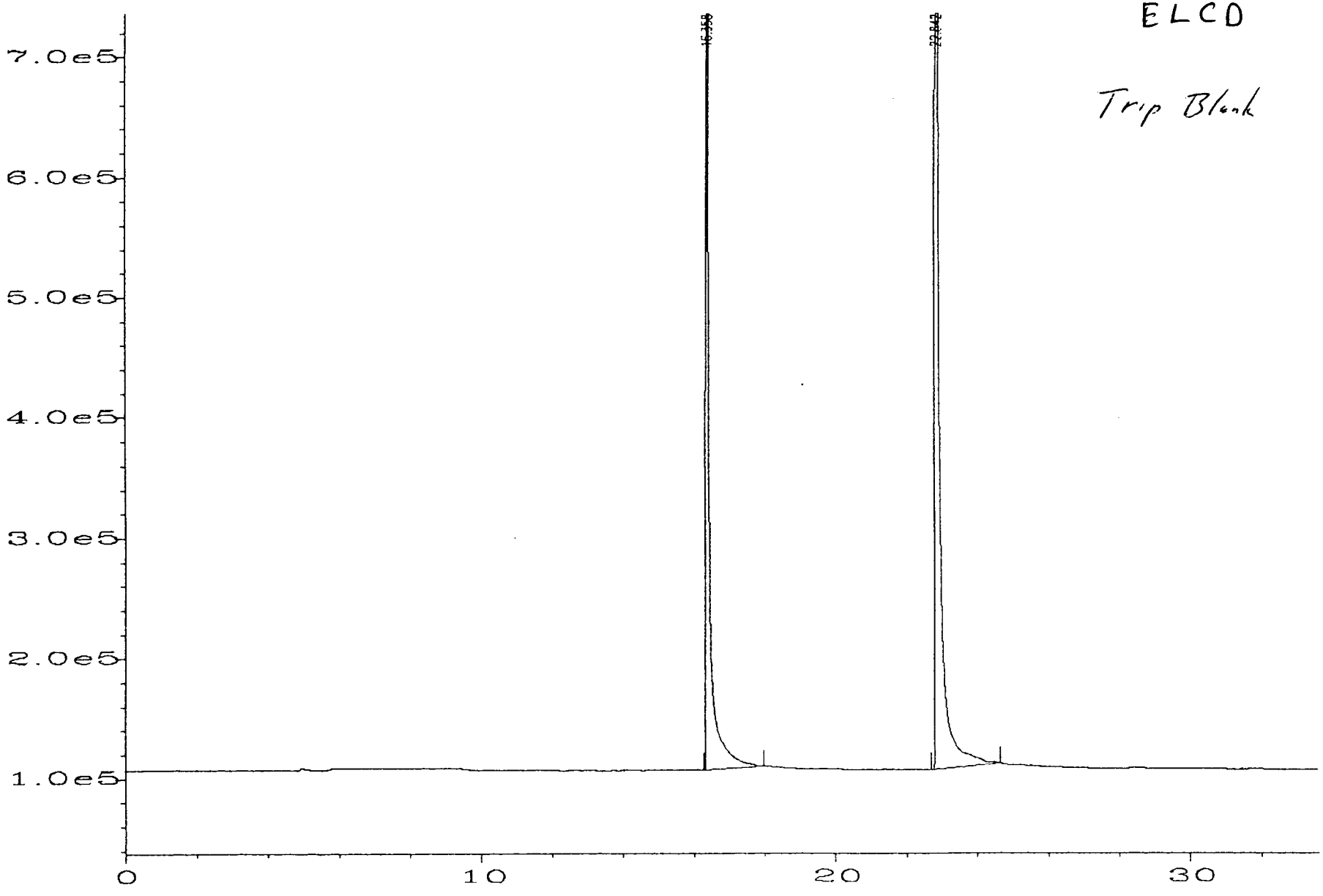
MW-22



Sig. 2 in C:\HPCHEM\1\DATA\17DECVOL\052R0101.D

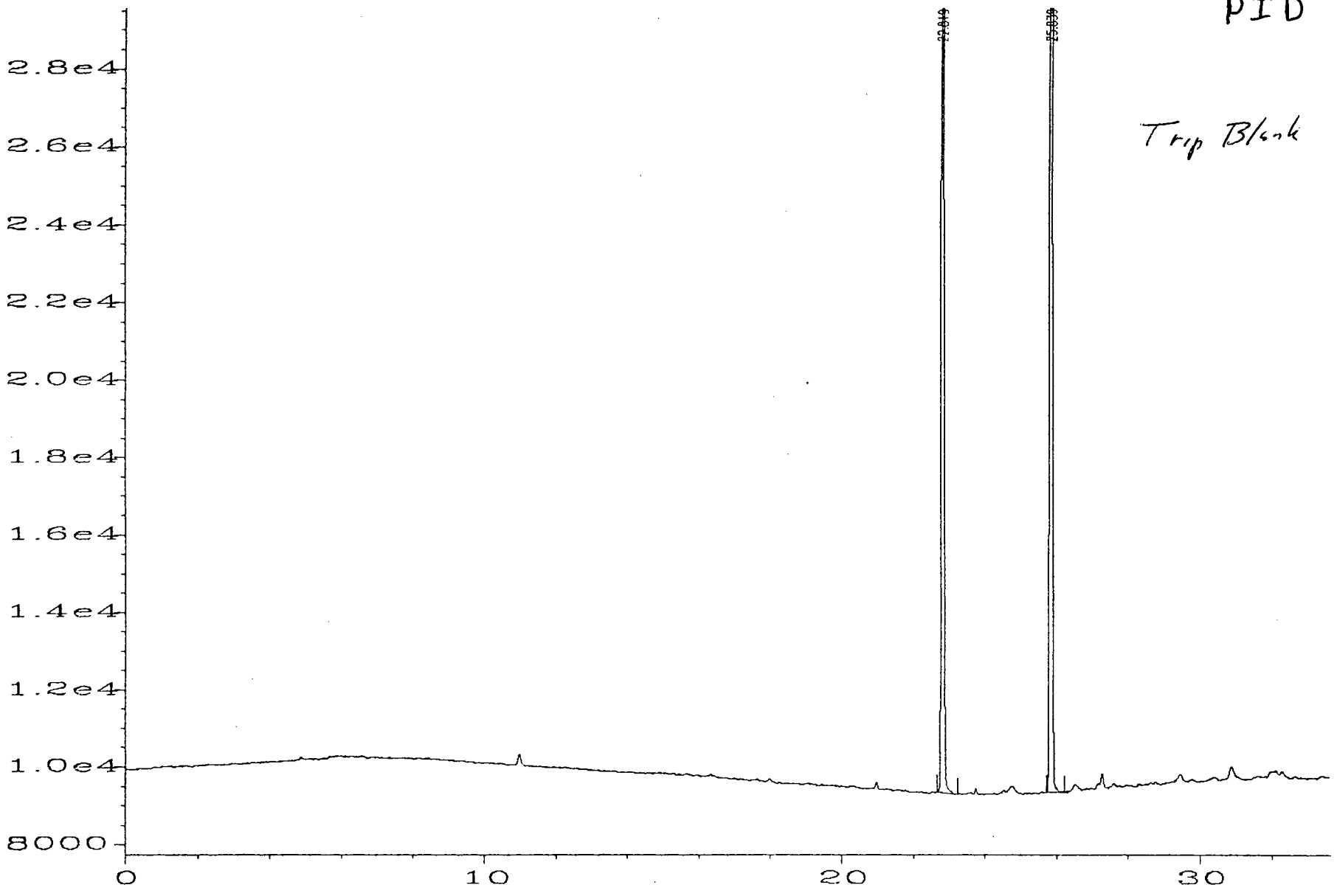
Sample # 3000
DF 1
ELCD

Trip Blank



Sig. 1 in C:\HPCHEM\1\DATA\17DECVOL\034F0101.D

Sample # 3000
DF 1
PID



Sig. 2 in C:\HPCHEM\1\DATA\17DECVOL\034R0101.D

CHAIN-OF-CUSTODY

516 601/602 5515 230 1125 6159

Project No.: 9131.01

Project Name: MAVERIK KIRTLAND 4th Qtr 1992

Samplers: (Signature) PRW

Sample No.	Date	Time	Sample Location	No. of Containers	BTEX	1,2 Dichloroethane	Sulfide	Sulfate			Remarks
MW-9	12/16/92	15:45	Monitoring Well	3	X	X					
MW-10		14:20		3	X	X					
MW-14		16:00		3	X	X					
MW-16		16:30		3	X	X					
MW-17		10:45		5	X	X	X	X			
MW-18		12:05		3	X	X					
MW-19		14:50		3	X	X					
MW-20		13:20		3	X	X					
MW-21		12:45		3	X	X					
MW-22		9:15		5	X	X	X	X			
MW-24		8:30		3	X	X					359-3059 15%
	12/16/92	8:15	Trip Blank	2	X						BTEX ONLY
				(1 vial for Trip Blank)							TRIP BLANKS NOT IN COOLER
					SLB 12-18-92						

rec'd trip blank 1 vial only 12/18/92

Relinquished by: (Signature)	Date/Time	Recieved by: (Signature)	Relinquished by: (Signature)	Date/Time	Recieved by: (Signature)
Paul Wenaker	12/18 8:25	Len Ford			
Relinquished by: (Signature)	Date/Time	Recieved by: (Signature)	Relinquished by: (Signature)	Date/Time	Recieved by: (Signature)

Relinquished by: (Signature)	Date/Time	Recieved for Laboratory by: (Signature)	Date/Time

Remarks:

GeoWest Golden, Inc.
530 Commons Drive Golden, CO 80401 (303) 526-9836

Analytical Report

Mountain States Analytical
The Quality Solution

Geowest Golden, Inc. Salt Lake Office
175 West 200 South
Suite # 2006
Salt Lake City, Ut 84101

Attn: Mr. Paul Wessenborn
Project: Maverik Kirtland Refinery

Sample ID: MW-9
Matrix: Waste Water

MSAI Sample: 7434
MSAI Group: 1609
Date Reported: 04/12/93

Discard Date: 05/12/93
Date Submitted: 04/05/93
Date Sampled: 03/30/93
Collected by: PW
Purchase Order:
Project No.: 9131.01

Test	Analysis	Results as Received	Units	Limit of Quantitation
0705A	Unheated P&T, Individual Cmpds.			
	Method: 600 SERIES 601			
	1,2-Dichloroethane	1.5	ug/l	1.0
0516	BTEX Analysis, Water			
	Method: EPA 602/5030			
	Benzene	< 1.0	ug/l	1.0
	Toluene	< 1.0	ug/l	1.0
	Ethylbenzene	< 1.0	ug/l	1.0
	m,p-Xylene	< 1.0	ug/l	1.0
	o-Xylene	< 1.0	ug/l	1.0
6159	Chromatograms/Etc.	See Attached		
	Method: IN HOUSE MSAI			

Respectfully Submitted,
Reviewed and Approved by:

Leon A. Peterson
Project Manager

Analytical Report

Mountain States Analytical
The Quality Solution

Geowest Golden, Inc. Salt Lake Office
175 West 200 South
Suite # 2006
Salt Lake City, Ut 84101

Attn: Mr. Paul Wessenborn
Project: Maverik Kirtland Refinery

Sample ID: MW-10
Matrix: Waste Water

MSAI Sample: 7435
MSAI Group: 1609
Date Reported: 04/15/93

Discard Date: 05/15/93
Date Submitted: 04/05/93
Date Sampled: 03/30/93
Collected by: PW
Purchase Order:
Project No.: 9131.01

Test	Analysis	Results as Received	Units	Limit of Quantitation
0705A	Unheated P&T, Individual Cmpds.			
	Method: 600 SERIES 601			
	1,2-Dichloroethane	< 1.0	ug/l	1.0
0516	BTEX Analysis, Water			
	Method: EPA 602/5030			
	Benzene	< 1.0	ug/l	1.0
	Toluene	< 1.0	ug/l	1.0
	Ethylbenzene	< 1.0	ug/l	1.0
	m,p-Xylene	< 1.0	ug/l	1.0
	o-Xylene	< 1.0	ug/l	1.0
6159	Chromatograms/Etc.	See Attached		
	Method: IN HOUSE MSAI			

Respectfully Submitted,
Reviewed and Approved by:

Leon A. Peterson
Project Manager

Mountain States Analytical
The Quality Solution

Geowest Golden, Inc. Salt Lake Office
175 West 200 South
Suite # 2006
Salt Lake City, Ut 84101

Attn: Mr. Paul Wessenborn
Project: Maverik Kirtland Refinery

Sample ID: MW-13
Matrix: Waste Water

MSAI Sample: 7436
MSAI Group: 1609
Date Reported: 04/15/93

Discard Date: 05/15/93
Date Submitted: 04/05/93
Date Sampled: 03/30/93
Collected by: PW
Purchase Order:
Project No.: 9131.01

Test	Analysis	Results as Received	Units	Limit of Quantitation
0705A	Unheated P&T, Individual Cmpds.			
	Method: 600 SERIES 601			
	1,2-Dichloroethane	< 1.0	ug/l	1.0
0516	BTEX Analysis, Water			
	Method: EPA 602/5030			
	Benzene	< 1.0	ug/l	1.0
	Toluene	< 1.0	ug/l	1.0
	Ethylbenzene	< 1.0	ug/l	1.0
	m,p-Xylene	< 1.0	ug/l	1.0
	o-Xylene	< 1.0	ug/l	1.0
6159	Chromatograms/Etc.	See Attached		
	Method: IN HOUSE MSAI			

Respectfully Submitted,
Reviewed and Approved by:

Leon A. Peterson
Project Manager

Mountain States Analytical
The Quality Solution

Geowest Golden, Inc. Salt Lake Office
175 West 200 South
Suite # 2006
Salt Lake City, Ut 84101

Attn: Mr. Paul Wessenborn
Project: Maverik Kirtland Refinery

Sample ID: MW-14
Matrix: Waste Water

MSAI Sample: 7437
MSAI Group: 1609
Date Reported: 04/15/93

Discard Date: 05/15/93
Date Submitted: 04/05/93
Date Sampled: 03/30/93
Collected by: PW
Purchase Order:
Project No.: 9131.01

Test	Analysis	Results as Received	Units	Limit of Quantitation
0705A	Unheated P&T, Individual Cmpds. Method: 600 SERIES 601			
	1,2-Dichloroethane	< 1.0	ug/l	1.0
0516	BTEX Analysis, Water Method: EPA 602/5030			
	Benzene	< 1.0	ug/l	1.0
	Toluene	< 1.0	ug/l	1.0
	Ethylbenzene	< 1.0	ug/l	1.0
	m,p-Xylene	< 1.0	ug/l	1.0
	o-Xylene	< 1.0	ug/l	1.0
6159	Chromatograms/Etc. Method: IN HOUSE MSAI	See Attached		

Respectfully Submitted,
Reviewed and Approved by:

Leon A. Peterson
Project Manager

Mountain States Analytical
The Quality Solution

Geowest Golden, Inc. Salt Lake Office
175 West 200 South
Suite # 2006
Salt Lake City, Ut 84101

Attn: Mr. Paul Wessenborn
Project: Maverik Kirtland Refinery

Sample ID: MW-15
Matrix: Waste Water

MSAI Sample: 7438
MSAI Group: 1609
Date Reported: 04/15/93

Discard Date: 05/15/93
Date Submitted: 04/05/93
Date Sampled: 03/30/93
Collected by: PW
Purchase Order:
Project No.: 9131.01

Test	Analysis	Results as Received	Units	Limit of Quantitation
0705A	Unheated P&T, Individual Cmpds.			
	Method: 600 SERIES 601			
	1,2-Dichloroethane	< 1.0	ug/l	1.0
0516	BTEX Analysis, Water			
	Method: EPA 602/5030			
	Benzene	< 1.0	ug/l	1.0
	Toluene	< 1.0	ug/l	1.0
	Ethylbenzene	< 1.0	ug/l	1.0
	m,p-Xylene	< 1.0	ug/l	1.0
	o-Xylene	< 1.0	ug/l	1.0
6159	Chromatograms/Etc.	See Attached		
	Method: IN HOUSE MSAI			

Respectfully Submitted,
Reviewed and Approved by:

Leon A. Peterson
Project Manager

Analytical Report

Mountain States Analytical
The Quality Solution

Geowest Golden, Inc. Salt Lake Office
175 West 200 South
Suite # 2006
Salt Lake City, Ut 84101

Attn: Mr. Paul Wessenborn
Project: Maverik Kirtland Refinery

Sample ID: MW-16
Matrix: Waste Water

MSAI Sample: 7439
MSAI Group: 1609
Date Reported: 04/15/93

Discard Date: 05/15/93
Date Submitted: 04/05/93
Date Sampled: 03/30/93
Collected by: PW
Purchase Order:
Project No.: 9131.01

Test	Analysis	Results as Received	Units	Limit of Quantitation
0705A	Unheated P&T, Individual Cmpds. Method: 600 SERIES 601			
	1,2-Dichloroethane	< 1.0	ug/l	1.0
0516	BTEX Analysis, Water Method: EPA 602/5030			
	Benzene	< 1.0	ug/l	1.0
	Toluene	< 1.0	ug/l	1.0
	Ethylbenzene	< 1.0	ug/l	1.0
	m,p-Xylene	< 1.0	ug/l	1.0
	o-Xylene	< 1.0	ug/l	1.0
6159	Chromatograms/Etc. Method: IN HOUSE MSAI	See Attached		

Respectfully Submitted,
Reviewed and Approved by:

Leon A. Peterson
Project Manager

1645 West 2200 South, Salt Lake City, Utah 84119 (801) 973-0050 FAX (801) 972-6278

Analytical Report

Mountain States Analytical
The Quality Solution

Geowest Golden, Inc. Salt Lake Office
175 West 200 South
Suite # 2006
Salt Lake City, Ut 84101

Attn: Mr. Paul Wessenborn
Project: Maverik Kirtland Refinery

Sample ID: MW-17
Matrix: Waste Water

MSAI Sample: 7440
MSAI Group: 1609
Date Reported: 04/15/93

Discard Date: 05/15/93
Date Submitted: 04/05/93
Date Sampled: 03/30/93
Collected by: PW
Purchase Order:
Project No.: 9131.01

Test	Analysis	Results as Received	Units	Limit of Quantitation
0230	Sulfide, Low Level Method: EPA 376.2	1	mg/l	1
1125	Sulfate, Turbidimetric Method: EPA 375.4	12	mg/l	2
0705A	Unheated P&T, Individual Cmpds. Method: 600 SERIES 601			
	1,2-Dichloroethane	16.8	ug/l	1.0
0516	BTEX Analysis, Water Method: EPA 602/5030			
	Benzene	13,800	ug/l	500
	Toluene	6,830	ug/l	500
	Ethylbenzene	1,110	ug/l	500
	m,p-Xylene	4,960	ug/l	500
	o-Xylene	1,970	ug/l	500
6159	Chromatograms/Etc. Method: IN HOUSE MSAI	See Attached		

Respectfully Submitted,
Reviewed and Approved by:

Leon A. Peterson
Project Manager

Analytical Report

Mountain States Analytical
The Quality Solution

Geowest Golden, Inc. Salt Lake Office
175 West 200 South
Suite # 2006
Salt Lake City, Ut 84101

Attn: Mr. Paul Wessenborn
Project: Maverik Kirtland Refinery

Sample ID: MW-18
Matrix: Waste Water

MSAI Sample: 7441
MSAI Group: 1609
Date Reported: 04/15/93

Discard Date: 05/15/93
Date Submitted: 04/05/93
Date Sampled: 03/30/93
Collected by: PW
Purchase Order:
Project No.: 9131.01

Test	Analysis	Results as Received	Units	Limit of Quantitation
0705A	Unheated P&T, Individual Cmpds.			
	Method: 600 SERIES 601			
	1,2-Dichloroethane	< 1.0	ug/l	1.0
0516	BTEX Analysis, Water			
	Method: EPA 602/5030			
	Benzene	117	ug/l	1.0
	Toluene	8.0	ug/l	1.0
	Ethylbenzene	96.1	ug/l	1.0
	m,p-Xylene	222	ug/l	1.0
	o-Xylene	4.0	ug/l	1.0
6159	Chromatograms/Etc.	See Attached		
	Method: IN HOUSE MSAI			

Respectfully Submitted,
Reviewed and Approved by:

Leon A. Peterson
Project Manager

1645 West 2200 South, Salt Lake City, Utah 84119 (801) 973-0050 FAX (801) 972-6278

Analytical Report

Mountain States Analytical
The Quality Solution

Geowest Golden, Inc. Salt Lake Office
175 West 200 South
Suite # 2006
Salt Lake City, Ut 84101

Attn: Mr. Paul Wessenborn
Project: Maverik Kirtland Refinery

Sample ID: MW-19
Matrix: Waste Water

MSAI Sample: 7442
MSAI Group: 1609
Date Reported: 04/15/93

Discard Date: 05/15/93
Date Submitted: 04/05/93
Date Sampled: 03/30/93
Collected by: PW
Purchase Order:
Project No.: 9131.01

Test	Analysis	Results as Received	Units	Limit of Quantitation
0705A	Unheated P&T, Individual Cmpds. Method: 600 SERIES 601			
	1,2-Dichloroethane	2.4	ug/l	1.0
0516	BTEX Analysis, Water Method: EPA 602/5030			
	Benzene	< 1.0	ug/l	1.0
	Toluene	< 1.0	ug/l	1.0
	Ethylbenzene	< 1.0	ug/l	1.0
	m,p-Xylene	< 1.0	ug/l	1.0
	o-Xylene	< 1.0	ug/l	1.0
6159	Chromatograms/Etc. Method: IN HOUSE MSAI	See Attached		

Respectfully Submitted,
Reviewed and Approved by:

Leon A. Peterson
Project Manager

Analytical Report

Mountain States Analytical
The Quality Solution

Geowest Golden, Inc. Salt Lake Office
175 West 200 South
Suite # 2006
Salt Lake City, Ut 84101

Attn: Mr. Paul Wessenborn
Project: Maverik Kirtland Refinery

Sample ID: MW-20
Matrix: Waste Water

MSAI Sample: 7443
MSAI Group: 1609
Date Reported: 04/15/93

Discard Date: 05/15/93
Date Submitted: 04/05/93
Date Sampled: 03/30/93
Collected by: PW
Purchase Order:
Project No.: 9131.01

Test	Analysis	Results as Received	Units	Limit of Quantitation
0705A	Unheated P&T, Individual Cmpds.			
	Method: 600 SERIES 601			
	1,2-Dichloroethane	2.1	ug/l	1.0
0516	BTEX Analysis, Water			
	Method: EPA 602/5030			
	Benzene	< 1.0	ug/l	1.0
	Toluene	< 1.0	ug/l	1.0
	Ethylbenzene	< 1.0	ug/l	1.0
	m,p-Xylene	< 1.0	ug/l	1.0
	o-Xylene	< 1.0	ug/l	1.0
6159	Chromatograms/Etc.	See Attached		
	Method: IN HOUSE MSAI			

Respectfully Submitted,
Reviewed and Approved by:

Leon A. Peterson
Project Manager

1645 West 2200 South, Salt Lake City, Utah 84119 (801) 973-0050 FAX (801) 972-6278

Mountain States Analytical
The Quality Solution

Geowest Golden, Inc. Salt Lake Office
175 West 200 South
Suite # 2006
Salt Lake City, Ut 84101

Attn: Mr. Paul Wessenborn
Project: Maverik Kirtland Refinery

Sample ID: MW-21
Matrix: Waste Water

MSAI Sample: 7444
MSAI Group: 1609
Date Reported: 04/15/93

Discard Date: 05/15/93
Date Submitted: 04/05/93
Date Sampled: 03/30/93
Collected by: PW
Purchase Order:
Project No.: 9131.01

Test	Analysis	Results as Received	Units	Limit of Quantitation
0705A	Unheated P&T, Individual Cmpds.			
	Method: 600 SERIES 601			
	1,2-Dichloroethane	5.9	ug/l	1.0
0516	BTEX Analysis, Water			
	Method: EPA 602/5030			
	Benzene	< 1.0	ug/l	1.0
	Toluene	< 1.0	ug/l	1.0
	Ethylbenzene	< 1.0	ug/l	1.0
	m,p-Xylene	< 1.0	ug/l	1.0
	o-Xylene	< 1.0	ug/l	1.0
6159	Chromatograms/Etc.	See Attached		
	Method: IN HOUSE MSAI			

Respectfully Submitted,
Reviewed and Approved by:

Leon A. Peterson
Project Manager

Mountain States Analytical
The Quality Solution

Geowest Golden, Inc. Salt Lake Office
175 West 200 South
Suite # 2006
Salt Lake City, Ut 84101

Attn: Mr. Paul Wessenborn
Project: Maverik Kirtland Refinery

Sample ID: MW-22
Matrix: Waste Water

MSAI Sample: 7445
MSAI Group: 1609
Date Reported: 04/15/93

Discard Date: 05/15/93
Date Submitted: 04/05/93
Date Sampled: 03/30/93
Collected by: PW
Purchase Order:
Project No.: 9131.01

Test	Analysis	Results as Received	Units	Limit of Quantitation
0230	Sulfide, Low Level Method: EPA 376.2	< 1	mg/l	1
1125	Sulfate, Turbidimetric Method: EPA 375.4	< 2	mg/l	2
0705A	Unheated P&T, Individual Cmpds. Method: 600 SERIES 601			
	1,2-Dichloroethane	1,930	ug/l	50
0516	BTEX Analysis, Water Method: EPA 602/5030			
	Benzene	29,800	ug/l	500
	Toluene	14,100	ug/l	500
	Ethylbenzene	1,170	ug/l	500
	m,p-Xylene	4,920	ug/l	500
	o-Xylene	2,110	ug/l	500
6159	Chromatograms/Etc. Method: IN HOUSE MSAI	See Attached		

Respectfully Submitted,
Reviewed and Approved by:

Leon A. Peterson
Project Manager

Analytical Report

Mountain States Analytical
The Quality Solution

Geowest Golden, Inc. Salt Lake Office
175 West 200 South
Suite # 2006
Salt Lake City, Ut 84101

Attn: Mr. Paul Wessenborn
Project: Maverik Kirtland Refinery

Sample ID: MW-25 Dup of MW-21
Matrix: Waste Water

MSAI Sample: 7446
MSAI Group: 1609
Date Reported: 04/15/93

Discard Date: 05/15/93
Date Submitted: 04/05/93
Date Sampled: 03/30/93
Collected by: PW
Purchase Order:
Project No.: 9131.01

Test	Analysis	Results as Received	Units	Limit of Quantitation
0705A	Unheated P&T, Individual Cmpds. Method: 600 SERIES 601			
	1,2-Dichloroethane	< 8.0	ug/l	(1) 8.0
0516	BTEX Analysis, Water Method: EPA 602/5030			
	Benzene	< 1.0	ug/l	1.0
	Toluene	< 1.0	ug/l	1.0
	Ethylbenzene	< 1.0	ug/l	1.0
	m,p-Xylene	< 1.0	ug/l	1.0
	o-Xylene	< 1.0	ug/l	1.0
6159	Chromatograms/Etc. Method: IN HOUSE MSAI	See Attached		

(1) Due to carry-over, the LOQ had to be raised. Insufficient sample volume did not allow re-run.

Respectfully Submitted,
Reviewed and Approved by:

Leon A. Peterson
Project Manager

1645 West 2200 South, Salt Lake City, Utah 84119 (801) 973-0050 FAX (801) 972-6278

Mountain States Analytical
The Quality Solution

Geowest Golden, Inc. Salt Lake Office
175 West 200 South
Suite # 2006
Salt Lake City, Ut 84101

Attn: Mr. Paul Wessenborn
Project: Maverik Kirtland Refinery

Sample ID: Trip Blank
Matrix: Waste Water

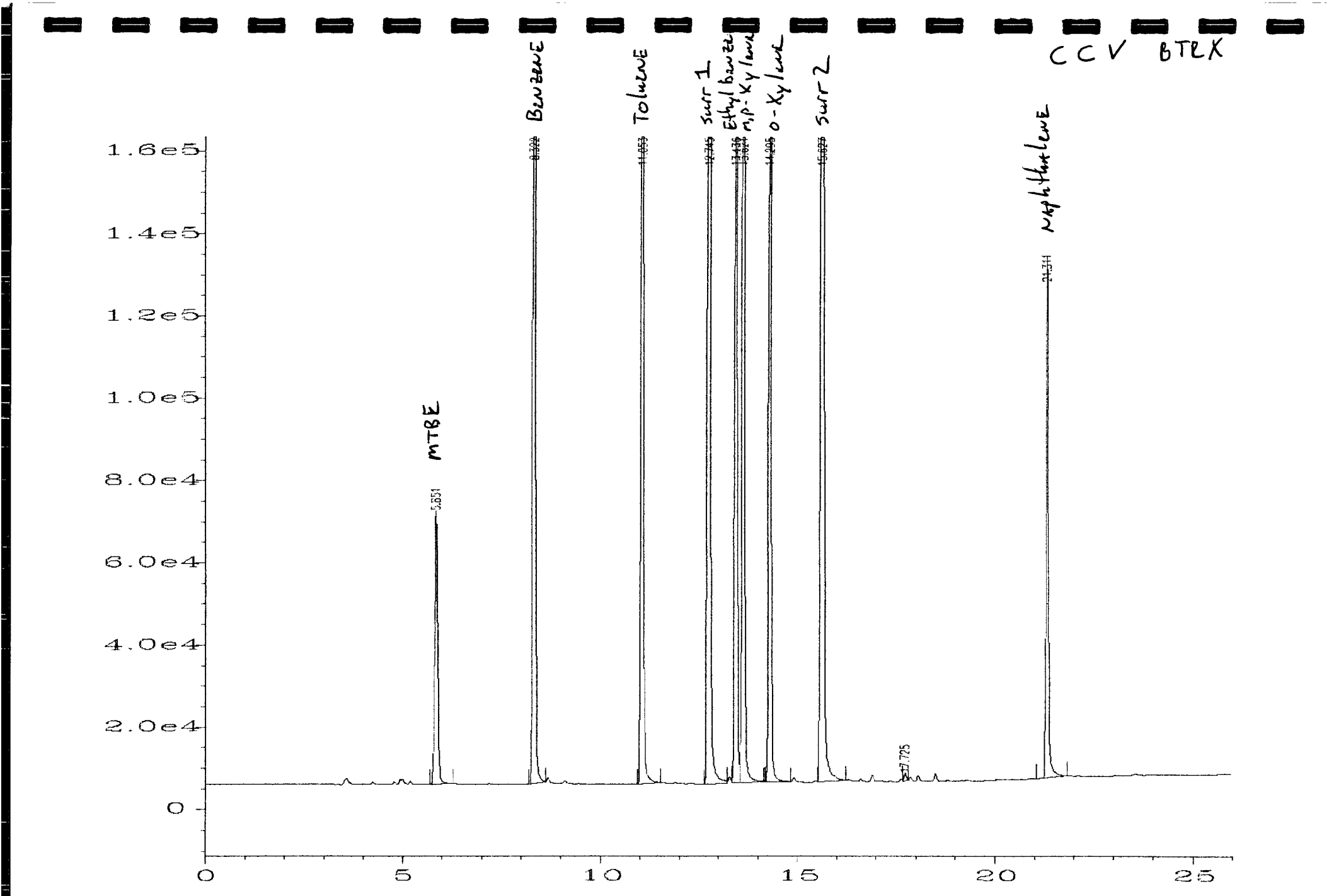
MSAI Sample: 7447
MSAI Group: 1609
Date Reported: 04/15/93

Discard Date: 05/15/93
Date Submitted: 04/05/93
Date Sampled: 03/30/93
Collected by: PW
Purchase Order:
Project No.: 9131.01

Test	Analysis	Results as Received	Units	Limit of Quantitation
0516	BTEX Analysis, Water Method: EPA 602/5030			
	Benzene	< 1.0	ug/l	1.0
	Toluene	< 1.0	ug/l	1.0
	Ethylbenzene	< 1.0	ug/l	1.0
	m,p-Xylene	< 1.0	ug/l	1.0
	o-Xylene	< 1.0	ug/l	1.0
6159	Chromatograms/Etc. Method: IN HOUSE MSAI	See Attached		

Respectfully Submitted,
Reviewed and Approved by:

Leon A. Peterson
Project Manager

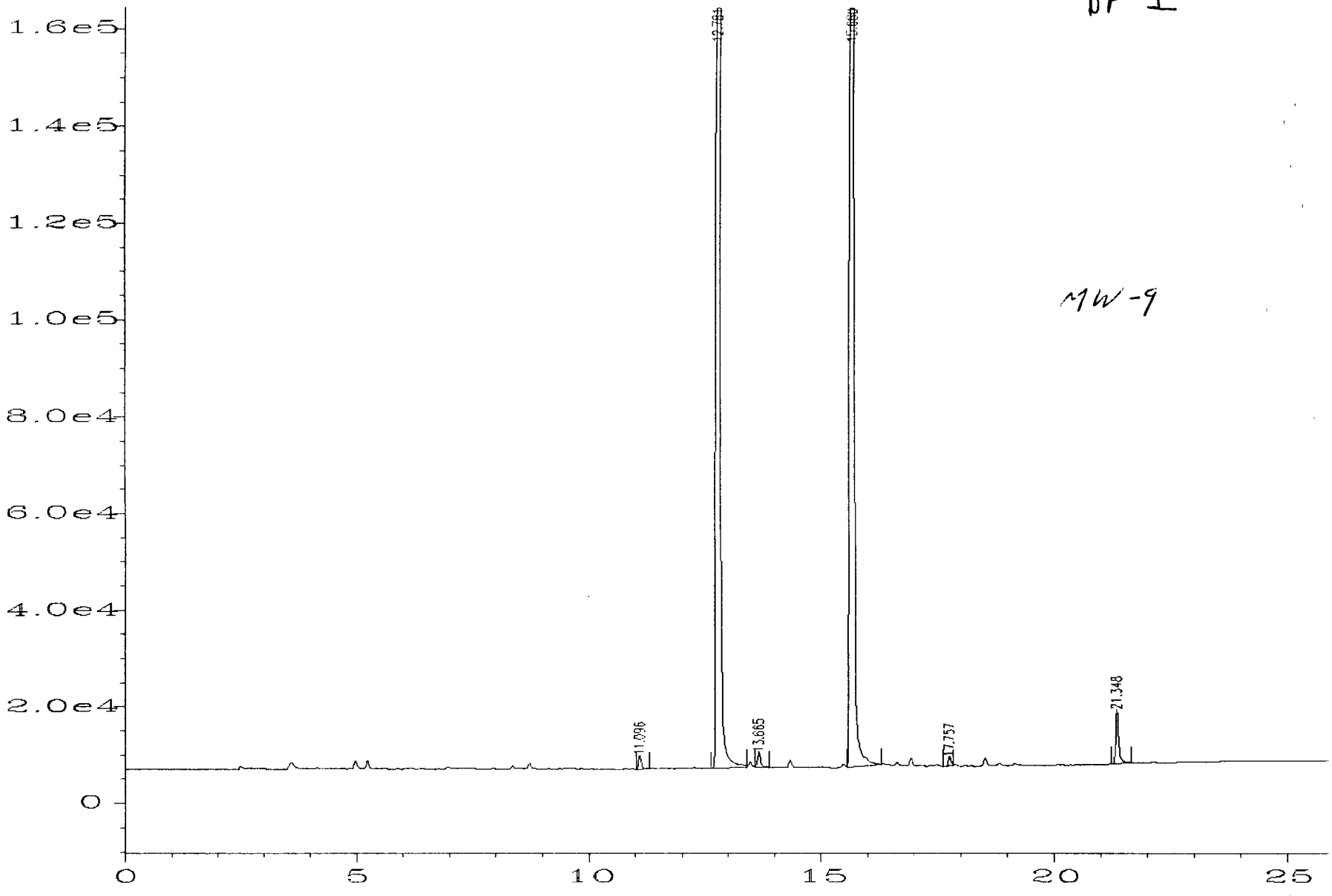


Sig. 2 in C:\HPCHEM\2\DATA\08APRBTX\024R0101.D

Sample # 7434

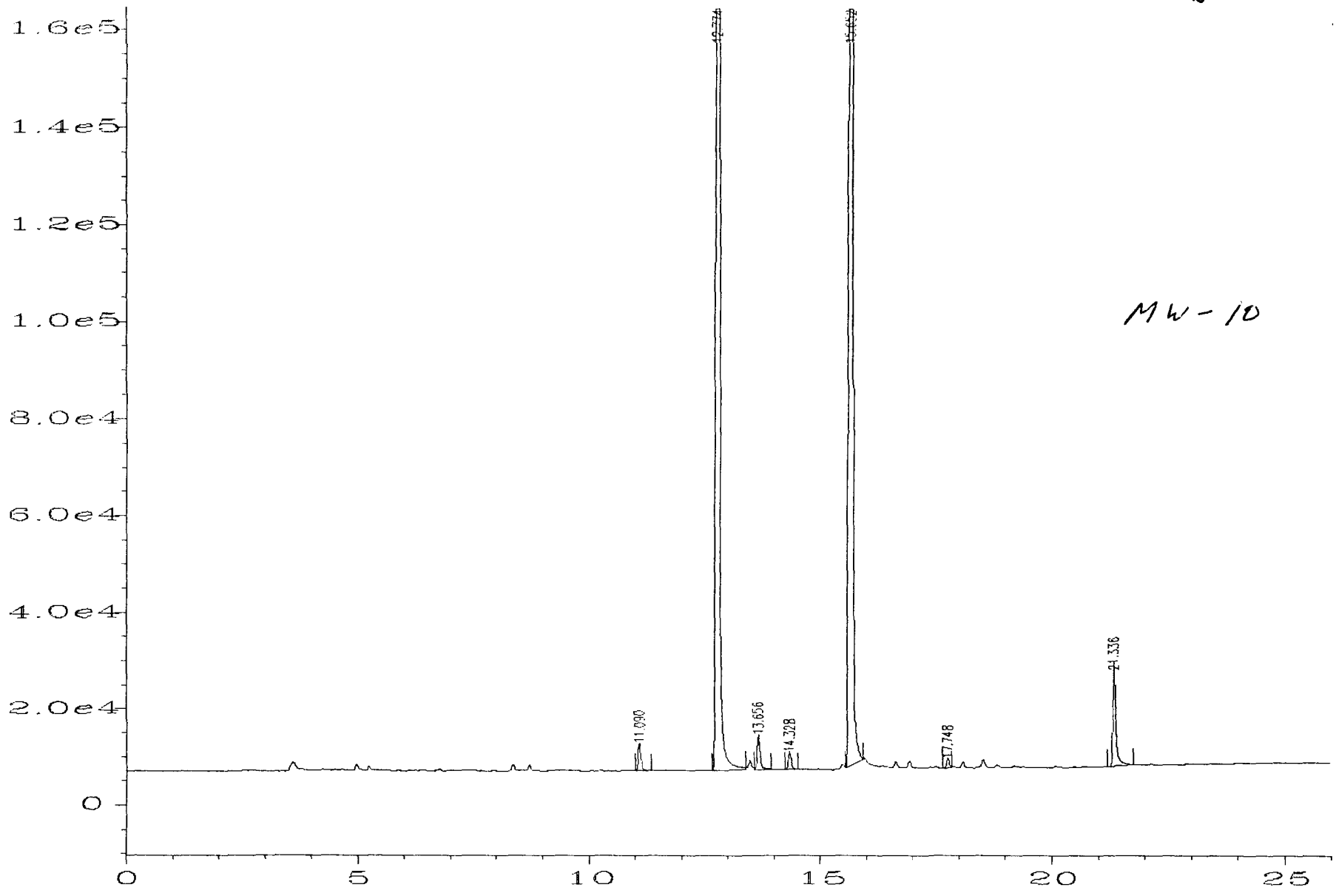
DF 1

MW-9



Sig. 2 in C:\HPCHEM\2\DATA\06APRBTX\024R0101.D

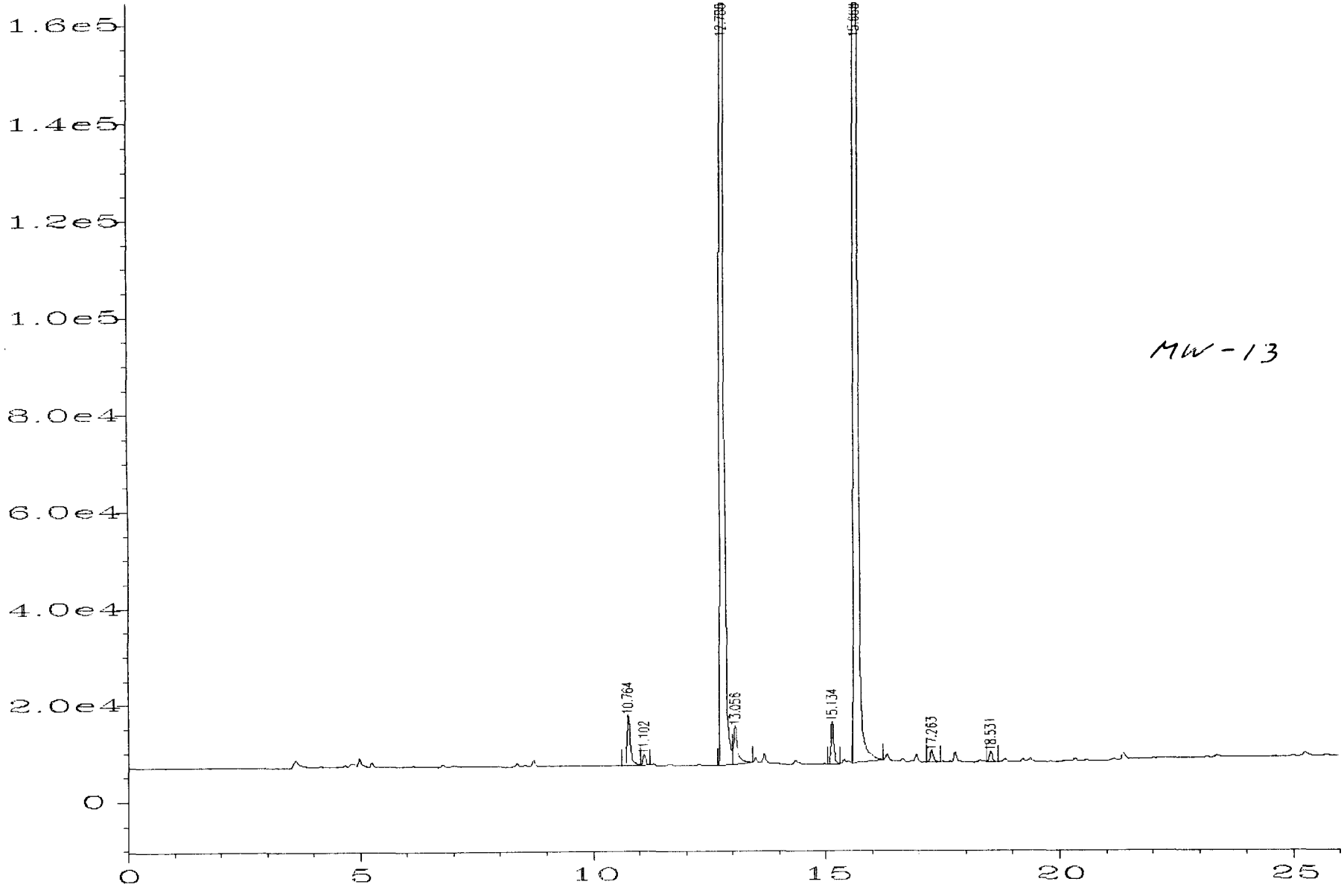
Sample # 7435
DF 1



MW-10

Sig. 2 in C:\HPCHEM\2\DATA\06APRBTX\025R0101.D

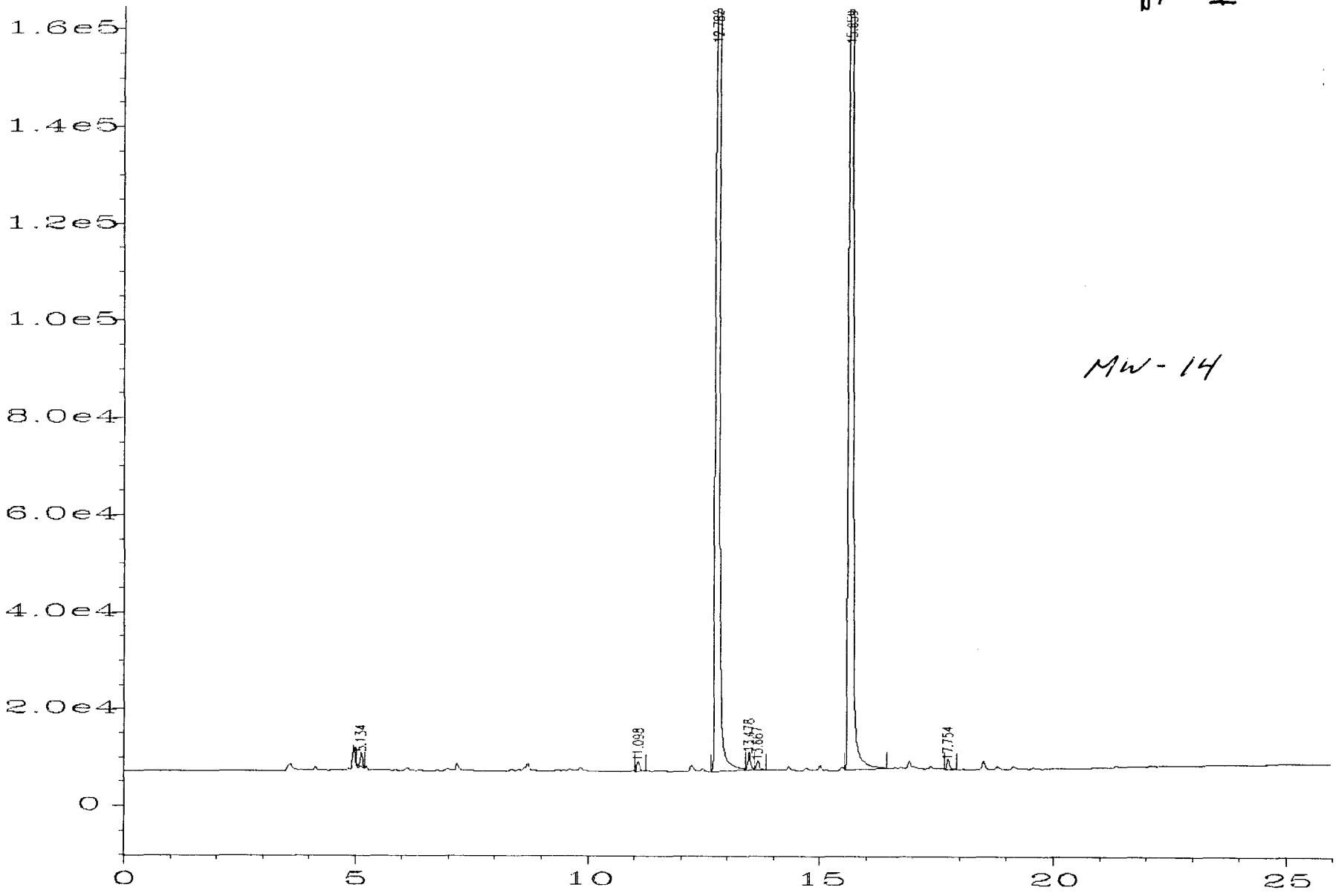
Sample # 7436
OF 1



MW-13

Sig. 2 in C:\HPCHEM\2\DATA\06APRBTX\026R0101.D

Sample # 7437
DF 1

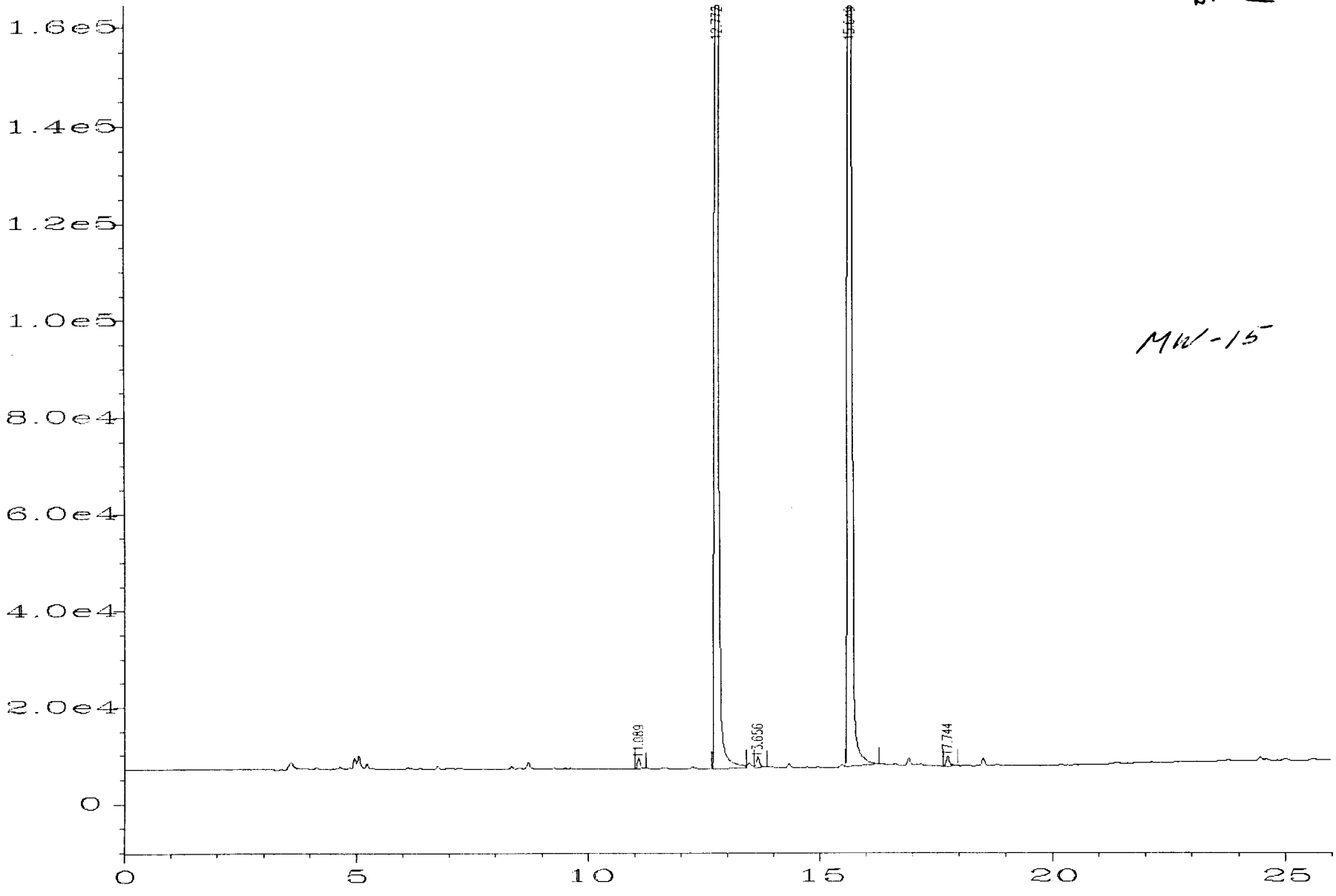


MW-14

Sig. 2 in C:\HPCHEM\2\DATA\06APRBTX\027R0101.D

Sample # 7438

DF 1

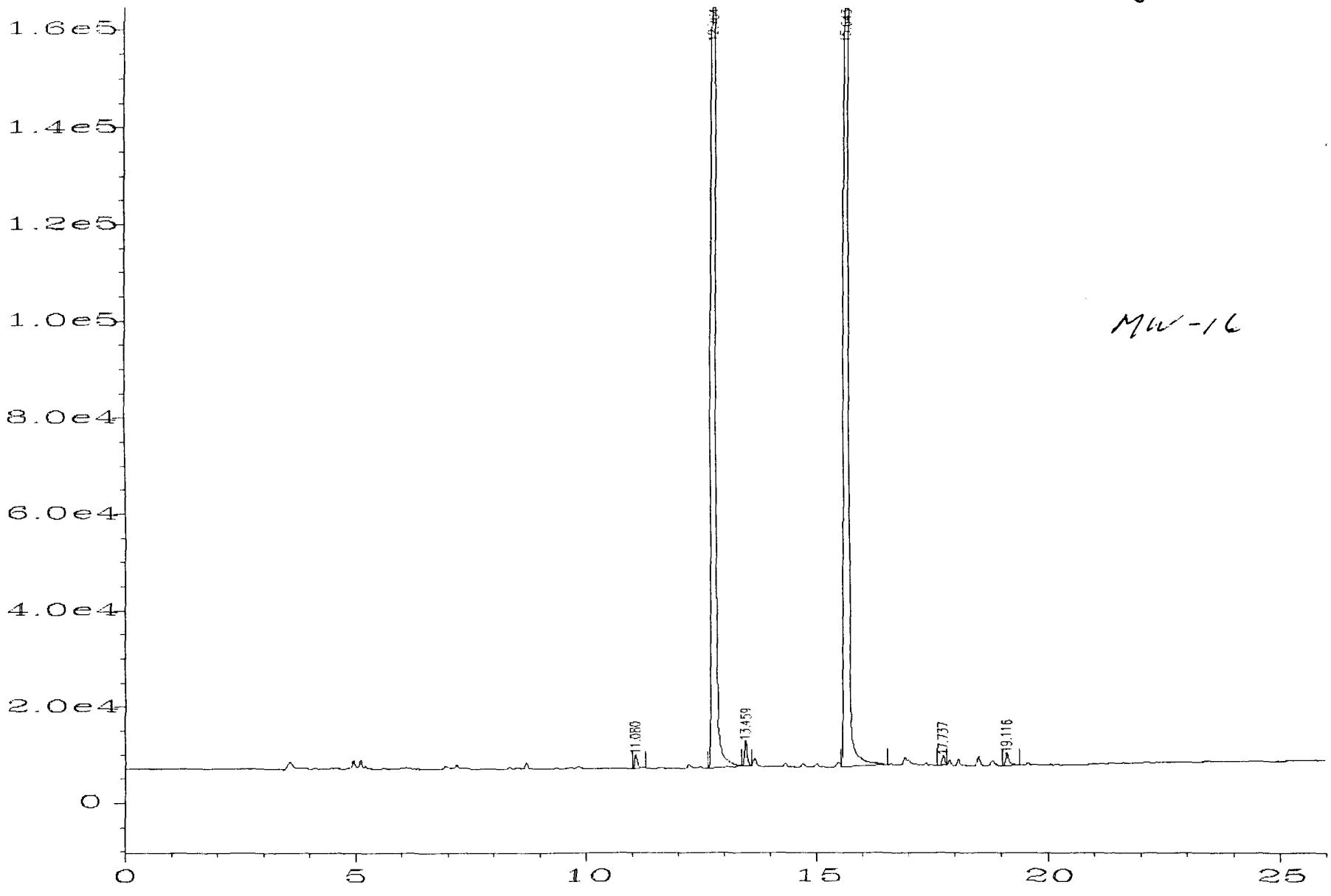


MW-15

Sig. 2 in C:\HPCHEM\2\DATA\06APRBTX\028R0101.D

Sample # 7439

OF 1

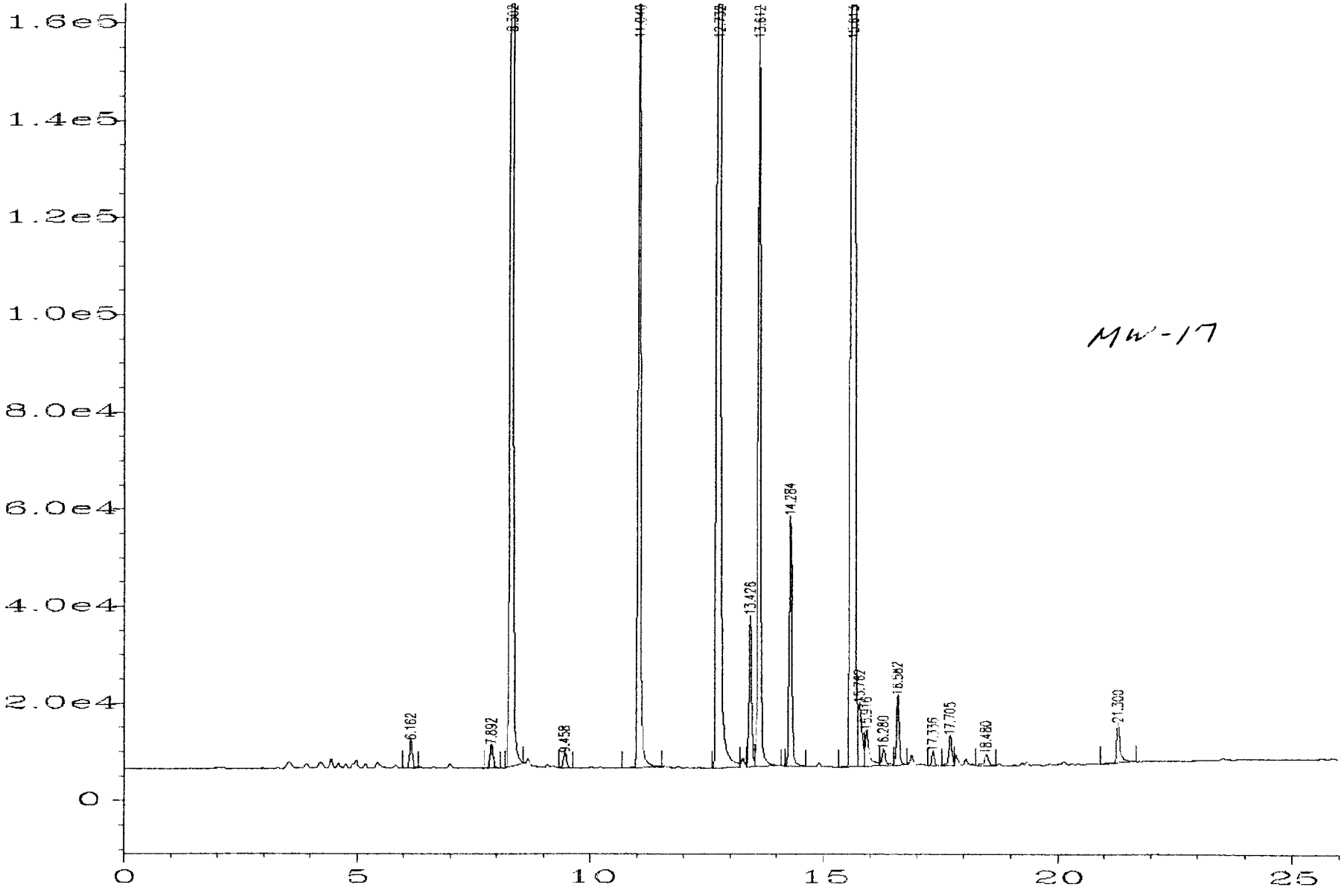


MW-16

Sig. 2 in C:\HPCHEM\2\DATA\06APRBTX\029R0101.D

Sample # 7440

DF 500

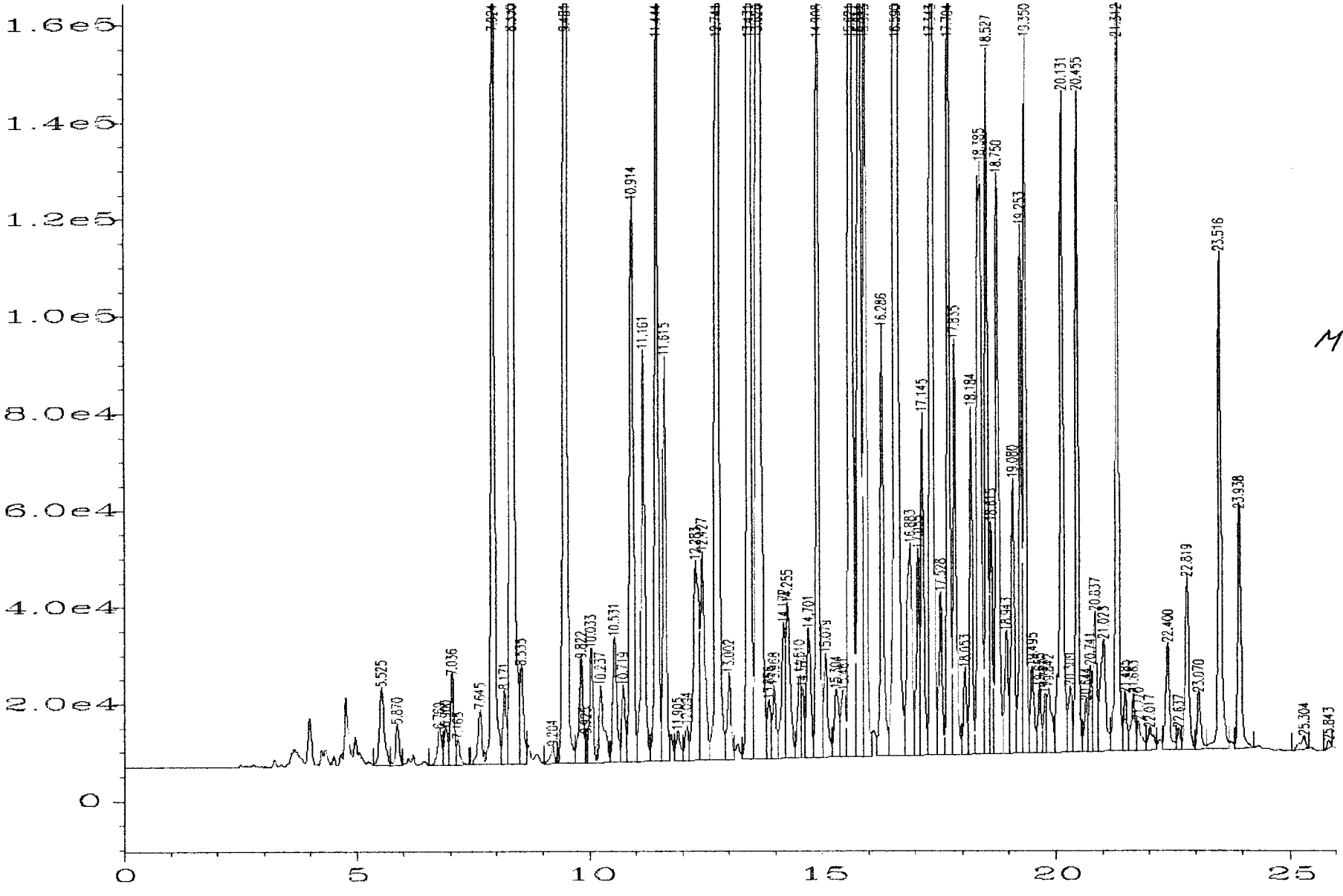


MW-17

Sig. 2 in C:\HPCHEM\2\DATA\08APRBTX\045R0101.D

Sample # 7441

OF 1

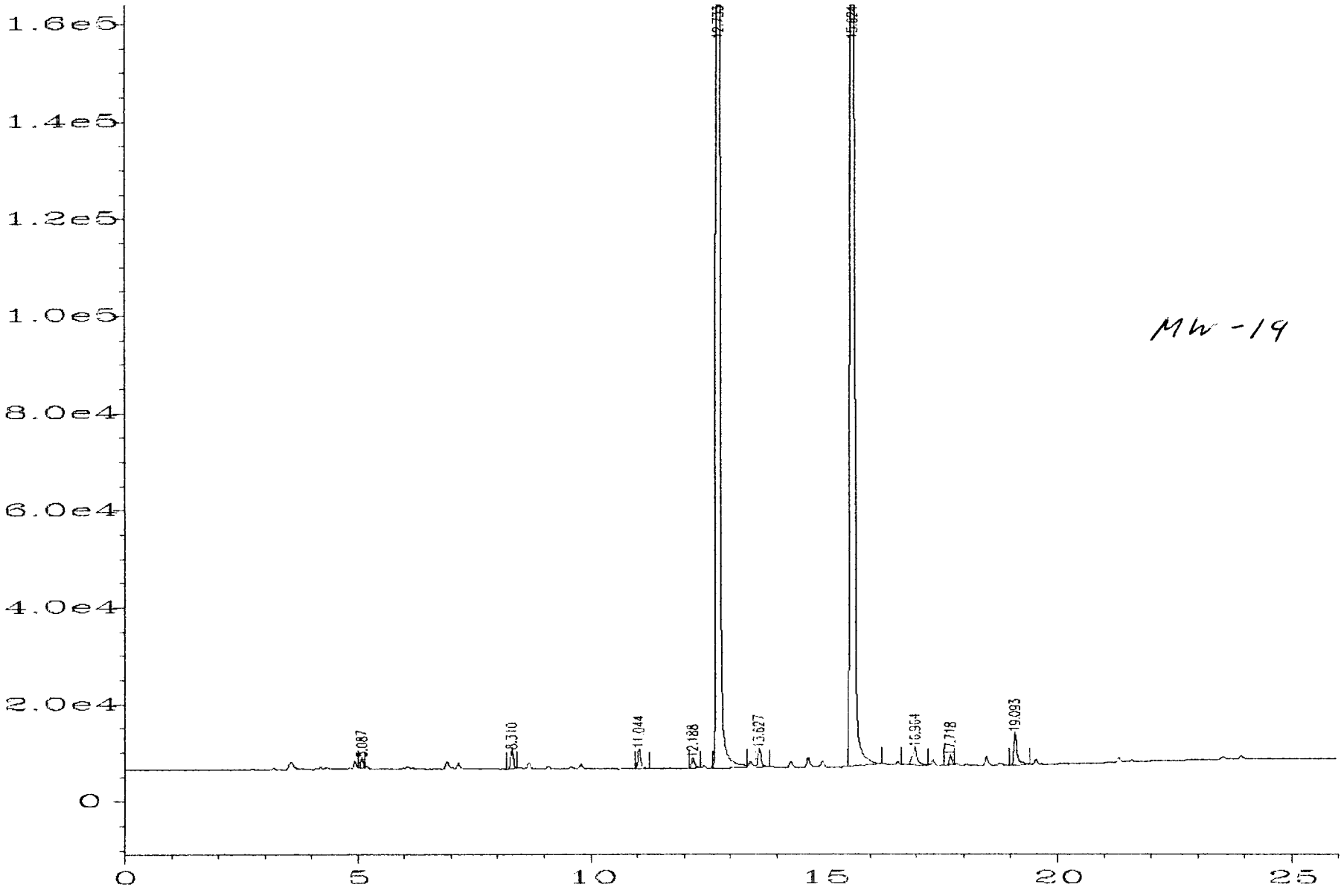


MW-18

Sig. 2 in C:\HPCHEM\2\DATA\08APRBTX\050R0101.D

Sample # 7442

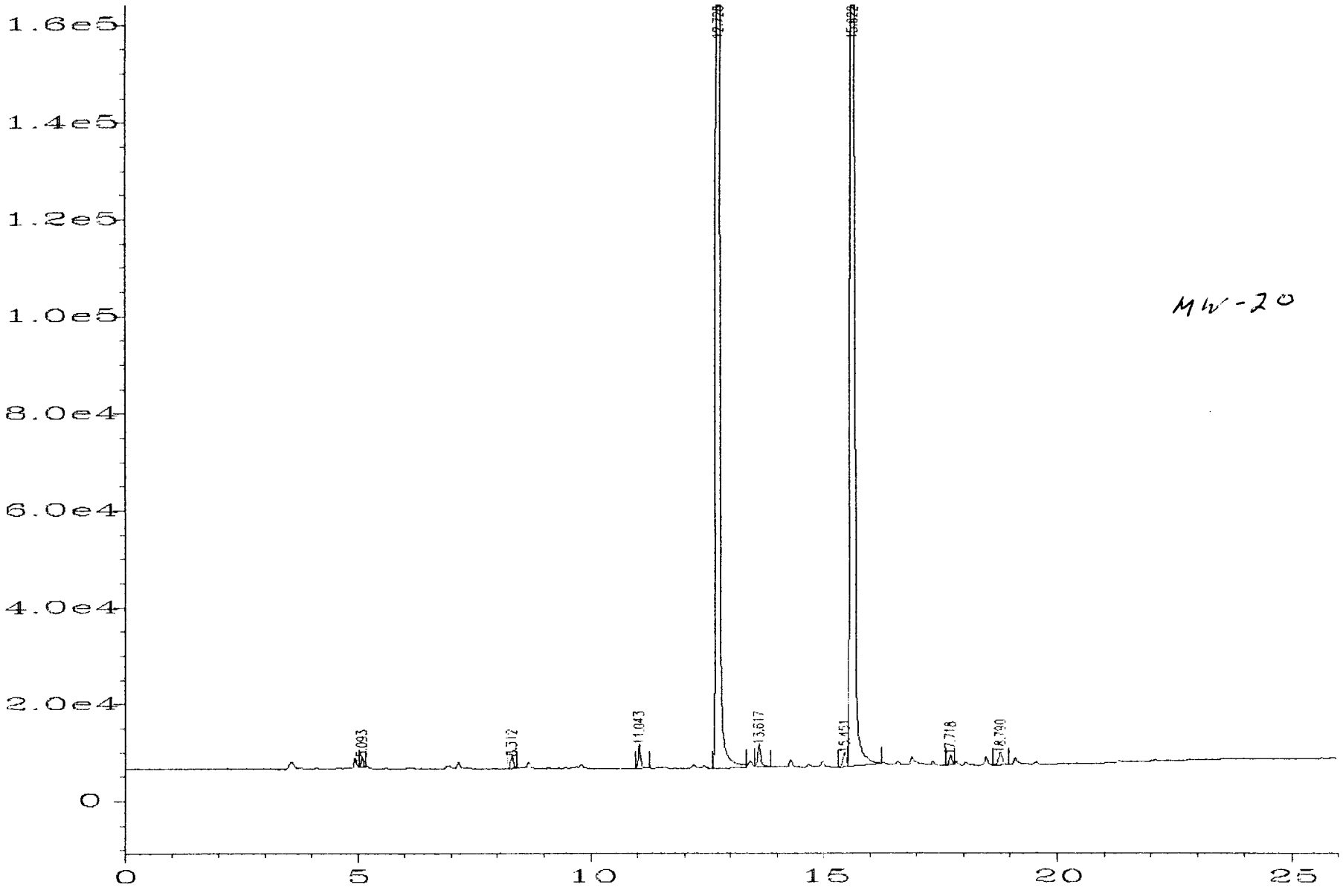
OF 1



MW-19

Sig. 2 in C:\HPCHEM\2\DATA\08APRBTX\034R0101.D

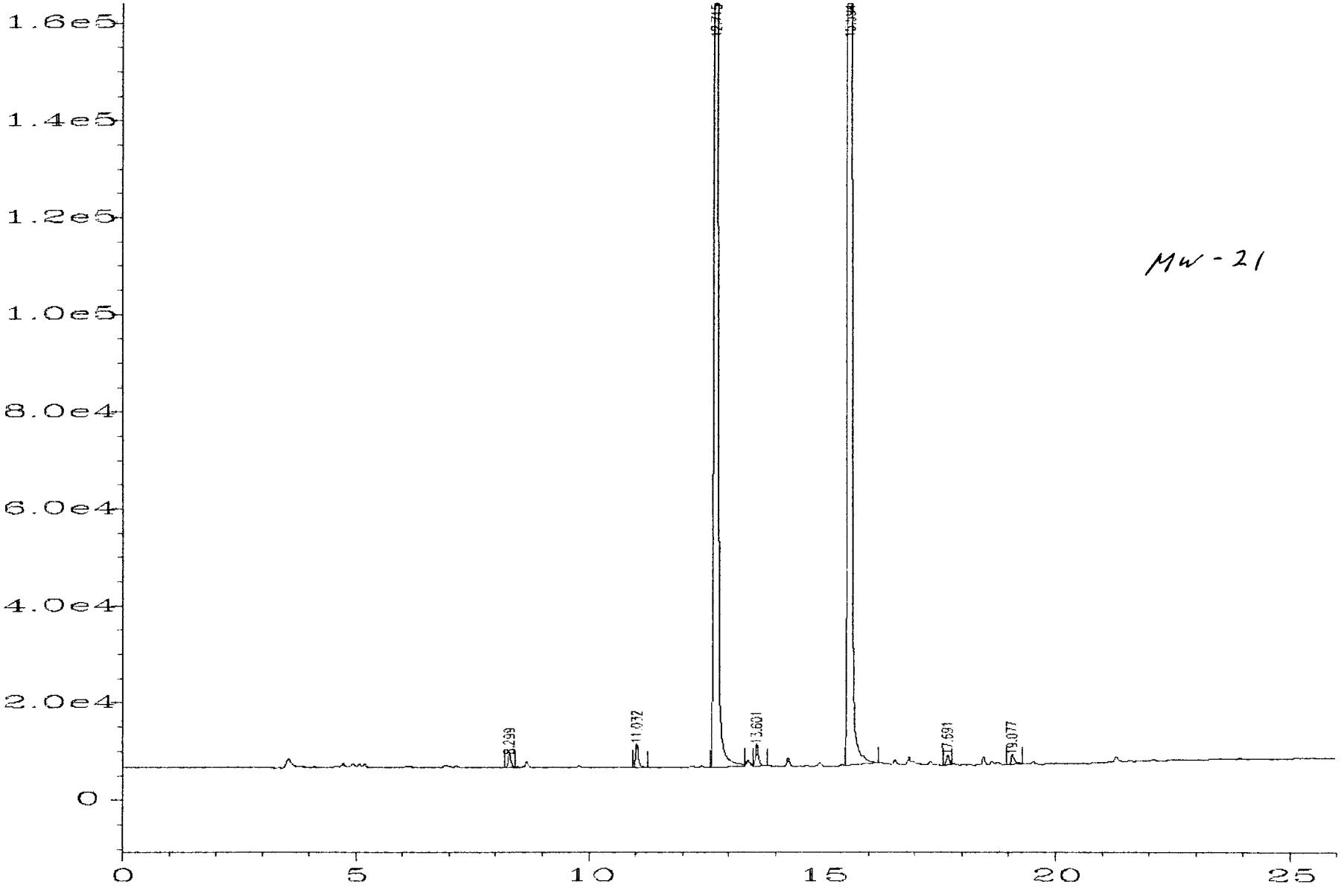
Sample # 7493
OF 1



Sig. 2 in C:\HPCHEM\2\DATA\08APRBTX\035R0101.D

Sample # 7444

DF 1

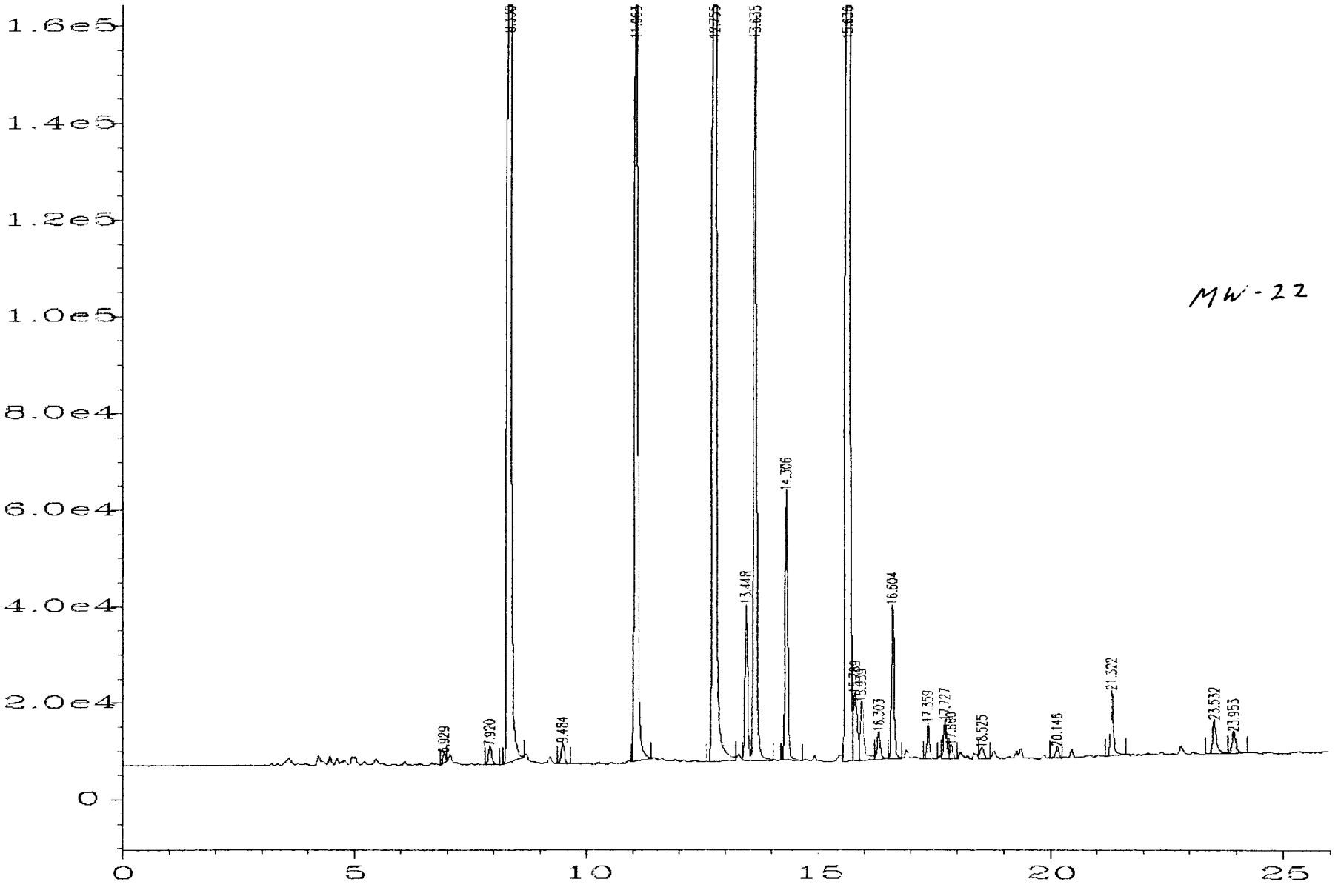


MW-21

Sig. 2 in C:\HPCHEM\2\DATA\08APRBTX\036R0101.D

Sample # 7445

DF 500

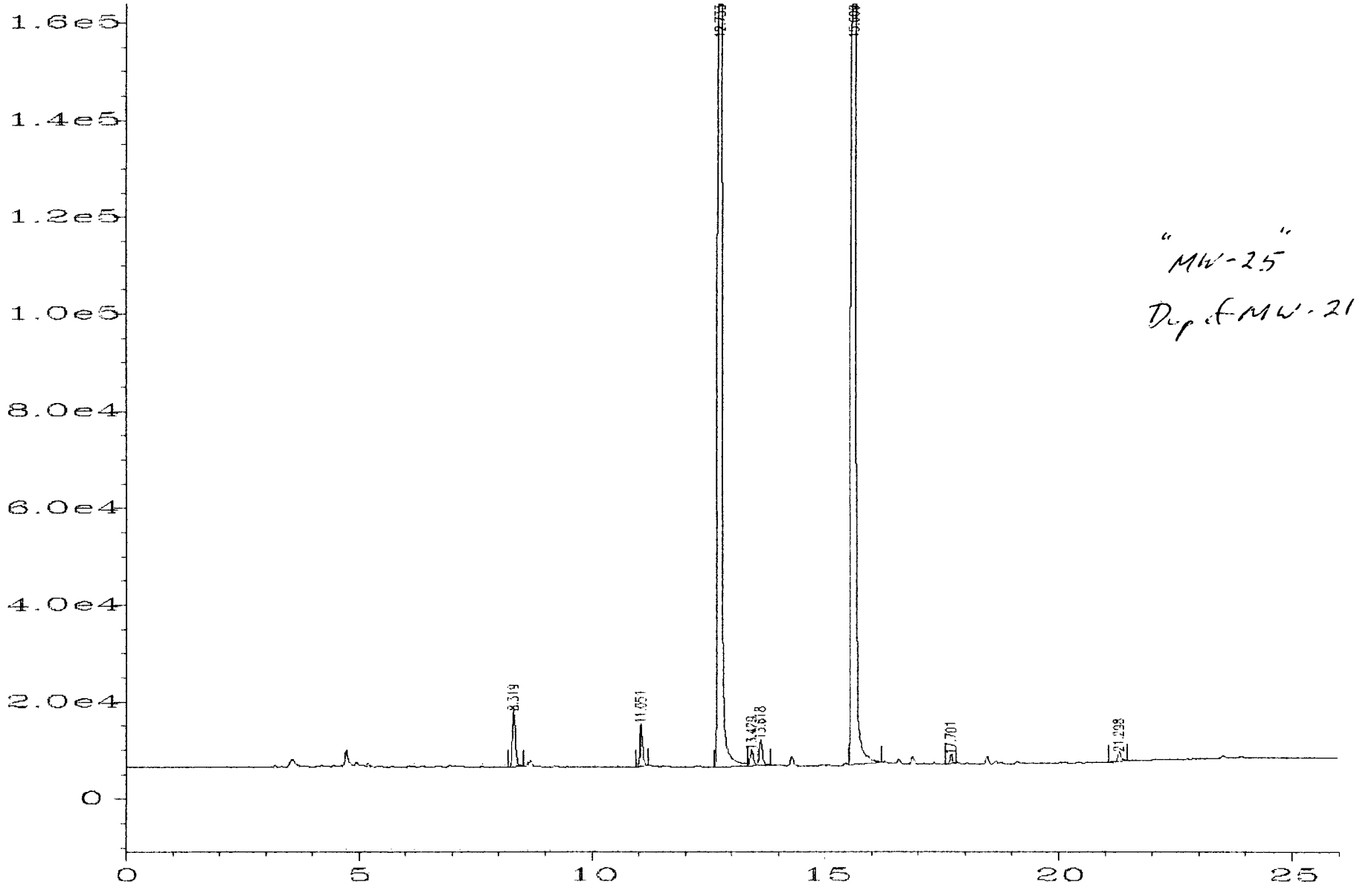


MW-22

Sig. 2 in C:\HPCHEM\2\DATA\08APRBTX\051R0101.D

Sample # 7446

DF 1



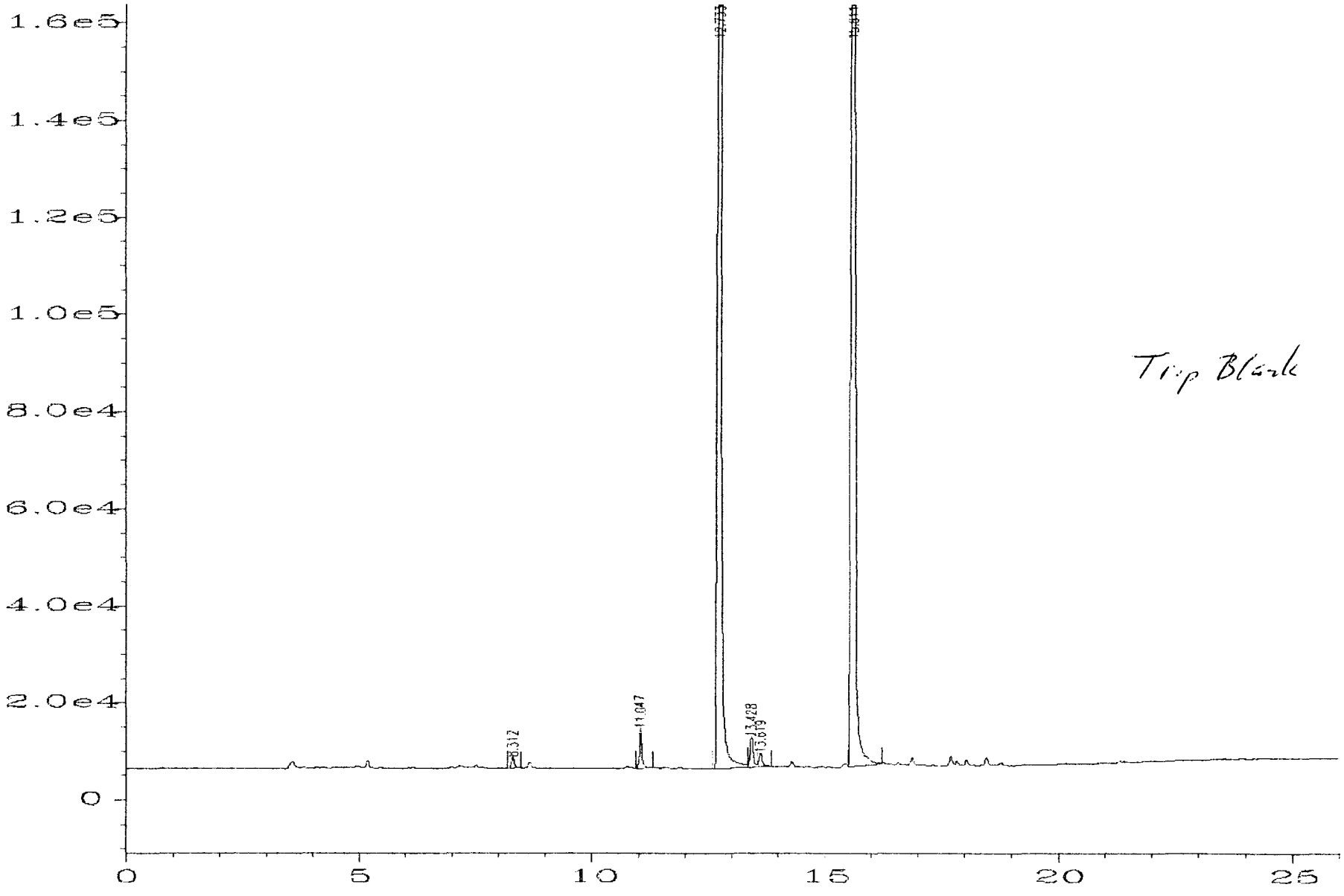
"MW-25"

Dup of MW-21

Sig. 2 in C:\HPCHEM\2\DATA\08APRBTX\039R0101.D

Sample # 7447

OF 1



Trip Blank

Sig. 2 in C:\HPCHEM\2\DATA\08APRBTX\041R0101.D

CHAIN-OF-CUSTODY

Project No. 9131.01

Project Name: 1st Qtr '93 Monitoring MAVERIK KIRTLAND Refinery

Samplers: (Signature)

Sample No.	Date	Time	Sample Location	No. of Containers	BTEX (8020)	1,2-DCA (8010)	Sulfide	Sulfate			Remarks
MW-9	3/30/93	1545	Monitoring Well	4	X	X					
MW-10		1415		4	X	X					
MW-13		1610		4	X	X					
MW-14		1520		4	X	X					
MW-15		1630		4	X	X					
MW-16		1500		4	X	X					
MW-17		1045		6	X	X	X	X			
MW-18		12:10		4	X	X					
MW-19		13:50		4	X	X					
MW-20		13:25		4	X	X					
MW-21		12:50		4	X	X					
MW-22		9:10		6	X	X	X	X			
MW-25		8:15		2	X	X					
Trip BLANK			TRIP BLANK	~~1~~ 2 [illegible] 4/6/93	X						

Relinquished by: (Signature)	Date/Time	Recieved by: (Signature)	Relinquished by: (Signature)	Date/Time	Recieved by: (Signature)
Paul [signature]	4/5/93 09:15	[signature]			
Relinquished by: (Signature)	Date/Time	Recieved by: (Signature)	Relinquished by: (Signature)	Date/Time	Recieved by: (Signature)

Relinquished by: (Signature)	Date/Time	Recieved for Laboratory by: (Signature)	Date/Time

Remarks:

GeoWest Golden, Inc.
530 Commons Drive Golden, CO 80401 (303) 526-9838

APPENDIX B

MONITOR WELL AND PIEZOMETER INSTALLATION PROJECT
MAVERIK KIRTLAND REFINERY, KIRTLAND, NEW MEXICO

TABLE OF CONTENTS

1.0 INTRODUCTION

A monitor well and piezometer installation project was completed at the site of the former Maverik Country Stores, Inc tank farm located in Kirtland, New Mexico during the period June 10-12, 1992. The project was completed to 1) replace two ground water monitoring wells destroyed during 1991 tank farm closure activities, and 2) install four piezometers within the slurry wall containment area. Both monitor well replacement and piezometer installation activities were completed to provide ground water quality and gradient data within and in close proximity to the containment area during future monitoring activities. Details of project activities are discussed in this report including monitor well installation (Section 2.0), piezometer installation (Section 3.0), and surveying (Section 4.0).

2.0 MONITOR WELL INSTALLATION

2.1 General

Two replacement ground water monitoring wells were installed at the locations indicated in Figure 1. Well MW-17 is located within the southwest portion of the containment area, while MW-18 is located a short distance north of the containment area. These wells provide a means of comparison of ground water conditions within and outside of the containment system. Installation details including borehole drilling, well construction, well development, and drop-pipe installation are discussed in the following paragraphs.

2.2 Drilling

Boreholes for the monitoring wells were drilled by Enviro-Drill,Inc. of Farmington, New Mexico, using a CME-55 truck-mounted drill rig. Hollow stem augers having an inner diameter of 4.0 inches and an outer diameter of 7.0 inches were utilized. Split spoon sampling was conducted according to ASTM D-1586-84 procedures. Eighteen inch long split-spoon samples were collected at 5 foot intervals during borehole drilling. Soils were logged according to the Unified Soil Classification (USCS) by experienced GeoWest personnel. Observations noted during borehole drilling are included on the drilling log forms attached.

Following classification of soils, each sample was field screened for the presence of organic vapors. Screening was accomplished by placing a portion of each sample into an 8-ounce mason jar and sealing the jar with aluminum foil and the lid. Samples were allowed to attain equilibrium at room temperatures. Screening measurements were taken by an HNU model PI-101 photoionization detector (PID) having a 10.2 eV lamp calibrated to a benzene equivalent standard. Organic vapor field screening measurements are provided on the drilling log forms attached.

The drill rig and auger sections were decontaminated between borings using a portable steam cleaner. Soil sampling equipment was decontaminated between samples by scrubbing with a non-phosphate detergent solution followed by a potable water rinse. Drill cuttings were placed within the slurry wall containment area.

2.3 Monitoring Well Construction Details

Monitoring wells were constructed according to specifications consistent with U.S. Environmental Protection Agency protocol. Monitoring well construction details for individual wells are presented in Table B-1 and graphically illustrated in on the well completion logs. Construction of the monitor wells was completed in the following manner:

1. Wells consisted of 2-inch diameter, flush threaded, schedule 40 PVC and endcap. Monitoring well materials were factory sealed and clean prior to insertion into the borehole.

2. Well screens consisted of one 10-foot length of 0.010 inch factory slotted schedule 40 PVC. Screens were positioned to account for seasonal water table fluctuations.

3. Annular materials were positioned as illustrated on the Monitoring Well Completion Logs attached. A filter pack consisting of #20-40 silica sand was placed from the bottom of the borehole to a level of approximately 1 foot above the top of the screen.

4. An annular seal consisting of a one-foot thickness of sodium bentonite pellets was placed above the filter pack.

5. A cement grout containing 3 to 5% bentonite was placed to within 1 foot of the ground surface.

6. A concrete surface seal was placed on top of the cement grout.

7. A 4-foot high, 8-inch diameter locking steel protective cover was installed around and over the PVC casing. A smooth concrete apron was constructed around the protective casing.

2.4 Well Development

Wells were developed June 10-12, using surge and bail methods. Wells were surged for approximately 10 minutes using a 2 inch diameter stainless steel and teflon surge block mounted on 1 inch diameter PVC pipe. After surging ground water was evacuated from the well using a disposable HDPE bailer. Upon recovery of the well, the procedure was completed a second time. Further development involved bailing a minimum of 8 casing volumes of ground water until specific conductance and pH measurements stabilized. Development water was disposed within the confines of the slurry wall containment area. Field parameters and observations are presented on the attached well development forms.

2.5 Drop Pipe Installation

Upon well evacuation in preparation for ground water quality sampling, a free-phase hydrocarbon sheen was noticed on water evacuated water from well MW-17 and existing well MW-22. In order to sample below this free-phase layer, a one inch ID drop pipe was installed into each of the two monitoring wells. Drop-pipes were installed by covering the lower opening of the pipe with a latex sheath and removing with a nylon string after lowering below the free-phase layer.

3.0 PIEZOMETER INSTALLATION

3.1 General

Four piezometers were installed within the slurry wall containment area at the locations indicated in Figure 1. These locations correspond approximately to the four corners of the containment area, and were selected to evaluate the ground water gradient within the containment area. Piezometer installation activities including borehole drilling and construction are described below.

3.2 Drilling

Drilling of piezometer boreholes was completed in essentially the same manner as were monitor well borings. Boreholes were drilled to approximate depths of eight feet to accommodate a 5 foot well screen and appropriate riser. Soil samples were not collected from the piezometer borings. Drill cuttings were left in the slurry wall containment area. Augers were steam-cleaned between borings.

3.3 Piezometer Construction Details

Upon completion of borehole drilling, piezometers were constructed according to the following procedures:

1. Piezometers were constructed of 2 inch diameter, flush threaded, schedule 40 PVC and endcap. Materials were factory sealed.

2. Screens consisted of one 5-foot length of 0.010 inch factory slotted schedule 40 PVC. Screens were positioned to account for seasonal water table fluctuations.

3. Annular materials were positioned as illustrated on the attached piezometer completion log. A filter pack consisting of #10-20 silica sand was placed from the bottom of the borehole to a level 1.5 feet above the top of the screen.

4. An annular seal consisting of a 1-foot thickness of bentonite chips was placed above the filter pack to a level approximately 6 inches below grade.

5. A concrete surface seal was placed on top of the annular sealant. Protective surface casings were not utilized.

4.0 MONITORING WELL AND PIEZOMETER LOCATION SURVEY

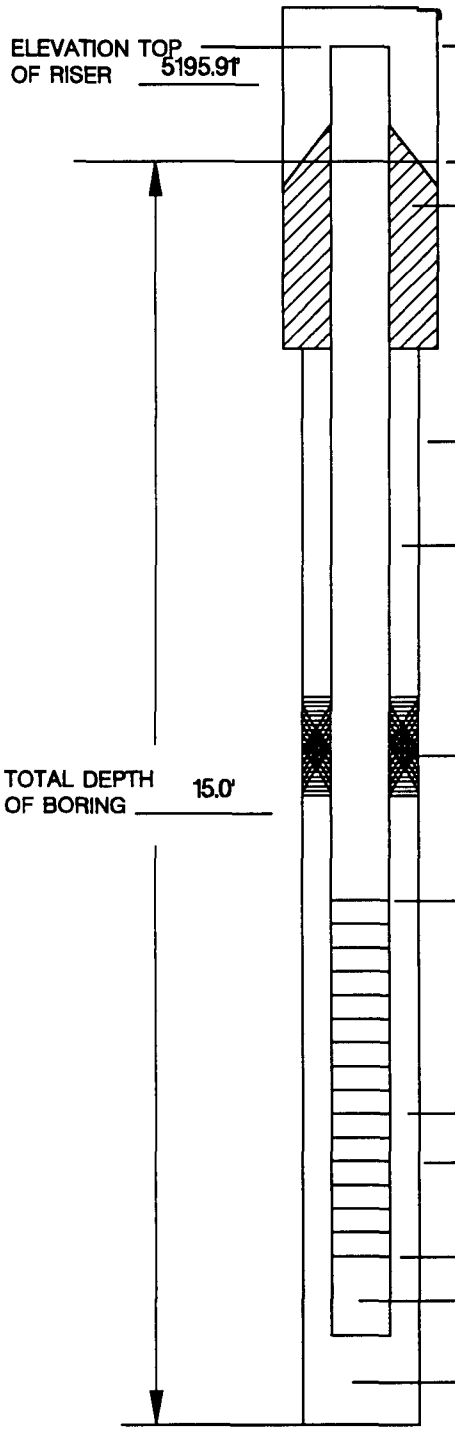
All newly installed monitoring wells and piezometers were located horizontally and vertically by licensed surveyors, San Juan Engineers. Elevation measurements of the ground surface, top of the PVC riser, and top of the steel protective casing were measured to within 0.01 feet accuracy at each monitoring well location. Elevation measurements of the top of the PVC riser and ground surface were measured at each piezometer location. Locations were tied to an existing survey point at the NE corner of Section 17, T20N, R14W, N.M.P.M., where arbitrary Northing and Easting coordinates of 10,000.00 feet and 10,000 feet were established. Survey data are included in Table B-1.

TABLE B-1

MONITOR WELL AND PIEZOMETER SURVEY DATA

	Location Coordinates (ft)		Elevations (ft. msl)		
Monitor Well	North	East	Top of PVC Casing	Top of Steel Casing	Ground
MW-17	9147.20	8757.50	5195.91	5196.49	5192.19
MW-18	9478.42	8820.62	5201.75	5202.27	5197.94
Piezometers					
P-1	9425.40	8747.13	5197.66	------	5195.74
P-2	9032.35	8746.58	5192.32	------	5190.50
P-3	9023.11	8891.64	5193.21	------	5191.44
P-4	9361.10	8901.00	5198.82	------	5197.06

WELL COMPLETION LOG



ELEVATION TOP OF RISER 5195.91'

PROTECTIVE CASING -MATERIAL Steel
-HEIGHT 4.3'
-DIAMETER 8 in.

GROUND SURFACE ELEVATION 5192.19'

SURFACE SEAL -MATERIAL Concrete

RISER -MATERIAL SCH 40 PVC
-DIAMETER 2 in.

ANNULUS -MATERIAL Cement-Bentonite Grout

TOTAL DEPTH OF BORING 15.0'

SEAL -MATERIAL Bentonite Pellets
-DEPTH 12-22'

SCREEN -TOP 3.2'
-MATERIAL SCH 40 PVC
-SLOT SIZE 0.010 in.
-LENGTH 9.2'

PACK -MATERIAL 10-20 Silica Sand

BORING -DIAMETER 7.0 in. (O.D.)

SCREEN -DEPTH 12.4'

SUMP -LENGTH 0.6'

BACKFILL -MATERIAL Native Soil, 10-20 Silica Sand

NOTE: ALL MEASUREMENTS IN FEET. ALL DEPTHS BELOW GROUND SURFACE UNLESS NOTED OTHERWISE.

CHECKED BY:
DRAWN BY:
DATE 9/25/92
FILE NAME: 13WELL07

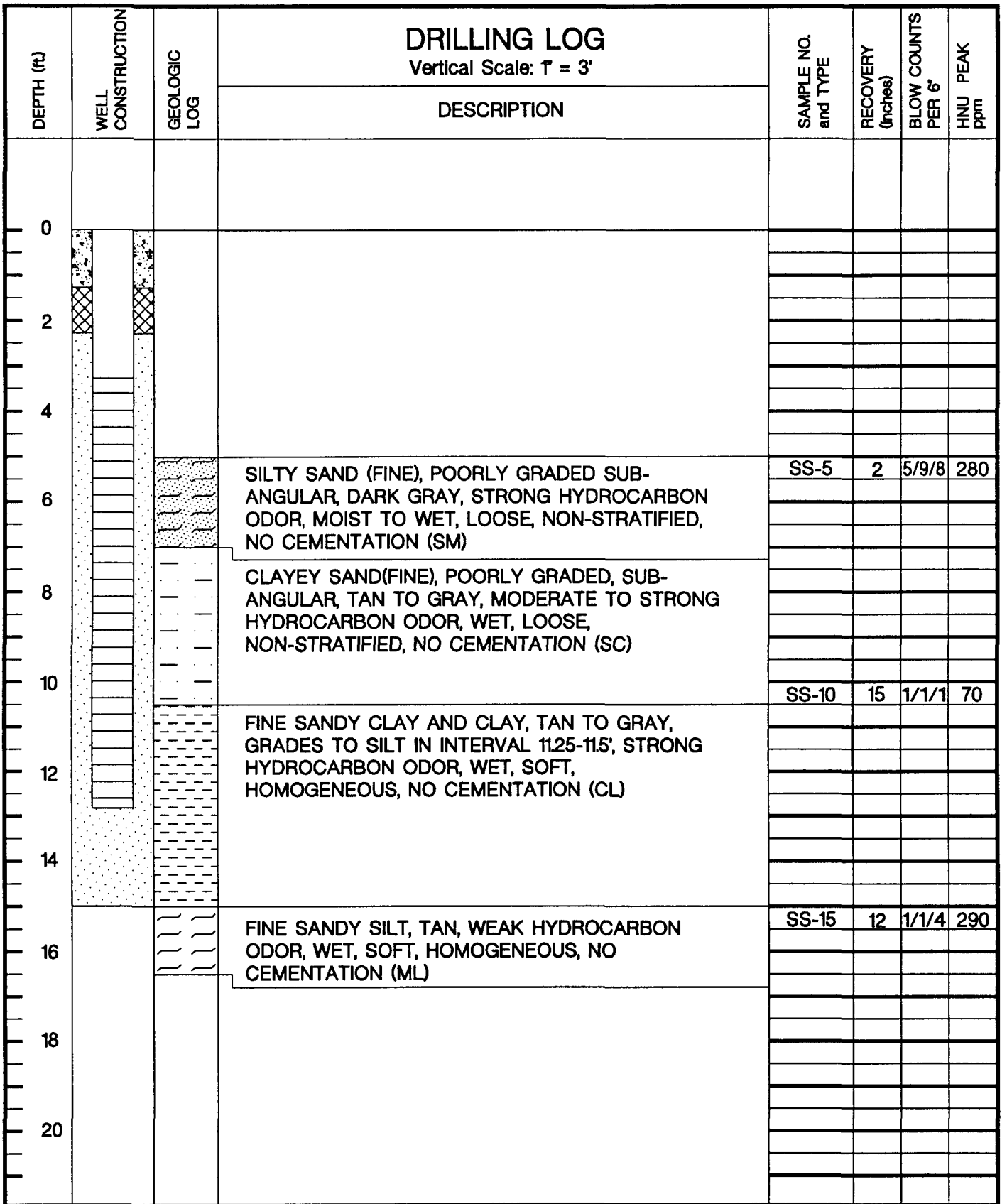
WATER LEVEL UPON COMPLETION 5188.47'
DRILLER Enviro-Drill, Inc.
METHOD HSA
RIG TYPE CME-55
SOIL SAMPLING METHOD Split Spoon
DEVELOPMENT DATE 6/11/92
DEVELOPMENT METHOD Surge & Bail

PROJECT Maverik, Kirkland Refinery
PROJECT NO. 9131.01
WELL NO. MW-17
SHEET 1 OF 1
ENGINEER P. Weissenborn
DATES OF DRILLING 6/10/92

GeoWest
Golden, Inc.
215 UNION BLVD, SUITE 215
LAKEWOOD, COLORADO 80228

DRILLING LOG

Vertical Scale: 1" = 3'



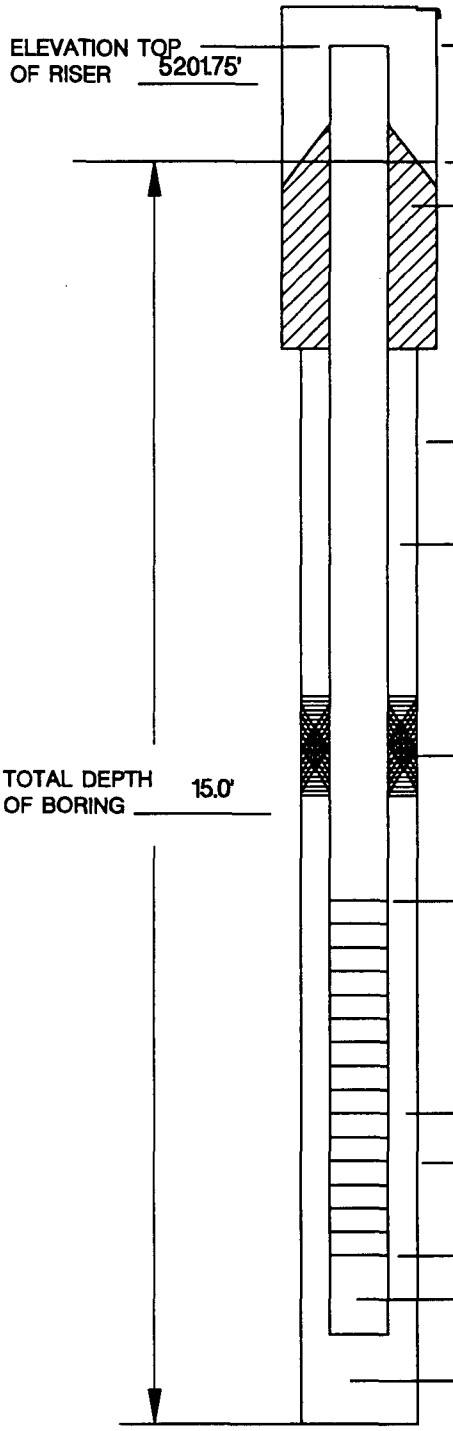
DEPTH (ft)	DESCRIPTION	SAMPLE NO. and TYPE	RECOVERY (inches)	BLOW COUNTS PER 6"	HNU PEAK ppm
6	SILTY SAND (FINE), POORLY GRADED SUB-ANGULAR, DARK GRAY, STRONG HYDROCARBON ODOR, MOIST TO WET, LOOSE, NON-STRATIFIED, NO CEMENTATION (SM)	SS-5	2	5/9/8	280
8–10	CLAYEY SAND(FINE), POORLY GRADED, SUB-ANGULAR, TAN TO GRAY, MODERATE TO STRONG HYDROCARBON ODOR, WET, LOOSE, NON-STRATIFIED, NO CEMENTATION (SC)	SS-10	15	1/1/1	70
12–14	FINE SANDY CLAY AND CLAY, TAN TO GRAY, GRADES TO SILT IN INTERVAL 11.25-11.5', STRONG HYDROCARBON ODOR, WET, SOFT, HOMOGENEOUS, NO CEMENTATION (CL)				
16	FINE SANDY SILT, TAN, WEAK HYDROCARBON ODOR, WET, SOFT, HOMOGENEOUS, NO CEMENTATION (ML)	SS-15	12	1/1/4	290

SURFACE ELEVATION 5192.19
DATE STARTED 6/10/92
DATE COMPLETED 6/10/92
CLASSIFIED BY P. Weissenborn

PROJECT Maverik - Kirkland Refinery
PROJECT NO. 9131.01
DRILL HOLE ID. MW-17
SHEET 1 OF 1

GeoWest
Golden, Inc.
215 Union Blvd. Suite 215 Lakewood, Colorado 80228

WELL COMPLETION LOG



ELEVATION TOP OF RISER 5201.75'

PROTECTIVE CASING -MATERIAL Steel
-HEIGHT 4.33'
-DIAMETER 8 in.

GROUND SURFACE ELEVATION 5197.94'

SURFACE SEAL -MATERIAL Concrete

RISER -MATERIAL SCH 40 PVC
-DIAMETER 2 in.

ANNULUS -MATERIAL Cement-Bentonite Grout

TOTAL DEPTH OF BORING 15.0'

SEAL -MATERIAL Bentonite Pellets
-DEPTH 3.0-4.0'

SCREEN -TOP 5.2'
-MATERIAL SCH 40 PVC
-SLOT SIZE 0.010 in.
-LENGTH 9.2'

PACK -MATERIAL 10-20 Silica Sand

BORING -DIAMETER 7.0 in.

SCREEN -DEPTH 14.4'

SUMP -LENGTH 0.6'

BACKFILL -MATERIAL ---

NOTE: ALL MEASUREMENTS IN FEET. ALL DEPTHS BELOW GROUND SURFACE UNLESS NOTED OTHERWISE.

CHECKED BY:
DRAWN BY:
DATE 8/25/92
FILE NAME: SWL418

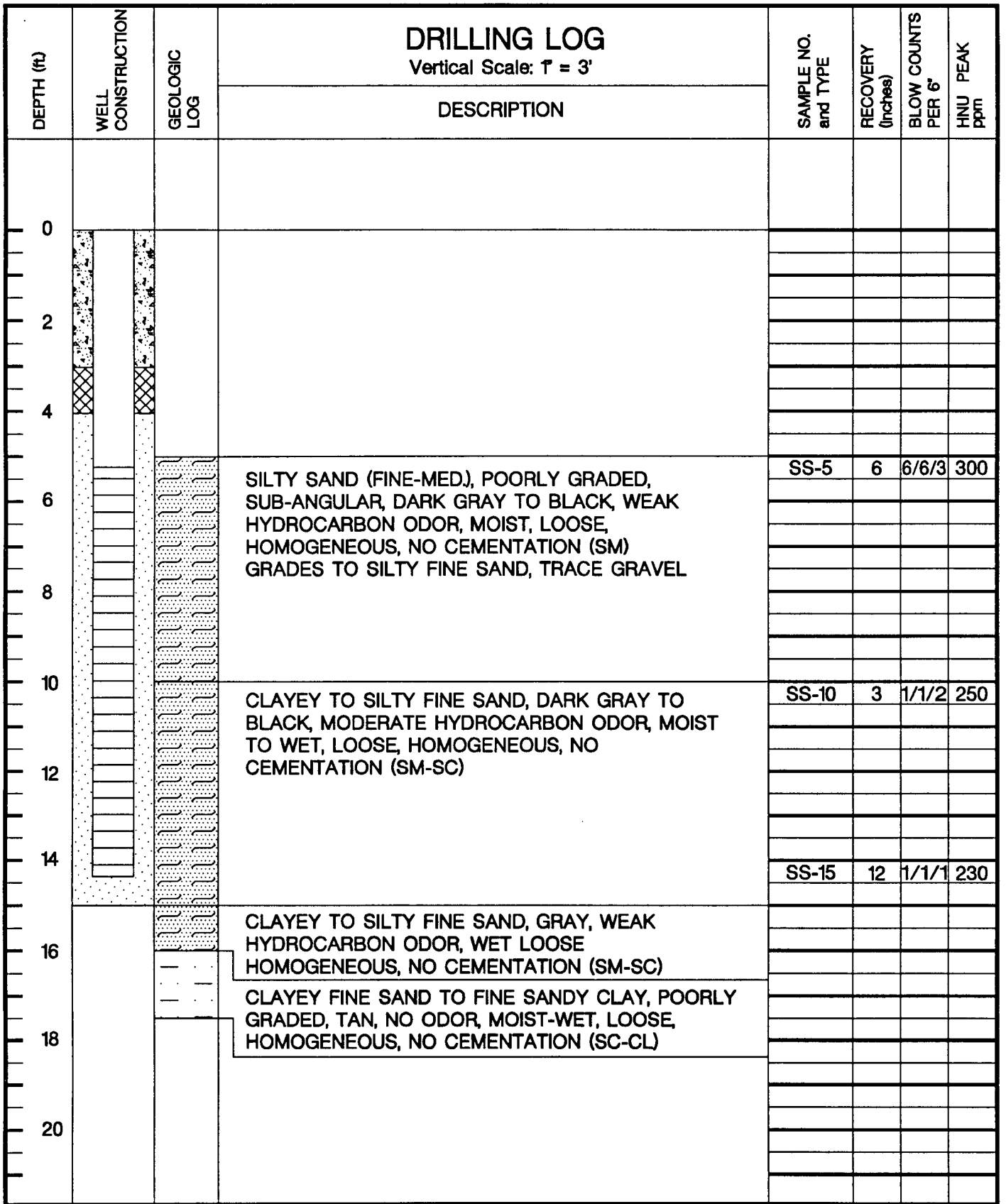
WATER LEVEL UPON COMPLETION 5190.84'
DRILLER Enviro-Drill, Inc.
METHOD HSA
RIG TYPE CME-55
SOIL SAMPLING METHOD Split Spoon
DEVELOPMENT DATE 6/11/92
DEVELOPMENT METHOD Surge & Bail

PROJECT Maverik, Kirkland Refinery
PROJECT NO. 913101
WELL NO. MW-18
SHEET 1 OF 1
ENGINEER P. Weissenborn
DATES OF DRILLING 6/10/92

GeoWest
Golden, Inc.
215 UNION BLVD., SUITE 215
LAKEWOOD, COLORADO 80228

DRILLING LOG

Vertical Scale: 1" = 3'



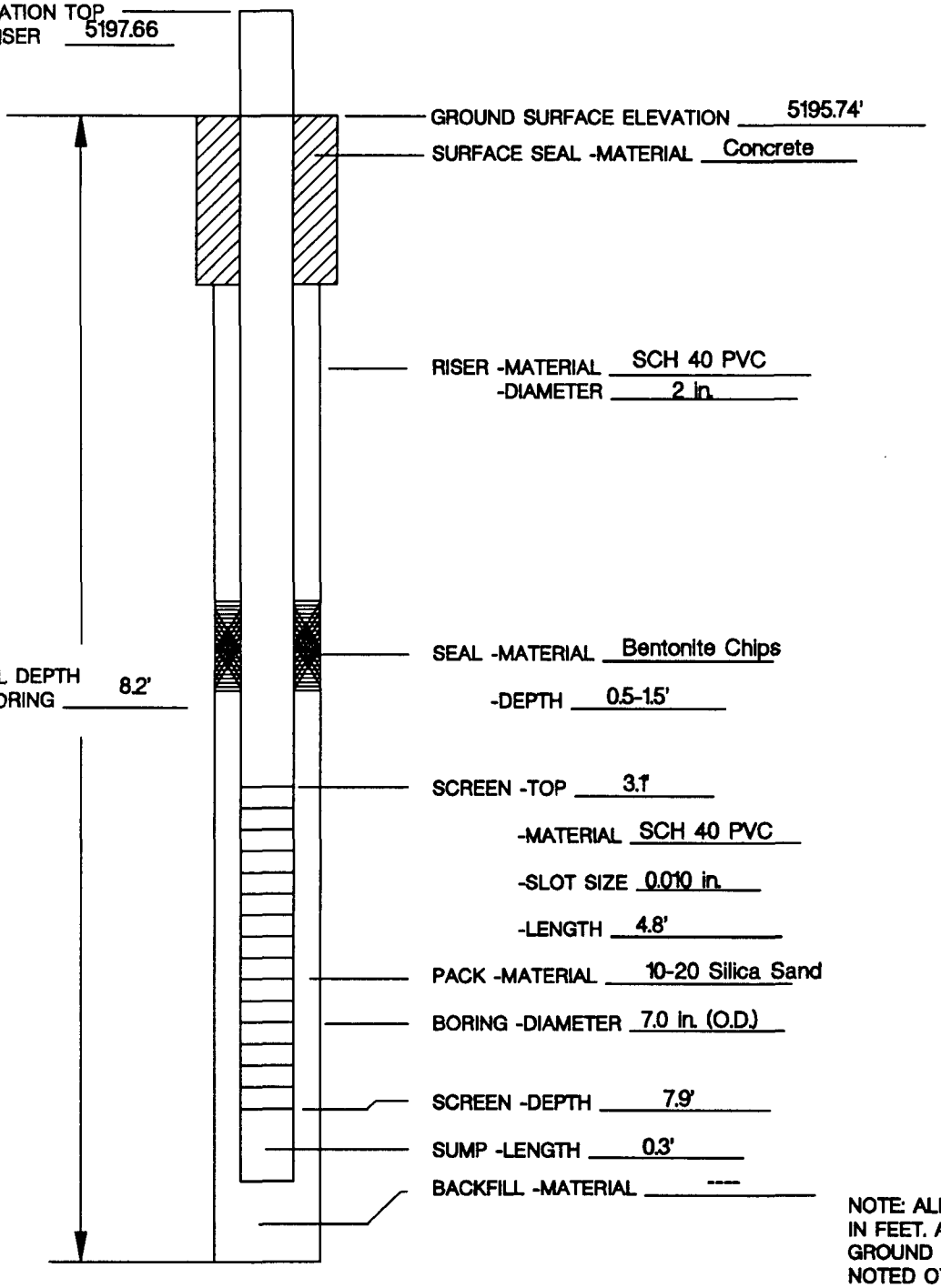
DEPTH (ft)	DESCRIPTION	SAMPLE NO. and TYPE	RECOVERY (inches)	BLOW COUNTS PER 6"	HNU PEAK ppm
0					
2					
4					
6	SILTY SAND (FINE-MED.), POORLY GRADED, SUB-ANGULAR, DARK GRAY TO BLACK, WEAK HYDROCARBON ODOR, MOIST, LOOSE, HOMOGENEOUS, NO CEMENTATION (SM) GRADES TO SILTY FINE SAND, TRACE GRAVEL	SS-5	6	6/6/3	300
8					
10	CLAYEY TO SILTY FINE SAND, DARK GRAY TO BLACK, MODERATE HYDROCARBON ODOR, MOIST TO WET, LOOSE, HOMOGENEOUS, NO CEMENTATION (SM-SC)	SS-10	3	1/1/2	250
12					
14		SS-15	12	1/1/1	230
16	CLAYEY TO SILTY FINE SAND, GRAY, WEAK HYDROCARBON ODOR, WET LOOSE HOMOGENEOUS, NO CEMENTATION (SM-SC)				
18	CLAYEY FINE SAND TO FINE SANDY CLAY, POORLY GRADED, TAN, NO ODOR, MOIST-WET, LOOSE, HOMOGENEOUS, NO CEMENTATION (SC-CL)				
20					

SURFACE ELEVATION 5197.94
DATE STARTED 6/10/92
DATE COMPLETED 6/10/92
CLASSIFIED BY P. Weissenborn

PROJECT Maverik - Kirkland Refinery
PROJECT NO. 9131.01
DRILL HOLE ID. MW-18
SHEET 1 OF 1

GeoWest
Golden, Inc.
215 Union Blvd. Suite 215 Lakewood, Colorado 80228

PIEZOMETER COMPLETION LOG



NOTE: ALL MEASUREMENTS IN FEET. ALL DEPTHS BELOW GROUND SURFACE UNLESS NOTED OTHERWISE.

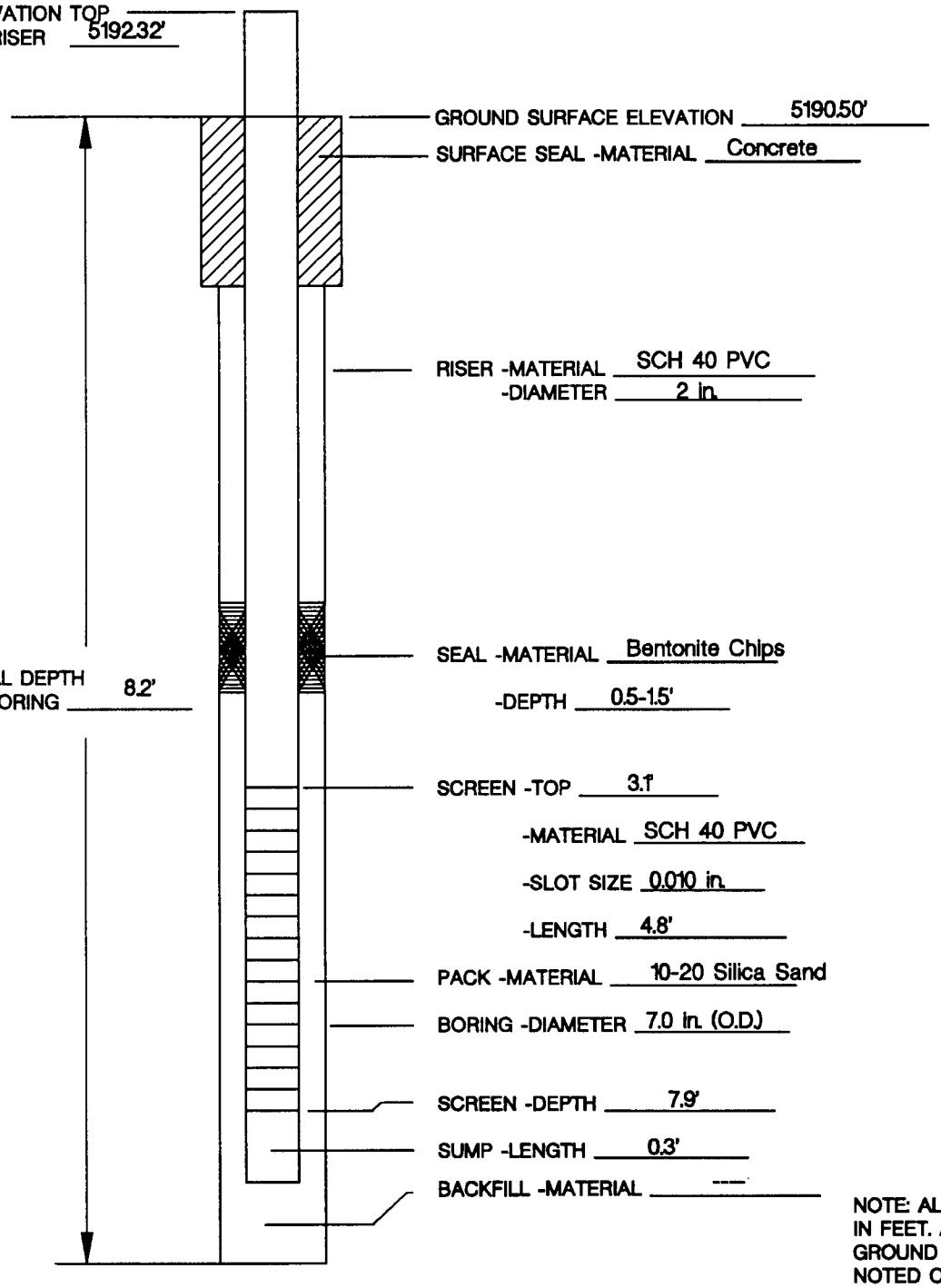
CHECKED BY:
DRAWN BY: E.S.S.
DATE: 9/25/92
FILE NAME: 131PLPZ1

WATER LEVEL UPON COMPLETION	---
DRILLER	Enviro-Drill, Inc.
METHOD	HSA
RIG TYPE	CME-55
SOIL SAMPLING METHOD	----
DEVELOPMENT DATE	----
DEVELOPMENT METHOD	----

PROJECT	Maverik, Kirkland Refinery
PROJECT NO.	913101
PIEZ. NO.	PZ-1
SHEET	1 OF 1
ENGINEER	P. Weissenborn
DATES OF DRILLING	6/10/92

GeoWest
Golden, Inc.
215 UNION BLVD., SUITE 215
LAKEWOOD, COLORADO 80228

PIEZOMETER COMPLETION LOG



NOTE: ALL MEASUREMENTS IN FEET. ALL DEPTHS BELOW GROUND SURFACE UNLESS NOTED OTHERWISE.

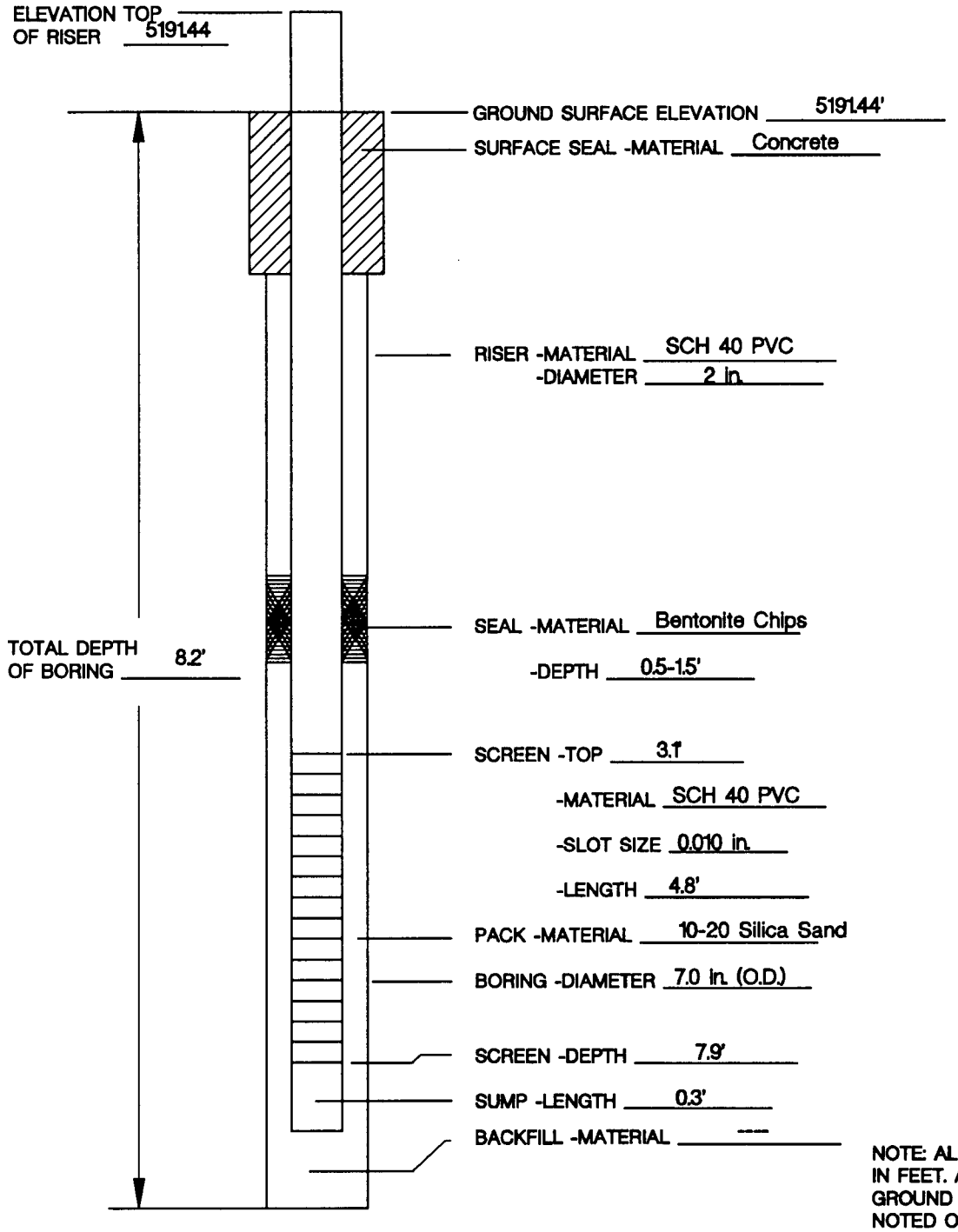
FILE NAME: 131PLPZ2 DATE: 9/25/92 DRAWN BY: E.S.S. CHECKED BY:

WATER LEVEL UPON COMPLETION	---
DRILLER	Enviro-Drill, Inc.
METHOD	HSA
RIG TYPE	CME-55
SOIL SAMPLING METHOD	----
DEVELOPMENT DATE	----
DEVELOPMENT METHOD	----

PROJECT	Maverik, Kirkland Refinery
PROJECT NO.	913101
PIEZ. NO.	PZ-2
SHEET	1 OF 1
ENGINEER	P. Weissenborn
DATES OF DRILLING	6/10/92

GeoWest
Golden, Inc.
215 UNION BLVD, SUITE 215
LAKEWOOD, COLORADO 80228

PIEZOMETER COMPLETION LOG



NOTE: ALL MEASUREMENTS IN FEET. ALL DEPTHS BELOW GROUND SURFACE UNLESS NOTED OTHERWISE.

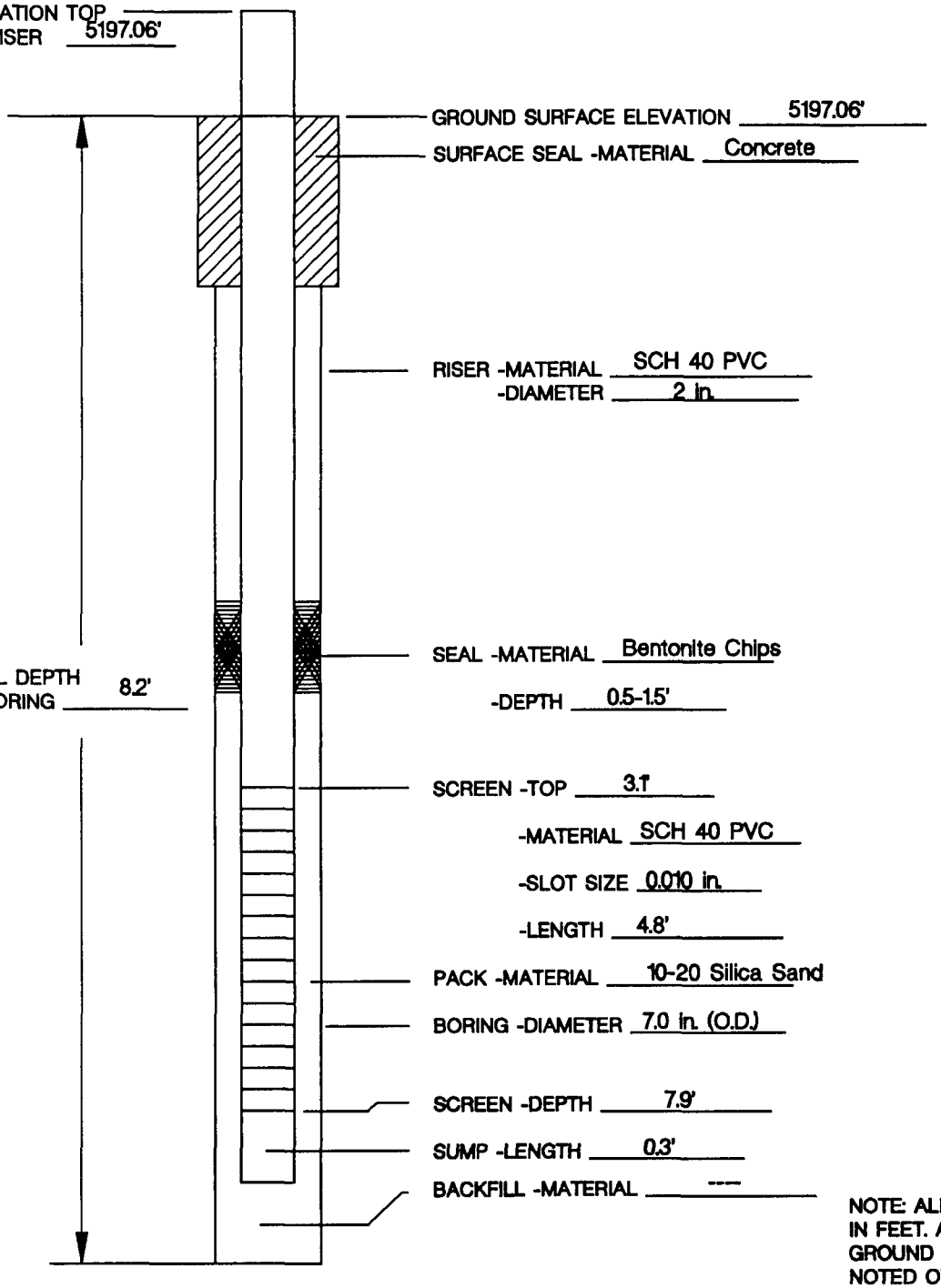
FILE NAME: 131PLPZ3 DATE: 9/25/92 DRAWN BY: E.S.S. CHECKED BY:

WATER LEVEL UPON COMPLETION	---
DRILLER	Enviro-Drill, Inc.
METHOD	HSA
RIG TYPE	CME-55
SOIL SAMPLING METHOD	----
DEVELOPMENT DATE	----
DEVELOPMENT METHOD	----

PROJECT	Maverik, Kirkland Refinery
PROJECT NO.	913101
PIEZ. NO.	PZ-3
SHEET	1 OF 1
ENGINEER	P. Weissenborn
DATES OF DRILLING	6/10/92

GeoWest
Golden, Inc.
215 UNION BLVD., SUITE 215
LAKEWOOD, COLORADO 80228

PIEZOMETER COMPLETION LOG



NOTE: ALL MEASUREMENTS IN FEET. ALL DEPTHS BELOW GROUND SURFACE UNLESS NOTED OTHERWISE.

FILE NAME: 131PLPZ4 DATE: 9/25/92 DRAWN BY: E.S.S. CHECKED BY:

WATER LEVEL UPON COMPLETION	---
DRILLER	Enviro-Drill, Inc.
METHOD	HSA
RIG TYPE	CME-55
SOIL SAMPLING METHOD	----
DEVELOPMENT DATE	----
DEVELOPMENT METHOD	----

PROJECT	Maverik, Kirkland Refinery
PROJECT NO.	913101
PIEZ NO.	PZ-4
SHEET	1 OF 1
ENGINEER	P. Weissenborn
DATES OF DRILLING	6/10/92

GeoWest
Golden, Inc.
215 UNION BLVD, SUITE 215
LAKEWOOD, COLORADO 80228

WELL DEVELOPMENT FORM

Date: 6/10/92 Field Engineer: P. Weissenborn

Weather Conditions: Sunny, 85° F

Well ID: MW-18 pH Meter: Hydac SC Meter: Hydac

Calibration Record: pH 7+10, SC 1000 umhos
6/10 - 15:00 6/12 - 09:00
6/11 - 14:50

	Time	Temp. (°F)	pH	SC	Gallons Pumped	Description of Turbidity
6/10	14:30	74.5	7.30	1670	0.5	brown-gray, muddy HC odor, no sheen
6/11	09:30	61.2	6.96	1596	3.0	brown, cloudy, HC odor
	12:00	67.0	6.81	1510	5.0	clear to slightly cloudy HC odor, colorless
6/12	09:40	62.0	7.07	1480	8.6	colorless, clear to slightly cloudy, HC odor
		TD = 18.85 DTW = 14.15 CV = 0.75				

WELL DEVELOPMENT FORM

Date: 6/10/92 Field Engineer: P. Weissenborn

Weather Conditions: Sunny, 85° F

Well ID: MW-17 pH Meter: Hydac SC Meter: Hydac

Calibration Record: pH 7+10, SC 1000 µmhos
6/11/92 - 14:50 6/10 - 15:00
6/12/92 - 09:00

	Time	Temp. (°F)	pH	SC	Gallons Pumped	Description of Turbidity
6/10	15:50	75	8.06	2690	1	brown, cloudy - muddy, HC odor
6/11						
	8:40	63	7.47	2770	4	brown, cloudy HC odor
	11:50	73	7.22	2730	8	Tan, slightly cloudy HC odor
6/12						
	09:15	63.3	7.26	2730	12	slightly cloudy, tan HC odor, streaky HC sheen
		TD = 14.98	Before	Surface	Completion	
		DTW = 6.09				
		CV = 1.4				