LIMITED REMEDIAL ACTION REPORT
FOR
MOXEE SEWER TREATMENT PLANT FACILITY
7520 POSTMA ROAD
MOXEE, WASHINGTON

Prepared for:

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Project No. 5609601750

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TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

EXECUTIVE SUMMARY

This report presents the findings of a site investigation and soil remediation activities completed by Maxim Technologies, Inc. (Maxim) personnel at the Moxee Sewer Treatment Plant in Moxee, Washington. Our field activities were conducted from May through October 1996. We performed the environmental investigation in accordance with our agreement with Mr. Byron Adams dated July 10, 1996. The environmental investigations and soil remediation described in this report were conducted in accordance with Washington State Department of Ecology (Ecology) requirements. The site investigation was followed by remediation of the site soils.

This report is generally organized in accordance with Ecology's Independent Remedial Action Report (IRAP) format described in Ecology publication No. 94-18 and addresses information required under the Model Toxics Control Act (MTCA) Cleanup Regulations, Chapter 173-340 WAC. This report also provides additional information regarding a preliminary groundwater investigation at the site. Finally, the report provides conclusions and recommendations for further investigative activities at the site.

Soil and groundwater at the Moxee Sewer Treatment Plant were impacted with elevated concentrations of petroleum hydrocarbons released from two 1000 gallon gasoline underground storage tanks (USTs). The contamination sources were identified through soil sampling and successfully remediated. The site was sampled by collecting soil samples beneath the two excavated USTs and from stockpiles associated with the USTs. Groundwater will be remediated via natural attenuation processes.

Findings of the Moxee Sewer Treatment Plant Site Investigation and Remedial Actions are summarized below:

- The petroleum contaminates soil associated with the two USTs at this site were excavated and successfully treated. Approximately thirty yards of petroleum contaminated soil were bio-remediated on-site by the City of Moxee. The treated soil was used to backfill the excavation. Based on results of confirmation soil sampling, no soil exceeding the MTCA Method A levels for TPH as gasoline, benzene toluene ethylbenzene and xylenes (BTEX), and lead remains in the UST area. Therefore, remediation of sources of contamination at this site is considered to have been successful.

- Groundwater samples were collected from four test pits excavated with a backhoe. Petroleum contamination was present in the test pit immediately adjacent to the excavation, but not present in other downgradient pits. This result indicates that groundwater contamination is confined to the local area of the USTs.

We offer the following recommendations for this site:

- In order to comply with WAC 173-340-450, a groundwater monitoring program should be instituted for the constituents of concern.

- The City of Moxee should review Risk Based Corrective Action methods and discuss their applicability at this site with Ecology.

1.0 PROJECT BACKGROUND/SITE DESCRIPTION

1.1 PROJECT BACKGROUND

The Moxee Sewer Treatment Plant (MSTP) is located within the city limits of Moxee City, in Washington (**Figure 1**). The site is located in the industrial area of Moxee City. Adjoining properties surrounding the site are also industrial in nature.

In May 1996, Northwest Petroleum Equipment (NPE) and Tri-Valley Construction (TVC) decommissioned and removed from the site one 1000 gallon unleaded gasoline tank and one 1000 gallon regular gasoline tank. Sage Earth Sciences, Inc. (Sage) performed site assessment services upon the removal of the tanks (Sage, 1996). The assessment revealed the presence of petroleum hydrocarbons and total lead at the site. The City of Moxee requested Maxim to perform additional investigations to determine the extent of contamination in soil and groundwater and remediate the site soil.

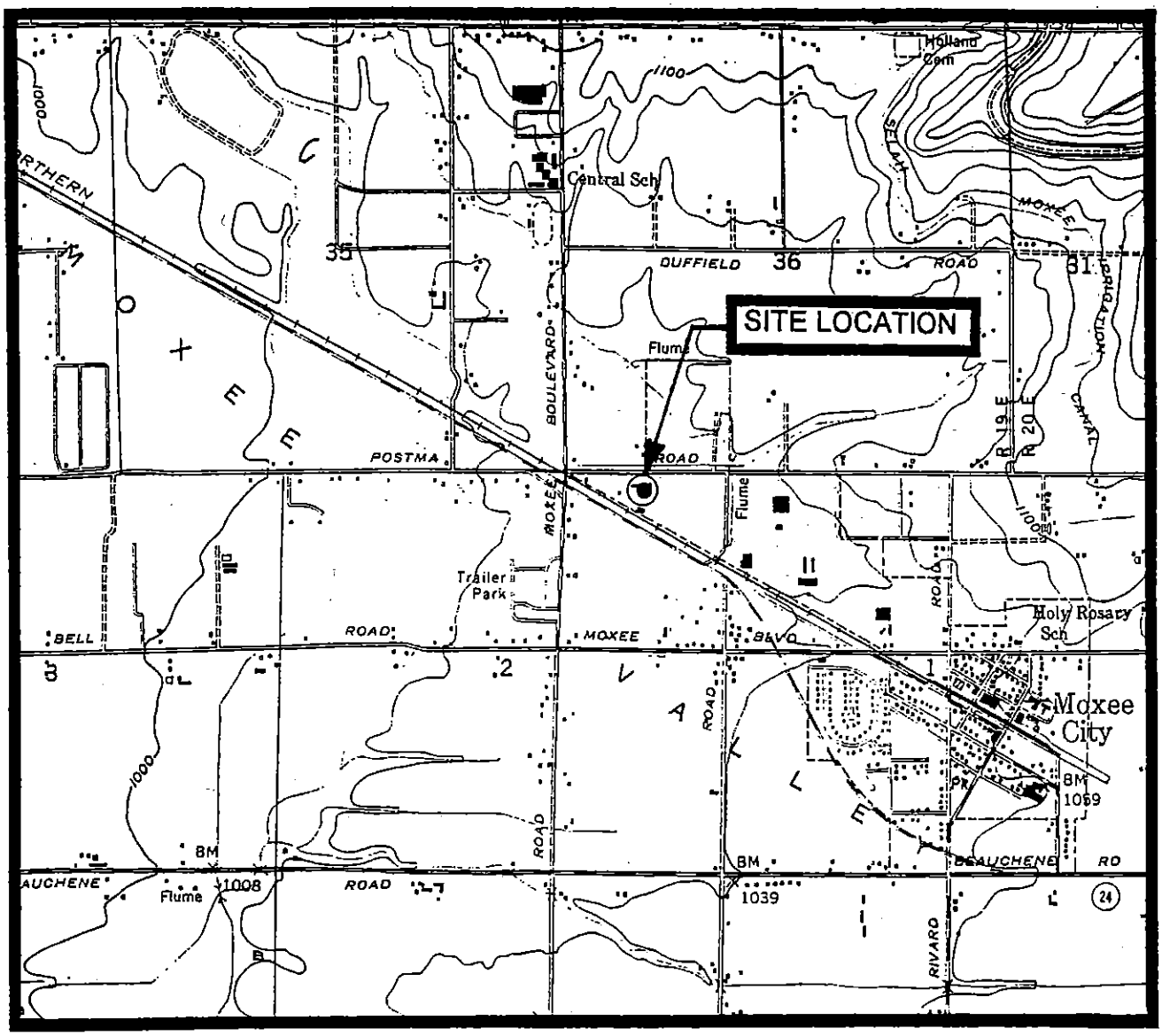
This report presents the findings of a site investigation and soil remediation activities completed by Maxim Technologies, Inc. (Maxim) personnel at the Moxee Sewer Treatment Plant. Our field activities were conducted from May through October 1996. We performed the environmental investigation in accordance with our agreement with Mr. Byron Adams dated July 10, 1996. The environmental investigations and soil remediation described in this report were conducted in accordance with Washington State Department of Ecology (Ecology) requirements (WAC 173-340, 1991). The site investigation was followed by remediation of the site soils.

1.1.1 Compliance With the Model Toxics Control Act (MTCA)

The City of Moxee seeks to satisfy MTCA method A cleanup levels for the site. To achieve petroleum hydrocarbon concentrations at or below MTCA Method A cleanup levels, Ecology requires "source control" or remediation of the impacted soil at the site and evaluation of groundwater quality through a monitoring program. Ecology has determined that these conditions may be met through an Independent Cleanup Action but recommended an Independent Remedial Action Program (IRAP) under the Model Toxics Control Act (MTCA). Ecology requires that these actions consist of a site investigation in accordance with a sampling and analysis plan (SAP) and groundwater investigations in accordance with MTCA guidelines. This Limited Remedial Action report summarizes activities conducted in response to Ecology requirements.

This report is generally organized in accordance with Ecology's Independent Remedial Action Report (IRAP) format described in Ecology publication No. 94-18 (WDOE, 1994) and addresses information required under the Model Toxics Control Act (MTCA) Cleanup Regulations, Chapter 173-340 WAC. This report also provides additional information regarding a preliminary groundwater investigation at the site. Finally, the report provides conclusions and recommendations for further investigative activities at the site.

Moxee Wastewater Treatment Facility, Moxee, WA



SCALE 1:24 000

1 0 1 MILE

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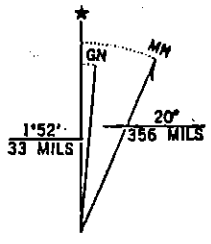
QUADRANGLE LOCATION

FOR SALE BY U. S. GEOLOGICAL SURVEY



UTM GRID AND 1985 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

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FIGURE 1 LOCATION MAP

1.1.2 Project Objectives

Maxim personnel developed the following objectives for this site investigation and remediation:

(1) Determine the extent of petroleum and total lead contamination in soil and groundwater at the site.

(2) Evaluate groundwater quality.

(3) Remediate the site soil

1.2 SITE DESCRIPTION

The MSTP site occupies 3.69 acres. The facility is owned and operated by the City of Moxee. The site is occupied by a sewer/wastewater treatment plant which consists of a building, aeration lagoon and sludge dewatering cells. A maintenance shop and laboratory are also located on the property. A layout of the MSTP is presented in **Figure 2**. The area surrounding the site is primarily industrial, rural residential, and agricultural. Postma Road is located immediately north of the site. Moxee Drain lies immediately north of, and parallel to, Postma Road. The Simplot Soil Builders Plant lies east of the site. The Burlington Northern railroad tracks and Highway 24 lie south of the site. Beaudry Road is west of the site.

1.2.1 Site Location

The MSTP is located at 7520 Postma road, Moxee City Washington, at the intersection of Highway 24 and Postma Road. The site is located in the northeast quarter of the northeast quarter of Section 2, Township 12 North, Range 19 East in Yakima County, Washington (**Figure 1**). Site latitude is 42 degrees 33 minutes 45 seconds north and site longitude is 120 degrees 23 minutes 55 seconds west.

1.2.2 Geology and Topography

The City of Moxee is located in the western part of the Columbia Basin within the Yakima Fold Belt which is a series of anticlinal ridges and synclinal valleys in the western and central parts of the Basin. Structural trends are predominantly east-west. Two predominant anticlines, Umtanum and Yakima ridges, extend across the entire fold belt. Most of the anticlinal ridges are associated with faults. Although the faults are rarely exposed, nearly all the steep forelimbs of the asymmetrical anticlines are faulted.

Topography at the site is generally flat. Elevation at the site is approximately 1030 feet above mean sea level (USGS, 1985 Topo). The site is underlain by the Yakima Gravels, which in turn, overly the Ellensburg Formation. The Yakima Gravels are a locally derived open framework alluvial and colluvial deposits and range in thickness between 0 and 100 ft. The gravels are a laterally discontinuous stratum common on basin margins and uplifted ridges (Reidel and others, 1994).

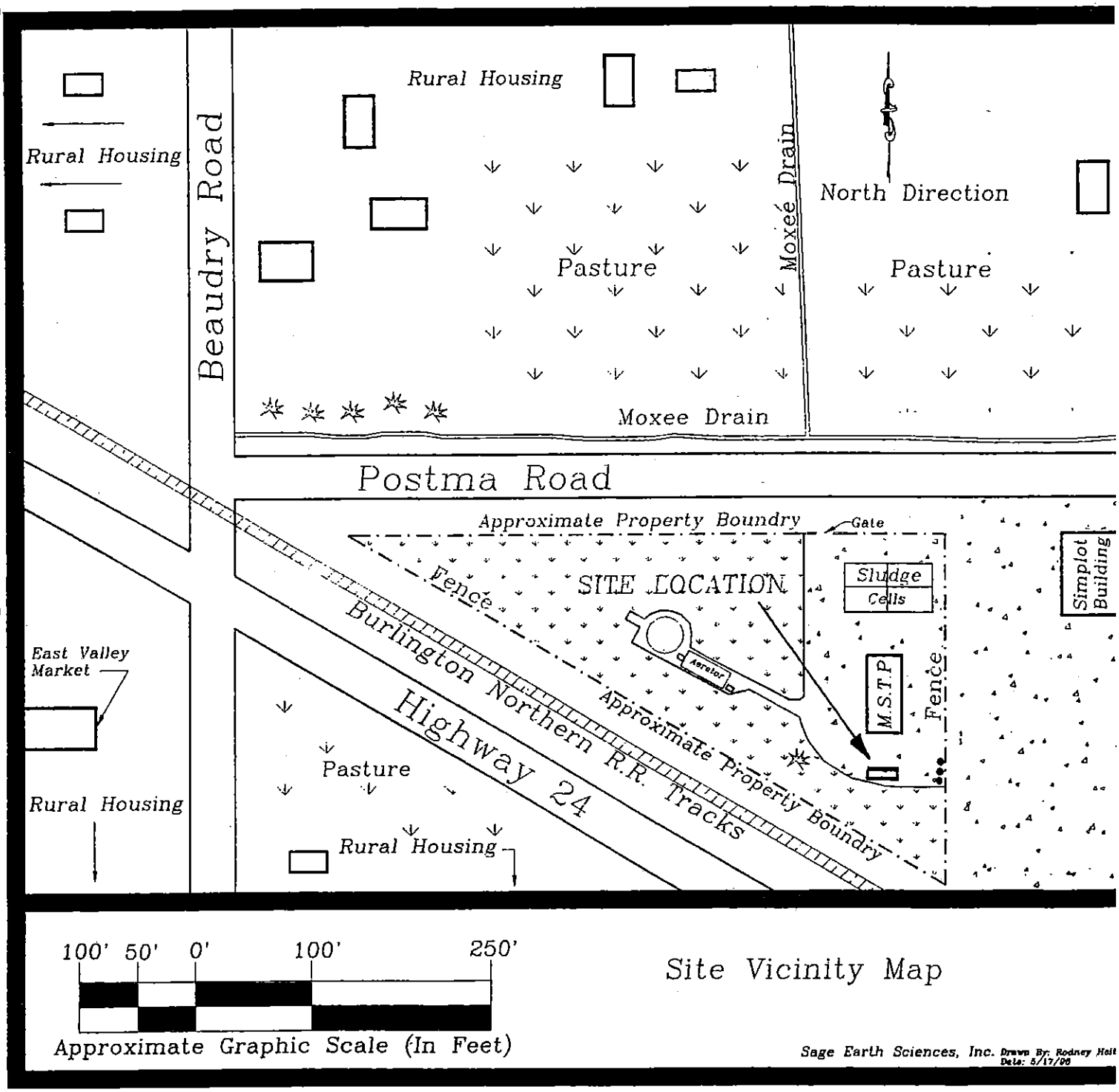

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FIGURE 2 SITE MAP

1.2.3 Soil

The predominant soil type at the site is classified as Naches Loam by the United States Department of Agriculture. This soil formed in old alluvium on stream terraces and in valleys (USDA, 1985). The top three feet of material at the site consists of medium brown, clayey silt. A blue-green silty clay underlies this soil unit and extends to approximately 6.5 feet. These soils are underlain by basalt gravels (Sage, 1996).

1.2.4 Surface Water and Groundwater

The nearest surface water to the site is the southeasterly flowing Yakima River which is located approximately 1.8 miles west of the site. Groundwater occurs at depths of 6 feet below ground surface and generally flows toward the west/southwest.

2.0 PREVIOUS INVESTIGATIONS/RELEASE INFORMATION

2.1 PREVIOUS INVESTIGATIONS

Previous environmental investigations (Sage, 1996) determined that petroleum hydrocarbon contamination at concentrations of 60 to 720 milligram per kilogram (mg/kg or ppm) were measured in soil samples collected at the site. Laboratory analyses results show that groundwater contamination including gasoline, benzene, toluene, ethylbenzene, xylenes (BTEX) and lead was also present.

In summary, the Independent Cleanup/Limited Remedial Action of MSTP site was prompted by the discovery of the following adverse environmental conditions:

(1) *The presence of petroleum hydrocarbon contamination in soil associated with USTs at the site.*

Petroleum hydrocarbons as gasoline at concentrations above Washington MTCA Method A cleanup levels was found during the UST Closure Site Assessment in May 1996 (Sage, 1996). Additionally, low but detectable concentrations of BTEX and total lead were also detected in soil samples.

(2) *The presence of contamination in groundwater underlying the USTs at the site.*

Petroleum hydrocarbon as gasoline and BTEX and total lead above Washington MTCA Method A cleanup levels was found in groundwater underlying the USTs.

2.2 CONTAMINANTS OF CONCERN

Contaminants of concern (COCs) suspected to be found due to current or past practices on-site are gasoline-range, volatile organic compounds including benzene, toluene, ethylbenzene, and xylenes (BTEX) hydrocarbons, and lead. These COCs were selected to investigate the potential contamination from the two gasoline USTs located on the site. Laboratory results of soil samples analyzed for these constituents of concern indicated that TPH as gasoline, BTEX and lead were detected at measurable concentrations in site soil and groundwater (Sage, 1996).

3.0 SELECTION OF CLEANUP STANDARDS

Cleanup standards for the MSTP are defined in this section in terms of hazardous substance concentrations that protect human health and the environment. Selected constituents for analysis are TPH as gasoline, BTEX and total lead. These analytes were selected as constituents of concern (COCs) based on the results of previous investigations at the site (Section 2.1 of this report). Cleanup levels for COCs in soil are based on MTCA A cleanup levels [WAC 173-340-740-(2), 1991]. Cleanup levels for COCs in groundwater are based on U.S EPA drinking water standards and MTCA Method A cleanup levels [WAC 173-340-720-(2), 1991, WDOE, 1992]. These standards are designed to be protective of human health and the environment and are listed in **Table 1**. Points of compliance are located at the property boundaries.

TABLE 1
SELECTED ANALYTES AND CLEANUP STANDARDS
MOXEE SEWER TREATMENT PLANT (MSTP)

Analyte	Cleanup Standard (MTCA Method A)	
	Soil mg/kg (ppm)	Groundwater µg/L (ppb)
TPH-Gasoline	100.0	1000.0
Benzene	0.5	5.0
Toluene	40.0	40.0
Ethylbenzene	20.0	30.0
Xylenes	20.0	20.0
Lead	250.0	5.0

µg/L(ppb) = micrograms per Liter/parts per billion
mg/kg(ppm) = milligram per kilogram/parts per million

4.0 SOIL INVESTIGATION AND RESULTS

This section describes the methods and procedures used to conduct the MSTP soil investigation and remediation. To achieve objectives listed in Section 1.1.2 of this report, Maxim followed Sage Earth Sciences' recommendations to sample the soil and address groundwater contamination. Soil remediation was implemented directly by the client, the City of Moxee.

4.1 METHODS OF SAMPLING AND ANALYSIS

The excavated area associated with the USTs was left open after removal of the USTs in May 1996, pending receipt of laboratory analysis results. Since laboratory analysis results indicated soil and groundwater contamination, Sage Earth Sciences report recommended additional soil and groundwater investigations. In July 1996, Maxim personnel directed the collection of an additional soil sample from the wall of the excavation at northwest corner. The soil sample was shipped to Maxim's Billings, Montana laboratory for TPH-gasoline analysis in accordance with Sage's recommendations.

4.1.1 Soil Sampling and Analysis

Soil sample locations were selected to delineate the lateral and vertical extent of TPH-gasoline in the vadose zone, to the west and northwest side of the excavation. In July 1996, the excavation in the northwest corner was extended approximately 4 feet to the west-northwest using a backhoe. The excavated soil was added to the existing stockpiles located south of the excavation. Two soil sample were then collected, one from the west wall, and the other from the northwest wall. Both samples were collected at 4 feet below ground surface as recommended by Sage Earth Science report (May 1996). **Figure 3** depicts the location of the soil samples collected and the outline of the expanded excavation. The two samples were then composited and shipped to Maxim's laboratory for TPH-gasoline analysis. Laboratory analysis results reported TPH-gasoline concentrations of 1.2 mg/kg, well below MTCA Method A cleanup levels of 100 mg/kg. The stockpile at the site was not re-sampled.

4.2 SUMMARY OF SOIL INVESTIGATION

Summary of results from the May,1996 Site Closure Assessment by Sage Earth Sciences (Sage, 1996) and the July 1996 investigation by Maxim are presented in this section. Results of laboratory analysis of soil samples collected in July 1996 are shown on **Figure 3** and included in Appendix A. As the results of the analyses indicate, all gasoline contaminated soil has been successfully removed from the excavation. The excavated soil is stockpiled adjacent to the excavation.

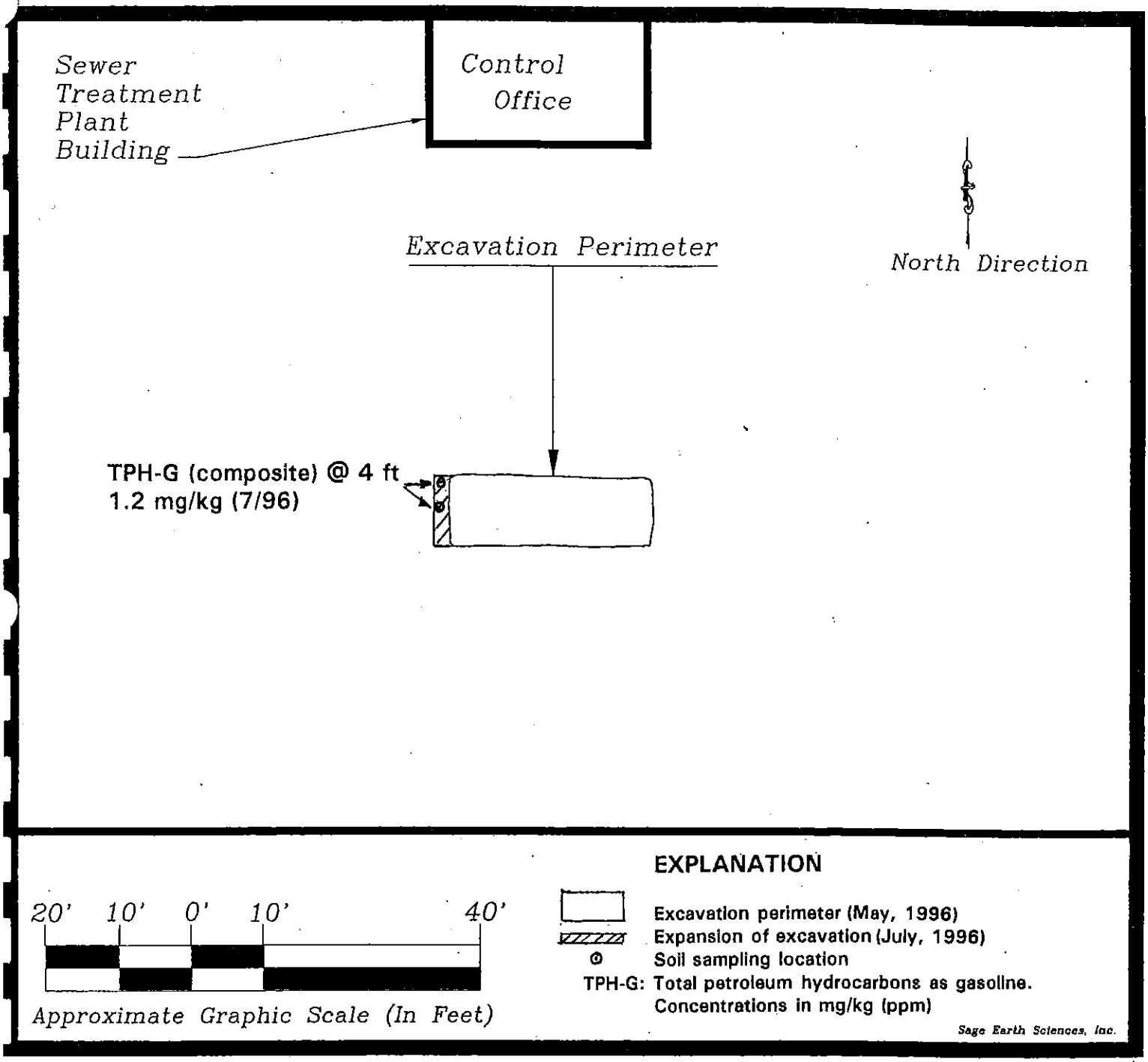

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FIGURE 3 SOIL INVESTIGATION MAP AND SAMPLE RESULTS

5.0 EVALUATION OF REMEDIAL ACTION OPTIONS

Upon receipt of laboratory analytical results from the May and July 1996 soil sampling, remedial action on the stockpiled soil was necessary. Maxim personnel evaluated remediation alternatives consistent with MTCA criteria (WAC 173-340-360(4)(a)) which include the following:

1. Overall protectiveness of human health and the environment;
2. Long term effectiveness;
3. Short term effectiveness;
4. Permanent reduction of toxicity, mobility and volume;
5. Ability to implement;
6. Cleanup costs; and,
7. Community concerns.

These criteria, along with the existing and proposed site use, were considered during evaluation of remediation alternatives. Alternatives evaluated by Maxim personnel included the following:

1. Off-site disposal (landfill); and,
2. Solid phase, in-situ bio-remediation.

The treatment methods involving bio-remediation were considered more feasible by the Moxee City Council representatives then off-site disposal. Since the in-situ alternative methods met the project timetable, the method of in-situ bio-remediation was chosen by the City of Moxee.

6.0 SOIL REMEDIATION ACTIVITIES AND RESULTS

The petroleum contaminated soils (PCS) stockpiled immediately adjacent to the excavation were the only soils targeted for remediation. The gasoline contaminated soil was successfully bio-remediated. Confirmational soil sampling results indicated that TPH-gasoline concentrations were below method detection limits (ND).

This section summarizes the City of Moxee's soil remediation activities conducted between July and October, 1996. An outline of the excavated area is presented in **Figure 3**. Laboratory analysis results of confirmational soil and stockpile samples are presented in **Table 2** and laboratory sheets in Appendix A. Powell Christensen's bio-remediation protocol for the City of Moxee and product specifications are presented in Appendix C.

TABLE 2
Confirmational Soil Samples - City of Moxee Sewer Treatment Plant

Verification Sample Number	Gasoline mg/kg (TPH-G)	Benzene mg/kg	Toluene mg/kg	Ethyl-Benzene mg/kg	Xylenes mg/kg	Lead mg/kg	Date
# 1	nd	nd	nd	nd	nd	10	10/17/96
# 2	nd	nd	nd	nd	nd	6	10/17/96
# 3	nd	nd	nd	nd	nd	7	10/17/96
# 3 duplicate	nd	nd	nd	nd	nd	6	10/17/96
Detection Limits	10	0.05	0.05	0.05	0.05	5	

6.1 SOIL REMEDIATION ACTIVITIES

Soil remediation activities were undertaken by the City of Moxee. These activities summarized in this section were described to us by Byron Adams (personal communication.)

In July 1996, the excavation was lined with 6 mill black plastic in order to create a barrier between the PCS and the and underlying clean soil. Stockpiled PCS from the south side of the excavation was then returned to the excavation and placed on the black plastic liner. The City of Moxee purchased directly from Powell Christensen Inc., a microbe distributer, five gallon buckets of "Oil Sponge" microbes. The microbes were mixed in with the PCS in the excavation. The mixture was sprayed with a hose and covered with the 6 mill black plastic. PCS contaminated soil was completely "encased" in plastic to avoid contact with the clean underlying soil and the atmosphere. Photographs showing the lining of the excavation are presented in Appendix B.

6.2 SOIL REMEDIATION RESULTS

The PCS was successfully bio-remediated. On October 16 1996, Maxim personnel collected three verification soil samples from the soil in the excavation to determine if bio-remedial actions at the site were successful. Laboratory analysis results reported the concentrations of gasoline and BTEX were below detection limits (ND) in verification samples (**Table 2**). Total lead concentrations ranged between 6 and 10 mg/kg, well below MTCA Method A cleanup levels of 250 mg/kg.

7.0 GROUNDWATER INVESTIGATION

Maxim directed the excavation of four groundwater test pits at MSTP on August 16, 1996. The test pits were excavated in response to groundwater contamination reported from the excavation during UST removal activities conducted in May 1996 by Sage Earth Sciences (Sage 1996). Gasoline contamination at concentrations of 270,000 micrograms per liter (μg/Liter or ppb), benzene contamination at 620 ppb, toluene contamination at 15,000 ppb, ethylbenzene contamination at 3,800 ppb, xylenes contamination at 32,000 ppb and lead contamination at 680 ppb were measured a groundwater sample collected from the base of the USTs excavation. Location of the groundwater sample collected in May 1996 is shown on **Figure 5.** Specific locations of the test pits were based on the physical constraints of the site and the backhoe. The test pits were excavated to provide preliminary information necessary to evaluate groundwater quality and approximate groundwater flow direction.

7.1 TEST PIT EXCAVATION

The four test pits were located so that one test pit (TP-1) was located hydraulically up-gradient and three (TP-2, TP-3, TP-4) were located hydraulically down- or cross-gradient from the excavation. The test pits were excavated to approximately 8 ft below ground surface. Groundwater was encountered between 6 ft and 8 ft below ground surface. The water in the test-pits was then sampled and the test pits were back filled.

7.2 SAMPLE COLLECTION AND ANALYSIS

Groundwater samples were collected using 4 oz glass jars. Glass jars were used instead of disposable bailers because the test pit excavation perimeter was not large enough to accommodate disposable bailers. The water samples were transferred to 40 milliliter vials. The samples were placed in an ice-filled cooler and shipped to a laboratory for analysis.

Maxim's Billings analytical laboratory analyzed the groundwater samples collected in August 1996. Samples collected from all four test pits were analyzed for gasoline by EPA Method GRO/8015, BTEX by EPA Method 602 and lead by EPA Method 6010 . A travel blank was provided to the analytical laboratory for the purpose of quality assurance/quality control (QA/QC).

7.3 RESULTS OF GROUNDWATER INVESTIGATION

7.3.1 Results of Test Pits Investigation

The four test pits excavated for groundwater sample collection encountered a relatively impermeable unit from the surface to approximately 6.0 ft below ground surface. This unit consisted of "fat" plastic dark organic rich clay. A strong "organic" odor was associated with the clay. This unit was underlain by silty and sandy gravels, approximately 60%-70% sands 20%-30% gravels, pebbles and some cobbles. Groundwater was intercepted between 6 ft and 8 ft below ground surface during August 1996. Gasoline odor was noted

in groundwater samples collected from test pit TP-3. Test pit locations and analysis results are presented in **Figure 4.** Laboratory analysis sheets for the groundwater samples are contained in Appendix D.

Groundwater flow direction was estimated to be towards the Yakima River, southwest of the site. According to Mr. Byron Adams (personal communication) the groundwater flow in this area is not influenced by irrigation waters.

7.3.2 Results of Groundwater Quality Investigation

Groundwater quality analysis results for the two sampling events conducted at the MSTP are summarized in **Table 3.** Laboratory analysis sheets for the water samples are contained in Appendix D.

Elevated concentrations of gasoline, benzene, ethylbenzene, and xylenes were found in water samples collected TP-3 in August 1996. TP-3 was located 7 feet south-west of the excavation. The concentrations measured in TP-3 were significantly lower than concentrations measured in the excavation in May 1996. A comparison of the May and August contamination is presented in **Table 3.** Groundwater sample analysis from the remaining test pits shows concentrations below cleanup levels or detection limits (ND) for all analyzed constituents. The presence of gasoline and BTEX contamination in TP-3 and their absence from the other test pits suggests the release from the USTs was confined to the excavation and did not migrate and contaminate a large area.

TABLE 3

MOXEE SEWER TREATMENT PLANT
Concentrations of Petroleum Hydrocarbons and Lead in Groundwater

Location	Gasoline µg/L (ppb) EPA GRO/8015	Benzene µg/L (ppb) EPA 602	Toluene µg/L (ppb) EPA 602	Ethyl-benzene µg/L (ppb) EPA 602	Total Xylenes µg/L (ppb) EPA 602	Total Lead µg/L (ppb) EPA 6010	Date
TP-1	300	<1	<1	<1	<3	<0.06	8/21/96
TP-2	300	<1	<1	<1	<3	<0.06	8/21/96
TP-3	12,000	280	<17	970	3,800	<0.06	8/21/96
TP-4	<0.2	<1	<1	<1	<3	<0.06	8/21/96
EXCAVATION	270,000	620	15,000	3,800	32,000	680	5/21/96
	MTCA Method A cleanup levels 1000 ppb	MTCA Method A cleanup levels 5 ppb	MTCA Method A cleanup levels 40 ppb	MTCA Method A cleanup levels 30 ppb	MTCA Method A cleanup levels 20 ppb	MTCA Method A cleanup levels 5 ppb	

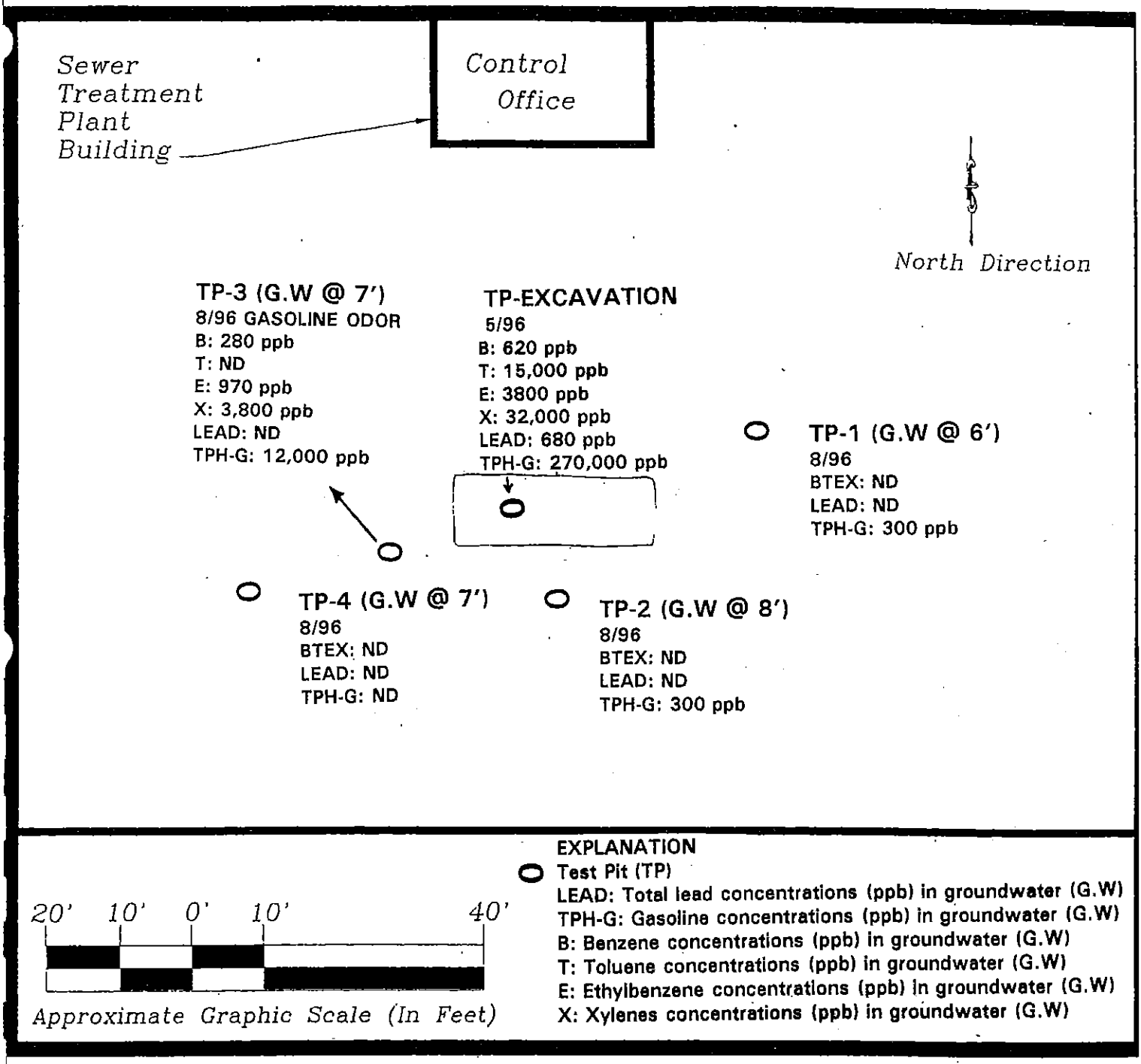

FIGURE 4 GROUNDWATER INVESTIGATION MAP AND SAMPLE RESULTS

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8.0 DISCUSSION AND CONCLUSIONS

Petroleum hydrocarbon contamination sources above groundwater associated with a release from former gasoline USTs at the site were successfully removed. The City of Moxee successfully bio-remediated the contaminated soil on-site .

Petroleum hydrocarbon contamination was measured in a groundwater sample collected at the base of the excavation and confirmed by a sample collected from a possible down-gradient test pit (TP-3), 7 ft south-west of the excavation. The groundwater contamination appears to be localized in the excavation area and has not spread laterally or downgradient. The comparison between the contamination measured in groundwater in May 1995, with the contamination measured in TP-3 in July 1996 suggests that contaminant concentrations in July 1996 are significantly lower than the contamination measured in May 1996. This suggests that "source control" may have contributed to the decline in groundwater contamination.

The relatively impervious clay underlying the site and the apparently small release from the USTs have restricted the lateral extent of groundwater contamination. Because there are no groundwater monitoring wells at the site, the true lateral and vertical extent are not known at the present time. Since "source control" activities have been successful, we expect the groundwater will continue to remediate naturally over time.

9.0 RECOMMENDATIONS

Petroleum hydrocarbon contaminated soil associated with gasoline USTs at the site was identified, removed, and successfully bio-remediated on-site by City of Moxee personnel. Because of these activities, potential sources of groundwater contamination appear to have been successfully removed from the site. Based on these findings and conclusions, we provide the following recommendations for future activities and considerations at the site:

- In accordance with WAC 173-340-450, three groundwater monitoring wells and a quarterly groundwater monitoring program are required to characterize the groundwater at the site. Additionally, a well survey will be necessary to determine the hydraulic gradient.

- We recommend that groundwater sampling rounds include laboratory analysis for petroleum hydrocarbons, BTEX and total lead, so that all contaminants of concern will be addressed.

- We recommend the City of Moxee review Risk Base Corrective Actions (RBCA) implemented at other states and discuss with WDOE regulators whether RBCA may be applicable to this site. At the present time the State of Washington is reviewing RBCA for petroleum hydrocarbon contaminated sites. If RBCA is not applicable to this site then all MTCA cleanup actions will need to be implemented as detailed above. RBCA assessment information is contained in Appendix E.

10.0 LIMITATIONS

The portion of the work performed by Maxim Technologies, Inc. was performed in accordance with generally accepted practices of other consultants undertaking similar studies. Maxim observed a degree of care and skill generally exercised by other consultants under similar circumstances and conditions. Maxim Technologies, Inc. takes no responsibility for the portions of work described in this document which were performed by others. Maxim's findings and conclusions must not considered as scientific certainties, but as opinions based on our professional judgement concerning the significance of the data gathered during the course of monitoring. Other than this, no warranty is implied or intended.

Prepared and submitted by:

Bill Bucher for Rachel Tauman

Rachel Tauman
Yakima Office Manager

Reviewed by:

Bill Bucher

Bill Bucher
Senior Engineer

11.0 REFERENCES

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APPENDIX A

LABORATORY REPORTS OF SOILS SAMPLE ANALYSES

Maxim
600 South 25th Street
P O Box 30615
Billings, MT 59107
(406) 248-9161
FAX (406) 248-9282

TECHNICAL REPORT

REPORT TO:	ATTN: RACHEL TAUMAN MAXIM TECHNOLOGIES, INC. 201 EAST D. STREET YAKIMA WA 98901	**DATE:** **JOB NUMBER:** **SHEET:** **INVOICE NO.:**	July 18, 1996 95-932 1 of 2 035374

REPORT OF: Soil Analysis - Moxee Sewer Treatment Plant - Platinum #5609601750.99

SAMPLE IDENTIFICATION:

On July 12, 1996, this soil sample (laboratory number 176396) was received in our laboratory for analysis. Tests were conducted in accordance with SW-846 *"Test Methods for Evaluating Solid Waste"*, 3rd Edition, updates I, II, IIA, IIB and State of Washington method WIPH-G and EPA 1993 Draft Methods entitled, *"Gasoline Range Organics"*.

The condition of the sample upon receipt at the laboratory is ntoed on the attached sampe receipt checklist. Chain of custody documentation is enclosed. Chromatograms are attached for your reference.

The test results are shown on the following page.

A < sign indicates the value reported was the practical quantitation limit for this sample using the method described. Concentrations of analyte, if present, below this were not quantifiable.

Reviewed by _____

Attachments: Sample Receipt Checklist
Chain of Custody
Chromatograms

caj

Client Name: MAXIM - Yakima
Project No.: 95-932
Laboratory No.: 176396
Sample Name: NW WALL WEST WALL
Sample Date: 07/10/96
Collected by: RACHEL TAUMAN
Time Sampled: 1030
Sample Type: SOIL

PARAMETER	MEASURED VALUE		METHOD NUMBER	DATE ANALYZED
TOTAL PURGEABLE HYDROCARBONS (SOIL)				
Data File Number-TPH Purgeable	ra184			
Total Purgeable Hydrocarbons as rec'd	1.2	mg/kg	WTPH-G15	07/16/96

ATTACHMENTS

MAXIM TECHNOLOGIES INC

SAMPLE RECEIPT CHECKLIST

Client Name: M-Yakima

Project: Makee Sewer Treatment Plant

Laboratory number(s): 176396

Checklist completed by: SE 7/12/96 (Initials / Date)

Date/Time Received: 7/12/96 (Date) 0855 (Time)

Received by: GT

Carrier name: UPS

Sample Type: Soil

		YES	NO
1.	Shipping container in good condition?	✓	
2.	Custody seals present on shipping container?	✓	
3.	Condition: Intact ✓ Broken		
4.	Chain of custody present?	✓	
5.	Chain of custody signed when relinquished and received?	✓	
6.	Chain of custody agrees with sample labels?	✓	
7.	Custody seals on sample bottles?		✓
8.	Condition: Intact ____ Broken ____		
9.	Samples in proper container/bottle?	✓	
10.	Samples intact?	✓	
11.	Sufficient sample volume for indicated test?	✓	
12.	VOA vials have zero headspace?	N/A	
13.	Trip Blank received?	N/A	
14.	(Ice)/Frozen Blue Ice present in shipping container? (circle one)	✓	
	Ice Melted upon receipt.		
15.	Container temperature 1. 14.2°C 2. ____ 3. ____		

		YES	NO
16.	All samples rec'd within holding time?	✓	
	Preservation		
17.	pH check performed by: ____		
18.	Metals bottle(s) pH <2?	N/A	
19.	Nutrient bottle(s) pH <2?		
20.	Cyanide bottle(s) pH >12?		
21.	Sulfide bottle(s) pH >9?		
22.	Oil & grease bottle(s) pH <2?		
23.	TOC bottle(s) pH <2?		
24.	DRO/418.1 bottle(s) pH <2?		
25.	Phenolics bottle(s) pH <2?		
26.	Volatiles (VOA) pH <2? (VOA pH checked by analyst)		
27.	Client contacted?		
28.	Person contacted		
29.	Date contacted		
30.	Contacted by		
31.	Regarding?		

Note: Samples may be affected when not transported at the temperature recommended by the EPA for the test you've selected. Please contact the lab if you have concerns about the temperature of your samples.

COMMENTS: _____

5609601750.99

Project or Site Name

Moxee Sewer Treatment Plant

Project Number

RACHEL TAUMAN

Sampler Name (Printed)

CHAIN OF CUSTODY RECORD

MAXIM TECHNOLOGIES INC

- ☐ Billings, MT
- ☐ Boise, ID
- ☐ Great Falls, MT
- ☐ Helena, MT
- ☐ Missoula, MT
- ☒ Yakima, WA

RACHEL TAUMAN

Contact or Report to

YAKIMA

Contact Address or Location

Rachel Tauman

Sampler Signature

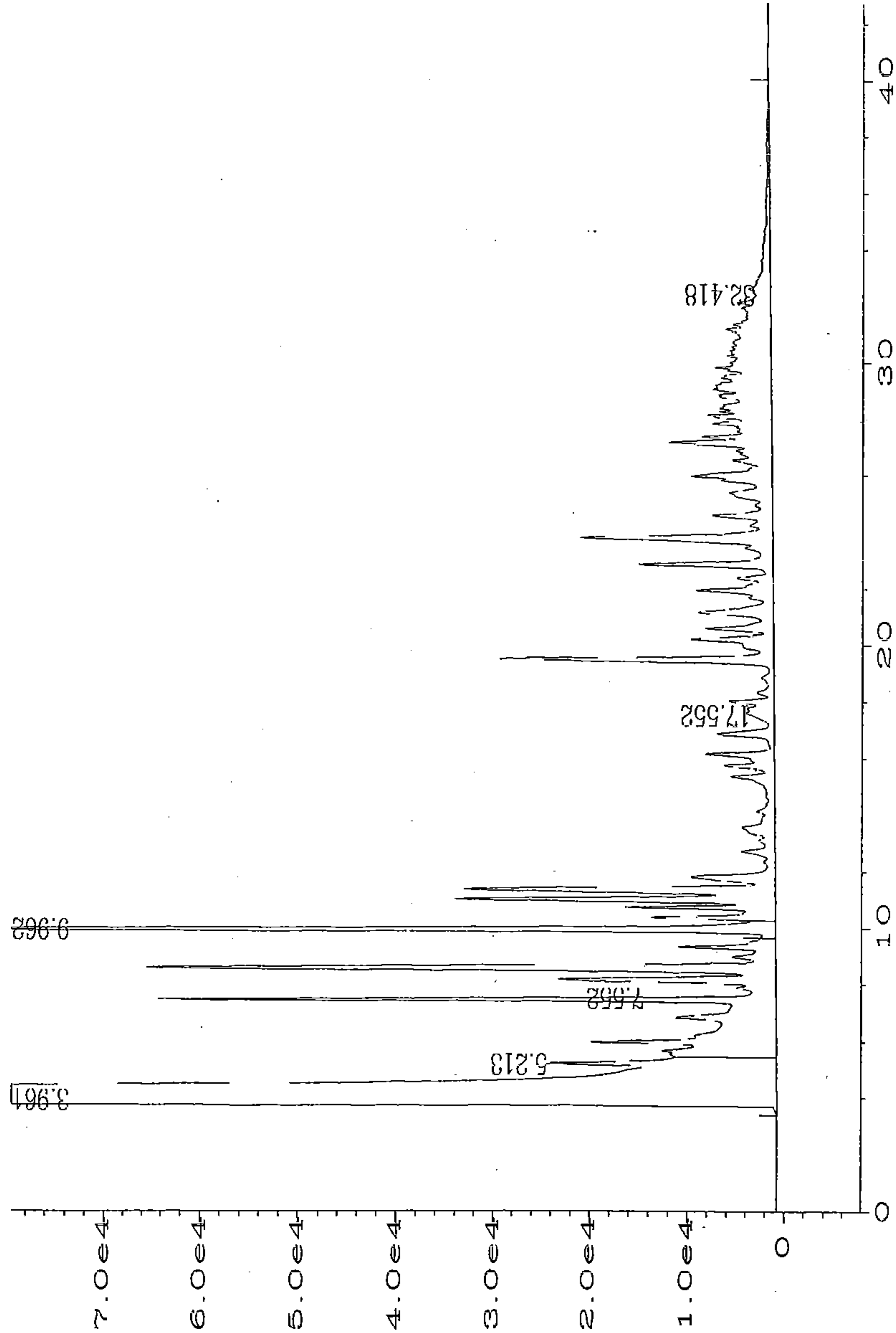
DATE COLLECTED	TIME COLLECTED	SAMPLE LOCATION OR DESCRIPTION	COMP OR GRAB	SAMPLE MATRIX	NO. OF CONTAINERS	ANALYSIS REQUIRED: TPH-G	NOTES	LAB NUMBER
July 10	10:30	NW Wall west wall	Comp	Soil	1	X	W TPH-G	176396
							Cooler 14.2°C	

	Date	Time	Received by:
Relinquished by: Rachel Tauman	July 11	3:30	UPS Express
Relinquished by: UPS	7/12/96	0855	H Edmelund
Relinquished by:	Date	Time	Received by:
Relinquished by:	Date	Time	Received by:

Remarks:

composite of 2 samples at 4' BGS.
Sample 1 from NW wall
Sample 2 from West Wall

Sig. 2 in C:\HPCHEM\1\DATA\NV-Ra184.D



TRANSGLOBAL ENVIRONMENTAL GEOSCIENCES NORTHWEST, INC.

7110 38th Drive SE
Lacey, Washington 98503

Mobile Environmental Laboratories
Environmental Sampling Services

Telephone: **360-459-4670**
Fax: **360-459-3432**

October 22, 1996

CONFIRMATIONAL SOIL SAMPLING OF BIOREMEDIATED STOCKPILE

Rachel Tauman
Maxim Technologies
P.O. Box 2887
Yakima, WA 98907

Dear Ms. Tauman:

Please find enclosed the data report for off-site analyses of soil samples conducted on October 17, 1996, for the Moxee Sewer Treatment Plant Project, Project No. 1750.08, in Yakima, Washington. The soil samples were analyzed for Gasoline by WTPH-G and BTEX by EPA Method 8020, and Heavy Metals by the EPA 7000 Series Method.

The results of the analyses are summarized in the attached tables. All soil values are reported on a dry weight basis. Applicable detection limits and QA/QC data are included. An invoice for this work is also enclosed.

TEG Northwest appreciates the opportunity to have provided analytical services to Maxim Technologies for this project. It was a pleasure working with you, and we are looking forward to the next opportunity to work together.

Sincerely,

Michael A Korosec

Michael A. Korosec
President

TRANSGLOBAL ENVIRONMENTAL GEOSCIENCES NORTHWEST INC.

MOXEE SEWER TREATMENT PLANT PROJECT
Yakima, Washington
MAXIM Technologies, Inc.
Project No: 1750.08

Gasoline (WTPH-G) & BTEX (EPA 8020) Analyses for Soils

Sample Number	Date Analyzed	Benzene mg/kg	Toluene mg/kg	Eth Benz mg/kg	Xylene mg/kg	Gasoline mg/kg	Recovery (%)
Meth. Blank	10/17/96	nd	nd	nd	nd	nd	100
Stockpile #1	10/17/96	nd	nd	nd	nd	nd	110
Stockpile #2	10/17/96	nd	nd	nd	nd	nd	113
Stockpile #3	10/17/96	nd	nd	nd	nd	nd	101
Stockpile #3 Dup	10/17/96	nd	nd	nd	nd	nd	113
Detection Limits		0.05	0.05	0.05	0.05	10	

"nd" Indicates not detected at the listed detection limits.
"int" Indicates that interferences prevent determination.

MOXEE SEWER TREATMENT PLANT PROJECT
Yakima, Washington
MAXIM Technologies, Inc.
Project No: 2750.08

Heavy Metals in Soil by EPA-7000 Series

EPA-Method #		7420
Sample Number	Date	Pb mg/kg
Meth. Blank	10/17/96	nd
Stockpile #1	10/17/96	10
Stockpile #2	10/17/96	6
Stockpile #3	10/17/96	7
Stockpile #3 Dup	10/17/96	6
Method Detection Limit		5

"nd" Indicates not detected at the listed detection limit.

QA/QC FOR ANALYTICAL METHODS

GENERAL

The TEG Northwest Laboratory quality assurance and quality control (QA/QC) procedures are conducted following the guidelines and objectives which meet or exceed certification/-accreditation requirements of California DOHS, Washington DOE, and Oregon DEQ. The Quality Control Program is a consistent set of procedures which assures data quality through the use of appropriate blanks, replicate analyses, surrogate spikes, and matrix spikes, and with the use of reference standards that meet or exceed EPA standards.

When analyses are taking place on-site with the mobile lab, the need for Field Blanks or Travel/Trip Blanks is eliminated. If there is going to be a delay before sample preparation for analysis, the sample is stored at 4° C.

ANALYTICAL METHODS

TEG Northwest Labs use analytical methodologies which are in conformity with U. S. Environmental Protection Agency (EPA), Washington DOE, and Oregon DEQ methodologies. When necessary and appropriate due to the nature or composition of the sample, TEG may use variations of the methods which are consistent with recognized standards or variations used by the industry and government laboratories.

TPH-Gasoline, TPH-Diesel
(Gasoline and/or Diesel, Modified EPA 8015, WTPH-G and WTPH-D)

A blank and a calibration standard are run at the beginning of the day. The standard must be within 15% of the continuing calibration curve value. The standard is rerun at the end of the day. All samples are prepared with a surrogate spike, and the recovery must be between 65% and 135%. A duplicate sample is run at a rate of 1 per 10 samples (or a matrix spike sample is prepared and analyzed). At least 1 method blank is run per 10 samples analyzed.

Purgeable Volatile Aromatics
(BTEX, EPA 602/8020)

A blank and a calibration standard are run at the beginning of the day. The standard must be within 15% of the continuing calibration curve value. The standard is rerun at the end of the day if more than 10 samples have been run. All samples are prepared with a surrogate spike, and the recovery must be between 65% and 135%. At least 1 method blank is run per day.

CHAIN OF CUSTODY RECORD

Nixee Sewer Treatment Plant
Project or Site Name

1750.08
Project Number

RACHEL TAUMAN
Sampler Name (Printed)

MAXIM TECHNOLOGIES INC

- ☐ Billings, MT
- ☐ Boise, ID
- ☐ Great Falls, MT
- ☐ Helena, MT
- ☐ Missoula, MT
- ☒ Yakima, WA

RACHEL TAUMAN
Contact or Report to

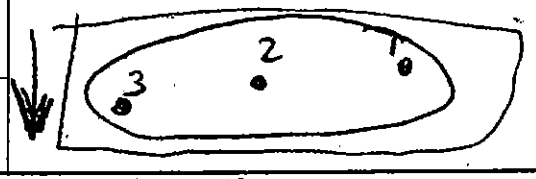
FAX (509) 577-8520
Contact Address or Location

PHONE (509) 577-8592
Sampler Signature

DATE COLLECTED	TIME COLLECTED	SAMPLE LOCATION OR DESCRIPTION	COMP OR GRAB	SAMPLE MATRIX	NO. OF CONTAINERS	ANALYSIS REQUIRED: TPH G + BTEX	ANALYSIS REQUIRED: Total LEAD	NOTES	LAB NUMBER
10/16/96	10:00	Stockpile #1	Grab	Soil	1	X	X	TPH-G + BTEX, LEAD confirmational sampling	
↓	10:05	#2	Grab	Soil	1	X	X		
↓	10:10	#3	Grab	Soil	1	X	X		

	Date	Time	Received by:
Relinquished by: Rachel Tauman	10/17/96	11:50	Michael Kramer
Relinquished by:	Date	Time	Received by:
Relinquished by:	Date	Time	Received by:
Relinquished by:	Date	Time	Received by:

Remarks: TPH-G + BTEX
TOTAL LEAD



Building

APPENDIX B

LINING OF EXCAVATION PHOTOGRAPHS (JULY 1996)

July 1996 - Excavation prior to plastic lining

July 1996 - Excavation after lining with 6 mill black lining

July 1996 - Excavation area with plastic lining and PCS contaminated soil

APPENDIX C

BIO-REMEDIATION PROTOCOLS AND PRODUCT SPECIFICATION

POWELL-CHRISTENSEN INC.
dba Bissel Distributing Co.
2627 East 1680 South
Spanish Fork, Utah 84660

Rachel Tauman
Maxim Technologies
Yakima, Washington
509-577-8592 fax 509-577-8520

September 3, 1996

Rachael:

The following is the cover letter and bioremediation protocol you requested for Moxee City. The information included contains specifics about:

- The type of bioremediation to be utilized
- The type of microorganisms to be used
- How the microorganisms work
- Approximate time period for remediation of the site
- Steps needed to assure rapid remediation of the site

As you are fully aware, the technologies to be used are speculative. We cannot fully guarantee that the site will be fully remediated within the time frame allotted. Every site has different environmental and geological characteristics. These different characteristics make it difficult to predict exactly what will happen. If care is taken to carefully follow the steps we have outlined, the microorganisms, both indigenous and those supplied by Bissel Distributing, will be utilized most effectively.

If you have any further questions please contact me at 801-794-1407. Our fax machine is currently linked to 801-794-1407 as well. I look forward to working with you in the future.

Sincerely,

Brandon Z. Christensen
Environmental Consultant/Sales Manager

POWELL-CHRISTENSEN INC.
dba Bissel Distributing Co.
2627 East 1680 South
Spanish Fork, Utah 84660

To whom it may concern:

The following information concerns a remediation project for Moxee City. The technical information for this detailed recommendation has been supplied by the manufacturer of the products we recommend for this project.

Product to be used

The product we recommend to use in order to enhance remediation of the site is "Oil Sponge." "Oil Sponge" is a combination of agriculture by-products inoculated with all the necessary ingredients to enhance biodegradation of hydrocarbons.

Description of Products

"OIL SPONGE"
"Oil Sponge" microbes are facultative saprophytic anaerobes and achieve the bioconversion of petroleum hydrocarbons through both catabolic and metabolic enzyme digestion, under both aerobic and anaerobic conditions.

How it works

"OIL SPONGE" MICROBES (TYPE R-5)
The microbes remain in a dormant state in the "Oil Sponge" until activated by hydrocarbons. Once activated, the microbes will begin the task of looking for food (i.e. hydrocarbons.) The activated microbes will create an effluent which consists of enzymes and more bacteria which help in the elimination of most petroleum fractions including BTEX/VOC's and semi-volatile compounds.

"Oil Sponge" is simply applied by blending the dry absorbent with the contaminated soil as effectively and efficiently as possible. One the hydrocarbon contacts the "Oil Sponge" it is completely encapsulated (up to the saturation point) and cannot be extracted by natural occurring contact with water. This extraordinary characteristic separates "Oil Sponge" from other sorbents and allows the exceptional bacterial remediation to occur

Duration of the remediation project

Remediation of site in Moxee City should be complete within four to six months if all steps we have outlined are followed strictly. But, we cannot fully guarantee that the site will be fully remediated within this time frame. Every site has different environmental and geological characteristics. These different characteristics make it difficult to predict exactly what will happen. If care is taken to carefully follow the steps we have outlined, the microorganisms, both indigenous and those supplied by Bissel Distributing, will be utilized most effectively.

Supplier of the product to be used

Bissel Distributing buys direct from the manufacturer of "Oil Sponge." Because of this middleman's costs are eliminated.

POWELL-CHRISTENSEN INC.
dba Bissel Distributing Co.
2627 East 1680 South
Spanish Fork, Utah 84660

SOIL REMEDIATION PROTOCOL FOR MOXEE CITY

1. Ph of soil or liquid to be remediated should be at a level of not less than 6.5 and no higher than 8.5 for optimum bacterial growth.

2. Excessive levels of some heavy metals, PCP, fungicides and pesticides will slow bacterial growth.

3. For low level soil remediation (below 10,000 ppm) we recommend effective tilling with a minimum of 1 and 1/2 bag of "Oil Sponge" per cubic yard of soil. You may want to dampen the soil during the tilling procedure to promote migration of hydrocarbon particles into the absorbent.

After the tilling is completed, thoroughly wet the area down, be careful about flooding.

Retain a moisture level of no less than 30%, soil should be tilled every seven (7) days for optimum aeration. Additional nutrients (i.e. miracle grow, triple 16 fertilizer) should be added every 15 days.

Temperatures above 120 F and below 40 F for extended periods will slow bacterial growth.

For high levels of soil contamination (up to 450,000 ppm) please contact Brandon Christensen at Bissel Distributing for correct Soil Remediation Protocol.

Attainable Bioremediation Limits

Compound	Lower Limits	
Total Petroleum Hydrocarbons	100 ppm or less	95
Benzene	10 ppm or less	ND
Ethylbenzene	10 ppm or less	0.9
Toluene	10 ppm or less	5.1
Xylenes (o,m,p)	10 ppm or less	9.1

4-6 month

LETTER OF TRANSMITTAL

DATE	JOB NO.
7-16-96	

ATTENTION: Rachel Tauman

RE: Information on Eliminator III Microbial Products

Maxim Technologies, Inc.
P.O. Box 2887
Yakima, WA 98907

Moxee 575-8851

WE ARE SENDING YOU ☒ Attached ☐ Under separate cover via _____ the following items:

☐ Shop drawings ☐ Prints ☐ Plans ☐ Samples ☐ Specifications
☐ Copy of letter ☐ Change order ☒ Information on Oil Eating Bugs

COPIES	DATE	NO.	DESCRIPTION
1			Demonstration Guide
1			R.E. Powell Distributing Co. price list
1			Environmental Products list
2			Misc. flyers

THESE ARE TRANSMITTED as checked below:

☐ For approval ☐ Approved as submitted ☐ Resubmit _____ copies for approval
☒ For your use ☐ Approved as noted ☐ Submit _____ copies for distribution
☒ As requested ☐ Returned for corrections ☐ Return _____ corrected prints
☐ For review and comment ☐ _____
☐ FOR BIDS DUE _____ 19 _____ ☐ PRINTS RETURNED AFTER LOAN TO US

REMARKS

Rachel - Please review and let me know what action we will take.

Thank you,

Byron

COPY TO _____

SIGNED: _____

R.E. POWELL DISTRIBUTING CO.

ESP PRICE LIST
SUGGESTED LIST PRICE

PRODUCT #	PRODUCT NAME	PRICE
	ABSORBENT PARTICULATE	
OT 86000	OIL SPONGE REMEDIAL - 30lb. BAG	21.95
OT 87000	OIL SPONGE REMEDIAL - 1 GALLON/5lb.	7.99
OT 88000	OIL SPONGE GENERAL PURPOSE - 30lb. BAG	14.99
	BIO REMEDIAL CLEANER/LIQUID	
STC 82000	ELIMINATOR - 1 GALLON	19.95.
STC 83000	ELIMINATOR - 5 GALLON	92.95
STC 84000	ELIMINATOR - 55 GALLON	989.95
	BIO-REMEDIAL PILLOWS/SOCKS - FLOATING PILLOWS/SOCKS	
STS 71000	GENERAL PURPOSE SOCKS (3" x 48" / 30 CASE)	119.95
STS 72000	GENERAL PURPOSE SOCKS (3" x 10" / 12 CASE)	119.95
STS 73000	FLOATING SOCKS (3" x 48" / 30 CASE)	169.00
STB 74000	FLOATING BOOMS (4" x 10' / 10 CASE)	175.00
STP 75000	GENERAL PURPOSE PILLOW (18" x 18" x 2" / 30 CASE)	175.00
STP 76000	FLOATING PILLOW (18" x 18" x 2" / 30 CASE)	250.00
	BARRELL TOPS	
PG 1000	PIG BARRELL TOPS/SORBENT PADS (25 UNITS/CASE)	99.99
	HAND CLEANERS	
EHC 88000	ELIMINATOR HAND CLEANER - 1 GALLON	14.99
EHC 89000	ELIMINATOR HAND CLEANER PUMP	2.99
	BIO-REMEDIAL WIPES/CLEANERS	
STW C 35	SAFE T WIPE (REUSABLE CONTAINER FOR WIPES - 3.5 GALLON)	27.95

STW C 12	SAFE T WIPE (REUSABLE CONTAINER FOR WIPES - 1.2 GALLON)	21.95
	BIO-REMEDIAL WIPES/CLEANERS (con't)	
STW B 12	SAFE T WIPE - BIODEGRADABLE 60 PER ROLL - 6/CS	75.95
STWW B 35	SAFE T WIPE - BIODEGRADABLE 250 PER ROLL - 2/CS	75.95
STWW690	SAFE T WIPE - HEAVY DUTY 90 ROLL / 6 CASE	139.95
STWW 350	SAFE T WIPE - HEAVY DUTY 300 ROLL / 2 CASE	139.95
	SPECIALTY/PARTS CLEANERS/NEUTRALIZERS	
OC	OIL CATCHER (OIL UNIT CATCHER)	101.95
OCS	OIL CATCHER (SORBENT SOCK) 4"x10"	15.95
NLB	NEVER LIFT (ERGONOMIC MOP BUCKET) 5 GAL	95.50
STV	SAFE T VAT (30 GALLON PARTS CLEANER W/ATTACH)	245.00
PHS 30	PH SAFE (WATER BASED NEUTRALIZER WITH COLOR INDICATOR #30)	175.95
STT	SAFE T TRAPPER (OIL DRUM FILTER UNITS)	659.95
	EMERGENCY SPILL KITS	
SPK 61000	BASIC SPILL KIT (1 CASE)	65.95
SPK 62000	DELUXE SPILL KIT (1 CASE)	99.95
	GRAFFITI REMOVER	
JJ 50000	JERK JUICE (1 PINT / 8 CASE)	65.00
JJ 50001	JERK JUICE - 1 GALLON	40.00
JJ 50005	JERK JUICE - 5 GALLON	169.99
JJ 50055	JERK JUICE - 55 GALLON	1699.99

ALL PRICES F.O.B. SPANISH FORK, UT. PRICES ARE SUBJECT TO CHANGE WITHOUT NOTICE

"Eliminator"

ANYWHERE OIL IS A PROBLEM !!!

Demonstration Guide

The following procedure is recommended to demonstrate the cleaning effectiveness of "Eliminator". The most common occurrence of oil spills is on a concrete floor. This makes a good demonstration base.

Step 1: The following demonstration articles are required. Two trigger spray bottles, small bristle scrub brush, "Eliminator".

Step 2: Fill one spray bottle with "Eliminator" liquid. Fill one spray bottle with water.

Step 3: Apply the "Eliminator" by spraying the affected area. Use the scrub brush and agitate the area vigorously for appr. 15-30 seconds. While agitating the "Eliminator" solution, spray small amounts of water onto the solution (continue to agitate).

Step 4: It is very important to keep the area moist. Occasionally spray a light mist of water on the affected area. For optimum degradation let the microbes do their work for 15-30 minutes, depending on the severity of the oil contamination.

Step 5: Rinse the area with water. Allow the area to dry completely. Use an air gun to speed drying process. Once the area is dry, the color of the concrete should reappear.

"Oil Sponge"

ANYWHERE OIL (E.P.A,) IS A PROBLEM !!!

"Oil Sponge", is the preferred hydrocarbon absorbent for use on land. "Oil Sponge" works by encapsulating the oil, rather than simply absorbing it, which means the oil is prevented from leaching into the ground. *"Oil Sponge" which contains approximately 162,000,000,000 microbes,* then bio-degrades both itself and the hydrocarbon by means of bio-remediation. This makes it possible to handle spills in place, greatly reducing the cost of handling the spill.

1. Bioremedial; use on dry or swampy ground
2. One 1.5 cu.ft bag of "Oil Sponge" absorbs as much hydrocarbon based product as 8 bags of "Kitty Liter type products
3. Provides ground cleaning through bio-remediation
4. Makes disposal of product safer and easier
5. Lightweight; lowers spill transportation costs
6. Will absorb most chemicals found in hazardous waste effluents
7. Areas of use are: Tank storage, fuelling stations, oil production sites, roadway or highway spills, garage shop floors, ground soil remediation
8. "Oil Sponge" can be incinerated, generating up to 7,000/BTU as a fuel source

"Oil Sponge" vs. Clay and DE Products

Clay and DE	"Oil Sponge"
* **Hazardous:** contains **Silica Dust** (a probable cause of silicosis)	* No Silica Dust.
* **Hazardous:** probable carcinogen	* All natural, no carcinogen
* Leaches (liquids can be squeezed out)	* Encapsulates (up to saturation), **Non-leaching**
* Contaminated product usually classified as **Hazardous Waste**	* Usually **Non-toxic** and classified **Non-hazardous**
* **Slow** liquid absorption (cover liquid and wait)	* **Instant** liquid absorption (no absorption waiting time)
* Abrasive	* Non-abrasive
* Heavy by volume	* Lightweight by volume
* Non-incinerable	* Incinerable, little ash
* Leaves sheen on floors (slippery conditions)	* No sheen (dry floor)
* Not biodegradable	* **Biodegradable**
* Will not Bioremediate	* Will **Bioremediate** Hydrocarbons
* Costly (see cost comparison)	* **Cost effective**

Cost Comparison "Oil Sponge" vs. Clay Products

Comparison product was locally purchased and weighed 25 lbs. Retail purchase price was $3.99 before tax.

1. 1.6 lbs. of "**Oil Sponge**" will absorb 1 gallon of SAE 30 wt. oil.
2. 12.8 lbs. of Clay product will adsorb 1 gallon SAE 30 wt. oil.

Retail cost of 1.6 lbs. "**Oil Sponge**" **Remedial**	$1.06
Retail cost of 1.6 lbs. "**Oil Sponge**" **General Purpose**	$0.66
Retail Cost of 12.8 lbs. Clay	$2.04

A 1.5 cu. ft. bag of "**Oil Sponge**" absorbs approx. 18 gal. of oil.

A 25 lb. bag of Clay adsorbs approx. 1.95 gal. of oil.

It would take approx. 9.25 bags or 231 lbs. of Clay to absorb as much oil as 1 1.5 cu. ft. bag of "**Oil Sponge**"

Cost Difference!

"Oil Sponge" General Purpose	Clay
1 x $12.45 = $12.45	9.25 x $3.99 = $36.90

$24.45 or 66.0 % !!!

"Oil Sponge" Remedial	Clay
1 x $19.95 = $19.95	9.25 x $3.99 = $36.90

$16.95 or 45.9 % !!!

"Oil Sponge" is the Logical alternative to Clay

"Oil Sponge" vs. Corn Hulls

Listed below are some quality comparisons between **"Oil Sponge"** and **Corn Hulls**

	"Oil Sponge"	Corn Hulls
1. Biodegradable	Yes	Yes
2. Non-Toxic, Non-Abrasive	Yes	Yes
3. Absorbs Hydrocarbons, Chemicals	Yes	Yes
4. Oliophillic and Hydrophobic	Yes	No
5. Encapsulates	Yes	No
6. Non-Leaching	Yes	No
7. Flammable Vapor Suppressant	Yes	N/A
8. Bioremediates (plate count approx. 163,000,000,000 living bacteria per bag, Microbial Nutrients)	Yes	No

Both **"Oil Sponge"** and **Corn and Hulls** are packaged in plastic bags (Approx. 30" x 20"). Due to bulk density of products **"Oil Sponge"** weighs 30 lbs/bag, **Corn Hulls** weighs 40 lbs/bag.

Corn Hulls claim to absorb its own weight in contaminated oil products.

1 bag (40 lbs.) x 1 = 40 lbs contaminated product

"Oil Sponge" claims to absorb 5 times its own weight in contaminated products.

(40lbs.) absorbs 25 gallons or 200 lbs. contaminated product

Equal size bags of product show "Oil Sponge" to absorb 80% more contaminated product than Corn Hulls

Liquids Absorbed
by

"Oil Sponge"

Acetone
Acetonitrile
Amyl Acetate
Benzene
Butanol
2-Butanone
Bromodichloromethane
Bromoform
Bunker C
Carbon Disulfide
Carbon Tetrachloride
Chloroform
Chloromethane
Chlorobenzene
Corn Oil
Crude Oil
Cutting Oils
Cyclohexane
Dichlorobenzene
1,2 - Dichloroethane
Diesel Fuels
Ethanol
Gasoline
Heptane
Hexachlorobenzene
Hexachlorobutadiene
Hexachloroethane
Hexane
Hexene
Isobutanol
Soda Pop
Tea
Cooking Oil
Isoprene
Isopropanol
Jet Fuels
Kerosene
Methanol
Methylene Chloride
Methyl Ethyl Ketone
Methyl Phenol
Motor Oils
Naphthalene
2-Nitroanaline
Oil Base Paints
Oil Base Drilling Fluids
Oil Base Ink
Paraffin Oil
Pentane
Pentachlorophenol
Phenol
Propanol
Scintillation Liquid
Silicon Oils
Tetrahydrofuran
Toluene
Trichloroethylene
Trichlorophenol
Varsol
Vinyl Acetate
Vinyl Chloride
Xylenes
Blood
Milk
Coffee

** **NOTE:** Not for use on **Acids**

"Eliminator" Disposal Protocol

Case 1. Take used waste water from parts washer and spread on shop floor (Due to metal count, dispose of parts washer dirt and soil according to all local, state and federal laws). Brush floor with stiff bristle broom. Rinse floor with water. Waste water will help clean concrete floor and not leave a slippery surface.

NOTE: ***This procedure may only be used if approved by local government.***

Case 2. Take used waste water from parts washer and place in 55 gallon drum (Due to metal count, dispose of parts washer dirt and soil according to all local, state and federal laws). Set spare drum near an air source and aerate waste water for at least 6 hours per day (air from an air line or a aquarium bubbler). Every month change parts washer solution and put used solution in your spare drum. Depending on parts washer drum capacity, you should get 2 to 4 months capacity in spare drum. After spare drum is approximately 3/4 full, add 3 to 5 gallons of water and "Eliminator" Charge Kit. Let solution bubble for 15 days. Test water for ppm levels and dispose of accordingly to all local, state and federal laws.

Case 3. Make your own remediation site (compost pit). See "Oil Sponge Disposal Protocol Case #3.

"Oil Sponge" Disposal Protocol

Case 1. If state or county law allows, dispose of used "Oil Sponge" in garbage.

Case 2. "Oil Sponge" can be incinerated if allowed. "Oil Sponge" in its natural form will contribute approximately 7000 BTU/lb and yield very little ash.

Case 3. Create your own Remediation Site (compost pit). Find a convenient location on your property and dig a hole approximately 6' wide x 6' long x 3' deep. Place a heavy mil plastic liner in your pit to retain contaminated moisture. Dispose of used "Oil Sponge" and used "Eliminator" Parts Washer Solution into pit. Keep pit moist at all times. Continue to use until pit is nearly full. At this point call PHase III Hotline at 1-800-448-BUGS for final remediation instructions.

NOTE: ***Make sure no other cleaning or contaminated products other than "Oil Sponge" or "Eliminator" solutions are placed in remediation pit. If unsure about contaminated product call PHase III.***

Environmental
Safety Products, Inc.

Opportunity Spill, Texas A&M University at the F&B Pump Station (#2 Diesel)

he attached test results of soil sample analysis for the above-referenced project taken prior to treatment
3 locations inside berm are as follows:

Test #1	15,572 ppm (TPH soil)
Test #2	13,267 ppm (TPH soil)
Test #3	55,689 ppm (TPH soil)

or about April 20, 1993, site was treated with 220 gallons of Safe-T-Cleanse and Bio-Catalyst.

proximately eight (8) days later, we returned to the site for additional treatment of Safe-T-Cleanse
Bio-catalyst. Before treating this site a second time we took a soil sample. Test results are as follows:

Test #1	2,226 ppm (TPH soil)
Test #2	6,091 ppm (TPH soil)
Test #3	9,057 ppm (TPH soil)

May 6, 1993, we returned again to the test site and added 220 gallons of Bio-Catalyst. On May 18,
3, we returned again to the site and took another soil sample. Test results are as follows:

Test #1	455 ppm (TPH soil)
Test #2	913 ppm (TPH soil)
Test #3	3,850 ppm (TPH soil)

tside this berm that surrounds a tank where spills occurred, is a 5,000 gallon
rator tank that drains the berm should any water or other materials build up.

May 13, 1993, we treated the tank and lines with 220 gallons of Safe-T-Cleanse and Bio-Catalyst.
e job was to bioremediate any materials that came out of the berm.

of this date, May 21, 1993, we have reduced the waste material spilled in this berm by
proximately 93%. We will continue to monitor this site until all waste has been bioremediated.

"Safety Transformation not Transportation"
Environmental Safety Products, Inc.
1009 West Jackson Street
Demopolis, AL 36732
(205) 289-9201
Fax (205) 289-9708

"America West Airlines I" Testing Protocol

September 6 1994

A sample of used "Oil Sponge" was extracted from a half filled 55 gallon drum. The same "Oil Sponge" has been used repeatedly for 4 weeks and is still being used in the maintenance facility of America West Airlines (Phoenix). The "Oil Sponge" sample consists of Jet A aviation fuel, Aircraft Engine Oil and HyJet IV-A Aircraft Hydraulic Fluid. A sample was taken to Westech Laboratories, Inc. by Mr. Del Caudle (America West Airlines Safety and Environment Coordinator for Technical Services) for analysis.

Sample 1 had a TPH level of 19,000 ppm

Contaminated "Oil Sponge" was then mixed with soil and a small amount of clean "Oil Sponge" and placed in a 5 gallon pail and saturated with water. The contents were then placed in a locked facility to be remediated. Mr. Caudle checked the pail every week to make sure contents remained moist.

"America West 2" Testing Protocol

September 30 1994

A sample of mixed product was taken to Westech Laboratories, Inc. by Mr. Caudle for analysis.

Sample 2 had a TPH level of 11,000 ppm

This represents a 42% reduction in Hydrocarbon Contamination in 30 days

Mixed product was inoculated with a mixture of Type R-5 "Oil Sponge" microbe and nutrient on October 14 1994.

"America West 3" Testing Protocol

October 28 1994

A sample of mixed product was taken to Westech Laboratories, Inc. by Mr. Caudle for analysis

Sample 3 had a TPH level of 740 ppm

This represents a 99.96% reduction in Hydrocarbon Contamination in 52 days

R.E. POWELL DISTRIBUTING CO.
ENVIRONMENTAL PRODUCTS LIST

"Eliminator" is not a soap, detergent or petroleum solvent. "Eliminator" is a homogenous blend of colloids, sequesterants, surfactants, hyper-wetting agents and a pure super concentrate of microbial cultures (106,000,000,000 per gallon). "Eliminator" is non-hazardous, non-flammable, non-toxic, non-explosive, non-fuming and non-caustic. "Eliminator" is safe on plastics, fabrics, paints, leathers, metals, wood, glass, rubber and ceramics when used as directed.

note: Eliminator is the same product as Safe T Cleanse on price list.

"Eliminator Hand Cleaner" is a homogenous blend of colloids, sequesterants, surfactants, hyper-wetting agents with pumice and conditioners.

"Oil Sponge (Remedial) Absorbent" is a cotton based premium absorbent. Included is a microbial culture base (approx. 160,000,000,000 per bag), nutrients and other agricultural by-products. "Oil Sponge" absorbs oil-based liquids and chemicals, while repelling water. "Oil Sponge" prevents leaching up to saturation point and bio-remediates hydrocarbons. "Oil Sponge" absorbs 8 times more volume than kitty litter type products.

note: Oil Sponge is the same product as Oil Grab on the price list.

"Oil Sponge General Purpose Absorbent" is a cotton, nut based premium absorbent. "Oil Sponge" Floor Sweep absorbs oil-based liquids and chemicals, while repelling water. "Oil Sponge" prevents leaching up to saturation point. "Oil Sponge" absorbs 8 times more volume than kitty litter type products.

"Socks Booms and Pillows" R.E. Powell Distributing offers a variety of socks, booms and pillows for use on land and water. All products contain a cotton based fill and absorb approximately 20 times their weight in oil-based liquids and chemicals.

"Emergency Spill Kits" R.E. Powell Distributing offers a standard kit, deluxe kit and can customize individual spill kits. The standard kit absorbs 7.5 gallons of contaminant. The deluxe kit absorbs 14 gallons of contaminant.

The **"Basic Spill Kit"** includes:

- 1 - Red Nylon Bag
- 4 - 3" x 48" Socks
- 1 - 5 lb. Oil Sponge (1 gallon plastic container)
- 2 - Hand Wipes
- 1 - Latex Gloves
- 1 - Mask
- 2 - Disposal Bags

Absorbs 7.5 gallons of product

The **"Deluxe Spill Kit"** includes:

- 1 - Yellow Nylon Bag
- 2 - 3" x 48" Socks
- 2 - 3" x 10' Socks
- 1 - Latex Gloves
- 1 - Mask
- 2 - 5 lb. Oil Sponge
- 1 - Goggles
- 1 - Epoxy Putty
- 1 - Tyvek Coveralls
- 2 - Disposal Bags
- 2 - Hand Wipes

Absorbs 14 gallons of product

Eliminator ™ Microbial Cleaner/Degreaser

Eliminator is not a soap, detergent or petroleum sovent. Eliminator is an industrial strength concentrate, formulated to remove all common soils, grease, oil, wax, gum, dirt, dye, inks, carbon, smoke and exhaust stains. Eliminator will clean metal, plastic, rubber, porcelain, concrete and wood surfaces safely, effectively and economically. Eliminator is non-toxic, non-caustic with no V.O.C.'s.

Eliminator contains a pure super concentrate of oil eating microbes (106,000,000,000) per gallon.

SIZE	PART #	PACK
1 gallon	82000	4/case
5 gallon	83000	1 pail
55 gallon	84000	1 drum

Oil Sponge ™ G.P. Premium Absorbent

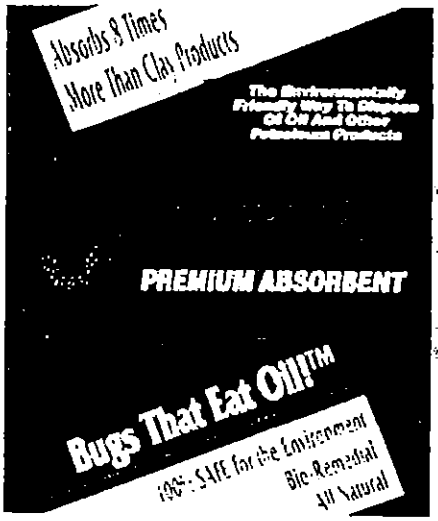
A derivative of our Oil Sponge Remedial Absorbent, G.P. absorbs oil based liquids and most chemicals; is non-leaching up to saturation point and passes E.P.A. Paint Filter/TCLP Testing. Makes disposal of contaminated materials safer and easier. G.P. is cost effective as it absorbs up to 8 times more than "Clay" type products. Not for use on acids.

SIZE	PART #	PACK
1.5 cu.ft.	88000	1 bag

Eliminator ™ Hand Cleaner with Pumice

The *Environmentally Safe* way to clean your hands of oil and grease. Contains no Citrus or Petroleum Solvents. Eliminator Hand Cleaner contains non-irritating conditioners and is biodegradable. Eliminator Hand Cleaner is formulated with PHase III, Inc.'s exclusive PDM-Technology ™

SIZE	PART #	PACK
1 gallon	89000	4/case
Pump	89001	1-4



Oil Sponge ™ Remedial Premium Absorbent

Oil Sponge is made from reclaimed cotton fibers with an oil eating microbial culture (106,000,000,000per bag). Oil Sponge absorbs oil based liquids and most chemicals, while repelling water. Oil Sponge encapsulates and prevents leaching of contaminated liquids. Oil Sponge passes E.P.A. Paint Filter/TCLP Testing. Oil Sponge absorbs up to 8 times more liquid than "Clay" type products.

Not for use on acids.

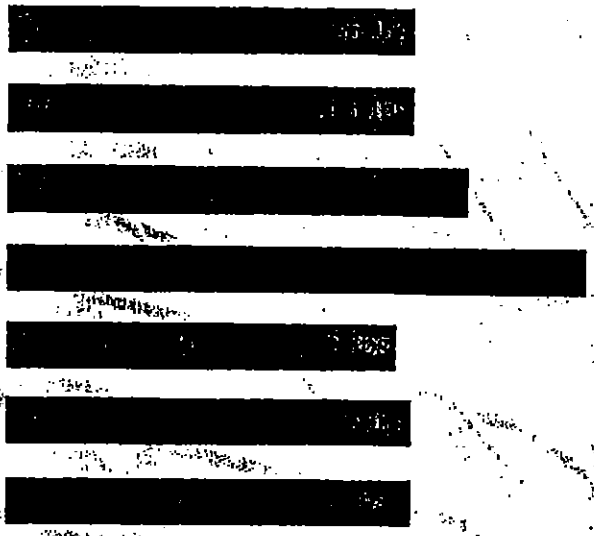
SIZE	PART #	PACK
1.5 cu.ft. (30 lbs.)	86000	1 bag
1 gallon (5 lbs.)	87000	4/case

Company Profile

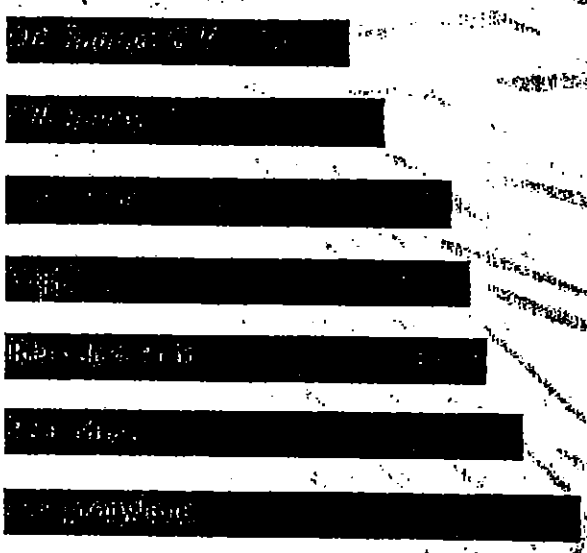
PHase III, Inc. manufactures Environmentally Safe Microbial Products for Automotive, Marine, Industrial and Commercial Industries. PHase III, Inc. products are manufactured from the highest quality materials and thoroughly tested, resulting in products that provide the most cost effective way to clean, absorb, treat and dispose of used oil, gas, grease and other petroleum based products. Not only are PHase III, Inc's. products biodegradable, but many have the unique capability to degrade most petroleum based products, making them safer for the environment. PHase III, Inc's. ongoing R & D Program is constantly striving to develop Safe Alternative Cleaning Products for our Environment.

Absorbent Comparison

Amount of Product to Absorb
1 Gallon 10/30 Wt. Motor Oil



Cost of Product to Absorb
1 Gallon 10/30 Wt. Motor Oil



Product Properties	*Oil Sponge General Purpose*	*Oil Sponge Remedial*	Clay	Corn Cob	Recycled Pulp	Poly	Peat Moss
Biodegradable	X	X		X	X	X	X
Bioremedial*		X					
Non-Abrasive	X	X			X	X	X
Non-Leaching	X	X			X		X
Vapor Suppression	X	X					X
Non-Carcinogenic	X	X		X	X	X	X
Repels Water	X	X					X
Renewable Resource	X	X		X	X	X	

* Contains Hydrocarbon (Oil, Gas, Grease) Eating Microbes

Distributed By:

R. E. Powell Distributing
Pasco, WA 99301
(509) 547-6122
1-800-628-8375

PHase III, Inc. Environmental Products
Microbial Cleaners/Absorbents

1717 S. Cooper Rd. Chandler, Arizona 85249
Ph. 602-786-4550 Fax 602-786-8505

"Bugs" That Eat Oil™ !!! 1-800-448-2847

APPENDIX D

LABORATORY REPORTS OF GROUNDWATER SAMPLE ANALYSES

Maxim
600 South 25th Street
P O Box 30615
Billings, MT 59107
(406) 248-9161
FAX (406) 248-9282

TECHNICAL REPORT

REPORT TO:	ATTN: RACHEL TAUMAN	**DATE:**	August 28, 1996
	MAXIM TECHNOLOGIES, INC.	**JOB NUMBER:**	95-932
	P O BOX 2887	**SHEET:**	1 of 6
	YAKIMA WA 98907	**INVOICE NO.:**	036268

REPORT OF: Water Analysis - City of Moxee Sewer Treatment Plant - 5609601750.99

SAMPLE IDENTIFICATION:

On August 19, 1996, these water samples (laboratory numbers 177737 through 177741) were received in our laboratory for analysis. Tests were conducted in accordance with EPA/600/4-79-020 *"Methods for Chemical Analysis of Water and Wastes"*; Code of Federal Regulations, Title 40, Part 136; and State of Washington method TPH-G.

The condition of the samples upon receipt at the laboratory is noted on the attached sample receipt checklist. Chain of custody documentation is enclosed. Chromatograms are attached for your reference.

The test results are shown on the following pages.

A < sign indicates the value reported was the practical quantitation limit for this sample using the method described. Concentrations of analyte, if present, below this were not quantifiable.

Reviewed by _____

Attachments: Sample Receipt Checklist
Chain of Custody
Chromatograms

ba

Client Name: MAXIM - Yakima
Project No.: 95-932
Laboratory No.: 177737
Sample Name: TP-1
Sample Date: 08/16/96
Collected by: RACHEL TAUMAN
Time Sampled: 0930
Sample Type: WATER

PARAMETER	MEASURED VALUE		METHOD NUMBER	DATE ANALYZED
EPA METHOD 602				
Data File Number-BETX	f9517			
Benzene	<1	ug/l	602	08/21/96
Ethylbenzene	<1	ug/l	602	08/21/96
Toluene	<1	ug/l	602	08/21/96
Total Xylenes	<3	ug/l	602	08/21/96
METALS				
Lead as Pb (Total)	<0.06	mg/l	6010	08/22/96
TOTAL PURGEABLE HYDROCARBONS				
Data File Number-TPH Purgeable	fa773			
Total Purgeable Hydrocarbons	0.3	mg/l	GRO/8015	08/21/96

Client Name: MAXIM - Yakima
Project No.: 95-932
Laboratory No.: 177738
Sample Name: TP-2
Sample Date: 08/16/96
Collected by: RACHEL TAUMAN
Time Sampled: 0900
Sample Type: WATER

PARAMETER	MEASURED VALUE		METHOD NUMBER	DATE ANALYZED
EPA METHOD 602				
Data File Number-BETX	f9518			
Benzene	<1	ug/l	602	08/21/96
Ethylbenzene	<1	ug/l	602	08/21/96
Toluene	<1	ug/l	602	08/21/96
Total Xylenes	<3	ug/l	602	08/21/96
METALS				
Lead as Pb (Total)	<0.06	mg/l	6010	08/22/96
TOTAL PURGEABLE HYDROCARBONS				
Data File Number-TPH Purgeable	fa774			
Total Purgeable Hydrocarbons	0.3	mg/l	GRO/8015	08/21/96

Client Name: MAXIM - Yakima
Project No.: 95-932
Laboratory No.: 177739
Sample Name: TP-3
Sample Date: 08/16/96
Collected by: RACHEL TAUMAN
Time Sampled: 0920
Sample Type: WATER

PARAMETER	MEASURED VALUE		METHOD NUMBER	DATE ANALYZED
EPA METHOD 602				
Data File Number-BETX	f9575			
Benzene	280	ug/l	602	08/26/96
Ethylbenzene	970	ug/l	602	08/26/96
Toluene	<17	ug/l	602	08/26/96
Total Xylenes	3800	ug/l	602	08/26/96
METALS				
Lead as Pb (Total)	<0.06	mg/l	6010	08/22/96
TOTAL PURGEABLE HYDROCARBONS				
Data File Number-TPH Purgeable	fa883			
Total Purgeable Hydrocarbons	12	mg/l	GRO/8015	08/26/96

Client Name: MAXIM - Yakima
Project No.: 95-932
Laboratory No.: 177740
Sample Name: TP-4
Sample Date: 08/16/96
Collected by: RACHEL TAUMAN
Time Sampled: 1000
Sample Type: WATER

PARAMETER	MEASURED VALUE		METHOD NUMBER	DATE ANALYZED
EPA METHOD 602				
Data File Number-BETX	f9534			
Benzene	<1	ug/l	602	08/22/96
Ethylbenzene	<1	ug/l	602	08/22/96
Toluene	<1	ug/l	602	08/22/96
Total Xylenes	<3	ug/l	602	08/22/96
METALS				
Lead as Pb (Total)	<0.06	mg/l	6010	08/22/96
TOTAL PURGEABLE HYDROCARBONS				
Data File Number-TPH Purgeable	fa776			
Total Purgeable Hydrocarbons	<0.2	mg/l	GRO/8015	08/21/96

Client Name: MAXIM - Yakima
Project No.: 95-932
Laboratory No.: 177741
Sample Name: TRAVEL BLANK
Sample Date: 08/16/96
Collected by: RACHEL TAUMAN
Time Sampled: 0800
Sample Type: WATER

PARAMETER	MEASURED VALUE		METHOD NUMBER	DATE ANALYZED
TOTAL PURGEABLE HYDROCARBONS				
Data File Number-TPH Purgeable	fa777			
Total Purgeable Hydrocarbons	<0.2	mg/l	GRO/8015	08/22/96

ATTACHMENTS

CHAIN OF CUSTODY RECORD

City of Moxee Sewer Treatment Plant
Project or Site Name

5609601750.99
Project Number

RACHEL TAUMAN
Sampler Name (Printed)

MAXIM TECHNOLOGIES INC

☐ Billings, MT ☐ Helena, MT
☐ Boise, ID ☐ Missoula, MT
☐ Great Falls, MT ☒ Yakima, WA

Rachel Tauman
Contact or Report to

(509) 577-8592
Contact Address or Location

Rachel Tauman
Sampler Signature

DATE COLLECTED	TIME COLLECTED	SAMPLE LOCATION OR DESCRIPTION	COMP OR GRAB	SAMPLE MATRIX	NO. OF CONTAINERS	ANALYSIS REQUIRED: TPH-G+BTEX	ANALYSIS REQUIRED: LEAD (TOTAL)	ANALYSIS REQUIRED: TPH-G	NOTES	LAB NUMBER
Aug 16, 1996	9:30	TP-1	Grab	Water	2	X	X		GWC 6	177737
Aug 16	9:00	TP-2	Grab	Water	3 RT	X	X		VOA Broken in lab 7 excessive headspace Both vials VOAs 38
Aug 16	9:20	TP-3	Grab	Water	2	X	X		excessive headspace Both VOA's GWC 8 Gasoline odor 39
Aug 16	10:00	TP-4	Grab	Water	2	X	X		excessive headspace Both VOA's GWC 40
Aug 16	8:00	TRAVEL BLANK		Water	1			X	excessive headspace / Water Blank Trip Blank 41
									Cooler temp 20.3°C HCl Added	

Relinquished by: Rachel Tauman	Date: Aug 17	Time: 10:00	Received by: Fed Ex
Relinquished by: Fed x	Date: 8/19/96	Time: 0915	Received by: K Chevelan
Relinquished by:	Date	Time	Received by:
Relinquished by:	Date	Time	Received by:

Remarks: Grab Ground water samples from Test Pits excavated with a backhoe

TPH-G + BTEX TOTAL LEAD

MAXIM TECHNOLOGIES INC

SAMPLE RECEIPT CHECKLIST

Client Name: M-Yakima
Project: City of Moxee
Laboratory number(s): 17737-41
Checklist completed by: [Initials] / 8/19 [Date]

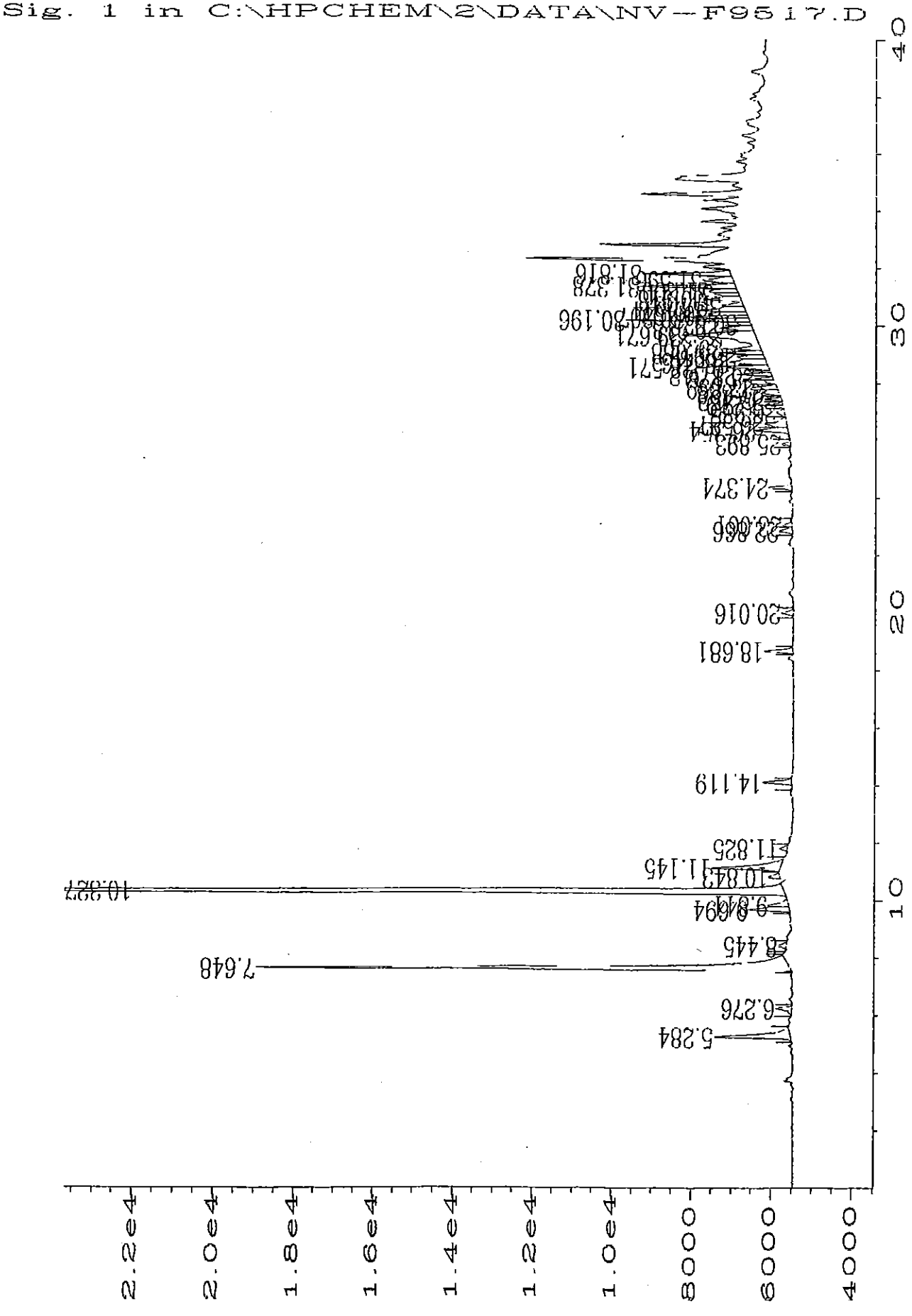
Date/Time Received: 8/19/96 0915 (Date / Time)
Received by: [signature]
Carrier name: Fed X
Sample Type: Water

		YES	NO
1.	Shipping container in good condition?	✓	
2.	Custody seals present on shipping container?	✓	
3.	Condition: Intact ✓ Broken		
4.	Chain of custody present?	✓	
5.	Chain of custody signed when relinquished and received?	✓	
6.	Chain of custody agrees with sample labels?	✓	
7.	Custody seals on sample bottles?		✓
8.	Condition: Intact ____ Broken ____		
9.	Samples in proper container/bottle?	✓	
10.	Samples intact?	✓	
11.	Sufficient sample volume for indicated test?	✓	
12.	VOA vials have zero headspace?		✓
13.	Trip Blank received?	✓	
14.	Ice/Frozen Blue Ice present in shipping container? (circle one)	✓	
15.	Container temperature 1. 2.0-3.0°C 2. ____ 3. ____		

		YES	NO
16.	All samples rec'd within holding time?	✓	
	Preservation		
17.	pH check performed by: ____		
18.	Metals bottle(s) pH <2?		
19.	Nutrient bottle(s) pH <2?		
20.	Cyanide bottle(s) pH >12?		
21.	Sulfide bottle(s) pH >9?		
22.	Oil & grease bottle(s) pH <2?		
23.	TOC bottle(s) pH <2?		
24.	DRO/418.1 bottle(s) pH <2?		
25.	Phenolics bottle(s) pH <2?		
26.	Volatiles (VOA) pH <2? (VOA pH checked by analyst)		
27.	Client contacted?		
28.	Person contacted	____	
29.	Date contacted	____	
30.	Contacted by	____	
31.	Regarding?	____	

Note: Samples may be affected when not transported at the temperature recommended by the EPA for the test you've selected. Please contact the lab if you have concerns about the temperature of your samples.

COMMENTS: #12 all VOA's have excessive headspace except TP-1; Lead sample must be taken from VOA's after Organics are run so no pH taken at login JG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31.816
2.2e4
2.0e4
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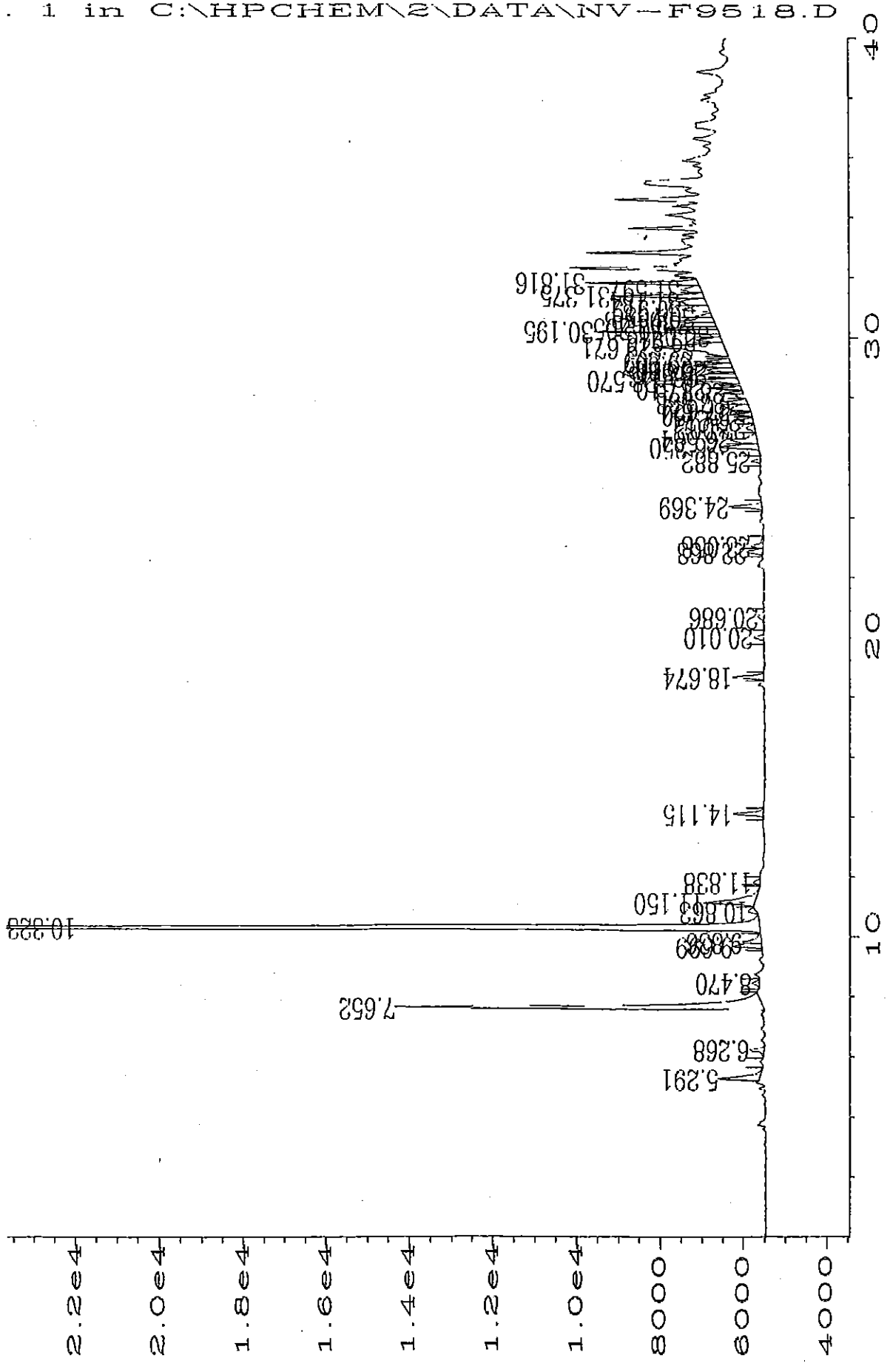

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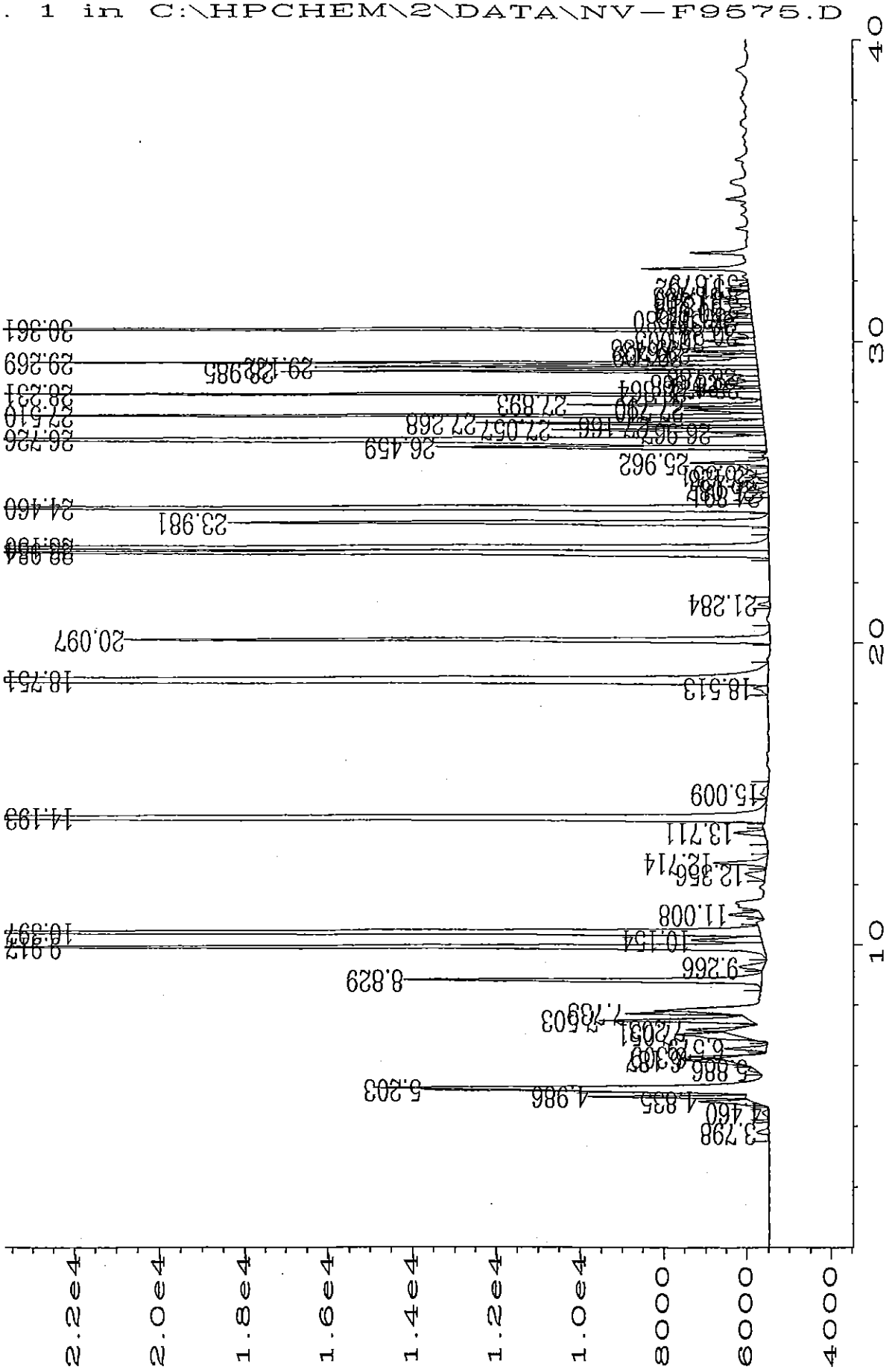

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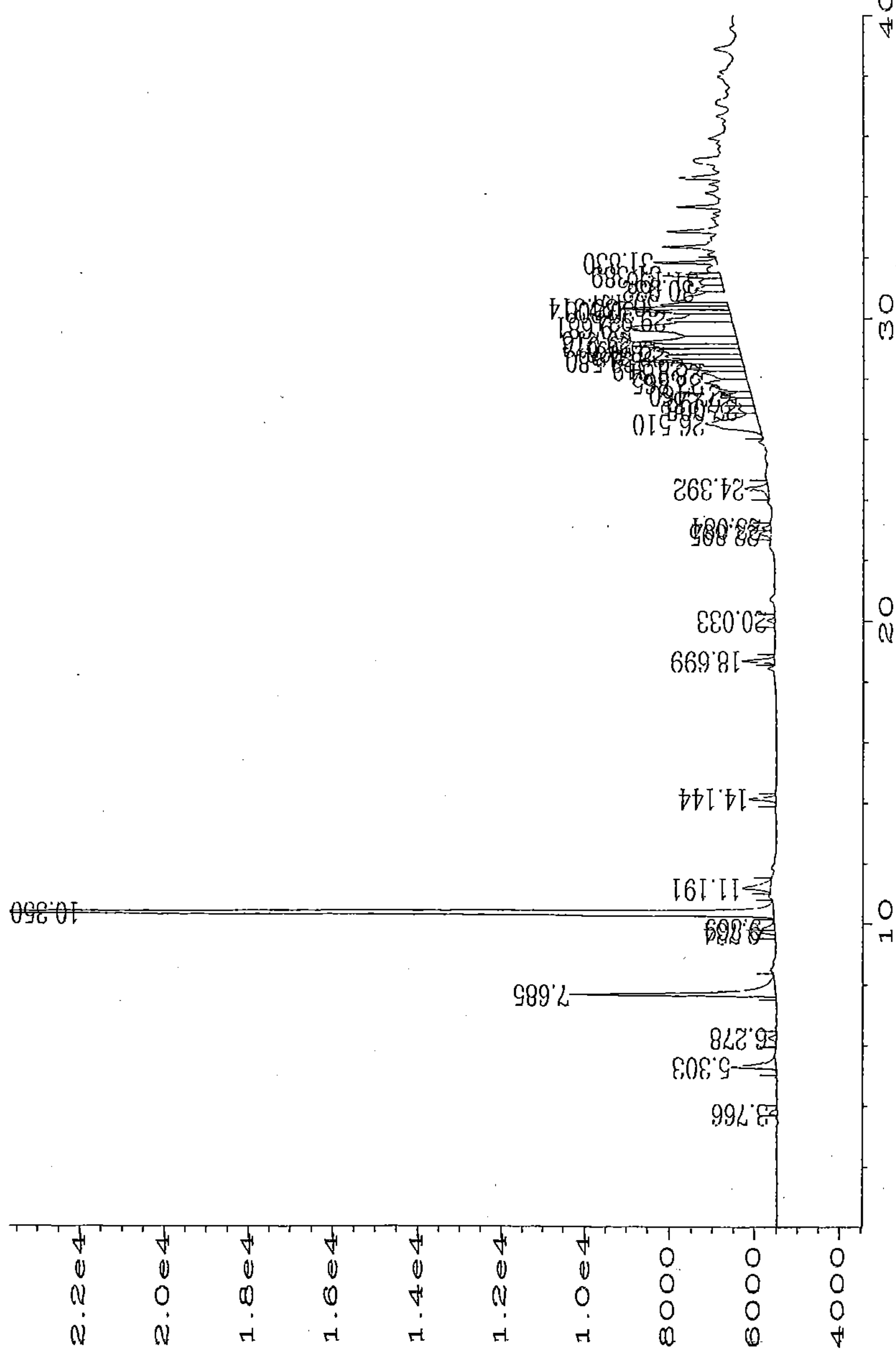

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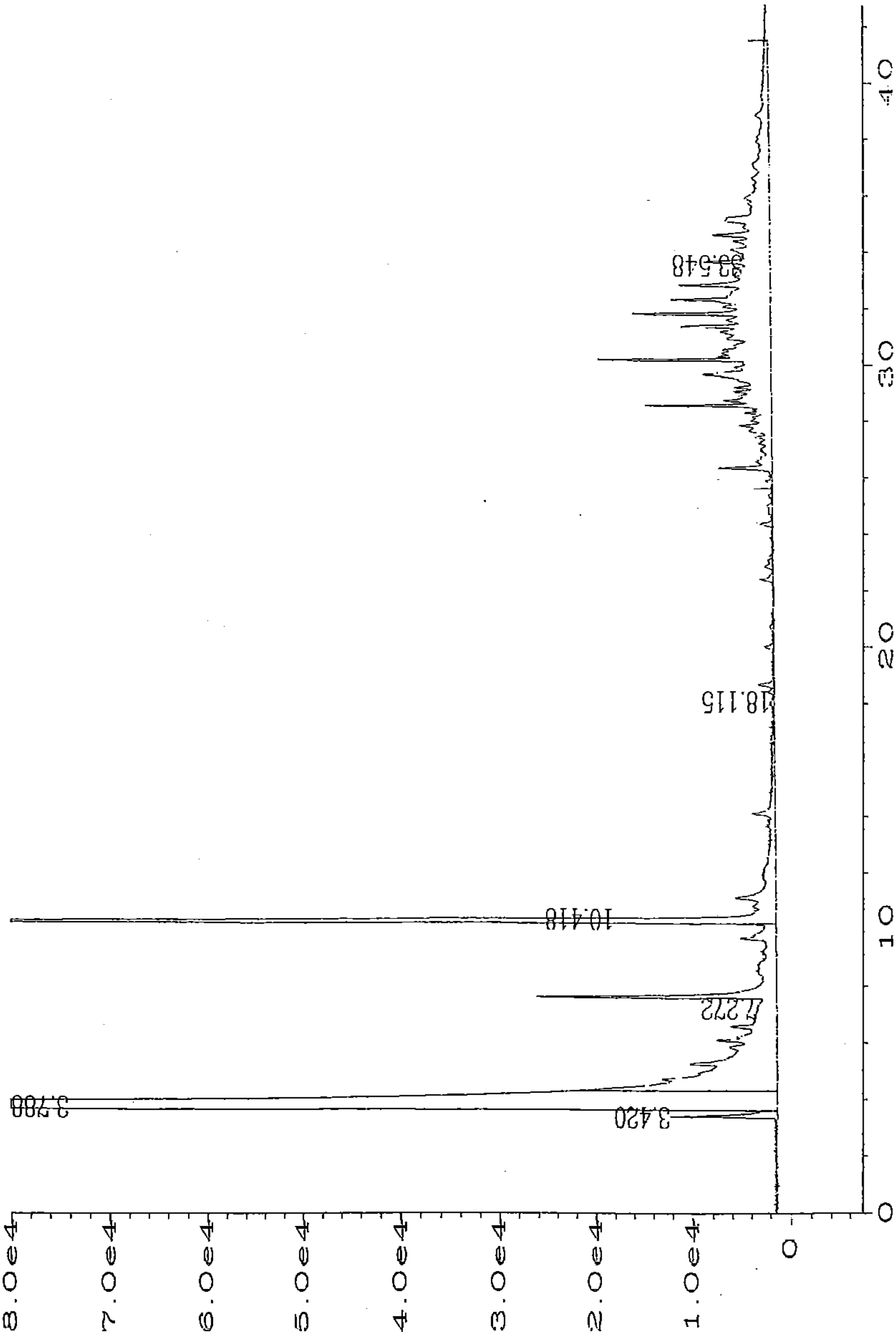

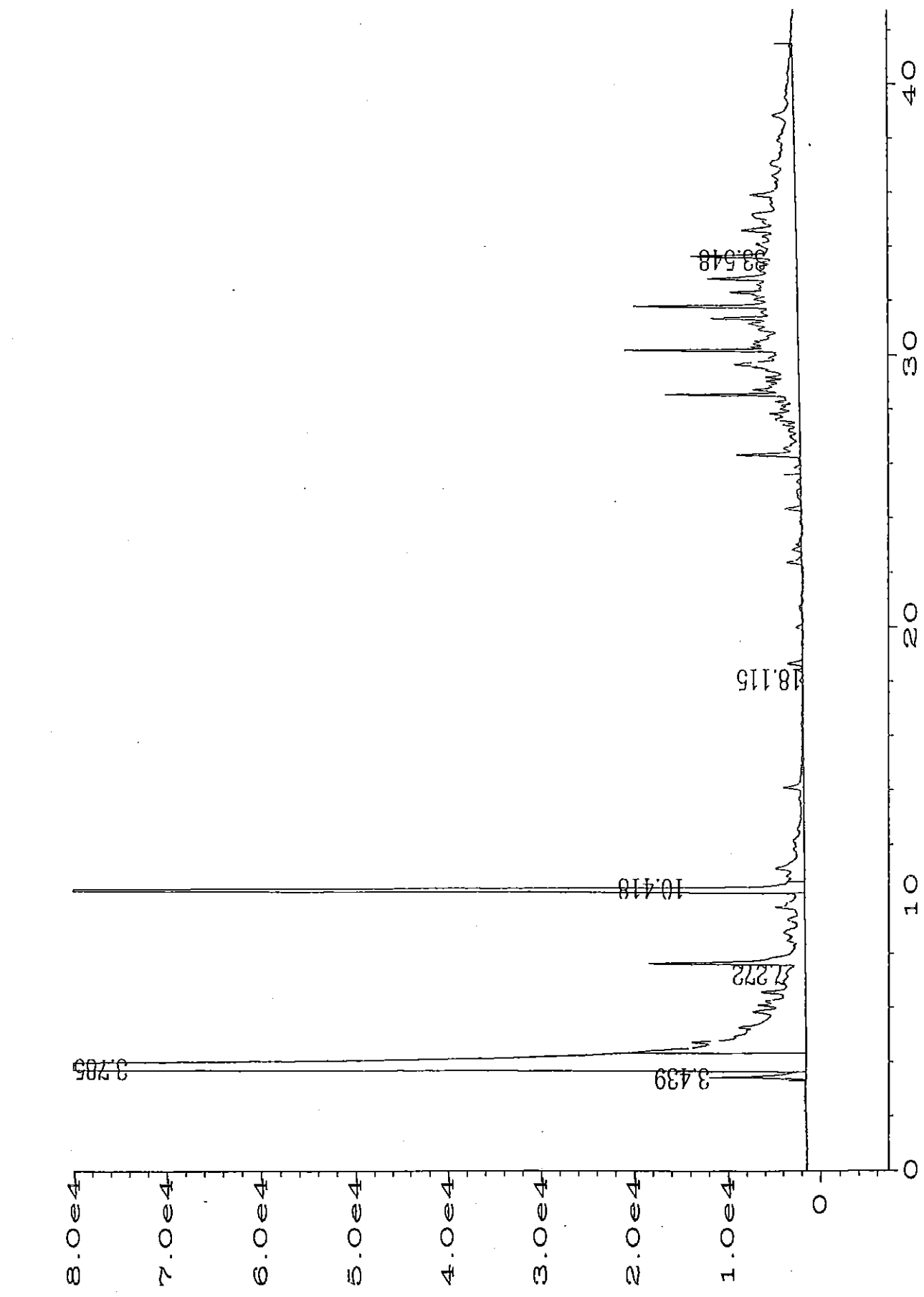
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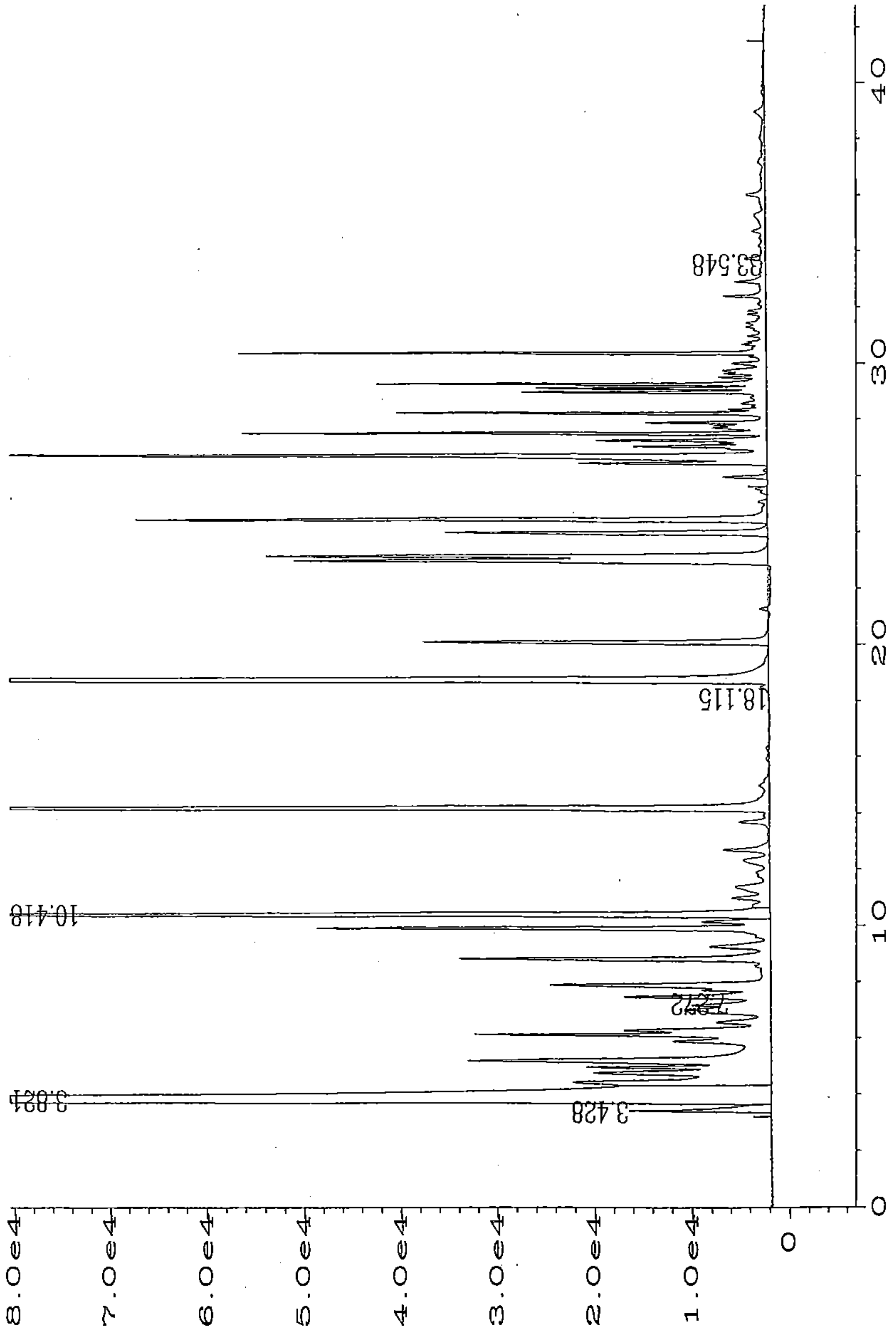

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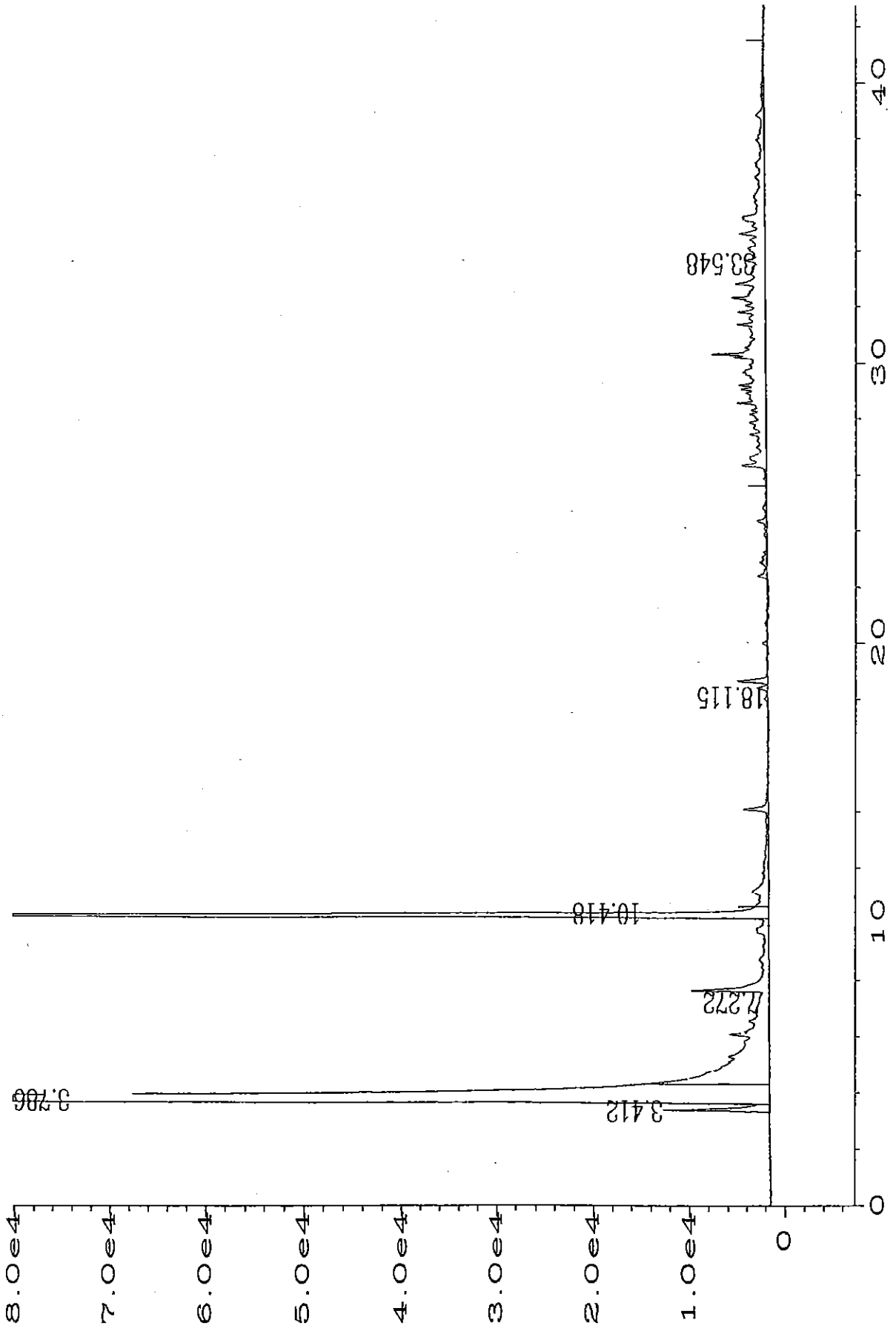

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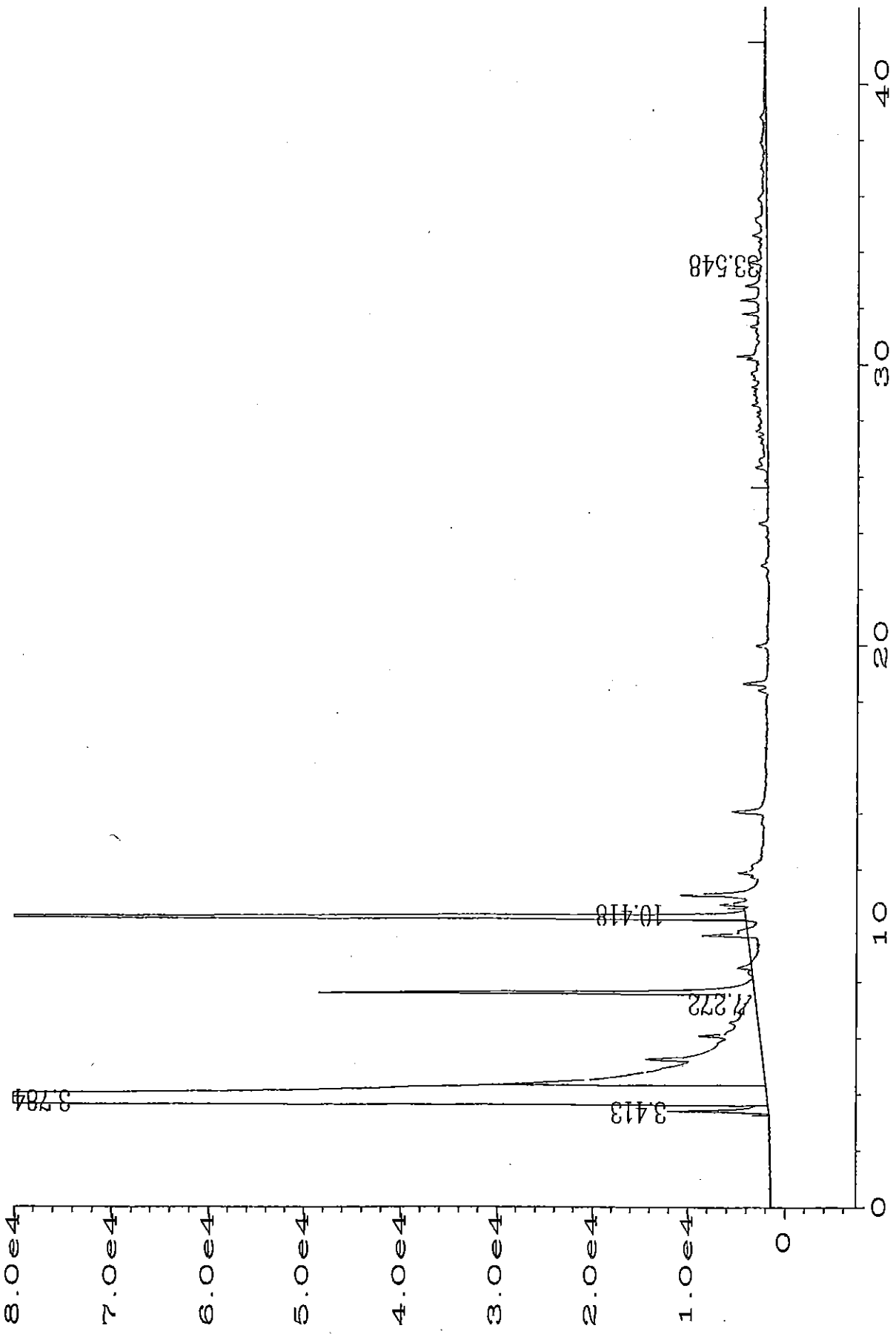

APPENDIX E

RISK BASED CORRECTION ACTION (RBCA) INFORMATION

RBCA ASSESSMENT INFORMATION

Presented June 29, 1996
Salt Lake City, Utah

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Risk Based Corrective Action (RBCA) assessment protocols are being developed by many States. Most State guidances follow ASTM Standard E1739-95.

RBCA assessments consist of the following:

1. Site Assessment
2. Site Classification
3. Tiered Evaluation of Risk to Human Health and the Environment

This tiered approach to risk assessment is summarized below:

Tier 1 - Site conditions are evaluated and contaminant levels measured in field. Site contaminant levels are then compared with ASTM or State-supplied look up tables which provide risk-based screening levels (RBSLs).

- Assumptions used to determine RBSLs are conservative.
- Tier 1 assessments are the simplest and least expensive to complete (2K to 3K).

Tier 2 - Site conditions and contaminant levels are evaluated as in Tier 1. However, conservative assumptions used for Tier 1 RBSLs are replaced with actual measured site parameters collected during the assessment. These alternative site specific levels are referred to as site specific target levels (SSTLs).

- SSTLs are usually, but not always higher than RBSLs.
- Additional costs will be incurred to collect the additional site parameters.
- Additional costs must be evaluated against other benefits to determine if Tier 2 is appropriate.

Tier 3 - Additional information is collected during the site assessment. The information is used to conduct computer modelling of transport mechanisms and exposure pathways. The results of the modelling are then used to quantitatively evaluate risk and determine SSTLs.

- Tier 3 assessments are expensive (10K), but may reduce remediation costs.
- These detailed evaluations are probably not necessary for most sites.
- Tier 3 assessments depend heavily on mathematical models which are only as good as the data you collect and the assumptions you make.

SUGGESTED ITEMS FOR A RBCA SITE ASSESSMENT

(Worksheets are available from Groundwater Services, Inc., Houston, Texas which assist in gathering necessary site assessment information. Some States are adapting similar worksheets.)

Before beginning a RBCA approach consider the benefits. RBCA assessments will generally result in more assessment and reporting costs than traditional assessments. Do the benefits of the RBCA assessment outweigh the additional costs?

GOOD CANDIDATES FOR RISK ASSESSMENT

1. Soil contamination is stable, or beneath pavement, no groundwater contamination.
2. Established site, groundwater exceeds MCLs but does not migrate off-site, based on several quarters of groundwater monitoring.
3. Intrinsic bioremediation can be demonstrated.

LESS LIKELY CANDIDATES FOR RISK ASSESSMENT

1. Off-site groundwater contamination extending onto adjacent residential or commercial property.
2. Contaminant levels are below MCLs.
3. Contaminant levels pose immediate threat to human health and the environment?

Preliminary Assessment - Information to gather before you conduct subsurface assessment.

1. Site Features
   a. Property boundaries
   b. Location and details of construction of buildings
   c. Location of present and past petroleum facilities
   d. Buried utilities = Conduits for contaminants
   e. etc. - other useful information
2. Environmental hazard identification - type and quantity of chemicals on-site
3. Site History
   a. Tank tightness tests
   b. Product inventory
   c. Historical leaks
4. Potential Receptors
   a. Nearby utility structures
   b. Basements
   c. Surface water
   d. Groundwater - Water wells
5. Locate Sensitive Receptors - Hospitals and hospices, day care facilities, primary and secondary schools, nursing homes

6. Interview site owner - any plans for future construction?
7. Other adjacent environmental concerns?

Detailed Site Assessment

(Collect as much information as necessary, but no more. Balance thoroughness with cost considerations)

1. Geophysical survey?
2. Soil gas survey - May reduce drilling costs
3. Prepare a soil and groundwater sampling plan in which representative soil and groundwater samples are collected from all representative subsurface horizons.

a. RBCA identifies 3 subsurface horizons as presented below:
   - Surface soil (generally less than 3 feet)
   - Subsurface soil (generally greater than 3 feet)
   - Saturated zone (within groundwater = aquifer)

b. Be sure to also consider various lithologies encountered, regardless of depth

4. Evaluate for presence of vapors - PID/FID or analytical methods
5. Ecological receptor survey

Soil Sampling Parameters

1. Soil classification tests (sieve analysis, plasticity index)
2. Moisture content
3. Collect representative undisturbed samples for the following analyses:
   - Effective porosity
   - Permeability
   - Fractional organic carbon
   - Bulk density
4. Contaminants of Concern (usually State specific)
5. Intrinsic Bioremediation Parameters?
   - Sulfate, nitrate, dissolved iron, dissolved oxygen, others?

Groundwater Sampling Parameters

1. Potability characteristics (Total dissolved solids, specific yield, other primary drinking water standards?)
2. Presence of free product
3. Contaminants of Concern
4. Conduct aquifer test?

SITE CLASSIFICATION

Conducted after site assessment is completed. Allows prioritization of sites to efficiently allocate cleanup funds.

Four site classifications presented in ASTM:

Priority 1 - Immediate threat to human health and the environment

1. Explosive vapor levels in buildings or utility conduits
2. Contamination effects a drinking water supply well
3. Sensitive habitat is endangered

Actions:

1. Evacuate affected occupants
2. Provide alternative drinking water supply
3. Begin active remediation

Priority 2 - Short term (0-2 years) threat to human health and the environment

1. Potential for explosive vapors in buildings or utility structures
2. Contaminated surface soil (0-3 feet) within 500 feet of sensitive receptors
3. Impacted surface water, storm water or groundwater discharging within 500 feet of a sensitive habitat

Actions:

1. Notify owner of need for treatment
2. Groundwater monitoring
3. Remediation feasibility study

Priority 3 - Long term (> 2 years) threat to human health and the environment

1. Impacted groundwater will eventually reach water supply well
2. Impacted subsurface soil located within 50 feet of potable aquifer
3. Impacted surface water, storm water or groundwater discharging within 1500 feet of a sensitive habitat

Actions:

1. Groundwater monitoring
2. Identify future receptors
3. Restrict access to impacted soil

Priority 4 - No identified threat to human health and the environment

1. Aquifer is non-potable
2. Impacted subsurface soil with greater than 50 feet to groundwater

Actions:

1. Groundwater monitoring

2. Evaluate for intrinsic bioremediation
3. Site closure?

RBCA ASSESSMENT REPORTING

This is another good time to decide if a RBCA assessment is appropriate, or whether site conditions warrant a traditional cleanup.

1. Complete a Baseline Exposure Flowchart to identify primary and secondary contaminant source, transport mechanisms, and exposure pathways.
2. Summarize contaminant concentrations in soil, groundwater, vapors?
3. Compare site contaminant concentrations with State-supplied RBSLs.

Are RBSLs exceeded, if so, there are several options:

1. Remediate site until concentrations are less than RBSLs
2. Complete a Tier 2 or Tier 3 assessment to determine SSTLs based on site specific parameters
3. Impose an institutional control to prevent contact with the exceeded RBSL

RBCA SOFTWARE

RBSLs are calculated using formulas presented in ASTM, or some alternative method approved by each State. The formulas are simple algebraic equations, but calculations are tedious and involve many assumed variables.

There are several sources of software available for calculation of RBSLs and SSTLs. These packages include:

- API DSS (American Petroleum Institute) - Requires a 386 or 486 processor, math co-processor, 4 MB ram, Microsoft windows 3.1 and Excel 4.0
- RBCA Toolkit (Groundwater Services Inc.) - Pentium processor recommended, 8 MG ram, Microsoft Windows 3.1 and Excel 4.0

Both programs are relatively inexpensive (< $600) and allow you to replace standard RBSL assumptions with site specific levels for completion of Tier 1 and Tier 2 assessments.

Numerous other software available for completing fate and transport models. API DSS includes several of the models in their package.

RBCA

SSTL - Site specific Target level

4.5.5 Requiring the user to achieve technology-based remedial limits (for example, asymptotic levels) prior to requesting the approval for the RBSL or SSTL,

4.5.6 The use of predictive modelling that is not supported by available data or knowledge of site conditions,

4.5.7 Dictating that corrective action goals can only be achieved through source removal and treatment actions, thereby restricting the use of exposure reduction options, such as engineering and institutional controls,

4.5.8 The use of unjustified or inappropriate exposure factors,

4.5.9 The use of unjustified or inappropriate toxicity parameters,

4.5.10 Neglecting aesthetic and other criteria when determining RBSLs or SSTLs,

4.5.11 Not considering the effects of additivity when screening multiple chemicals,

4.5.12 Not evaluating options for engineering or institutional controls, exposure point(s), compliance point(s), and carcinogenic risk levels before submitting remedial action plans,

4.5.13 Not maintaining engineering or institutional controls, and

4.5.14 Requiring continuing monitoring or remedial action at sites that have achieved the RBSL or SSTL.

5. Tiered Approach to Risk-Based Corrective Action (RBCA) at Petroleum Release Sites

5.1 RBCA is the integration of site assessment, remedial action selection, and monitoring with USEPA-recommended risk and exposure assessment practices. This creates a process by which corrective action decisions are made in a consistent manner that is protective of human health and the environment.

5.2 The RBCA process is implemented in a tiered approach, involving increasingly sophisticated levels of data collection and analysis. The assumptions of earlier tiers are replaced with site-specific data and information. Upon evaluation of each tier, the user reviews the results and recommendations and decides whether more site-specific analysis is warranted.

5.3 *Site Assessment*—The user is required to identify the sources of the chemical(s) of concern, obvious environmental impacts (if any), any potentially impacted humans and environmental receptors (for example, workers, residents, water bodies, and so forth), and potentially significant transport pathways (for example, ground water flow, utilities, atmospheric dispersion, and so forth). The site assessment will also include information collected from historical records and a visual inspection of the site.

5.4 *Site Classification*—Sites are classified by the urgency of need for initial response action, based on information collected during the site assessment. Associated with site classifications are initial response actions that are to be implemented simultaneously with the RBCA process. Sites should be reclassified as actions are taken to resolve concerns or as better information becomes available.

5.5 *Tier 1 Evaluation*—A look-up table containing screening level concentrations is used to determine whether site conditions satisfy the criteria for a quick regulatory closure or warrant a more site-specific evaluation. Ground water, soil, and vapor concentrations may be presented in this table for a range of site descriptions and types of petroleum products ((for example, gasoline, crude oil, and so forth). The look-up table of RBSL is developed in Tier 1 or, if a look-up table has been previously developed and determined to be applicable to the site by the user, then the existing RBSLs are used in the Tier 1 process. Tier 1 RBSLs are typically derived for standard exposure scenarios using current RME and toxicological parameters as recommended by the USEPA. These values may change as new methodologies and parameters are developed. Tier 1 RBSLs may be presented as a range of values, corresponding to a range of risks or property uses.

5.6 *Tier 2 Evaluation*—Tier 2 provides the user with an option to determine SSTLs and point(s) of compliance. It is important to note that both Tier 1 RBSL and Tier 2 SSTLs are based on achieving similar levels of protection of human health and the environment (for example, 10^{-4} to 10^{-6} risk levels). However, in Tier 2 the non-site-specific assumptions and point(s) of exposure used in Tier 1 are replaced with site-specific data and information. Additional site-assessment data may be needed. For example, the Tier 2 SSTL can be derived from the same equations used to calculate the Tier 1 RBSL, except that site-specific parameters are used in the calculations. The additional site-specific data may support alternate fate and transport analysis. At other sites, the Tier 2 analysis may involve applying Tier 1 RBSLs at more probable point(s) of exposure. Tier 2 SSTLs are consistent with USEPA-recommended practices.

5.7 *Tier 3 Evaluation*—Tier 3 provides the user with an option to determine SSTLs for both direct and indirect pathways using site-specific parameters and point(s) of exposure and compliance when it is judged that Tier 2 SSTLs should not be used as target levels. Tier 3, in general, can be a substantial incremental effort relative to Tiers 1 and 2, as the evaluation is much more complex and may include additional site assessment, probabilistic evaluations, and sophisticated chemical fate/transport models.

5.8 *Remedial Action*—If the concentrations of chemical(s) of concern at a site are above the RBSL or SSTL at the point(s) of compliance or source area, or both, and the user determines that the RBSL or SSTL should be used as remedial action target levels, the user develops a remedial action plan in order to reduce the potential for adverse impacts. The user may use remediation processes to reduce concentrations of the chemical(s) of concern to levels below or equal to the target levels or to achieve exposure reduction (or elimination) through institutional controls discussed in Appendix X4, or through the use of engineering controls, such as capping and hydraulic control.

If below SSTL, then no action

6. Risk-Based Corrective Action (RBCA) Procedures

6.1 The sequence of principal tasks and decisions associated with the RBCA process are outlined on the flowchart shown in Fig. 1. Each of these actions and decisions is discussed as follows.

6.2 *Site Assessment*—Gather the information necessary for site classification, initial response action, comparison to the RBSL, and determining the SSTL. Site assessment may be conducted in accordance with Guide E 1599. Each successive tier will require additional site-specific data and information that must be collected as the RBCA process

Risk Assessment:
A Tiered Approach

For many years, risk assessment has been used as a valuable interpretive tool to determine the relative significance of contamination in food, soil, water, and air. The technologies of risk assessment, like many other technologies, have undergone significant changes and refinements since the first Superfund requirements more than a decade ago. Under Superfund, a risk assessment is required to assess the health risks associated with potential exposures to site contaminants; in addition, it plays a crucial role in the development of cleanup objectives for the site.

Although risk assessment was once reserved only for costly Superfund sites, today this remedial decisionmaking tool is increasingly being used for sites of all sizes and complexities as a cost-effective approach for setting cleanup objectives. Underground storage tank (UST) sites are an excellent example of where a risk assessment often is not required by regulatory agencies, but is rapidly becoming a cost-effective approach for setting cleanup objectives for these sites. Due to the financial constraints by state-funded programs to remediate all UST sites to pristine conditions, regardless of current and reasonable future land use, regulators and industry are recognizing the need to base cleanups on health risks rather than overly stringent uniform standards.

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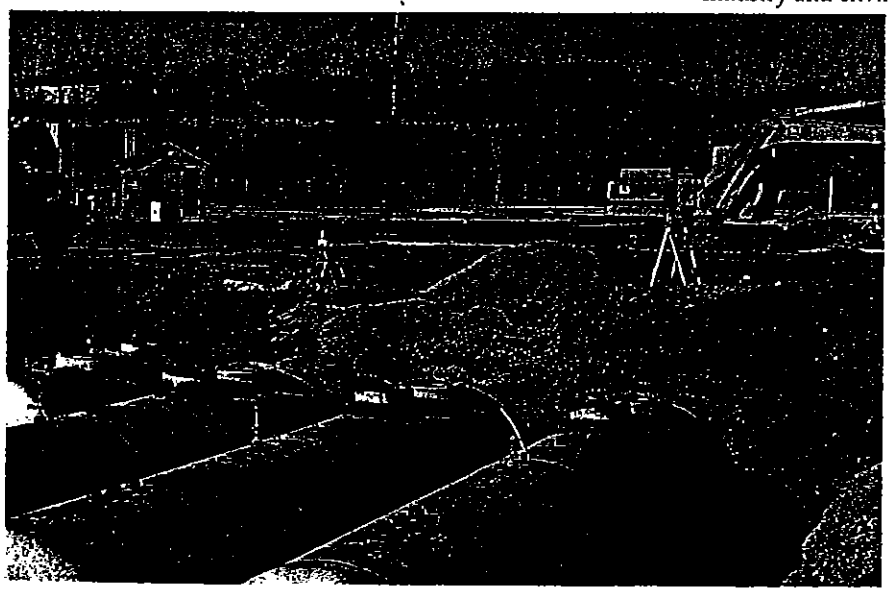
Since the promulgation of the U.S. Environmental Protection Agency's (EPA's) UST regulations, which established minimum upgrade and financial assurance requirements for owners and operators of USTs, the number of UST sites requiring corrective action has dramatically increased. Although the funding required by site cleanup programs has increased, many states do not have adequate resources to finance the remediation of all UST sites so that they meet the stringent cleanup levels often established by state regulatory programs. Understanding that a more effective management of available funding is needed, industry and environmental regulatory agencies are beginning to recognize the value of basing cleanups on health risks rather than an overly stringent uniform standard.



The release of petroleum products at a site can be a minor incident, or a serious contamination problem. The first step after experiencing a release is clear — the magnitude of the contamination must be determined. Normally, the extent of contamination is determined through soil and groundwater sampling, and if applicable, surface water sampling would also be performed.

Once the data have been collected and the extent of contamination has been determined, the least expensive approach for developing cleanup goals at the site should be ascertained. Risk assessment is the method of choice by many site owners and regulators. It is the quickest and most cost-effective way of developing and supporting either a "no action" decision or a remediation plan. The power of risk assessment lies in its flexibility. Risk assessment methods can be used to screen contamination levels and determine if no further action is necessary, or they can be applied to a site that has four different contaminated

Water Quality Criteria are presented, and the data are compared, but there is no quantitative development of risk estimates. For soil contamination, the ecological risk evaluation discusses the likelihood that sensitive receptors would be exposed to the site contaminants.

The Tier I risk assessment normally costs $3,000 to $5,000 to perform. The savings to the site owners may be very significant, especially if it can be shown that there are no receptors who may come into contact with a particular part of a site.

Tier II. Tier I assessment is necessarily conservative. A Tier II assessment is intended to reduce the uncertainty in the assessment conclusions by introducing more site-specific information with application of more accurate assessment procedures. Tier II sites are typically more complicated in the number of contaminated media and require more evaluation of fate and transport issues. A need for careful consideration of fate and transport of contaminants would be especially important if free product were present at the site. A site with free product (either in the soil or on the water table) would often be considered at least a Tier II site because of the higher probability of exposure and a presumption of higher cleanup costs.

Offsite migration of contamination may also be an issue for a Tier II site. There may be a surface water body directly offsite used for recreational purposes, or protected under a wildlife habitat ordinance. The potential for offsite migration of the contaminants needs to be quantitatively evaluated so that an estimate of the potential human or ecological harm can be evaluated.

The Tier II site normally has a limited number of contaminants whose toxicity and chemical parameters are well established in the literature. The ecological risk assessment is still qualitative, but the fate and transport modeling is the most deciding factor in pushing a site's needs from Tier I to Tier II. The cost of a Tier II risk assessment can vary depending on the complexity of the site, but generally the risk assessments cost between $6,000 and $10,000. A site owner could expect that realistic risk-based remediation goals may save him or her as much as 10 times the amount of money invested in the risk assessment for the site.

Tier III. Tier III sites involve the use of more complicated fate and transport models, and usually have multiple of contaminants that may not all be from the same family of chemicals. Statistical evaluation of relatively large data sets adds a substantial cost to the risk assessment process. The human health risks are often calculated for multiple scenarios and multiple exposure pathways for these sites.

Tier III is the point at which ecological risks are assessed quantitatively in a similar fashion as the human health risks. The evaluation of surface water concentrations compared with levels that would be protective of aquatic life was performed in the previous two tiers, but the quantitative evaluation of risks to birds and terrestrial wildlife is more complex at this level. The guidelines for ecological risk assessment are not as well developed as those for human health risks. EPA has developed exposure factors for certain wildlife species, which has made it possible to perform a low-cost ecological risk assessment. The quantitative ecological risk assessment is now being requested much more often by regulators and the methods for ecological risk assessment are becoming much more standardized. Further standardization of ecological risk assessment, combined with increased demand by regulators may lead to ecological concerns being addressed at Tiers I and II in the future.

Summary

A tiered approach to risk assessment and corrective action decisionmaking is the most cost-effective strategy for corrective action at contaminated sites. The strategy described here is similar to that presented in ASTM standard ES-38 94. The primary difference between these approaches is the neglect of ecological risk assessment in the ASTM RBCA standard. Ecological risks can drive corrective action, particularly at sites where contamination discharges to surface waters on or very near the site.

With more than 250,000 petroleum releases reported to regulatory agencies nationwide, available funding cannot restore each site to pristine conditions. Average corrective action cost estimates range from $100,000 to $500,000 per site. Any attempt to restore each site's groundwater to drinking water standards will result in bankrupting state funding mechanisms, leaving many "risky" sites unremediated. Consistent application of a RBCA approach will direct available funds to the riskiest sites, resulting in the greatest possible risk reduction.

A tiered approach to the risk assessment process itself is also cost-effective. Sites where the next remedial decision (e.g., remove floating product) is obvious will not require much allocation of resources to assessment. Additional assessment may be indicated when the first corrective action step is completed. Assessment resources will be allocated to sites where Tier I or II risk assessment findings are substantially uncertain and potential corrective action costs are large.

References

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