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FINAL
TREATABILITY STUDY IN SUPPORT OF INTRINSIC REMEDIATION FOR THE AAFES SERVICE STATION (SITE 56)

at

MACDILL AIR FORCE BASE
TAMPA, FLORIDA

October 1996

Prepared for:

AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE
TECHNOLOGY TRANSFER DIVISION
BROOKS AIR FORCE BASE
SAN ANTONIO, TEXAS

AND

6 CES/CEVR
MACDILL AIR FORCE BASE
TAMPA, FLORIDA

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TABLE OF CONTENTS

Page

EXECUTIVE SUMMARY ES-1

SECTION 1 - INTRODUCTION 1-1

1.1 Scope and Objectives 1-1
1.2 Facility and Site Background 1-3

SECTION 2 - SITE CHARACTERIZATION ACTIVITIES 2-1

2.1 Drilling, Soil Sampling, and Monitoring Point Installation 2-2
2.1.1 Groundwater Monitoring Point Locations and Completion Intervals 2-2
2.1.2 Groundwater Monitoring Point Installation and Soil Sampling Procedures 2-2
2.1.2.1 Pre-Installation Activities 2-2
2.1.2.2 Equipment Decontamination Procedures 2-6
2.1.2.3 Borehole Placement and Soil Sampling 2-6
2.1.3 Monitoring Point Installation 2-9
2.1.3.1 Monitoring Point Materials Decontamination 2-9
2.1.3.2 Monitoring Point Casing and Screen 2-9
2.1.3.3 Sand Filter Pack 2-9
2.1.3.4 Annular Sealant 2-10
2.1.3.5 Flush-Mount Protective Cover 2-10
2.1.4 Monitoring Point Development 2-10
2.2 Groundwater Sampling 2-10
2.2.1 Groundwater Sampling Locations 2-11
2.2.2 Preparation and Equipment Cleaning 2-12
2.2.3 Groundwater Sampling Procedures 2-12
2.2.3.1 Preparation of Location 2-12
2.2.3.2 Water Level and Total Depth Measurements 2-13
2.2.3.3 Well/Monitoring Point Purging 2-13
2.2.3.4 Sample Collection 2-13
2.2.4 Onsite Chemical Parameter Measurement 2-13
2.2.4.1 Dissolved Oxygen Measurements 2-13
2.2.4.2 pH and Temperature Measurements 2-14
2.2.4.3 Hach® and CHEMet® Field Chemistry Measurements 2-14
2.2.5 Sample Handling 2-14
2.2.5.1 Sample Containers, Preservation, and Labels 2-14
2.2.5.2 Sample Shipment 2-15
2.3 Aquifer Testing 2-15

TABLE OF CONTENTS (Continued)

Page

2.4 Surv 2-15

SECTION 3 - PHYSICAL CHARACTERISTICS OF THE STUDY AREA 3-1

3.1 Ground Surface Topography and Surface Water Hydrology 3-1
3.2 Climatology 3-2
3.3 Manmade Features 3-2
3.4 Regional Geology and Hydrogeology 3-2
3.5 Site Geology and Hydrogeology 3-2
3.6 Groundwater Use 3-9

SECTION 4 - NATURE AND EXTENT OF CONTAMINATION AND SOIL AND GROUNDWATER GEOCHEMISTRY 4-1

4.1 Sources of Contamination 4-1
4.2 Soil Chemistry 4-1
4.2.1 Soil Screening 4-1
4.2.2 Magnitude and Extent of BTEX in Soil 4-3
4.2.3 Magnitude and Extent of Total Petroleum Hydrocarbons in Soil 4-3
4.2.4 Total Organic Carbon 4-5
4.3 Groundwater Chemistry 4-5
4.3.1 Dissolved Hydrocarbon Contamination 4-5
4.3.1.1 Dissolved BTEX Contamination 4-5
4.3.1.2 Dissolved TPH Contamination 4-10
4.3.2 Halogenated Volatile Organic Compounds 4-10
4.3.3 Surface Water and Sediment Quality 4-10
4.3.4 Inorganic Chemistry and Geochemical Indicators of Biodegradation 4-11
4.3.4.1 Dissolved Oxygen 4-12
4.3.4.2 Nitrate/Nitrite 4-15
4.3.4.3 Ferrous Iron 4-17
4.3.4.4 Sulfate 4-19
4.3.4.5 Methane 4-21
4.3.4.6 Reduction/Oxidation Potential 4-23
4.3.4.7 Alkalinity 4-23
4.3.4.8 pH 4-23
4.3.4.9 Temperature 4-25
4.3.4.10 Total Assimilative Capacity 4-25

SECTION 5 - GROUNDWATER MODELING 5-1

5.1 General Overview and Model Description 5-1
5.2 Conceptual Model Design and Assumptions 5-2
5.3 Initial Model Setup 5-2

TABLE OF CONTENTS (Continued)

Page

5.3.1 Grid Design and Boundary Conditions 5-2
5.3.2 Groundwater Elevation and Gradient 5-5
5.3.3 BTEX Concentrations 5-5
5.3.4 Dissolved Oxygen 5-6
5.3.5 Anaerobic Degradation Rates 5-6
5.4 Model Calibration 5-10
5.4.1 Water Table Calibration 5-10
5.4.2 BTEX Plume Calibration 5-15
5.4.2.1 Discussion of Parameters Varied During Plume Calibration 5-18
5.5 Sensitivity Analysis 5-19
5.6 Model Results 5-27
5.6.1 Simulation of Intrinsic Remediation Alone (Models 56_A, and 56_B) 5-27
5.6.2 Engineered Source Reduction (Models 56_C and 56_D) 5-33
5.7 Conclusions and Discussion 5-41

SECTION 6 - COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES 6-1

6.1 Remedial Alternative Evaluation Criteria 6-1
6.1.1 Long-Term Effectiveness and Permanence 6-1
6.1.2 Implementability 6-2
6.1.3 Cost 6-2
6.2 Factors Influencing Alternatives Development 6-2
6.2.1 Program Objectives 6-2
6.2.2 Contaminant Properties 6-3
6.2.3 Site-Specific Conditions 6-4
6.2.3.1 Groundwater and Soil Characteristics 6-4
6.2.3.2 Potential Exposure Pathways 6-6
6.2.3.3 Remediation Goals for Shallow Groundwater 6-7
6.2.4 Summary of Remedial Technology Screening 6-8
6.3 Brief Description of Remedial Alternatives 6-13
6.3.1 Alternative 1--Intrinsic Remediation and Institutional Controls with Long-Term Groundwater and Surface Water Monitoring 6-13
6.3.2 Alternative 2--Soil Vapor Extraction and Bioventing/Biosparging I n Source Area, Intrinsic Remediation, and Institutional Controls with Long-Term Groundwater and Surface Water Monitoring 6-14
6.3.3 Alternative 3--Groundwater Extraction and Treatment, Soil Vapor Extraction and Bioventing, Intrinsic Remediation, and Institutional Controls with Long-Term Groundwater and Surface Water Monitoring 6-15

TABLE OF CONTENTS (Continued)

Page

6.3.4 Alternative 4--Soil Excavation and *Ex Situ* Treatment, Intrinsic Remediation, and Institutional Controls with Long-Term Groundwater and Surface Water Monitoring 6-16
6.4 Evaluation of Alternatives 6-16
6.4.1 Alternative 1--Intrinsic Remediation and Institutional Controls with Long-Term Groundwater and Surface Water Monitoring 6-16
6.4.1.1 Effectiveness 6-16
6.4.1.2 Implementability 6-17
6.4.1.3 Cost 6-18
6.4.2 Alternative 2 - SVE and Bioventing/Biosparging in Source Area, Intrinsic Remediation, and Institutional Controls with Long-Term Groundwater Monitoring 6-18
6.4.2.1 Effectiveness 6-18
6.4.2.2 Implementability 6-18
6.4.2.3 Cost 6-20
6.4.3 Alternative 3-Groundwater Extraction; SVE and Bioventing/ Biosparging in Source Areas; Intrinsic Remediation; and Institutional Controls with Long-Term Groundwater Monitoring 6-20
6.4.3.1 Effectiveness 6-20
6.4.3.2 Implementability 6-22
6.4.3.3 Cost 6-22
6.4.4 Alternative 4- Soil Excavation and *Ex Situ* Treatment, Intrinsic Remediation, and Institutional Controls with Long-Term Groundwater and Surface Water Monitoring 6-24
6.4.4.1 Effectiveness 6-24
6.4.2.2 Implementability 6-24
6.4.2.3 Cost 6-25
6.5 Recommended Remedial Approach 6-25

SECTION 7 - LONG-TERM MONITORING PLAN 7-1

7.1 Overview 7-1
7.2 Monitoring Networks 7-1
7.2.1 Groundwater Monitoring 7-1
7.2.1.1 Long-Term Monitoring Wells 7-2
7.2.2 Point-of-Compliance Wells 7-2
7.3 Surface Water Monitoring 7-9
7.4 Groundwater and Surface Water Sampling 7-9
7.4.1 Analytical Protocol 7-9
7.4.2 Sampling Frequency 7-9

TABLE OF CONTENTS (Continued)

Page

SECTION 8 - CONCLUSIONS AND RECOMMENDATIONS 8-1

SECTION 9 - REFERENCES 9-1

APPENDICES

Appendix A - Information from the *Draft Contamination Assessment Report* (BVWS, 1995)

Appendix B - Geologic Logs, Monitoring Point Installation Records, Monitoring Point/Well Development and Sampling Records, Slug Testing Results, and Survey Data

Appendix C - Laboratory Analytical Data

Appendix D - Model Input Parameters, Related Calculations, and Bioplume Model Mass Balance Error Discussion

Appendix E - Model Input and Output Files

Appendix F - Remedial Alternative Cost Calculations

LIST OF TABLES

No.	Title	Page
2.1	Monitoring Point and Well Completion Data	2-5
2.2	Analytical Protocol for Groundwater and Soil Samples	2-8
3.1	Water Level Data	3-7
4.1	1995 Soil Data for BTEX and TMB Compounds	4-4
4.2	Soil Total Organic Carbon Results	4-6
4.3	1995 Groundwater Quality Data for BTEX and TMB Compounds	4-7
4.4	1995 Groundwater Geochemical Data	4-13
4.5	Total Assimilative Capacity of Site 56 Groundwater	4-26
5.1	Representative First-Order Rate Constants	5-9
5.2	Bioplume II Model Input Parameters	5-11
5.3	Calculation of Retardation Coefficients	5-20
6.1	Point-of-Compliance Remediation Goals for Groundwater and Surface Water	6-9
6.2	Initial Technical Implementability Screening of Technologies and Process Options for Groundwater Remediation	6-10
6.3	Alternative 1 - Cost Estimate	6-19
6.4	Alternative 2 - Cost Estimate	6-21
6.5	Alternative 3 - Cost Estimate	6-23
6.6	Alternative 4 - Cost Estimate	6-26

TABLE OF CONTENTS (Continued)

LIST OF TABLES (Continued)

No.	Title	Page
6.7	Summary of Remedial Alternatives Evaluation Groundwater Remediation	6-27
7.1	Long-Term Groundwater Monitoring Analytical Protocol	7-3
7.2	Point-of-Compliance Groundwaterwater Monitoring Analytical Protocol	7-6
7.3	Long-Term Surface Water Monitoring Analytical Protocol	7-10

LIST OF FIGURES

No.	Title	Page
1.1	Regional Location Map	1-4
1.2	Site Location and Regional Topography	1-5
1.3	Site 56 Layout	1-6
2.1	Cross Section of Geoprobe®	2-3
2.2	Monitoring Point Locations	2-4
3.1	Hydrogeologic Cross-Section Location Map	3-3
3.2	Hydrogeologic Cross-Section A-A'	3-4
3.3	Hydrogeologic Cross-Section B-B'	3-5
3.4	Groundwater Elevation Map, March 1995	3-8
4.1	Total BTEX Concentrations in Soil	4-2
4.2	Total BTEX in Shallow Groundwater, March 1995	4-9
4.3	Dissolved Oxygen Isopleth Map for Shallow Groundwater, March 1995	4-14
4.4	Nirate Isopleth Map for Shallow Groundwater, March 1995	4-16
4.5	Ferrous Iron Isopleth Map for Shallow Groundwater, March 1995	4-18
4.6	Sulfate Isopleth Map for Shallow Groundwater, March 1995	4-20
4.7	Methane Isopleth Map for Shallow Groundwater, March 1995	4-22
4.8	Redox Potentials for Shallow Groundwater, March 1995	4-24
5.1	Model Grid Superimposed on Dissolved BTEX Isopleths	5-3
5.2	Calibrated Groundwater Surface	5-14
5.3	Locations of Simulated Injection Wells	5-16
5.4	Calibrated BTEX Plume	5-17
5.5	Concentrations Distributions for Various Values of Transmissivity (T)	5-22
5.6	Concentration Distributions for Various Values of Retardation (R)	5-23
5.7	Concentration Distributions for Various Anaerobic Decay Coefficients	5-24
5.8	Concentration Distributions for Various Values of Dispersion (D)	5-25
5.9	Simulated Maximum BTEX Concentrations in Plume Source Area Model 56_A	5-28
5.10	Simulated Maximum BTEX Concentrations at Drainage Ditch	5-29
5.11	Predicted BTEX Plume AFter 10 Years, Model 56_A	5-30

TABLE OF CONTENTS (Continued)

LIST OF FIGURES (Continued)

No.	Title	Page
5.12	Predicted BTEX Plume AFter 31 Years, Model 56_A	5-31
5.13	Predicted BTEX Plume AFter 51 Years, Model 56_A	5-32
5.14	Simulated Groundwater Surface, Model 56-B	5-34
5.15	Simulated Maximum BTEX Concentrations at Downgradient Model Boundary	5-35
5.16	Simulated BTEX Plume After 10 Years, Model 56-B	5-36
5.17	Simulated BTEX Plume After 31 Years, Model 56-B	5-37
5.18	Simulated BTEX Plume After 51 Years, Model 56-B	5-38
5.19	Comparison of Simulated Maximum BTEX Concentrations at Drainage Ditch Models 56_A and 56_C	5-39
5.20	Comparison of Simulated Maximum Source Area BTEX Concentrations Models 56_A and 56_C	5-40
5.21	Comparison of Simulated Maximum BTEX Concentrations at Downgradient Model Boundary Models 56_B and 56_D	5-42
7.1	Proposed Locations of Long-Term Monitoring and Point-of-Compliance Sampling Stations	7-7
7.2	Proposed Monitoring Well Completion Diagram	7-8

EXECUTIVE SUMMARY

This report presents the results of an intrinsic remediation treatability study (TS) performed by Parsons Engineering Science, Inc. (Parsons ES) at the Army Air Force Exchange (AAFES) Service Station (Site 56), MacDill Air Force Base (AFB, the Base), Tampa, Florida to evaluate the use of intrinsic remediation (natural attenuation) with long-term monitoring (LTM) as a remedial option for dissolved benzene, toluene, ethylbenzene, and xylenes (BTEX) contamination in the shallow saturated zone. Soil and groundwater contamination is documented for the site, with contamination being present in the aqueous (i.e., dissolved) and gaseous phases and as residual light nonaqueous-phase liquid (LNAPL) within the aquifer matrix. There is no evidence of mobile LNAPL (free product) at this site. This study focused on the impact of dissolved BTEX on the shallow groundwater system and surface water in a drainage ditch at and downgradient from the site. Site history and the results of soil, groundwater, and surface water investigations conducted previously are also summarized in this report.

Comparison of BTEX, electron acceptor, and biodegradation byproduct isopleth maps for groundwater at Site 56 provides strong qualitative evidence of biodegradation of BTEX compounds. Geochemical data strongly suggest that biodegradation of fuel hydrocarbons is occurring at the site, primarily via the anaerobic processes of sulfate reduction and methanogenesis. Patterns in the observed distribution of hydrocarbons, electron acceptors, and biodegradation byproducts provide additional indications that biodegradation is reducing dissolved BTEX concentrations in site groundwater.

An important component of this study was an assessment of the potential for contamination in groundwater to migrate from the source areas to potential receptors at concentrations above regulatory levels intended to be protective of human health and the environment. The Bioplume II model was used to estimate the rate and direction of dissolved BTEX movement through the shallow saturated zone under the influence of advection, dispersion, sorption, and biodegradation. Input parameters for the Bioplume II model were obtained from existing site characterization data, supplemented with data collected by Parsons ES. Model parameters that were not measured at the site were estimated using reasonable literature values.

The results of this study suggest that dissolved BTEX contamination present in groundwater poses no significant threat to human health or the environment in its present, or predicted future, concentration and distribution. However, dissolved BTEX concentrations in excess of state groundwater quality guidelines may persist in the vicinity of the site for approximately 50 years without the implementation of an engineered remedial action. The Air Force therefore recommends that intrinsic remediation with LTM be combined with source removal via bioventing or biosparging as the most appropriate remedial action to address dissolved BTEX contamination found in groundwater at this site.

To verify the Bioplume II model predictions, the Air Force recommends using five LTM wells and three point-of-compliance (POC) monitoring wells to monitor the long-

term migration and degradation of the dissolved BTEX plume. In addition, establishment of three surface water monitoring stations in the downgradient drainage ditch is recommended. Regular sampling and analysis of groundwater and surface water from these sampling points will allow the effectiveness of intrinsic remediation to be monitored and should allow sufficient time to implement additional engineering controls to contain the plume if BTEX compounds are detected in the drainage ditch or the POC wells at levels of concern. Contaminant fate and transport model results indicate that these stations should be sampled on an annual basis for approximately 14 years. Along with other analyses used to verify the effectiveness of intrinsic remediation, the groundwater samples should be analyzed for BTEX compounds by US Environmental Protection Agency Method SW8020. If BTEX concentrations in groundwater from the POC wells exceed the Florida Department of Environmental Protection (FDEP) guidelines of 50 micrograms per liter (µg/L) for benzene and total BTEX, or if concentrations in ditch water exceed the state guidelines of 71.28 µg/L for benzene, additional corrective actions may be required to remediate groundwater at the site.

such mandated investigations and reports. A secondary goal of this multi-site initiative is to provide a database from multiple sites that demonstrates that natural processes of contaminant degradation often can reduce contaminant concentrations in groundwater to below acceptable cleanup standards before potential receptor exposure pathways are completed.

The scope of work for this project involved the following tasks:

- Reviewing existing hydrogeologic and soil and groundwater quality data for the site;
- Conducting supplemental site characterization activities to determine the nature and extent of soil and groundwater contamination and to collect geochemical data in support of intrinsic remediation;
- Developing a conceptual hydrogeologic model of the shallow saturated zone, including the current distribution of contaminants;
- Determining if naturally occurring processes of contaminant attenuation and destruction are occurring in groundwater at the site;
- Simulating the fate and transport of fuel hydrocarbons [benzene, toluene, ethylbenzene, and xylenes (BTEX)] in groundwater under the influence of advection, dispersion, adsorption, and biodegradation using the Bioplume II model;
- Evaluating a range of model input parameters to determine the sensitivity of the model to those parameters and to consider several contaminant fate and transport scenarios;
- Determining if naturally occurring processes are sufficient to minimize BTEX plume expansion so that groundwater quality standards can be met at a downgradient point of compliance (POC);
- Developing remedial action objectives (RAOs) and reviewing available remedial technologies;
- Using the results of modeling to recommend the most appropriate remedial option based on specific effectiveness, implementability, and cost criteria; and
- Providing a long-term monitoring (LTM) plan that includes LTM and POC well locations and a sampling and analysis plan.

Site characterization activities in support of intrinsic remediation, performed in March and April 1995, included use of the Geoprobe® system for soil sample collection and monitoring point installation; aquifer testing; and sampling and analysis of groundwater from newly installed monitoring points and existing monitoring wells.

Site-specific data were used to develop a fate and transport model for the site using the groundwater flow and solute transport model Bioplume II, and to conduct a

preliminary exposure pathways analysis. The Bioplume II model was used to simulate the movement of dissolved BTEX in the shallow saturated zone under the influence of advection, dispersion, sorption, and biodegradation. Model results were used to help assess the potential for completion of exposure pathways involving groundwater and to identify whether intrinsic remediation with LTM is an appropriate and defensible remedial option for contaminated groundwater.

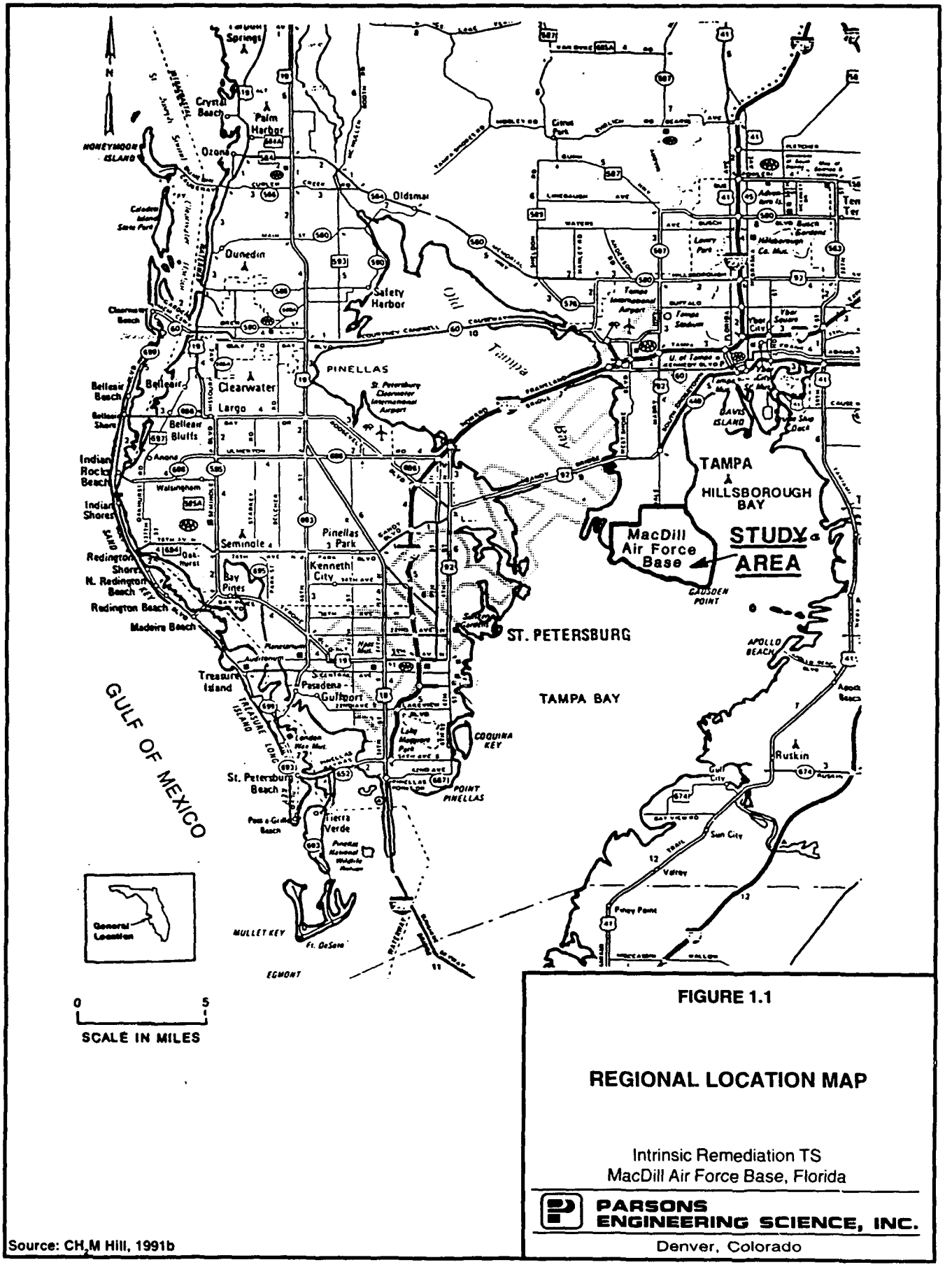
Much of the hydrogeologic and groundwater chemical data necessary to evaluate the various remedial options was available from previous investigations conducted at this site or at other sites with similar characteristics, or in the technical literature. The field work conducted under this program was oriented toward the collection of supplementary hydrogeologic and chemical data necessary to document and model the effectiveness of intrinsic remediation with LTM for fuel-hydrocarbon-contaminated groundwater.

This report contains nine sections, including this introduction, and six appendices. Section 2 summarizes site characterization activities. Section 3 summarizes the physical characteristics of the study area. Section 4 describes the nature and extent of soil and groundwater contamination and the geochemistry of soil and groundwater at the site. Section 5 describes the Bioplume II model and design of the conceptual model for the site, lists model assumptions and input parameters, and describes sensitivity analyses, model output, and the results of the Bioplume II modeling. Section 6 presents a limited comparative analysis of remedial alternatives. Section 7 presents the LTM plan for the site, and Section 8 presents the conclusions of this work. Section 9 lists the references used to develop this document. Appendix A contains pertinent figures and tables containing data collected during the previous site investigation [Black & Veatch Waste Science, Inc. (BVWS), 1995]. Appendix B contains Geoprobe® borehole logs, monitoring point installation, development, and sampling records, slug test results, and survey data. Appendix C presents soil and groundwater analytical results. Appendix D contains calculations and model input parameters, and Appendix E contains Bioplume II model input and output in ASCII format on a diskette. Appendix F contains remedial alternative design and cost calculations.

1.2 FACILITY AND SITE BACKGROUND

The Base, located on the southernmost tip of the Interbay Peninsula, covers nearly 7,000 acres in Hillsborough County, Florida, immediately south of the city of Tampa (Figure 1.1). The Base, which was established in the early 1950's, is bordered to the north by Tampa, to the east by Hillsborough Bay, and to the south and west by Tampa Bay. Site 56 is positioned at the intersection of Tampa Boulevard and Hangar Loop Road in the northeastern portion of the Base (Figure 1.2). Contamination at Site 56 originated from underground storage tanks (USTs) and/or pipelines associated with the AAFES Service Station.

Beneath Site 56 lie six 5,100-gallon USTs containing various grades of gasoline and one 500-gallon UST containing waste motor oil. The 5,100-gallon tanks lie to the north of the pump islands, and the 500-gallon tank is positioned beneath the service station building (Building 555). Figure 1.3 presents the layout for Site 56. Pipelines run from the tanks to the pump islands and from the tanks to an abandoned remote fill



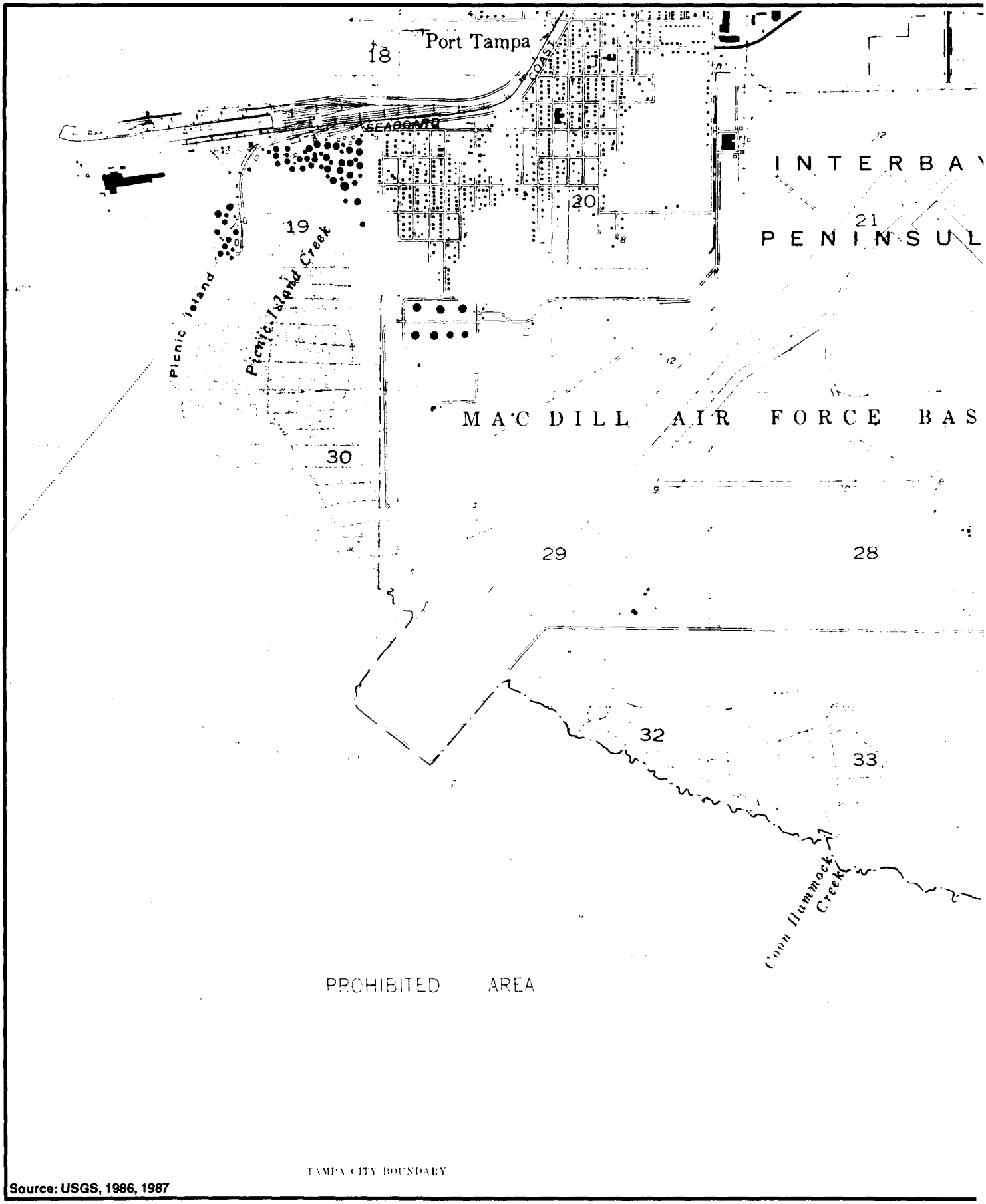
Source: CH2M Hill, 1991b

FIGURE 1.1

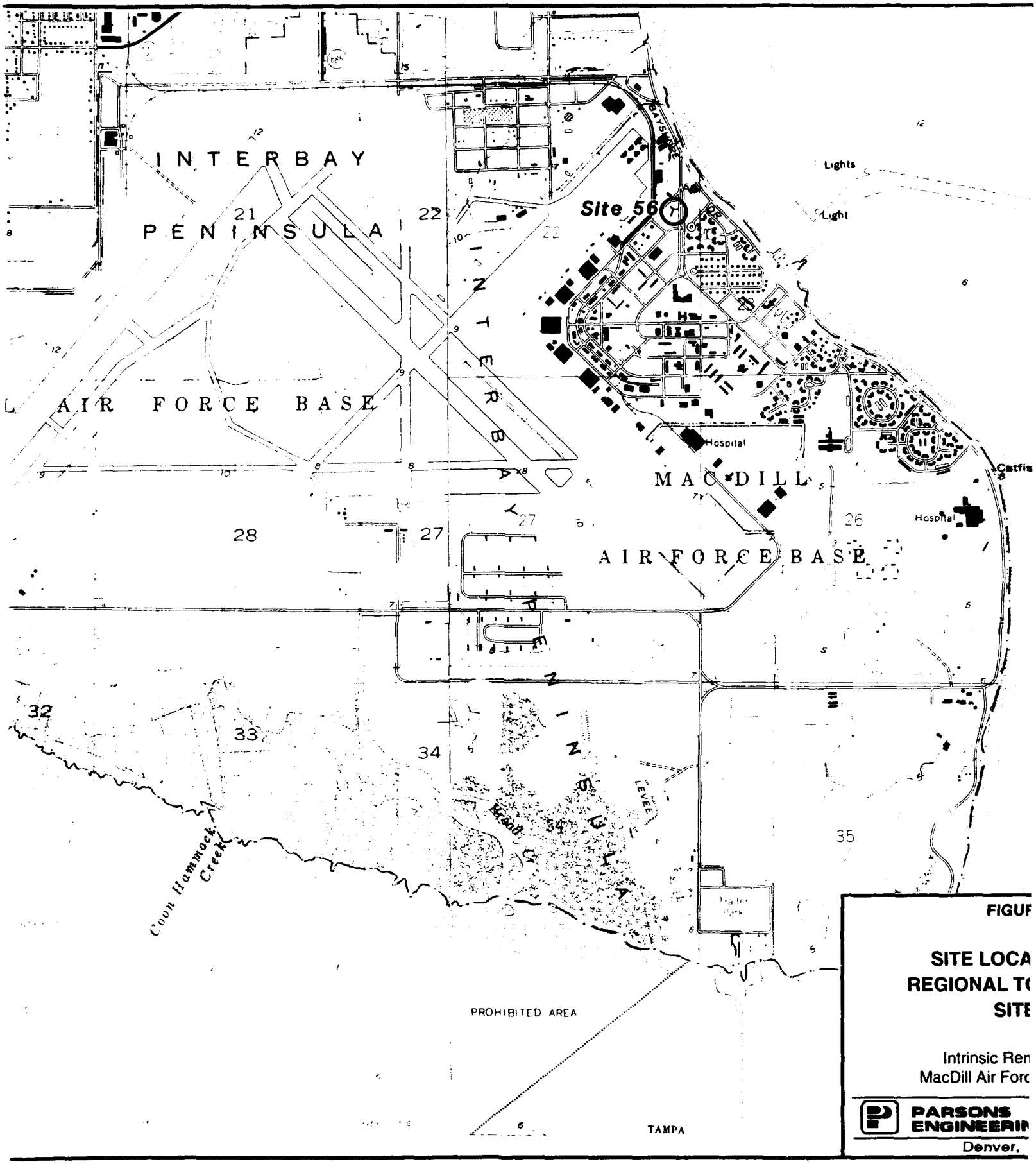
REGIONAL LOCATION MAP

Intrinsic Remediation TS
MacDill Air Force Base, Florida

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado



Source: USGS, 1986, 1987



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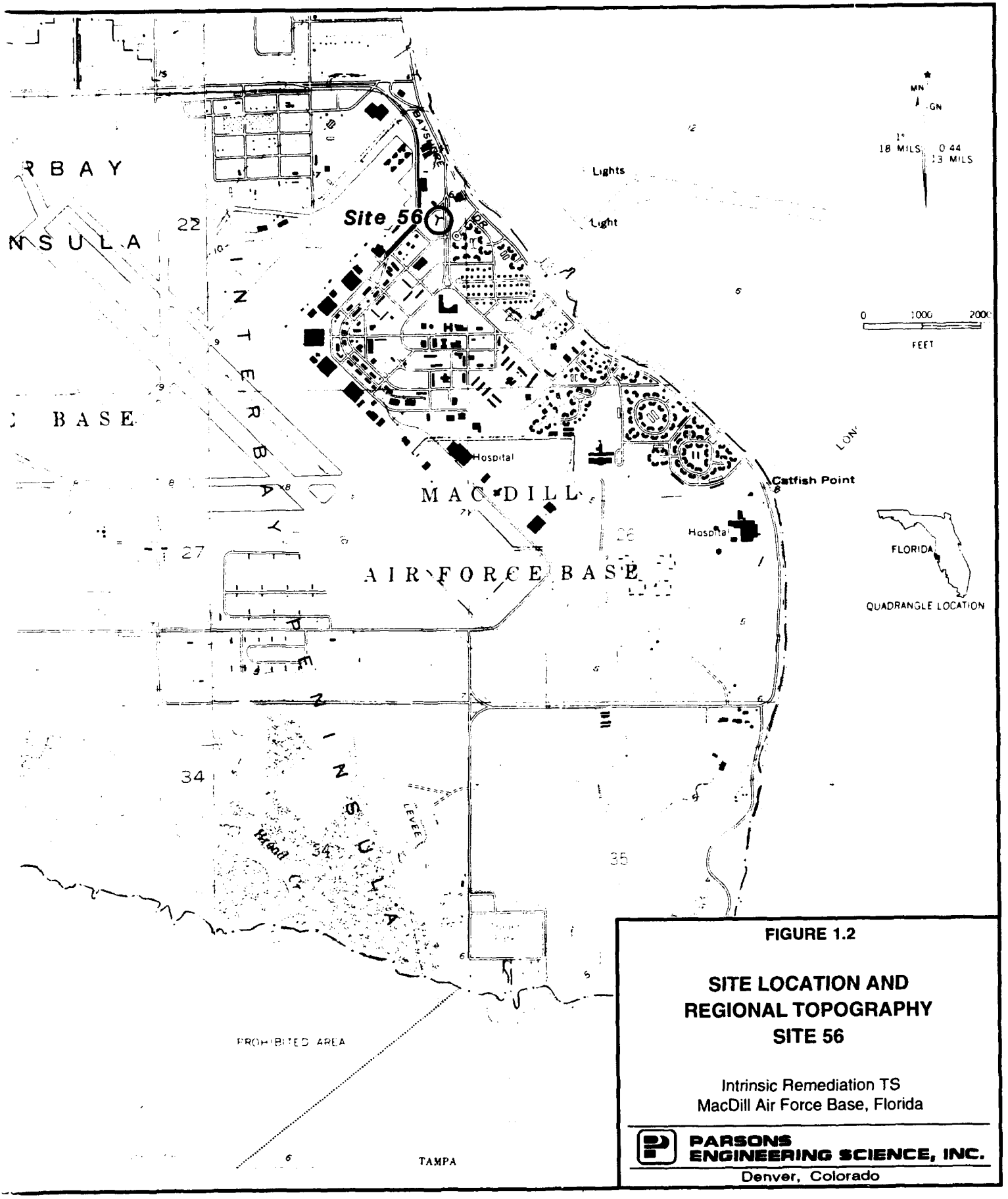

FIGURE 1.2

SITE LOCATION AND REGIONAL TOPOGRAPHY SITE 56

Intrinsic Remediation TS
MacDill Air Force Base, Florida

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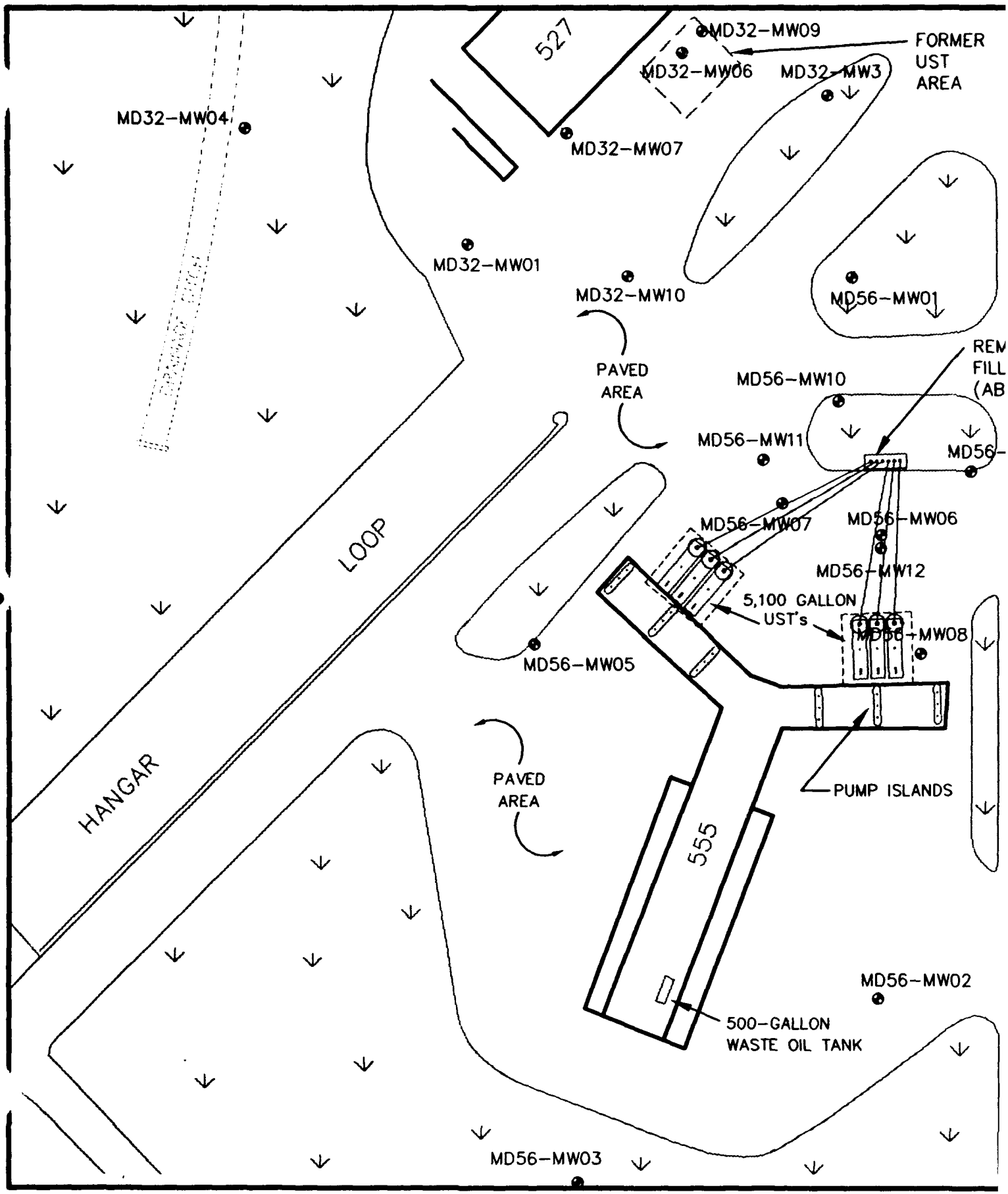
Denver, Colorado



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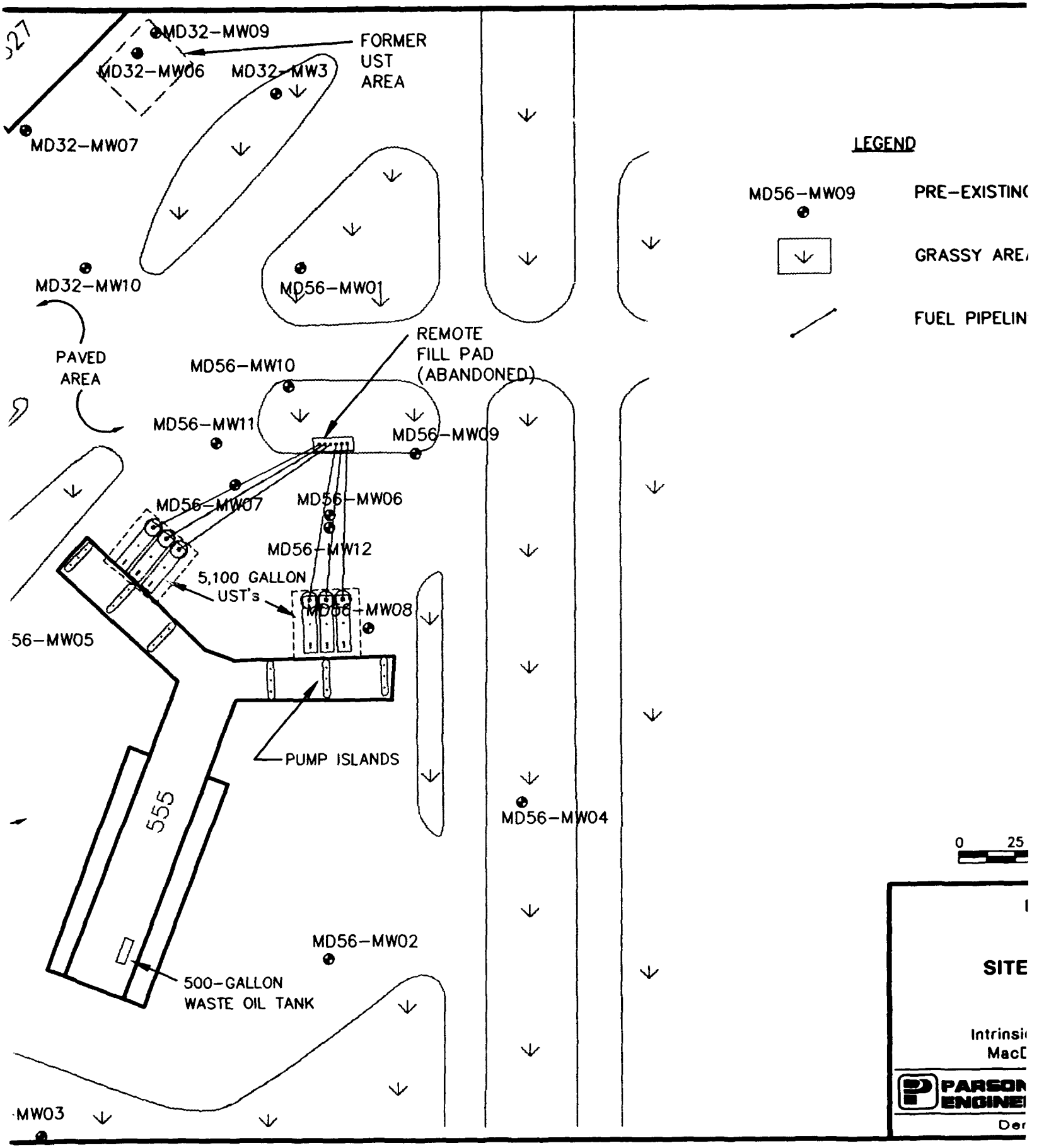
MD32-MW09
FORMER UST AREA
MD32-MW06
MD32-MW3
MD32-MW07
MD32-MW10
MD56-MW01
PAVED AREA
REMOTE FILL PAD (ABANDONED)
MD56-MW10
MD56-MW11
MD56-MW09
MD56-MW07
MD56-MW06
MD56-MW12
5,100 GALLON UST's
MD56-MW08
56-MW05
PUMP ISLANDS
555
MD56-MW04
MD56-MW02
500-GALLON WASTE OIL TANK
MW03
LEGEND
MD56-MW09
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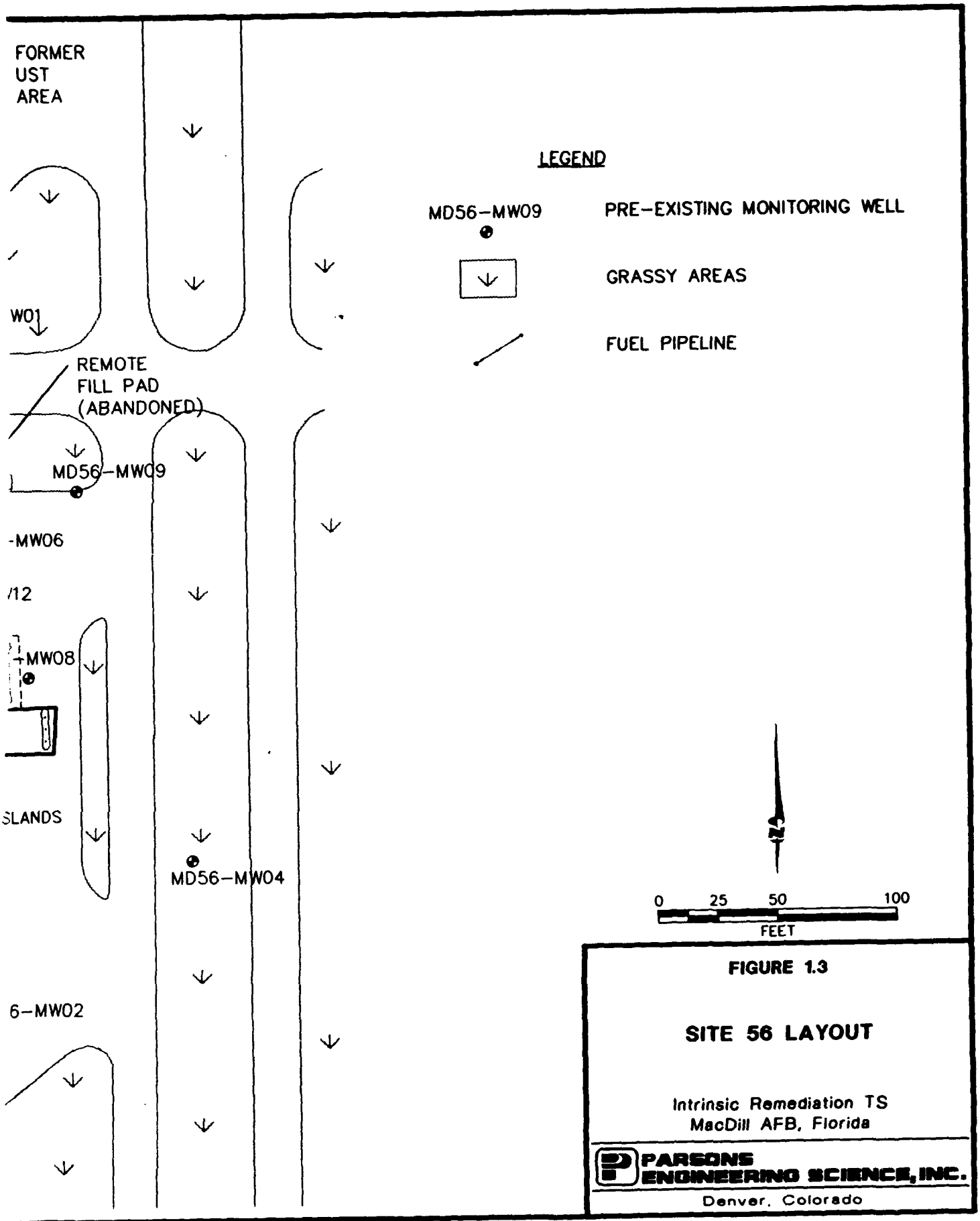


FIGURE 1.3

SITE 56 LAYOUT

Intrinsic Remediation TS
MacDill AFB, Florida

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

pad located north of the tanks. Prior to being equipped with overfill shut-off valves to prevent spillage, spills during filling of the six gasoline USTs occurred. Potential sources of contamination at Site 56 include areas of past spills around the six larger USTs, leakage from these tanks, and/or leakage from pipelines leading from the tanks to the pump islands or the abandoned remote filling pad. Removal of all USTs from the site may occur in 1997, when the AAFES Service Station is tentatively scheduled to be closed.

Eighteen Hydrocone® groundwater samples were collected from Site 56 in September 1993 by BVWS to delineate the extent of the suspected contaminant plume. Samples were screened for fuel components and volatile hydrocarbons using a portable gas chromatograph. In addition, seven monitoring wells were installed in October and November 1993. Slug tests were performed in the monitoring wells in order to estimate the hydraulic conductivity of the screened intervals. Soil and groundwater samples for laboratory chemical analysis were also collected during and after the monitoring well installation. In February 1994, headspace screening was performed on shallow soil samples from 62 locations to delineate the areal extent of soil contamination at Site 56. Also in February 1994, surface water and sediment samples were collected from six locations in a drainage ditch at the adjacent Site 32.

In June and July 1994, BVWS installed an additional five monitoring wells and collected groundwater samples in an effort to more accurately delineate groundwater contamination in the surficial aquifer. During the same 2-year period, BVWS also performed a contaminant assessment at the adjacent Site 32. Site 32 is a former service station located to the north of Site 56, and has documented petroleum contamination associated with leaks and spills at eight former USTs.

The results of the BVWS (1995) investigations at Sites 56 and 32 are summarized in the *Final Contamination Assessment Report*. Selected tables and figures from this report are contained in Appendix A of this document. Soil and groundwater beneath Site 56 were determined to be contaminated with fuel-related constituents in the vicinity of the USTs at Site 56. The maximum total concentrations of BTEX detected in soil and groundwater were 1,260,300JH micrograms per kilogram (µg/kg) and 17,160 micrograms per liter (µg/L), respectively (Appendix A). The qualifier "JH" indicates that the results may be biased high based on high surrogate recovery. Soil and groundwater contamination also were detected at the adjacent Site 32. Relatively low levels of volatile aromatic hydrocarbons were detected in surface water and sediment samples collected in the drainage ditch (Appendix A). The site-specific data presented in Sections 3, 4, and 5 are based on a review of the BVWS (1995) document and on data collected by Parsons ES under this program.

SECTION 2

SITE CHARACTERIZATION ACTIVITIES

This section presents the methods used by Parsons ES personnel to collect site-specific data at Site 56, the AAFES Service Station, MacDill AFB, Florida. To meet the requirements of the intrinsic remediation demonstration, additional data were required to evaluate near-surface geology and geochemistry, aquifer properties, and the extent of soil and groundwater contamination. Site characterization activities involved using the Geoprobe® system for soil sampling and groundwater monitoring point placement. Previous investigations conducted at the site utilized standard hollow-stem auger (HSA) drilling and soil sampling as well as sampling of groundwater via monitoring wells and Hydrocone®. Groundwater sampling was accomplished during this investigation using both newly installed monitoring points and pre-existing monitoring wells. One aquifer slug test was conducted at a previously installed well.

The physical and chemical data listed below were collected during the field work phase of the TS:

- Depth from measurement datum to the water table or potentiometric surface in monitoring wells and monitoring points;
- Stratigraphy of subsurface media;
- Hydraulic conductivity as determined from slug test data;
- Groundwater geochemical data [pH, temperature, electrical conductivity, total alkalinity, reduction/oxidation (redox) potential, dissolved oxygen (DO), chloride, nitrate, nitrite, ammonia, ferrous and total iron, sulfate, sulfide, manganese, ammonia, carbon dioxide, total organic carbon (TOC), and methane];
- Concentrations of chlorinated and aromatic volatile organic compounds (VOCs), total volatile (gasoline-range) petroleum hydrocarbons (TVH), and ethylene in groundwater; and
- Concentrations of aromatic VOCs, TVH, total extractable (diesel-range) petroleum hydrocarbons (TEH), and TOC in soil.

The following sections describe the procedures that were followed when collecting site-specific data. Additional details regarding investigative activities are presented in the draft work plan (Parsons ES, 1995a).

2.1 DRILLING, SOIL SAMPLING, AND MONITORING POINT INSTALLATION

Geoprobe®-related field work occurred between March 6 and March 24, 1995, and consisted of soil sampling and groundwater monitoring point installation for monitoring points 56MP-1S through 56MP-10S. The term "monitoring point" is used in this report to distinguish these groundwater monitoring stations from conventionally constructed monitoring wells. These activities were performed according to the procedures described in the work plan (Parsons ES, 1995a) and in the following sections.

The Geoprobe® system is a hydraulically powered percussion/probing machine used to advance sampling tools through unconsolidated soils. This system provides for the rapid collection of soil, soil gas, and groundwater samples at shallow depths while minimizing the generation of investigation-derived waste materials. Figure 2.1 is a diagram of the Geoprobe® system.

The Geoprobe®-collected soil samples were obtained using a probe-drive sampler. The probe-drive sampler serves as both the driving point and the sample collection device and is attached to the leading end of the probe rods. To collect a soil sample, the sampler was pushed or driven to the desired sampling depth, and the stop pin was removed, allowing the piston and drive point to retract as the sample barrel was pushed into undisturbed soil. The soil cores were retained within a clear acetate liner inside the sampling barrel. The probe rods were then retracted, bringing the sampling device to the surface. The soil sample was then extruded from the liners and transferred to analyte-appropriate jars supplied by the analytical laboratory. A portion of the sample was retained for visual logging and photoionization detector (PID) headspace screening.

2.1.1 Groundwater Monitoring Point Locations and Completion Intervals

Fourteen new groundwater monitoring points were installed at 10 locations to assist in the characterization of the contaminant distribution and the shallow groundwater flow system at Site 56. These points are identified as 56MP-1S, 56MP-2S, 56MP-3S, 56MP-3D, 56MP-4S, 56MP-5S, 56MP-5D, 56MP-6S, 56MP-6D, 56MP-7S, 56MP-7D, 56MP-8S, 56MP-9D, and 56MP-10S. The new monitoring points were installed in the locations shown on Figure 2.2, and Table 2.1 presents completion details. Nested points (e.g., 56MP-3S and 56MP-3D) were installed adjacent to each other, with one point (designated by the suffix "S") screened across the water table, and the other well (designated by the suffix "D") screened approximately 3 to 7 feet below the bottom of the shallow point. The monitoring point locations were selected to provide the hydrogeologic and chemical data necessary for successful implementation of the Bioplume II model and to support the intrinsic remediation demonstration.

2.1.2 Groundwater Monitoring Point Installation and Soil Sampling Procedures

2.1.2.1 Pre-Installation Activities

All subsurface utility lines or other man-made subsurface features were located, and proposed monitoring point locations were cleared and approved by the Base prior to

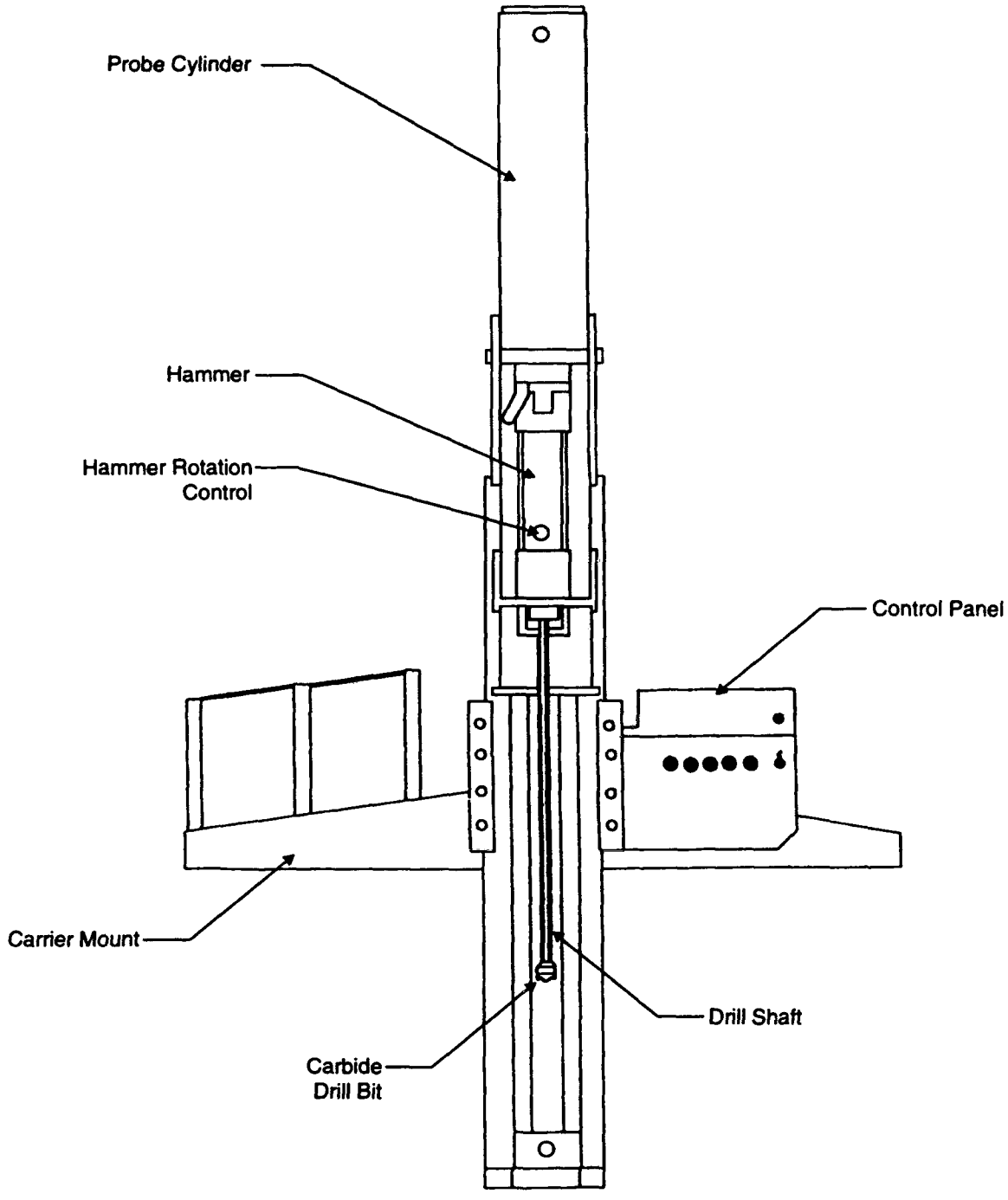


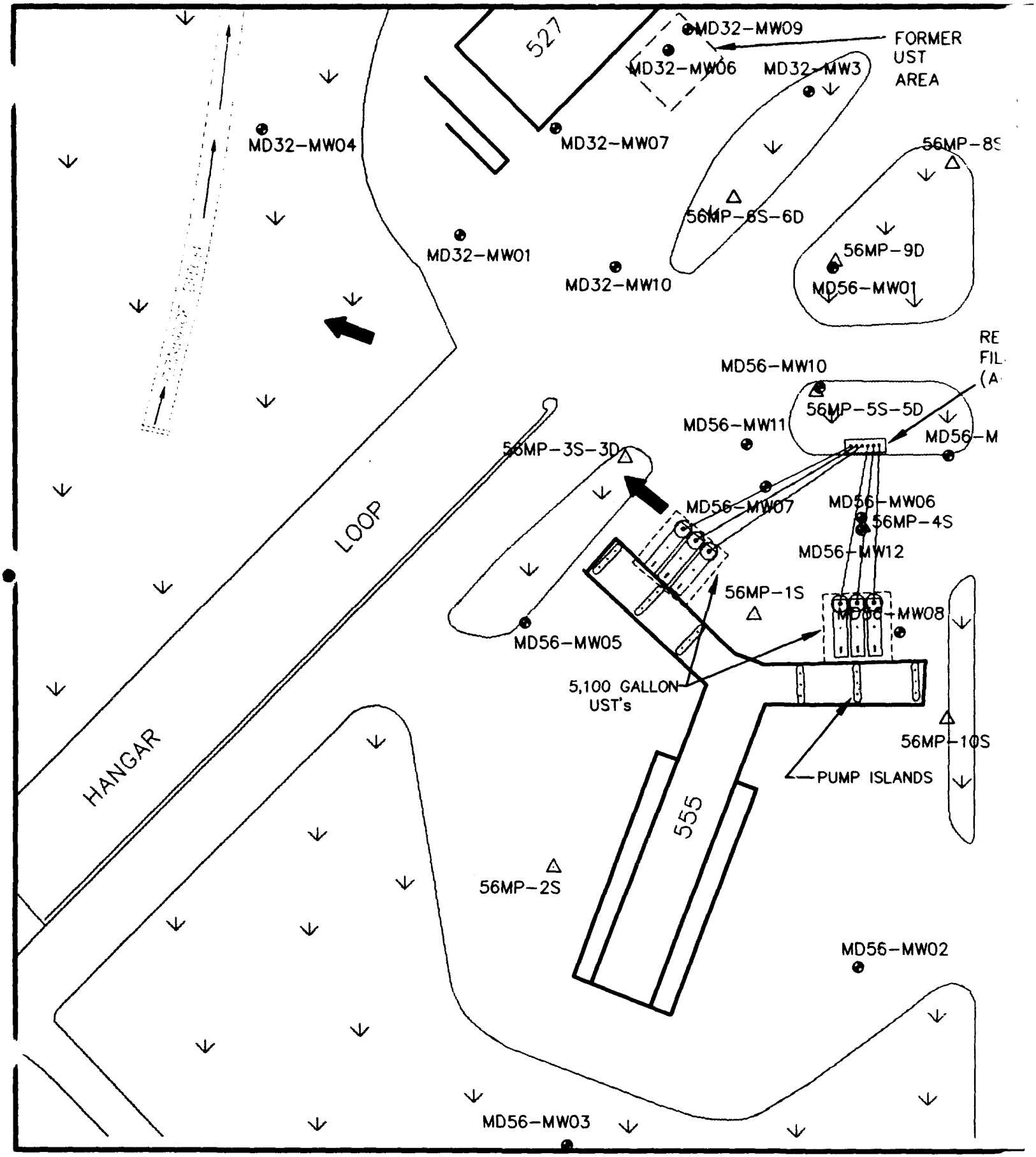
Figure 2.1

CROSS SECTION OF GEOPROBE®

Intrinsic Remediation TS
MacDill Air Force Base, Florida

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

COREL/DRAW/GEOPROBE.CDR NAP 8/29/95 -TIF



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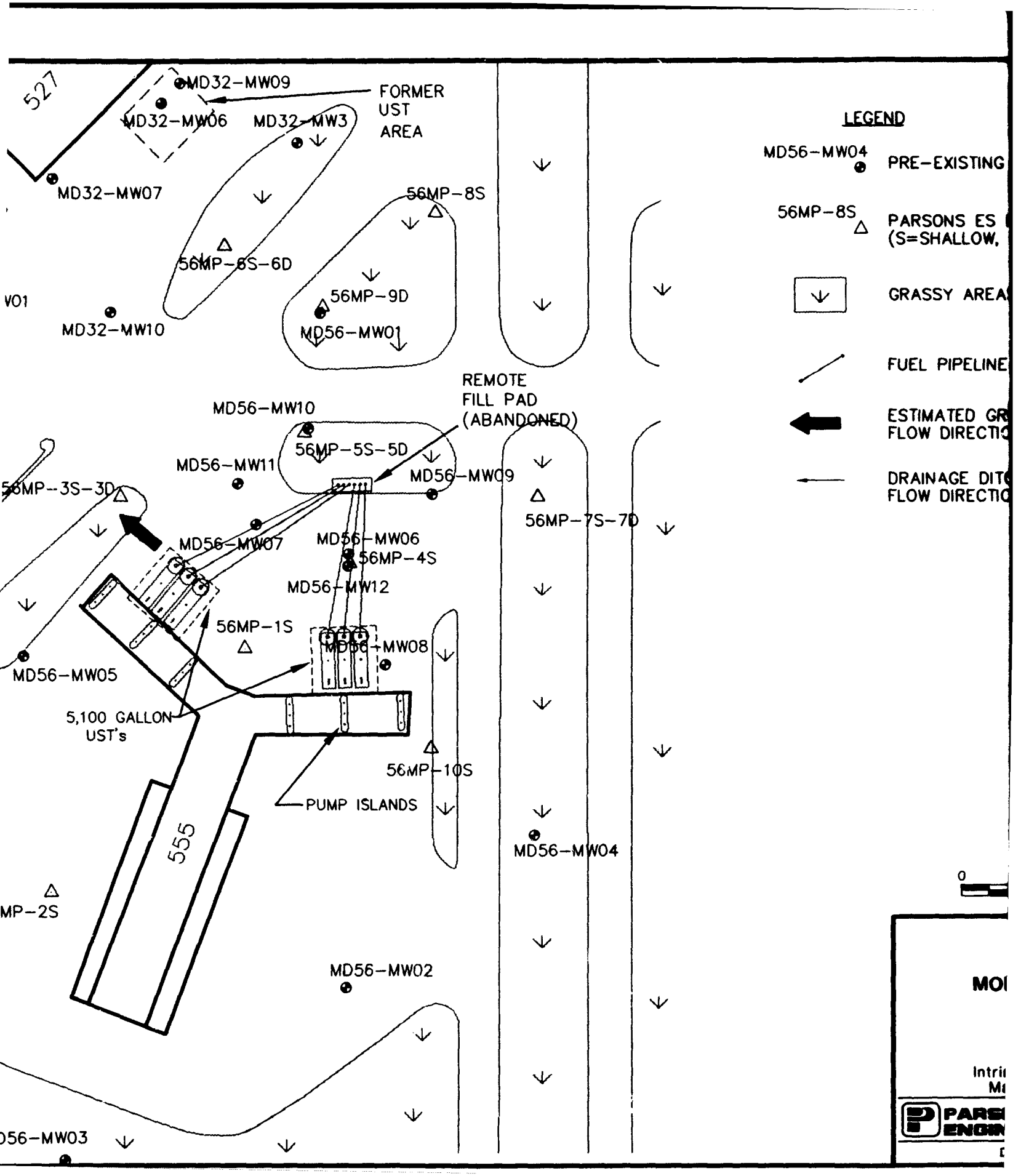

527
MD32-MW09
FORMER
UST
AREA
MD32-MW06
MD32-MW3
MD32-MW07
56MP-8S
56MP-6S-6D
56MP-9D
MD32-MW10
MD56-MW01
REMOTE
FILL PAD
(ABANDONED)
MD56-MW10
56MP-5S-5D
MD56-MW11
MD56-MW09
56MP-3S-3D
56MP-7S-7D
MD56-MW07
MD56-MW06
56MP-4S
MD56-MW12
56MP-1S
MD56-MW08
MD56-MW05
5,100 GALLON
UST's
56MP-10S
PUMP ISLANDS
555
MD56-MW04
MD56-MW02
MD56-MW03
LEGEND
MD56-MW04
PRE-EXISTING
56MP-8S
PARSONS ES
(S=SHALLOW,
GRASSY AREA
FUEL PIPELINE
ESTIMATED GR
FLOW DIRECTIO
DRAINAGE DITC
FLOW DIRECTIO

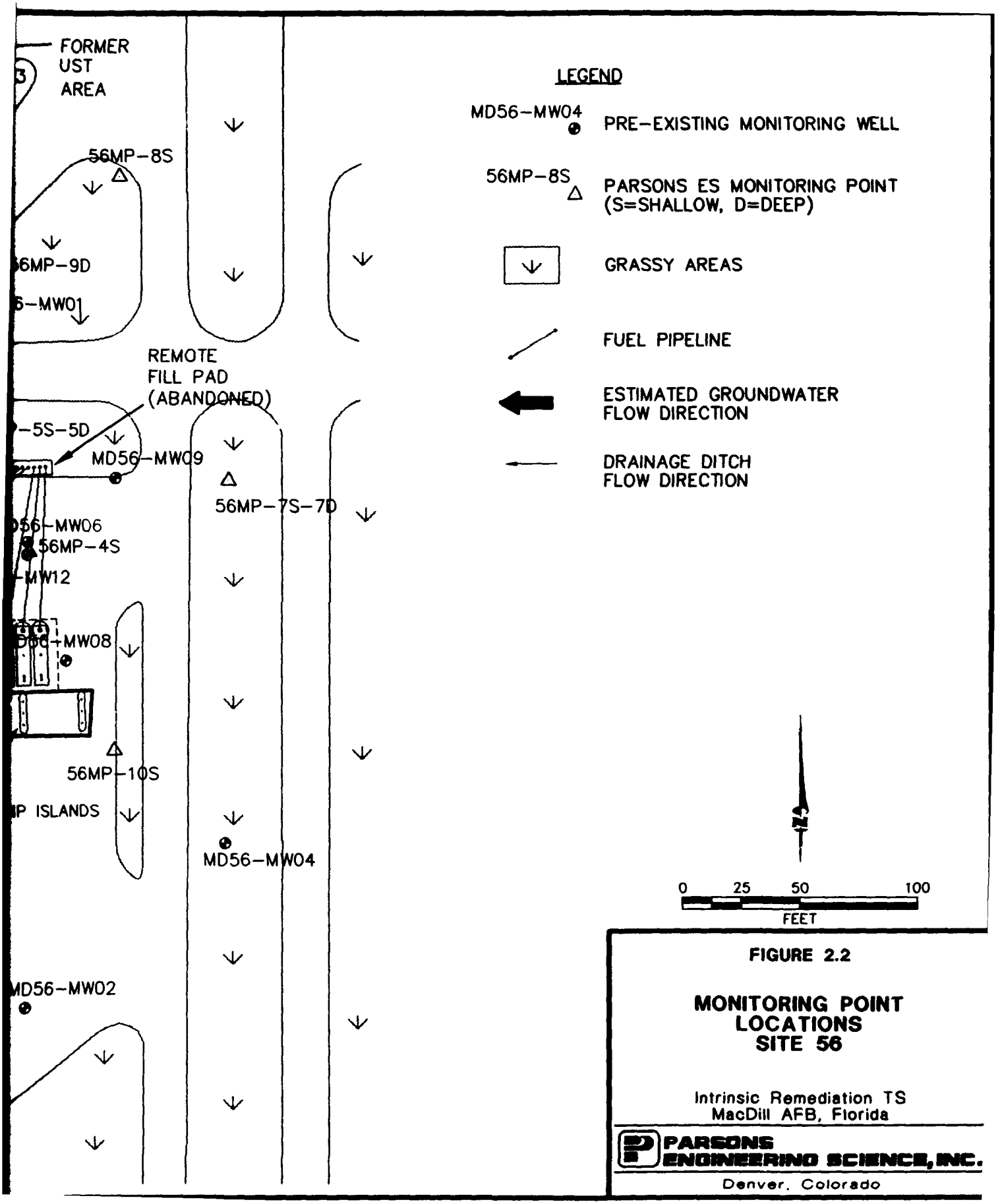


FIGURE 2.2

MONITORING POINT LOCATIONS SITE 56

Intrinsic Remediation TS
MacDill AFB, Florida

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

TABLE 2.1
MONITORING POINT AND WELL COMPLETION DATA
SITE 56
INTRINSIC REMEDIATION TS
MACDILL AFB, FLORIDA

Well Identification	Installation Date	Northing	Easting	Well Diameter (Inches)	Borehole Diameter (Inches)	Total Depth (ft bgs)[a/]	Sandpack Interval (ft bgs)	Screened Interval (ft bgs)	Elevation TOC (ft msl)[b/]	Elevation Ground (ft msl)
56MP-1S	3/17/95	1281421.044	498655.269	0.5	2.0	7.0	1.0-2.0	2.0-7.0	7.922	8.072
56MP-2S	3/17/95	1281310.072	498567.034	0.5	2.0	8.0	1.0-3.0	3.0-8.0	8.002	8.096
56MP-3S	3/17/95	1281491.160	498598.739	0.5	2.0	6.0	0.5-1.0	1.0-6.0	6.719	6.752
56MP-3D	3/17/95	1281491.160	498598.739	0.375	1.0	13.5	NP[c/]	13.0-13.5	NM[d/]	6.752
56MP-4S	3/20/95	1281460.443	498703.610	1.0	2.0	7.0	NP	2.0-7.0	7.556	7.752
56MP-5S	3/20/95	1281519.716	498682.892	1.0	2.0	7.0	1.0-2.0	2.0.-7.0	6.546	6.916
56MP-5D	3/20/95	1281519.716	498682.892	0.375	1.0	10.5	5.0-10.0	10.0-10.5	NM	6.916
56MP-6S	3/20/95	1281603.306	498646.493	1.0	2.0	7.0	NP	2.0-7.0	6.582	6.582
56MP-6D	3/20/95	1281603.306	498646.493	0.375	1.0	10.5	NP	10.0-10.5	NM	6.582
56MP-7S	3/20/95	1281490.048	498789.932	1.0	2.0	7.0	NP	2.0-7.0	7.162	7.236
56MP-7D	3/20/95	1281490.048	498789.932	0.375	1.0	11.0	NP	10.5-11	NM	7.236
56MP-8S	3/20/95	1281618.629	498743.107	1.0	2.0	7.0	1.0-2.0	2.0-7.0	6.549	6.522
56MP-9D	3/20/95	1281575.481	498691.202	0.375	1.0	15.0	NP	14.5-15.0	6.226	6.439
56MP-10S	3/20/95	1281375.800	498740.865	1.0	2.0	7.0	NP	2.0-7.0	7.462	7.602
MD56-MW01	10/24/93	1281573.102	498690.350	2.0	9.8	13.5	1.50-13.50	2.53-11.51	6.359	6.439
MD56-MW02	11/2/93	1281267.489	498701.790	2.0	9.8	13.5	1.70-13.50	2.48-11.46	7.649	7.879
MD56-MW03	11/2/93	1281189.545	498572.792	2.0	9.8	14.0	1.50-14.00	2.50-11.42	5.836	6.012
MD56-MW04	11/2/93	1281336.240	498788.477	2.0	9.8	13.5	1.60-13.50	2.35-11.33	7.319	7.562
MD56-MW05	11/3/93	1281417.781	498553.956	2.0	9.8	13.5	1.75-13.50	2.50-11.48	6.846	7.059
MD56-MW06	11/21/93	1281464.341	498702.891	2.0	9.8	13.5	1.75-13.50	2.50-11.48	7.572	7.752
MD56-MW07	11/21/93	1281477.791	498660.564	2.0	9.8	13.5	1.75-13.50	2.50-11.48	7.296	7.549
MD56-MW08	6/22/94	1281413.687	498720.014	2.0	11.0	13.5	1.9-13.5	2.9-11.87	7.439	7.632
MD56-MW09	6/21/94	1281490.924	498741.734	2.0	11.0	13.5	1.45-13.5	2.2-11.18	6.869	7.062
MD56-MW10	6/21/94	1281520.775	498684.409	2.0	11.0	13.5	2.0-13.5	3.0-11.96	6.686	6.916
MD56-MW11	6/22/94	1281495.927	498652.517	2.0	11.0	13.5	1.9-13.5	2.9-11.87	6.882	7.006
MD56-MW12	7/10/94	1281458.591	498702.952	2.0	11.0	35.7	24.22-35.7	27.74-32.05	7.609	7.752
MD32-MW01	9/7/90	1281586.889	498525.260	2.0	9.8	12.2	1.0-12.10	2.0-11.68	9.672	6.749
MD32-MW03	9/7/90	1281650.178	498679.710	2.0	9.8	12.5	1.0-12.4	2.0-12.2	9.466	6.746
MD32-MW06	10/28/93	1281673.787	498620.758	2.0	9.8	13.0	1.34-13.0	2.31-11.31	6.852	7.019
MD32-MW07	6/23/94	1281634.222	498567.734	2.0	11.0	13.5	1.5-13.5	2.25-11.23	6.719	6.872
MD32-MW09	7/9/94	1281677.071	498626.007	2.0	11.0	27.0	16.6-27.0	19.14-23.48	6.826	7.019
MD32-MW10	8/25/95	1281573.227	498594.143	2.0	9.8	13.5	1.79-13.5	2.54-11.51	6.276	6.489

a/ ft bgs = feet below ground surface.

b/ ft msl = feet above mean sea level.

c/ NP = no sandpack.

d/ NM = not measured.

any drilling activities. Water used in equipment cleaning or grouting was obtained from an onsite potable water supply.

2.1.2.2 Equipment Decontamination Procedures

Prior to arriving at the site and between each monitoring point location, all probe rods, tips, sleeves, pushrods, samplers, tools, and other downhole equipment were decontaminated using an Alconox® detergent and potable water solution followed by a high-pressure potable water wash. All equipment also underwent an additional rinse with isopropyl alcohol followed by a final rinse with deionized water.

During installation operations, the Geoprobe®, probe rods, and any downhole drilling and/or sampling equipment were decontaminated at a site decontamination pad. Water from the decontamination operation was collected in 55-gallon drums and was transported to an on-Base oil/water separator for disposal. Precautions were taken to minimize any impact to the area surrounding the decontamination pad that might result from the decontamination operations. All decontamination activities were conducted in a manner so that the excess water was controlled and not allowed to flow into any open borehole.

Fuel, lubricants, and other similar substances were handled in a manner consistent with accepted safety procedures and standard operating practices. All well completion materials were factory sealed and were not stored near or in areas that could be affected by these substances.

2.1.2.3 Borehole Placement and Soil Sampling

Soil sampling was accomplished using the Geoprobe® method. The boreholes were driven and continuously sampled to the total depth of the borehole. Where two monitoring points were installed adjacent to each other (i.e., nested), only the shallow point was logged and sampled. In many instances, highly saturated sand below the water table prevented collection of continuous samples. A final borehole diameter of 2 inches was used for the installation of shallow points with a 0.5- or 1-inch inside-diameter (ID) casing. For the deep monitoring points, a final borehole diameter of 1 inch was utilized.

Continuous soil samples were obtained using a 4-foot by 1.5-inch-ID and a 2-foot by 1-1/16-inch-ID sampling device. The large sampler was used for the initial 4 feet of soil. The smaller sampler was then advanced for the remainder of the borehole in an attempt to minimize the smearing of surface contamination into deeper portions of the borehole. Where possible, samples were collected continuously over the full depth of the soil borehole. Soil samples were removed from the sampler as a composite of soil in 1-foot intervals within a sample liner, transferred to jars, and submitted to a laboratory for chemical analysis and/or geotechnical testing. In addition, a portion of the soil sample was placed in an unused, sealable plastic bag for PID headspace measurements of VOCs. Soil remaining in the liner was used for lithologic and stratigraphic logging. Bags containing soil samples collected for the headspace screening procedure were quickly sealed and stored for 15 minutes at the ambient temperature. Semiquantitative measurements were made by puncturing the bag seal

with the PID probe and reading the concentration of the headspace gases. The PID relates the concentration of total VOCs in the sample to an isobutylene calibration standard. The PID was also used to monitor for VOCs in the worker breathing zone.

The Parsons ES field hydrogeologist observed Geoprobe® sampling and monitoring point installation activities and maintained a descriptive log of subsurface materials recovered. Final geologic borehole logs are presented in Appendix B. These logs contain:

- Sampled interval (top and bottom depth);
- Presence or absence of contamination based on odor, staining, and/or PID readings;
- Soil description, including color, major textural constituents, minor constituents, relative moisture content, plasticity of fines, cohesiveness, grain size, structure or stratification, and any other significant observations; and,
- Lithologic contacts, with the depth of lithologic contacts and/or significant textural changes recorded to the nearest 0.1 foot.

At a minimum, one soil sample from the vicinity of the water table was submitted for laboratory analysis. In addition, a deeper sample was generally submitted from each borehole to assess the vertical extent of contamination.

Analyte-appropriate sample containers for the targeted analytes were provided by the subcontracted laboratory, Evergreen Analytical Labs, Inc. of Wheatridge, Colorado. A sample label was firmly attached to the container side, and the following information was legibly and indelibly written on the label:

- Sample identification;
- Sample depth;
- Sampling date; and,
- Sample collector's initials.

After the samples were sealed and labeled, they were placed in a cooler with ice and held for overnight transport via Federal Express® to Evergreen Analytical Labs. A summary of the chemical analyses performed for soil and groundwater samples is presented in Table 2.2. Information regarding sample containers, preservatives, and holding times is presented in Table 4.2 of the project Quality Assurance Project Plan (QAPP) (Parsons ES, 1994). Any waste soils generated during monitoring point installation and sampling operations were spread on the ground surface in the vicinity of the site.

TABLE 2.2
ANALYTICAL PROTOCOL FOR GROUNDWATER AND SOIL SAMPLES
SITE 56
INTRINSIC REMEDIATION TS
MACDILL AIR FORCE BASE, FLORIDA

MATRIX	METHOD	ANALYTICAL LABORATORY
WATER		
Total Iron	Colorimetric, HACH Method 8008	Field
Ferrous Iron (Fe+2)	Colorimetric, HACH Method 8146	Field
Ferric Iron (Fe+3)	Difference between total and ferrous iron	Field
Manganese	Colorimetric, HACH Method 8034	Field
Sulfide	Colorimetric, HACH Method 8131	Field
Sulfate	Colorimetric, HACH Method 8051	Field
Sulfate	E300 or SW9056	Evergreen
Nitrate	Titrimetric, HACH Method 8039 and 8192	Field
Nitrate	E300 or SW9056	Evergreen
Nitrite	Titrimetric, HACH Method 8040	Field
Nitrite	E300 or SW9056	Evergreen
Redox Potential	A2580B, direct reading meter	Field
Oxygen	Direct reading meter	Field
pH	Direct reading meter	Field
Conductivity	Direct reading meter	Field
Temperature	Direct reading meter	Field
Alkalinity (Carbonate [CO3-2] and Bicarbonate [HCO3-1])	Titrimetric, HACH Method 8221	Field
Carbon Dioxide	CHEMetrics Method 4500	Field
Chloride	HACH Model 8P	Field
Chloride	E300 or SW9056	Evergreen
Ammonia--Diss. Gas in Water	CHEMetrics Method 4500	Field
Alkalinity	310.1	Evergreen
Methane	RSKSOP175	USEPA
Ethene	RSKSOP175	USEPA
Total Organic Carbon	EPA 415.1	Evergreen
Aromatic Hydrocarbons (Including Trimethylbenzenes and Tetramethylbenzene)	SW8020 (RSKSOP-133)	Evergreen
Total Volatile Hydrocarbons	SW8015, modified	Evergreen
Volatile Organics	GS/MS method, SW8240	USEPA
Free Product	GS/MSD fuel identification	Evergreen
SOIL		
Total Organic Carbon	SW9060	Evergreen a/
Moisture	EPA 160.3	Evergreen
Aromatic Hydrocarbons	SW8020	Evergreen
Total Volatile and Extractable Hydrocarbons	SW8015, modified	Evergreen

a/ Subcontracted by Evergreen to Huffman Laboratories of Golden Colorado.

2.1.3 Monitoring Point Installation

Groundwater monitoring points were installed in 14 boreholes under this program. Detailed monitoring point installation procedures are described in the following paragraphs. Monitoring point completion diagrams are included in Appendix B.

2.1.3.1 Monitoring Point Materials Decontamination

Monitoring point completion materials were inspected by the field hydrogeologist and determined to be clean and acceptable prior to use. All monitoring point completion materials were factory sealed in plastic wrap. Pre-packaged casing, sand, bentonite, and concrete mix were used in point construction, and the bags were inspected for possible external contamination before use. Materials that could not be cleaned to the satisfaction of the field hydrogeologist were not used.

2.1.3.2 Monitoring Point Casing and Screen

Shallow monitoring points were constructed of Schedule 40 polyvinyl chloride (PVC) riser pipe and screen having an ID of 0.5 or 1.0 inch. All casing and screen sections were flush threaded, and glued joints were not used. The riser pipe at each monitoring point was fitted with a PVC top cap, and a threaded PVC bottom cap was placed on the bottom of the screen. Monitoring point screens were 5 feet long and were factory slotted with 0.010-inch openings. Each shallow point was screened so that seasonal fluctuations of the water table could be measured and free-phase product, if present on the groundwater surface, could be detected.

Deep monitoring points were constructed using 0.25-inch ID by 0.375-inch OD Teflon® or Teflon®-lined polyethylene tubing threaded through the center of the Geoprobe® drive rods and attached to a 0.5-foot long, 0.25-inch-diameter stainless steel double woven wire screen with a 0.01-inch slot size. The monitoring point screen was threaded into a dedicated stainless steel drive point/implant anchor that remained in place after the drive rods were removed. The tubing was fitted with a plastic top cap to prevent the entrance of water or sediment.

The field hydrogeologist verified and recorded the borehole depth, the lengths of all casing sections and tubing, and the depth to the top of all monitoring point completion materials placed in the annulus between the casing/tubing and borehole wall. All lengths and depths were measured to the nearest 0.1 foot.

2.1.3.3 Sand Filter Pack

An attempt was made to place a graded 6-20 or 20-30 sand filter pack around the screened interval of each new monitoring point. The washed and bagged sand was distributed by Standard Sand and Silica Company. However, placement of the filter pack around the monitoring point casing screens was usually compromised by the collapse of the sand borehole walls. Therefore, most of the monitoring points are naturally sand-packed with the formation materials. However, due to the sandy nature of the formation materials, well development and purging activities were accomplished without incident.

2.1.3.4 Annular Sealant

A filter pack seal of sodium bentonite pellets was placed above the sand pack (natural or introduced) in the monitoring points. The filter pack seal was generally placed above the water table due to the collapse of saturated formation sands into the borehole following removal of the Geoprobe® rods, and was hydrated in place with potable water. The thickness of the seal varied depending on the length of borehole remaining open following removal of the Geoprobe® rods, but generally ranged from 0.5 to 2 feet.

2.1.3.5 Flush-Mount Protective Cover

Each monitoring point was completed with a 8-inch by 7.5-inch at-grade protective cover with a bolted cap. In all locations, the at-grade covers were cemented in place using concrete. All wells were completed with concrete pads that slope gently away from the protective casing to facilitate runoff during precipitation events. The space inside the protective covers (below the top of the PVC) was filled with native sandy soils to allow drainage of any precipitation that might collect within the cover.

2.1.4 Monitoring Point Development

Before being sampled, newly installed monitoring points were developed. Typically, well development removes sediment from inside the well casing and flushes fines, cuttings, and drilling fluids from the sand pack and the portion of the formation adjacent to the well screen. Use of the Geoprobe® system to place monitoring points eliminates cuttings and drilling fluids. As a result, development of monitoring points was primarily intended to minimize the amount of fine sediment that might accumulate in the casing.

Development was accomplished using a peristaltic pump with dedicated silicon and high-density polyethlyene (HDPE) tubing. The pump tubing was regularly lowered to the bottom of the shallow points so that fines were agitated and removed from the point in the development water. Development was continued until 10 casing volumes of water were removed, and the pH, temperature, and conductivity of the groundwater had stabilized. All development waters in known or suspected areas of contamination were collected in 55-gallon steel drums and transferred to the oil/water separator located on the Base.

2.2 GROUNDWATER SAMPLING

This section describes the procedures used for collecting groundwater quality samples. In order to maintain a high degree of quality control (QC) during this sampling event, the procedures described in the site work plan (Parsons ES, 1995a) and summarized in the following sections were followed.

Groundwater sampling occurred during March 1995, and consisted of collecting groundwater samples from new monitoring points and existing monitoring wells. In addition to the sampling events conducted under this program, BVWS (1995) has conducted groundwater sampling at the site.

Activities that occurred during groundwater sampling performed by Parsons ES are summarized below:

- Assembly and preparation of equipment and supplies;
- Inspection of the well integrity, including
  - Protective cover, cap and lock,
  - External surface seal and pad,
  - Well casing, cap, and datum reference, and
  - Internal surface seal;
- Groundwater sampling, including
  - Water level measurements,
  - Visual inspection of water,
  - Monitoring well/point purging, and
  - Sampling;
- Sample preservation and packaging, including
  - Sample preparation,
  - On-site measurement of physical parameters, and
  - Sample labeling;
- Completion of sampling records; and
- Sample delivery to Evergreen Analytical, Inc. in Wheat Ridge, Colorado, the US Environmental Protection Agency (USEPA) Robert S. Kerr Environmental Research Laboratory (RSKERL) in Ada, Oklahoma, and the on-Base Parsons ES Hach® Laboratory.

Detailed groundwater sampling and sample handling procedures that were used are presented in following sections.

2.2.1 Groundwater Sampling Locations

Groundwater samples were collected from 14 pre-existing monitoring wells and 14 newly installed monitoring points by Parsons ES personnel. The 14 new monitoring points, including four nested pairs, were installed at the 10 locations shown on Figure 2.2. After completion of installation and development activities, these monitoring points were purged and sampled using a peristaltic pump with dedicated HDPE and

silicon tubing. Fourteen existing monitoring wells, installed by BVWS (1995), also were sampled under this program. Existing wells that were sampled included MD56-MW01, MD56-MW02, MD56-MW04, MD56-MW05, MD56-MW06, MD56-MW07, MD56-MW08, MD56-MW10, MD56-MW11, MD56-MW12, MD32-MW01, MD32-MW03, MD32-MW07, and MD32-MW10.

2.2.2 Preparation and Equipment Cleaning

All equipment used for sampling was assembled and properly cleaned and calibrated (if required) prior to use in the field. All portions of sampling and test equipment that contacted the sample were thoroughly cleaned before use. This equipment included the water level probe and cable, equipment for measuring onsite groundwater chemical parameters, and other equipment that contacted the samples. The following cleaning protocol was used:

- Cleaned with potable water and phosphate-free laboratory-grade detergent;
- Rinsed with potable water;
- Rinsed with isopropyl alcohol;
- Rinsed with distilled or deionized water; and
- Air dried prior to use.

Any deviations from these procedures were documented in the field scientist's field notebook and on the groundwater sampling form.

As required, field analytical equipment was calibrated according to the manufacturers' specifications prior to field use. This requirement applied to direct-reading meters used for onsite chemical measurements of DO, pH, redox potential, and temperature, as well as the Hach® meter used for other onsite geochemical analyses

2.2.3 Groundwater Sampling Procedures

Special care was taken to prevent contamination of the groundwater and extracted samples through cross contamination from improperly cleaned equipment. Water level probes and cable used to determine static water levels and total well depths were thoroughly cleaned before and after field use and between uses at different sampling locations according to the procedures presented in Section 2.2.2. In addition, a clean pair of new, disposable latex gloves was worn each time a different well or monitoring point was sampled.

2.2.3.1 Preparation of Location

Prior to starting the sampling procedure, the area around the well or monitoring point was cleared of foreign materials, such as brush, rocks, and debris. These procedures prevented sampling equipment from inadvertently contacting debris around the monitoring well/point.

2.2.3.2 Water Level and Total Depth Measurements

Prior to removing any water from the well the static water level was measured. In the shallow, 0.5-inch-diameter PVC monitoring points, an electrical water level probe was used to measure the depth to groundwater below the well datum to the nearest 0.01 foot. An oil/water interface probe capable of measuring the depth to both petroleum product (if present) and water was used in the previously installed 2-inch diameter wells. Free-phase hydrocarbons were not detected in any of the wells. Water levels in the newly-installed points constructed of Teflon® or Teflon®-lined HDPE tubing were not obtained. After measurement of the static water level, the water level probe was lowered to the bottom of the well for measurement of total well depth (recorded to the nearest 0.1 foot). Based on these measurements, the volume of water to be purged from the wells was estimated.

2.2.3.3 Well/Monitoring Point Purging

Where possible, three times the calculated casing volume was removed from each well or monitoring point prior to sampling. Purging continued until the pH, DO concentration, redox potential, conductivity, and temperature stabilized for a 1-minute period. A peristaltic pump with dedicated silicon and HDPE tubing was used for well evacuation. Purge water from areas believed to be contaminated based on field observations and historical groundwater quality data was disposed of in the Base oil/water separator. Water presumed to be clean was discharged onto the ground surface in the vicinity of the sampling location.

2.2.3.4 Sample Collection

A peristaltic pump with dedicated silicon and HDPE tubing was used to extract groundwater samples from each well and monitoring point. Purging and sampling constituted one continuous sampling event, and there was no cessation of pumping prior to sample collection. For shallow monitoring points, the dedicated HDPE tubing was lowered down the casing to approximately the middle of the screened interval. Sampling from the deep points, constructed of tubing, was accomplished by attaching the silicon tubing directly to the top of the monitoring point tubing using a hose barb. The samples were transferred directly into the appropriate sample containers. The water was carefully poured down the inner walls of each sample bottle to minimize aeration of the sample. Sample bottles for BTEX, trimethylbenzene (TMB), tetramethylbenzene (tetraMB), TVH, methane, anions, alkalinity, VOCs, and Hach® field analyses were filled so that there was no headspace or air bubbles within the container. Table 2.2 lists the analyses performed on collected groundwater samples.

2.2.4 Onsite Chemical Parameter Measurement

2.2.4.1 Dissolved Oxygen Measurements

DO measurements were taken using an Orion® model 840 DO meter in a flow-through cell at the outlet of the peristaltic pump. DO concentrations were recorded after the readings stabilized, and in all cases represent the lowest DO concentration observed.

2.2.4.2 pH and Temperature Measurements

Because the pH and temperature of the groundwater change significantly within a short time following sample acquisition, these parameters were measured in the field, in the same flow-through cell used for DO measurements. The measured values were recorded on the groundwater sampling record.

2.2.4.3 Hach® and CHEMet® Field Chemistry Measurements

An onsite laboratory staffed by Parsons ES personnel was used to analyze for several indicator parameters in groundwater samples taken from pre-existing monitoring wells and newly installed monitoring points (Table 2.2). A HACH® DR/700 colorimeter was used to measure ferrous iron (Fe^{2+}), total iron (Fe), nitrate (NO_3^-), nitrite (NO_2^-), sulfate (SO_4^{2-}), manganese (Mn^{2+}), and sulfide (S^{2-}). Titrations using HACH® reagents were conducted to measure alkalinity [as mg/L calcium carbonate ($CaCO_3$)] and chloride (Cl^-); and CHEMet® color tests were used to measure ammonia (NH_3) and carbon dioxide (CO_2). These analyses were completed for each groundwater sample after all sample containers had been filled. The sample to be analyzed was poured into a clean glass container, capped, and transported to the Parsons ES on-Base laboratory for analysis. Special care was taken to avoid any headspace in the sample container which could influence the concentration of reduced species. The field holding time for each sample did not exceed 1 hour. Care was taken to minimize sample temperature changes and exposure to sunlight. Concentrations of these indicator parameters were not quantitatively measured in soil samples.

2.2.5 Sample Handling

2.2.5.1 *Sample Containers, Preservation, and Labels*

The off-Base analytical laboratories (Evergreen Analytical, Inc. and RSKERL) provided pre-preserved sample containers where appropriate. RSKERL provided a separate preservative for methane analysis, which was added to the samples by the Parsons ES field personnel.

The sample containers were filled as described in Section 2.2.3.4, and the container lids were tightly closed. The sample label was firmly attached to the container side, and the following information was legibly and indelibly written on the label:

- Analysis to be performed;
- Facility name;
- Sample identification;
- Sample type (groundwater);
- Sampling date;
- Sampling time;

- Preservatives added; and
- Sample collector's initials.

2.2.5.2 Sample Shipment

After the samples were sealed and labeled, they were packaged for transport to the analytical laboratory in Wheat Ridge, Colorado or to RSKERL in Ada, Oklahoma. The following packaging and labeling procedures were followed:

- Samples were packaged to prevent leakage or vaporization from the containers;
- Samples were cushioned to avoid breakage; and
- Ice was added to the cooler to keep the samples cool.

The packaged samples were delivered by overnight courier (Federal Express®) to the laboratory. Chain-of-custody procedures outlined in the project work plan (Parsons ES, 1995a) were followed. Laboratory samples for field analysis were hand delivered to the on-Base Parsons ES laboratory, where they were analyzed by Parsons ES using methods and reagents developed and sold by Hach Chemical Company and CHEMetrics.

2.3 AQUIFER TESTING

A slug test was performed in well MD32-MW01 (Figure 2.2) to provide additional estimates of the hydraulic conductivity of the shallow saturated zone in the vicinity of Site 56. Slug tests are single-well hydraulic tests used to estimate the hydraulic conductivity of an aquifer in the immediate vicinity of the tested well. Slug testing can be performed using either a rising head or a falling head test. Both rising head and falling head tests were used at this site. Detailed slug testing procedures are presented in the *Draft Technical Protocol for Implementing the Intrinsic Remediation with Long-Term Monitoring Option for Natural Attenuation of Dissolved-Phase Fuel Contamination in Groundwater* (Wiedemeier *et al.*, 1995), hereafter referred to as the Technical Protocol document.

Data obtained during slug testing were analyzed using the computer program AQTESOLV® (Geraghty and Miller, 1994) and the methods of Bouwer and Rice (1976) and Bouwer (1989) for unconfined conditions. The results of slug testing are presented in Section 3.3 and Appendix B.

2.4 SURVEYING

After completion of field work, the locations and elevations of all new monitoring points and pre-existing monitoring wells were surveyed by Landmark Surveying and Engineering, Inc. of Tampa, Florida. The horizontal locations and elevations of the measurement datum (top of PVC well casing) and the ground surface adjacent to the well casing were measured relative to existing on-Base survey control points. Horizontal locations were surveyed to the nearest 0.1 foot. Measurement datum and

ground surface elevations were surveyed to the nearest 0.01 foot. Survey data are presented in Table 2.1 and Appendix B.

SECTION 3

PHYSICAL CHARACTERISTICS OF THE STUDY AREA

This section incorporates data collected by Parsons ES in March 1995 and information contained in BVWS (1995) and CH2M Hill (1990, 1991a, and 1991b).

3.1 GROUND SURFACE TOPOGRAPHY AND SURFACE WATER HYDROLOGY

The Base is located on the western edge of Central Florida in the Southeast Coastal Plain Physiographic Province, a region characterized by slight local relief and low elevations. A topographic map of the Base area is presented in Figure 1.2. Elevations at the Base range from 0 to 12 feet above mean sea level (msl). Major surface water bodies near the Base include Tampa Bay, which borders the Base to the west and south; Hillsborough Bay, which forms the eastern border of the Base; and the Gulf of Mexico, which lies approximately 19 miles to the west. Three tidal inlets are present in mangrove swamps on the south side of the Base, including Coon Hammock Creek, Picnic Island Creek, and Broad Creek. Other surface water features include storm drains and drainage canals which traverse the Base, and small ponds and lakes. Runoff of surface water is carried by the drainage canals, which empty into Tampa Bay and Hillsborough Bay

The ground surface in the vicinity of Site 56 is relatively flat, with elevations ranging from approximately 5 to 7 feet above msl. The surface water drainage system at the site consists of two storm drains, which flow north toward Site 32, and then west to the bordering drainage ditch (BVWS, 1995). This ditch, which is approximately 3.5 to 4.0 feet deep in the vicinity of Site 32, discharges into Hillsborough Bay north of Site 56. In March 1995, the water in the ditch appeared to be stagnant, and in July 1995, there was measurable flow shortly after a storm event. The shallow nature of the groundwater surface in this area [approximately 3 to 5 feet below ground surface (bgs)], suggests that the ditch is in at least seasonal hydraulic communication with the uppermost portion of the saturated zone. Therefore, the ditch represents a potential discharge area for groundwater contamination migrating from Site 56. This observation is supported by information presented by Strack (1989), who provides an example in which a stream penetrates one-tenth of the aquifer thickness and captures approximately 94 percent of the groundwater flow from its upgradient side. The groundwater depth in Site 32 monitoring well MD32-MW04, which is located approximately 15 feet east of the drainage ditch (Figure 2.2), ranged from approximately 3.3 to 3.7 feet bgs in August 1994 (BVWS, 1995).

3.2 CLIMATOLOGY

According the BVWS (1995), the average annual precipitation at the Base is 44.3 inches, with the least rainfall in April and the most in August. The reported average annual evapotranspiration (ET) is 39 inches. However, ET rates will vary depending on the vegetative cover.

3.3 MANMADE FEATURES

As shown on Figure 2.2, much of the land surface at the site is paved or covered with buildings. A substantial percentage of the precipitation falling on unpaved areas probably infiltrates into the subsurface due to the flat surface topography and sandy soils. The extent to which underground utility corridors influence groundwater movement is not known. However, significant preferential movement of contaminants along utility corridors was not indicated by the previous site characterization (BVWS, 1995). The relatively sandy nature of the soils in the saturated zone, and the resulting higher permeabilities, would tend to minimize preferential migration of contaminants along utility corridors.

3.4 REGIONAL GEOLOGY AND HYDROGEOLOGY

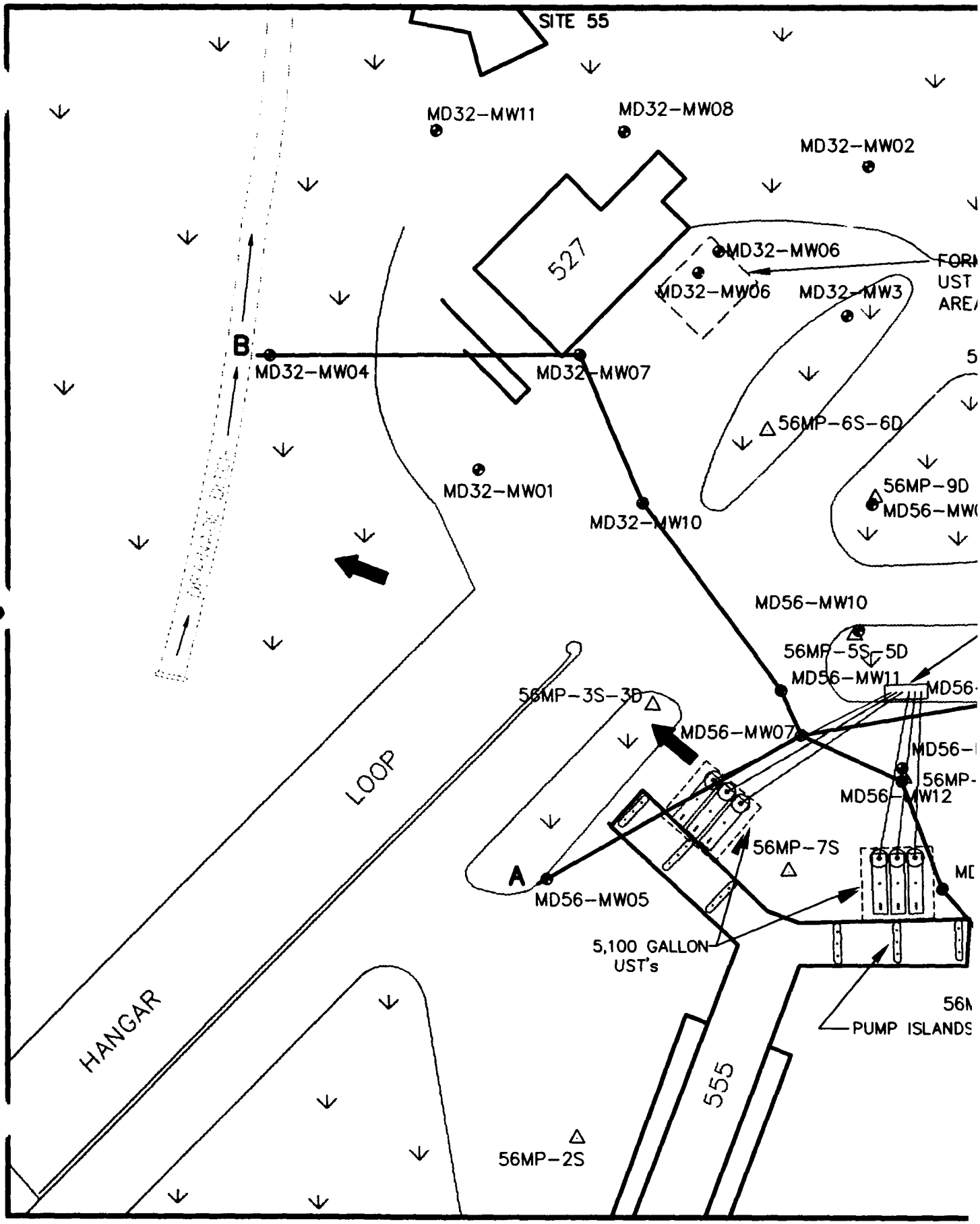
The information provided in this section is condensed from the more detailed discussions presented by BVWS (1995) and CH2M Hill (1990 and 1991a). The unconsolidated, Quaternary-age, coastal plain sediments found at the surface in the Tampa area consist predominantly of fine sand containing interbedded clay, marl, shell, limestone, and phosphorite. These sediments, which form the surficial, unconfined aquifer, range in thickness from almost zero to approximately 100 feet. The water table depth ranges from the ground surface to several feet bgs.

The surficial aquifer is underlain by Pliocene-age deposits consisting of phosphatic, clayey and pebbly sand, clay, marl, and shell. These deposits, which comprise a confining layer, are underlain by the carbonate and clastic sediments of the Hawthorn Formation and Tampa Limestone. The solutioned Tampa Limestone forms the uppermost confined limestone aquifer. The limestones of the Floridan Aquifer, which provides water for most of Florida and the southern third of Georgia, lie beneath the Tampa Limestone aquifer.

At the Base, the surficial, unconfined aquifer consists of 20- to 60-foot layers of fine quartz sand, silty sand, and clayey sand which overly a clay unit. The Tampa Limestone occurs beneath the clay and is estimated to be approximately 100 feet thick. In some areas, the surficial and Tampa Limestone aquifers may be hydraulically connected.

3.5 SITE GEOLOGY AND HYDROGEOLOGY

The locations of two site-specific hydrogeologic cross sections are depicted in Figure 3.1, and the sections themselves are shown in Figures 3.2 and 3.3. Sections A-A' and B-B' are oriented approximately perpendicular and parallel to the local, northwesterly groundwater flow direction, respectively. Site 56 is covered by a thin layer of asphalt



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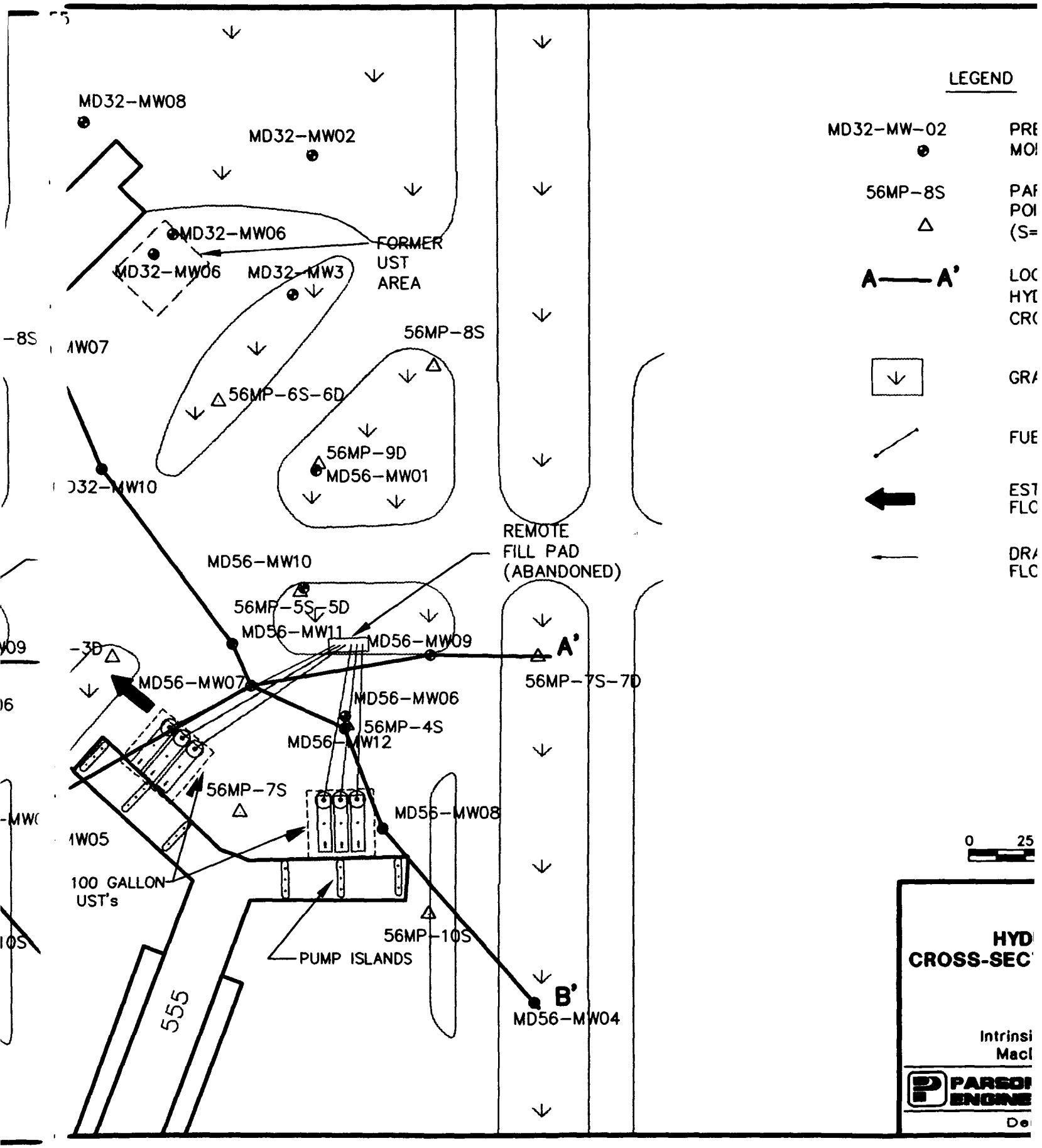
LEGEND
MD32-MW-02
56MP-8S
A——A'
MD32-MW08
MD32-MW02
MD32-MW06
MD32-MW06
MD32-MW3
FORMER
UST
AREA
56MP-8S
56MP-6S-6D
56MP-9D
MD56-MW01
REMOTE
FILL PAD
(ABANDONED)
MD56-MW10
56MP-5S-5D
MD56-MW11
MD56-MW09
A'
56MP-7S-7D
MD56-MW07
MD56-MW06
56MP-4S
MD56-MW12
56MP-7S
MD56-MW08
100 GALLON
UST's
56MP-10S
PUMP ISLANDS
B'
MD56-MW04
555
0
25

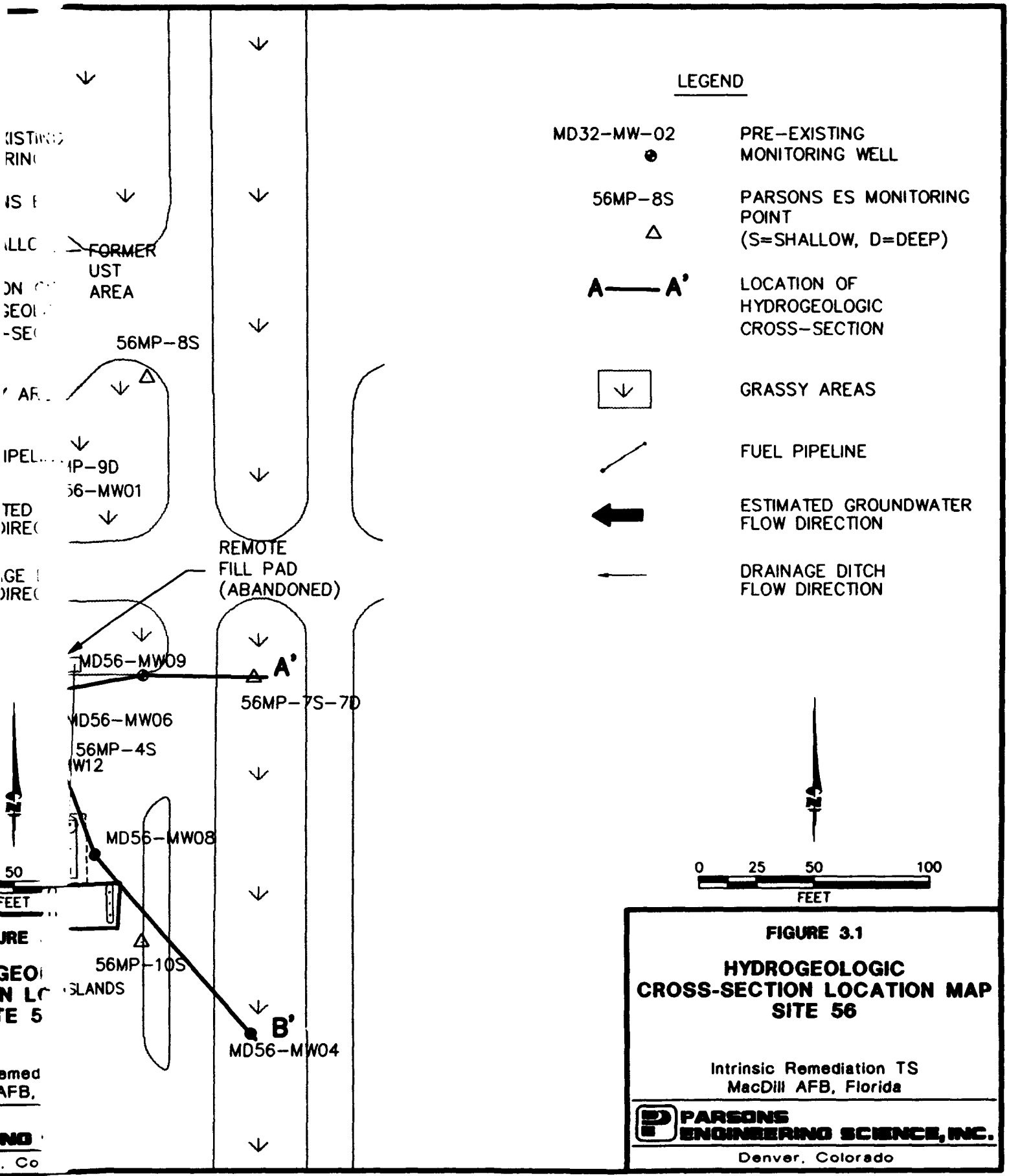

FIGURE 3.1

HYDROGEOLOGIC CROSS-SECTION LOCATION MAP SITE 56

Intrinsic Remediation TS
MacDill AFB, Florida

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

3-3

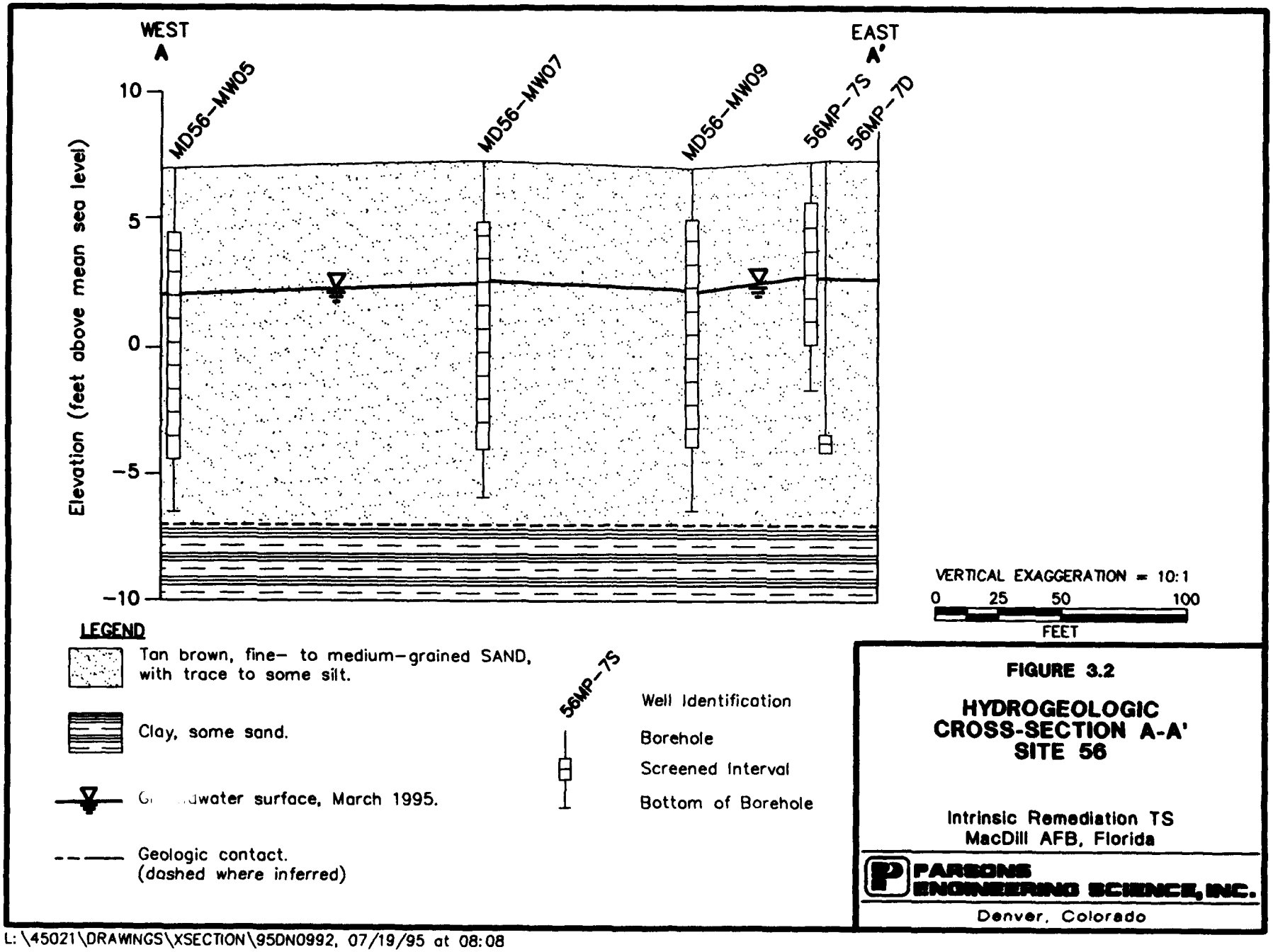

FIGURE 3.2

HYDROGEOLOGIC CROSS-SECTION A-A' SITE 56

Intrinsic Remediation TS
MacDill AFB, Florida

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

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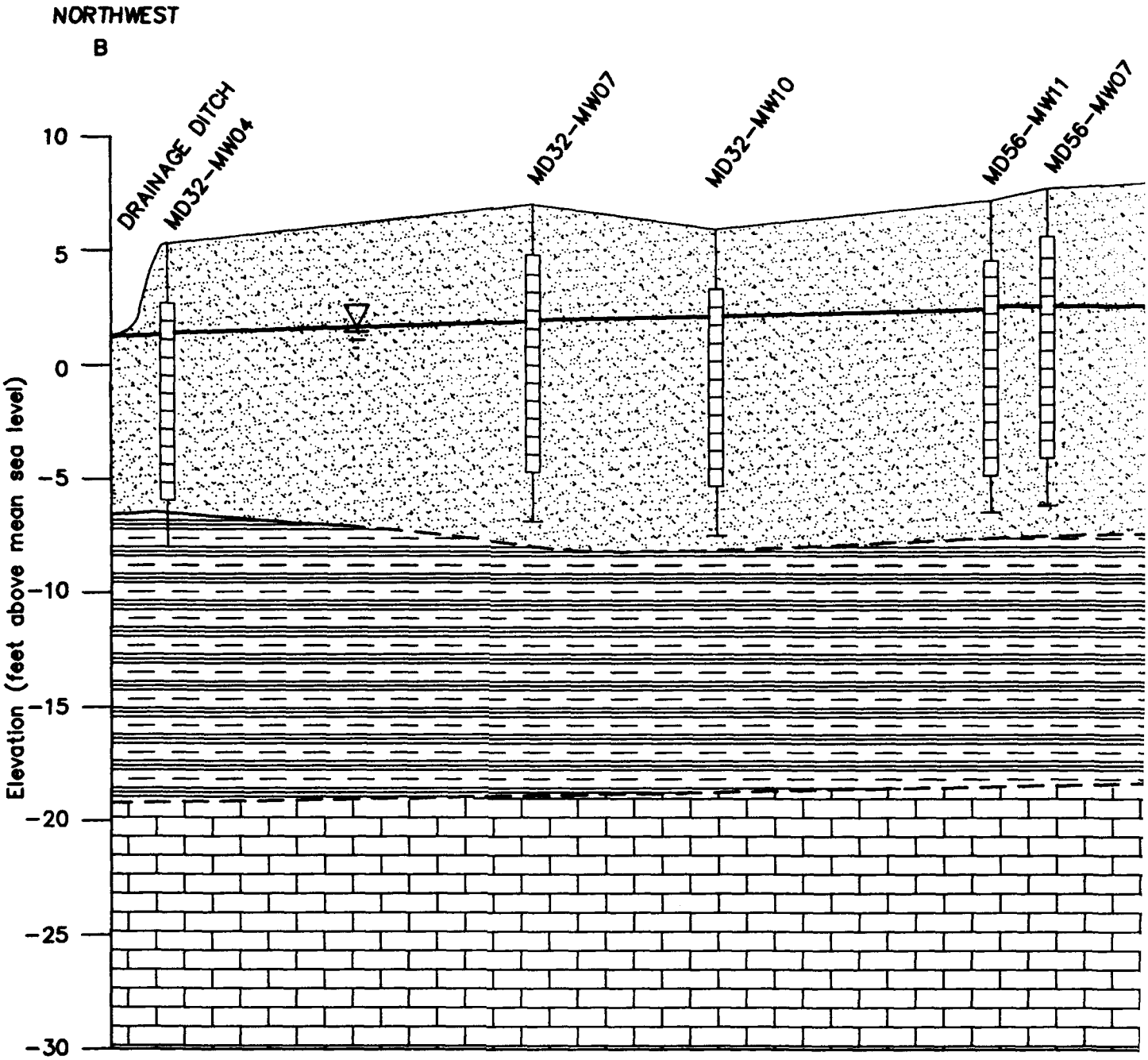

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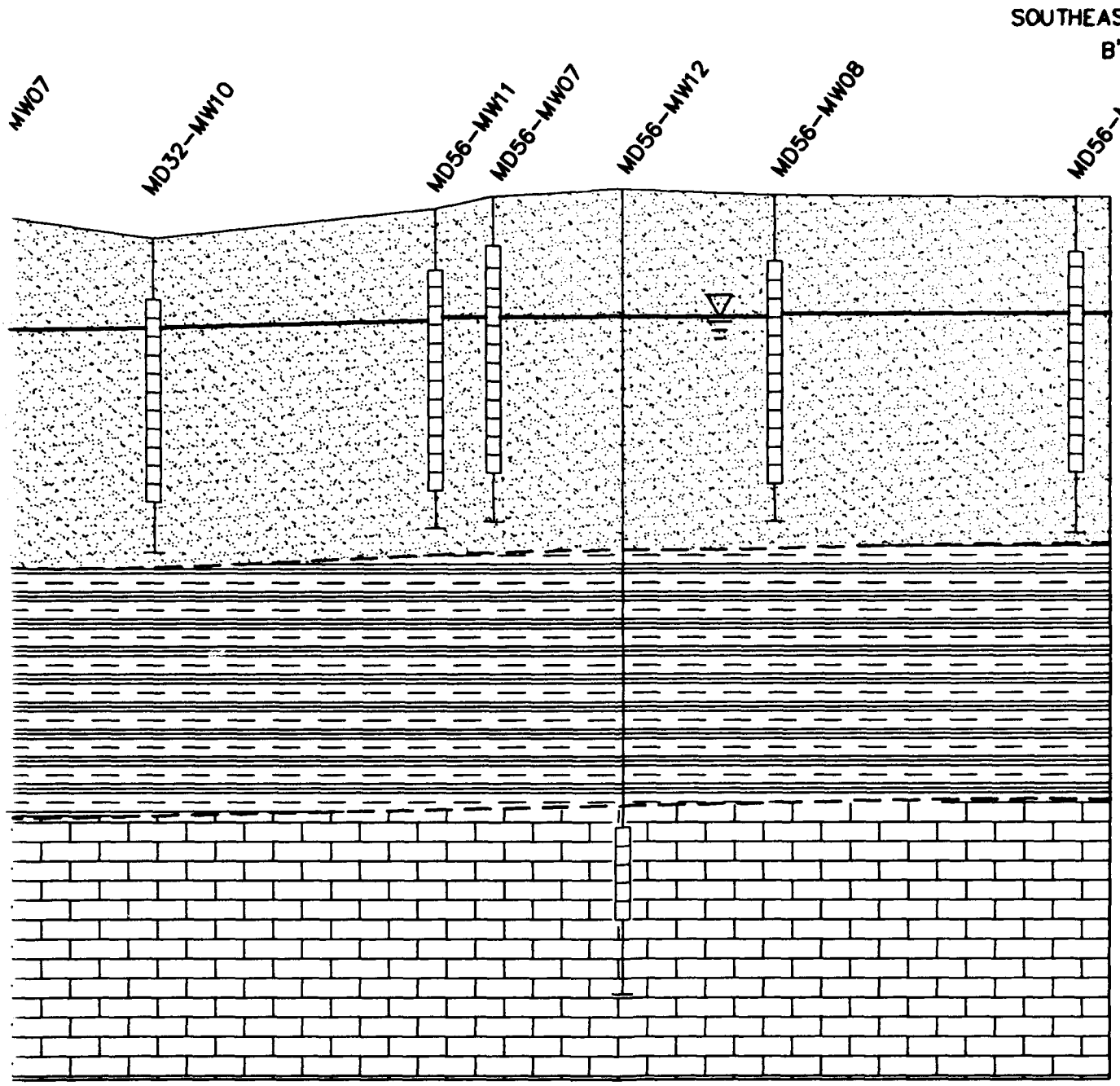
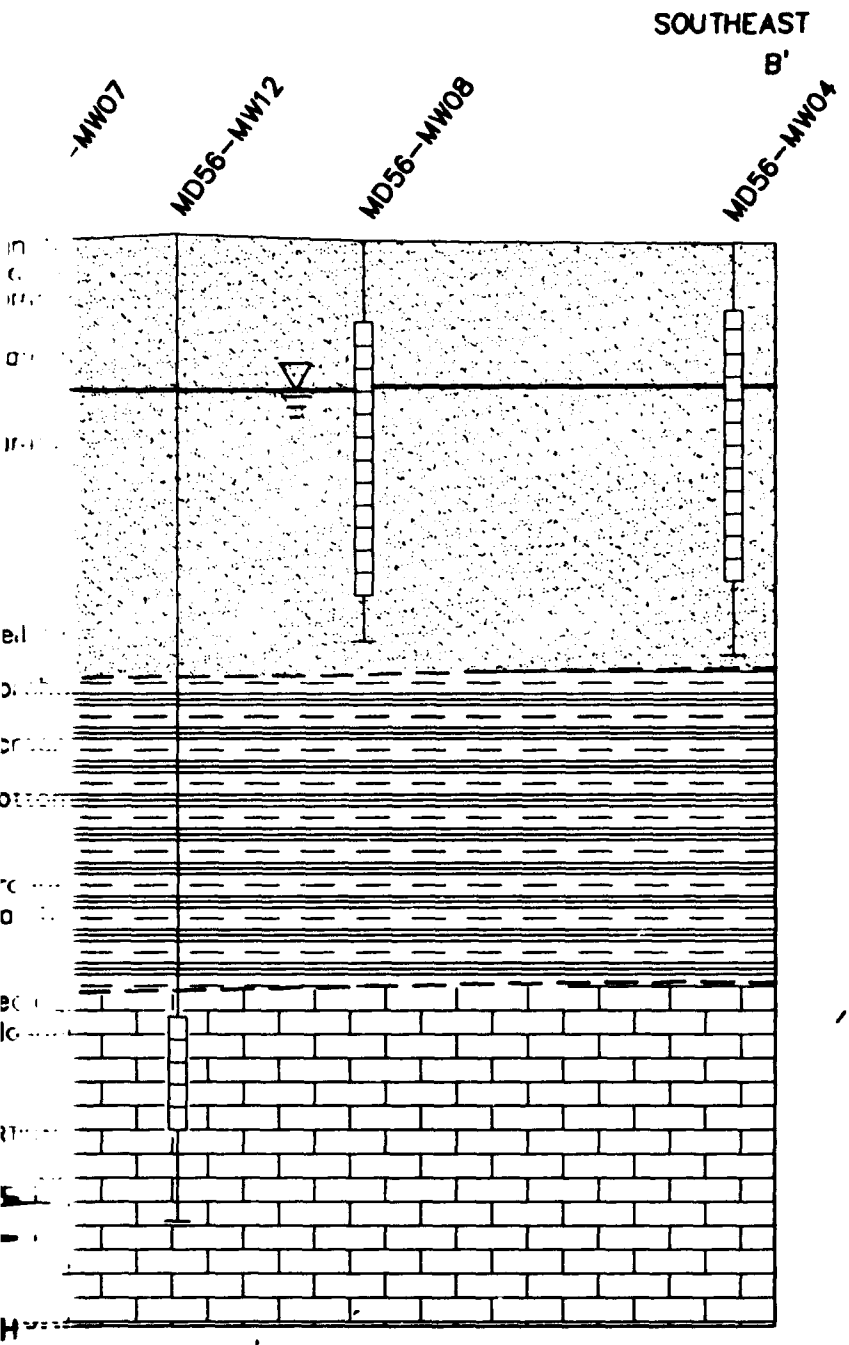

SOUTHEAST
B'
MW07
MD32-MW10
MD56-MW11
MD56-MW07
MD56-MW12
MD56-MW08
MD56-MW04



LEGEND

Tan brown, fine- to medium-grained SAND with trace to some silt.

Clay, some sand.

Tampa limestone, with clay.

MD56-MW04

Well Identification

Borehole

Screened Interval

Bottom of Borehole

Groundwater surface, March 1995

Geologic contact (dashed where inferred)

VERTICAL EXAGGERATION = 8:1

0 25 50 100

FEET

FIGURE 3.3

HYDROGEOLOGIC CROSS-SECTION B-B' SITE 56

Intrinsic Remediation TS
MacDill AFB, Florida

PARSONS ENGINEERING SCIENCE, INC.

Denver, Colorado

and hardpan (fill) ranging from 0.5 foot to 0.7 feet in thickness. The sediments underlying this surficial layer consist primarily of relatively well-sorted, fine-grained sand containing layers of silty to clayey sand that range up to approximately 13 feet in thickness. During the drilling of borehole MD56-MW12, BVWS (1995) encountered a clay layer at a depth of approximately 15 feet. The clay layer, which was approximately 5 to 10 feet thick, was underlain by clay and weathered, solutioned limestone. The stratigraphy beneath the adjacent Site 32 appears to be similar to that present beneath Site 56. Based on the available data, the thickness of the surficial sandy aquifer beneath Sites 56 and 32 is estimated to be approximately 10 feet.

The groundwater surface beneath Sites 56 and 32 is present at depths of approximately 4 to 5 feet bgs, and the groundwater flow direction is toward the northwest. Contouring of groundwater elevations measured in monitoring wells in March 1995 (Table 3.1 and Figure 3.4) indicated a lateral hydraulic gradient ranging from an average of approximately 0.002 foot per foot (ft/ft) beneath Site 56 to 0.004 ft/ft beneath Site 32. These measurements are in good agreement with lateral hydraulic gradients measured by BVWS (1995) in August 1994, which ranged from 0.003 to 0.004 ft/ft. Near the drainage ditch, the gradient appears to steepen.

Comparison of groundwater elevations in nested well pairs at Site 56 (MD56-MW06 and MD56-MW12) and Site 32 (MD32-MW06 and MD32-MW09) indicates that, in March 1995, a vertical (downward) component to the hydraulic gradient was present. Using the head difference between the shallow and deep wells, and the distance between the midpoints of their screens, the magnitude of the vertical hydraulic gradient varied from 0.004 ft/ft at the Site 32 well pair to 0.025 ft/ft at the Site 56 well pair.

A total of 18 slug tests were performed by BVWS (1995) in Site 56 and Site 32 monitoring wells screened in the sandy surficial aquifer. The resulting hydraulic conductivity values ranged from 7.5 to 14.4 feet per day (ft/day) [2.6×10^{-3} to 5.1×10^{-3} centimeter per second (cm/sec)] with an average value of 11.6 ft/day (4.1×10^{-3} cm/sec). Slug tests were also performed in two wells screened in the clay and limestone underlying the surficial sands (MD32-MW09 and MD56-MW12). These tests yielded hydraulic conductivity values of 8.0 and 16.6 ft/day (2.8×10^{-3} and 5.9×10^{-3} cm/sec). Parsons ES performed one slug test in well MD32-MW01; this well had not been tested previously by BVWS. This test yielded a hydraulic conductivity value of 25.9 ft/day (9.1×10^{-3} cm/sec).

The advective velocity of groundwater in the direction parallel to groundwater flow is given by:

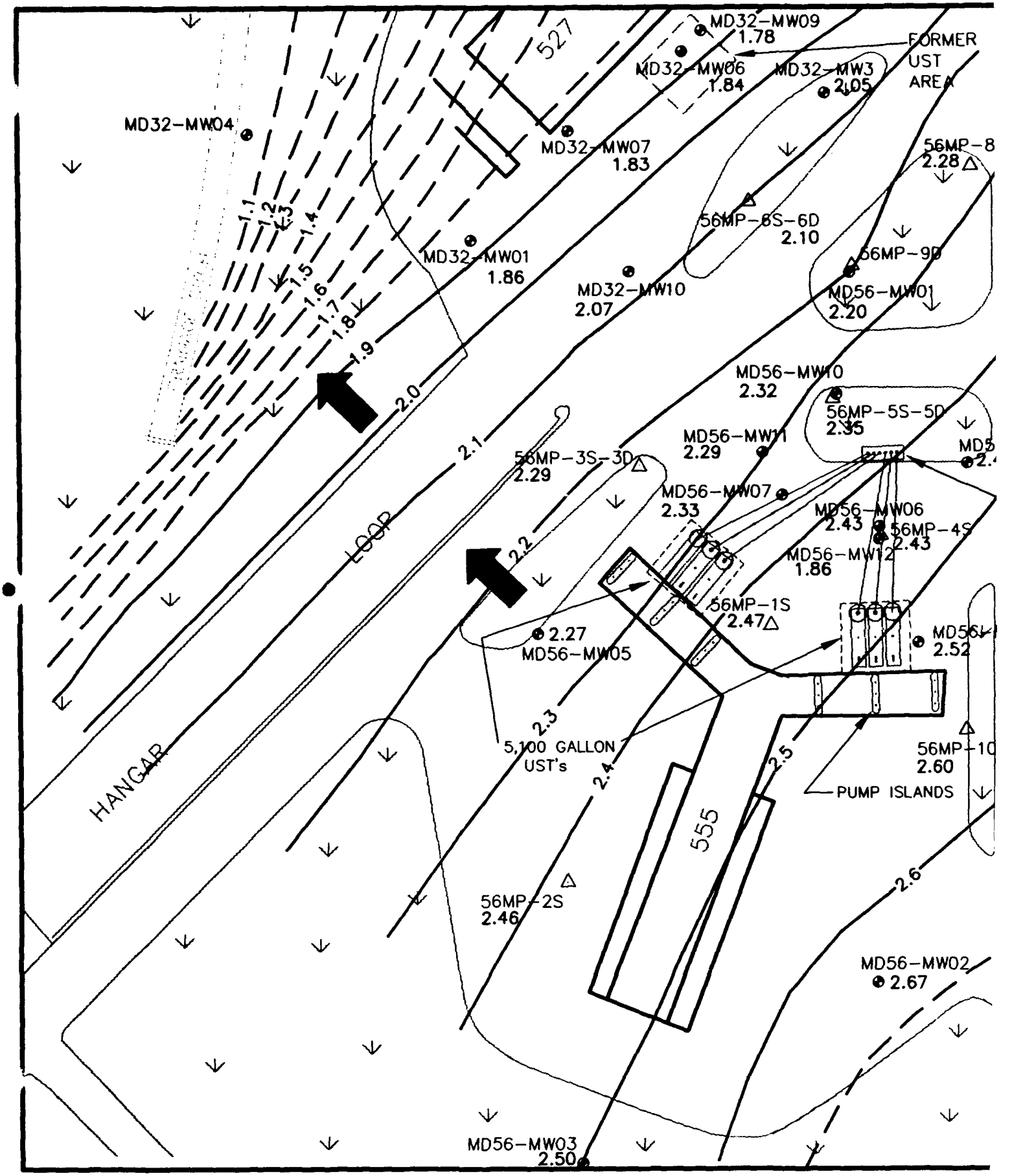
$$\bar{v} = \frac{K}{n_e} \frac{dH}{dL}$$

Where: v = Average advective groundwater velocity (seepage velocity) [L/T]
K = Hydraulic conductivity [L/T]
dH/dL = Gradient [L/L]
n_e = Effective porosity

TABLE 3.1
WATER LEVEL DATA
SITE 56
INTRINSIC REMEDIATION TS
MACDILL AIR FORCE BASE, FLORIDA

Well Location	Date	Northing	Easting	Well ID (inches)	Datum Elevation (ft msl)[a]	Ground Elevation (ft msl)	Total Depth to Water (ft bgs)[b]	Total Depth to Water (ft btoc)[c]	Elevation of Water Table (ft msl)
56MP-1S	3/30/95	1281421.044	498655.269	0.5	7.922	8.072	5.60	5.45	2.47
56MP-2S	3/30/95	1281310.072	498567.034	0.5	8.002	8.096	5.63	5.54	2.46
56MP-3S	3/30/95	1281491.160	498598.739	0.5	6.719	6.752	4.46	4.43	2.29
56MP-4S	3/30/95	1281460.443	498703.610	1.0	7.556	7.752	5.33	5.13	2.43
56MP-5S	3/30/95	1281519.716	498682.892	1.0	6.546	6.916	4.57	4.20	2.35
56MP-6S	3/30/95	1281603.306	498646.493	1.0	6.582	6.582	4.48	4.48	2.10
56MP-7S	3/30/95	1281490.048	498789.932	1.0	7.162	7.236	4.72	4.65	2.51
56MP-8S	3/30/95	1281618.629	498743.107	1.0	6.549	6.522	4.24	4.27	2.28
56MP-10S	3/30/95	1281375.800	498740.865	1.0	7.462	7.602	5.00	4.86	2.60
MD56-MW01	3/30/95	1281573.102	498690.350	2.0	6.359	6.439	4.24	4.16	2.20
MD56-MW02	3/30/95	1281267.489	498701.790	2.0	7.649	7.879	5.21	4.98	2.67
MD56-MW03	3/30/95	1281189.545	498572.792	2.0	5.836	6.012	3.52	3.34	2.50
MD56-MW04	3/30/95	1281336.240	498788.477	2.0	7.319	7.562	4.96	4.72	2.60
MD56-MW05	3/30/95	1281417.781	498553.956	2.0	6.846	7.059	4.79	4.58	2.27
MD56-MW06	3/30/95	1281464.341	498702.891	2.0	7.572	7.752	5.32	5.14	2.43
MD56-MW07	3/30/95	1281477.791	498660.564	2.0	7.296	7.549	5.22	4.97	2.33
MD56-MW08	3/30/95	1281413.687	498720.014	2.0	7.439	7.632	5.11	4.92	2.52
MD56-MW09	3/30/95	1281490.924	498741.734	2.0	6.869	7.062	4.64	4.45	2.42
MD56-MW10	3/30/95	1281520.775	498684.409	2.0	6.686	6.916	4.60	4.37	2.32
MD56-MW11	3/30/95	1281495.927	498652.517	2.0	6.882	7.006	4.72	4.59	2.29
MD56-MW12	3/30/95	1281458.591	498702.952	2.0	7.609	7.752	5.89	5.75	1.86
MD32-MW01	3/30/95	1281586.889	498525.260	2.0	9.672	6.749	4.89	7.81	1.86
MD32-MW03	3/30/95	1281650.178	498679.710	2.0	9.466	6.746	4.70	7.42	2.05
MD32-MW06	3/30/95	1281673.787	498620.758	2.0	6.852	7.019	5.18	5.01	1.84
MD32-MW07	3/30/95	1281634.222	498567.734	2.0	6.719	6.872	5.04	4.89	1.83
MD32-MW09	3/30/95	1281677.071	498626.007	2.0	6.826	7.019	5.24	5.05	1.78
MD32-MW10	3/30/95	1281573.227	498594.143	2.0	6.276	6.489	4.42	4.21	2.07

[a] ft msl = feet above mean sea level.
[b] ft bgs = feet below ground surface.
[c] ft btoc = feet below top of casing.



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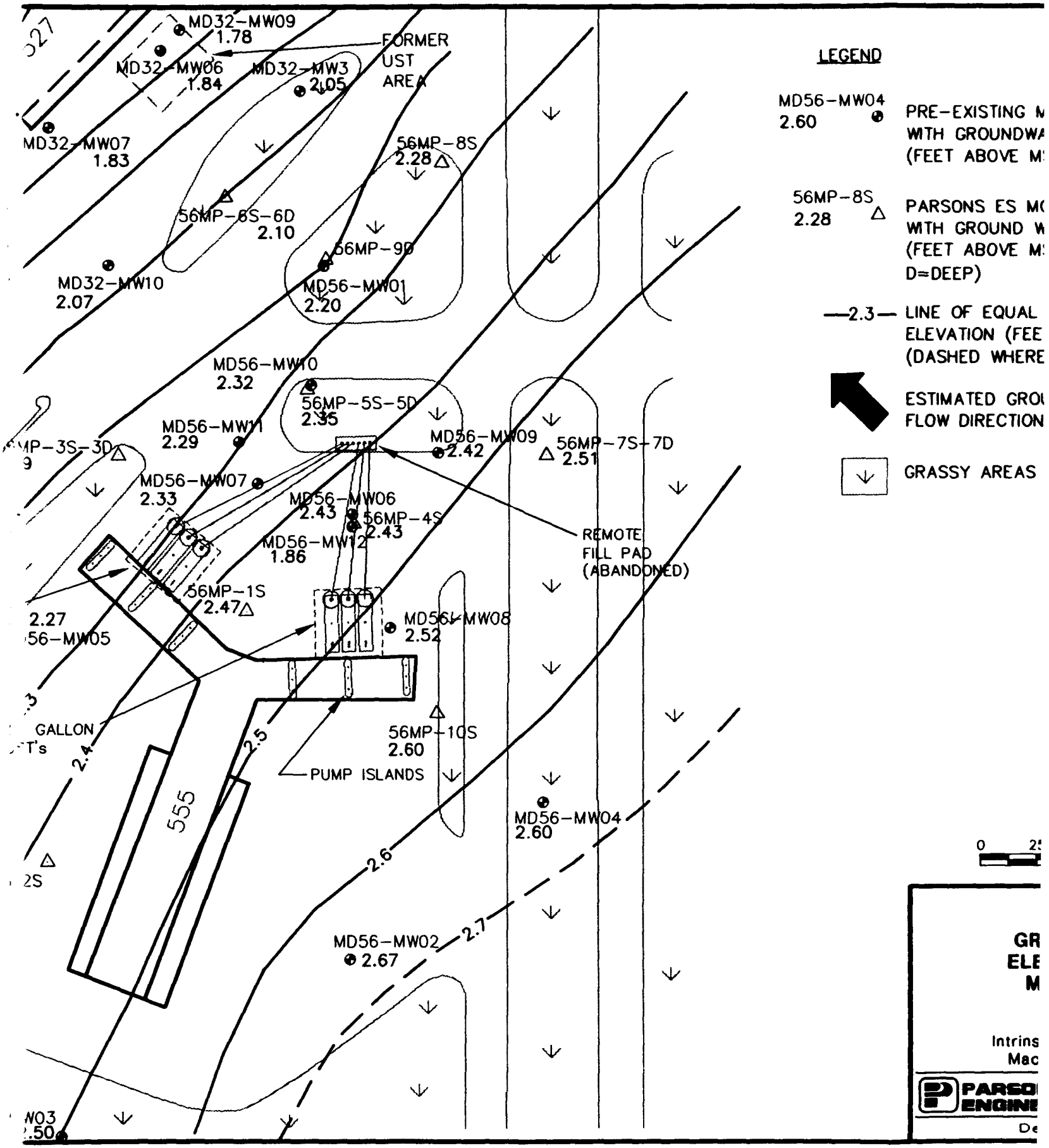
MD32-MW09
1.78
FORMER
UST
AREA
MD32-MW06
1.84
MD32-MW3
2.05
MD32-MW07
1.83
56MP-8S
2.28
56MP-6S-6D
2.10
56MP-9D
MD32-MW10
2.07
MD56-MW01
2.20
MD56-MW10
2.32
56MP-5S-5D
2.35
MD56-MW11
2.29
MD56-MW09
2.42
56MP-7S-7D
2.51
MD56-MW07
2.33
MD56-MW06
2.43
56MP-4S
2.43
MD56-MW12
1.86
REMOTE
FILL PAD
(ABANDONED)
56MP-1S
2.47
2.27
56-MW05
MD56-MW08
2.52
GALLON
T's
56MP-10S
2.60
PUMP ISLANDS
555
MD56-MW04
2.60
MD56-MW02
2.67
2.4
2.5
2.6
2.7
LEGEND
MD56-MW04
2.60
PRE-EXISTING M
WITH GROUNDWA
(FEET ABOVE M
56MP-8S
2.28
PARSONS ES MC
WITH GROUND W
(FEET ABOVE M
D=DEEP)
—2.3— LINE OF EQUAL
ELEVATION (FEE
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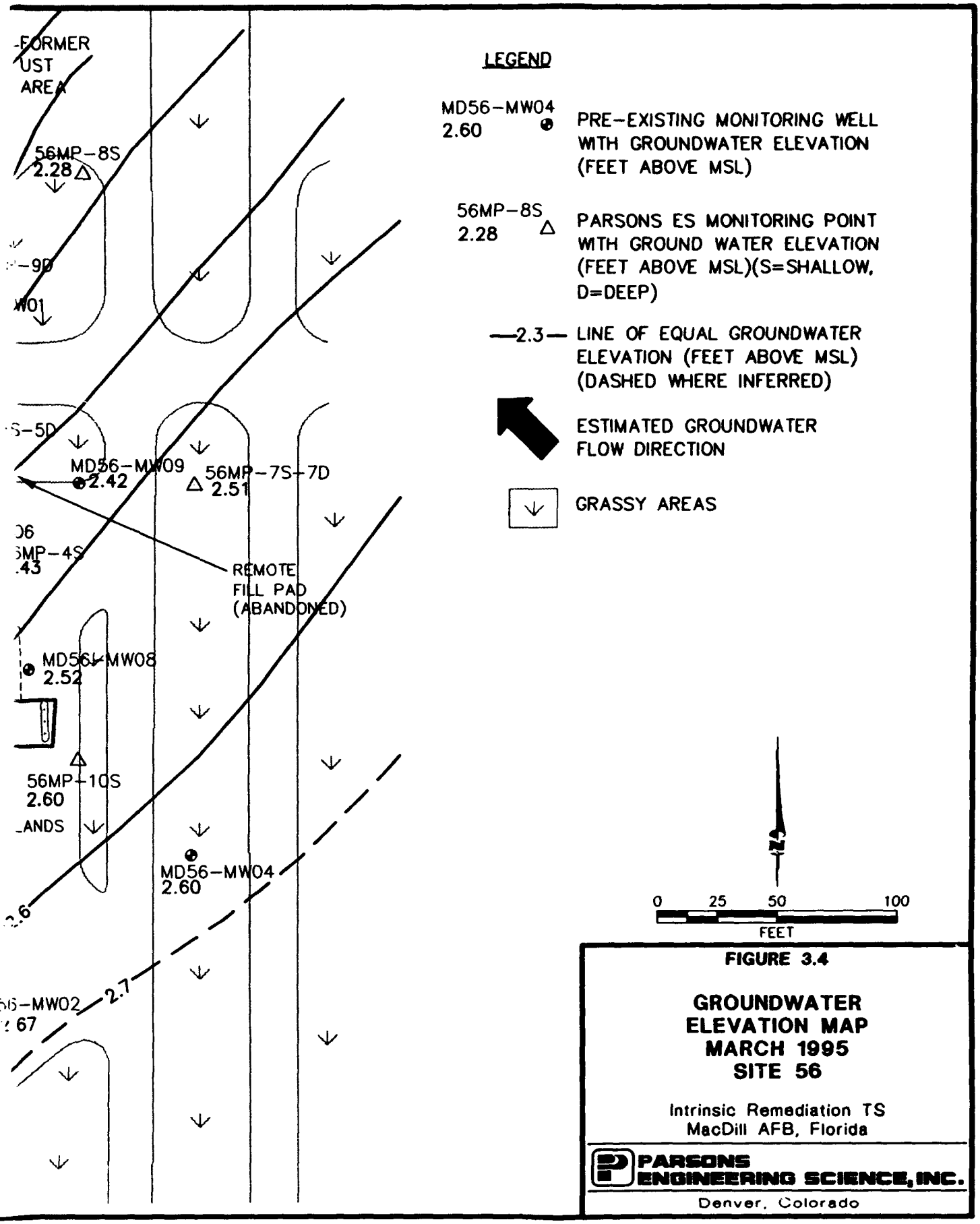


FIGURE 3.4

GROUNDWATER ELEVATION MAP MARCH 1995 SITE 56

Intrinsic Remediation TS
MacDill AFB, Florida

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

The average effective porosity of the shallow, sandy aquifer is estimated to be 0.25 based on literature values contained in Johnson (1967) and Walton (1988). Based on an average hydraulic conductivity of 11.6 ft/day (from BVWS slug tests), an average hydraulic gradient of 0.003 ft/ft, and an effective porosity of 0.25, the average advective groundwater velocity within the shallow, sandy aquifer is approximately 0.14 ft/day (51 ft/year). In the area characterized by a steeper hydraulic gradient near the drainage ditch, the advective velocity may range up to approximately 0.5 ft/day (183 ft/year).

Because significant quantities of organic carbon are present in the aquifer matrix, a somewhat retarded velocity (V_R) should be used for solute transport calculations. Section 4.2.4 presents TOC analysis results, and Section 5 contains V_R calculations.

3.6 GROUNDWATER USE

Groundwater from the shallow aquifer at MacDill AFB is not extracted for potable uses. The private well nearest to Site 56, located off-Base approximately 0.6 mile north of the site, is used for irrigation (BVWS, 1995). Groundwater flow at the site is toward the northwest; therefore, the irrigation well is not directly downgradient. The nearest Hillsborough County designated Wellhead Protection Area is located approximately 13 miles north of the Base. Therefore, there are no public water supply wells within 0.5 mile of Site 56 (BVWS, 1995).

SECTION 4

NATURE AND EXTENT OF CONTAMINATION AND SOIL AND GROUNDWATER GEOCHEMISTRY

4.1 SOURCES OF CONTAMINATION

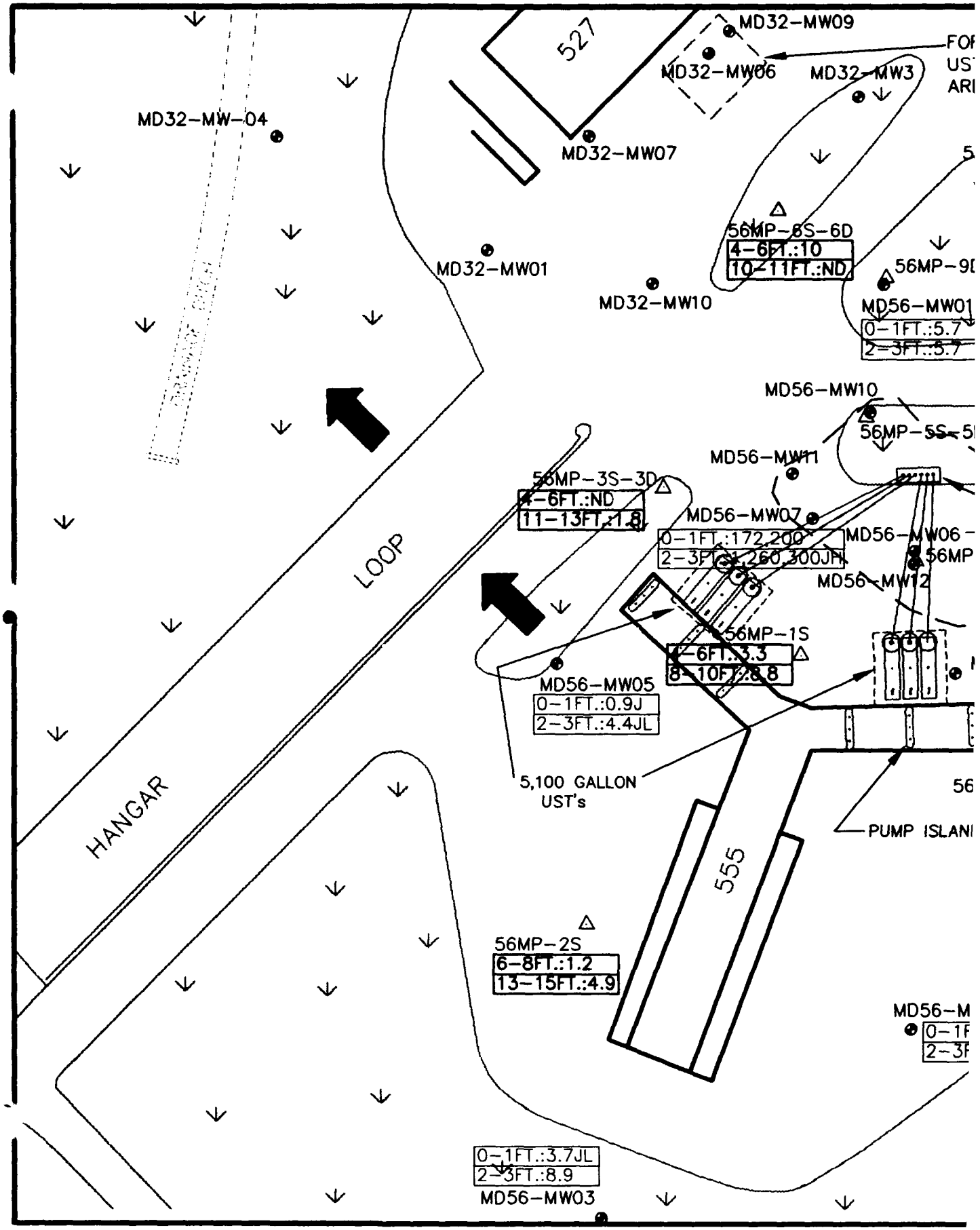
The source of the contamination identified at Site 56 is believed to be the gasoline USTs and/or the associated piping. According to BVWS (1995), previous soil contamination was documented at this site by Tracer Research Corp. based on soil vapor surveys. However, no leaking tanks have been documented at the site. The Air Force has contracted to have the annual tightness test performed, but no data were available as of this writing.

The leakage date is not known. However, existing groundwater quality data suggest that some leakage has occurred in the recent past. During the initial groundwater quality sampling performed by BVWS in December 1993, the total BTEX concentration in groundwater from monitoring well MD56-MW06, which is located approximately 30 feet downgradient from the easternmost group of USTs and adjacent to the pipelines that service them, was 5,719 µg/L. During subsequent sampling rounds performed in December 1994 by BVWS and March 1995 by Parsons ES, the BTEX concentrations in this well had risen to approximately 17,000 µg/L and 29,000 µg/L, respectively, suggesting that additional BTEX had been released into the groundwater since December 1994. Another possible explanation for the observed increase in BTEX concentrations is that in December 1993, the leakage was relatively recent, and the majority of the contamination had not migrated very far from the source. Continued migration of BTEX constituents between December 1993 and March 1995 may have caused the observed increase. In addition, the extremely high BTEX concentration detected in a shallow soil sample from MD56-MW06 (1,251,300 µg/L) suggests that the contamination is relatively fresh.

4.2 SOIL CHEMISTRY

4.2.1 Soil Screening

Soil headspace screening using an organic vapor analyzer (OVA) was performed by BVWS (1995) to preliminarily delineate the lateral extent of petroleum-contaminated soil at Site 56. Soils exhibiting a headspace vapor concentration of 500 parts per million volume per volume (ppmv) or greater were considered to be excessively contaminated. Soil samples were composited from the 0- to 3.5-foot depth interval at a total of 62 locations. The area of excessively contaminated soil delineated during this screening survey is shown on Figure 4.1.



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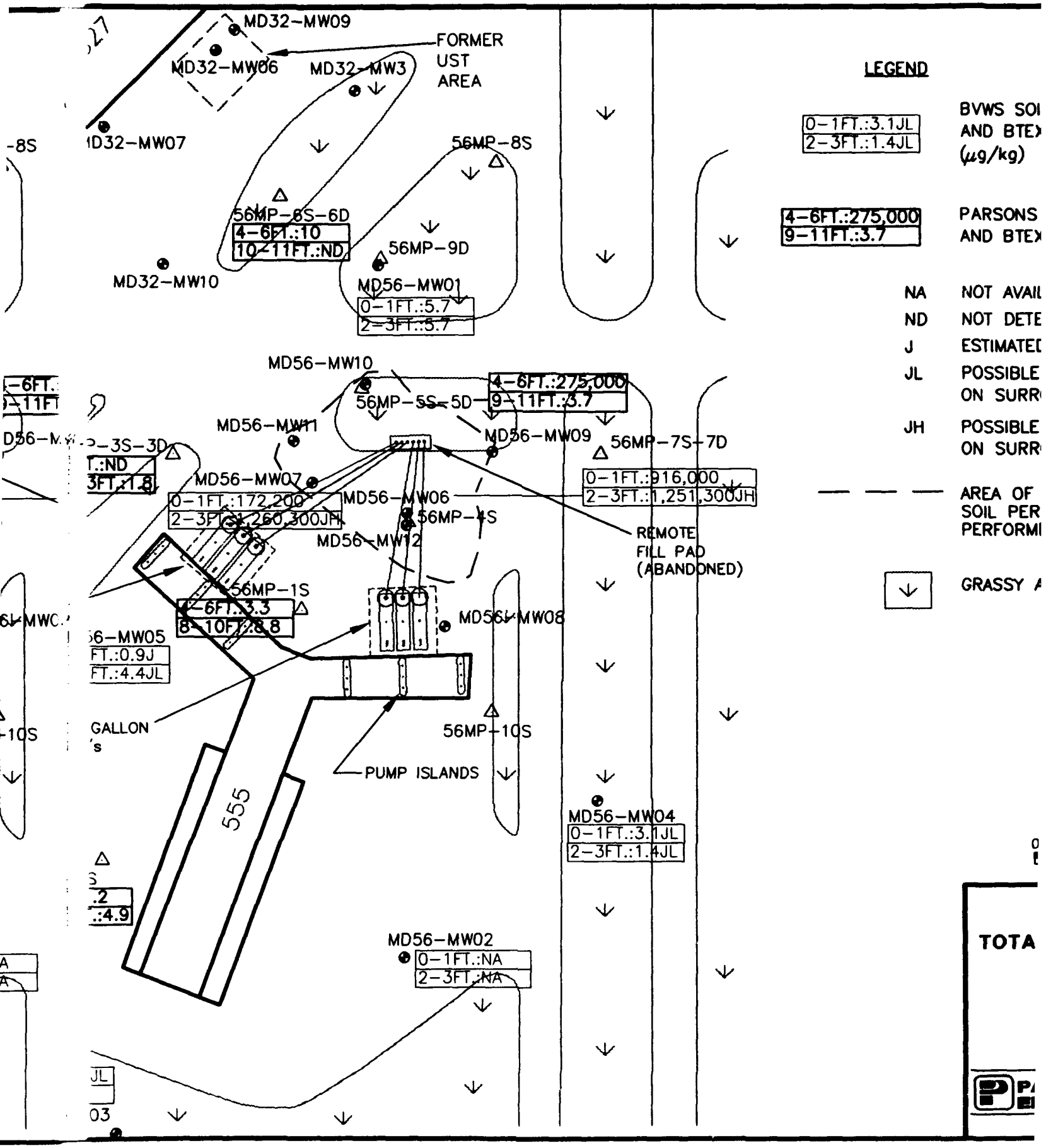
MD32-MW09
FORMER UST AREA
MD32-MW06
MD32-MW3
MD32-MW07
56MP-8S
56MP-8S-6D
4-6FT.:10
10-11FT.:ND
56MP-9D
MD32-MW10
MD56-MW01
0-1FT.:5.7
2-3FT.:5.7
MD56-MW10
4-6FT.:275,000
56MP-5S-5D
9-11FT.:3.7
MD56-MW11
MD56-MW09
56MP-7S-7D
MD56-MW07
0-1FT.:172,200
MD56-MW06
0-1FT.:916,000
2-3FT.:1,251,300JH
56MP-4S
MD56-MW12
REMOTE FILL PAD (ABANDONED)
56MP-1S
6FT.:3.3
8-10FT.:8.8
MD56-MW08
56MP-10S
PUMP ISLANDS
555
MD56-MW04
0-1FT.:3.1JL
2-3FT.:1.4JL
MD56-MW02
0-1FT.:NA
2-3FT.:NA
LEGEND
0-1FT.:3.1JL
2-3FT.:1.4JL
BVWS SOI
AND BTEX
(µg/kg)
4-6FT.:275,000
9-11FT.:3.7
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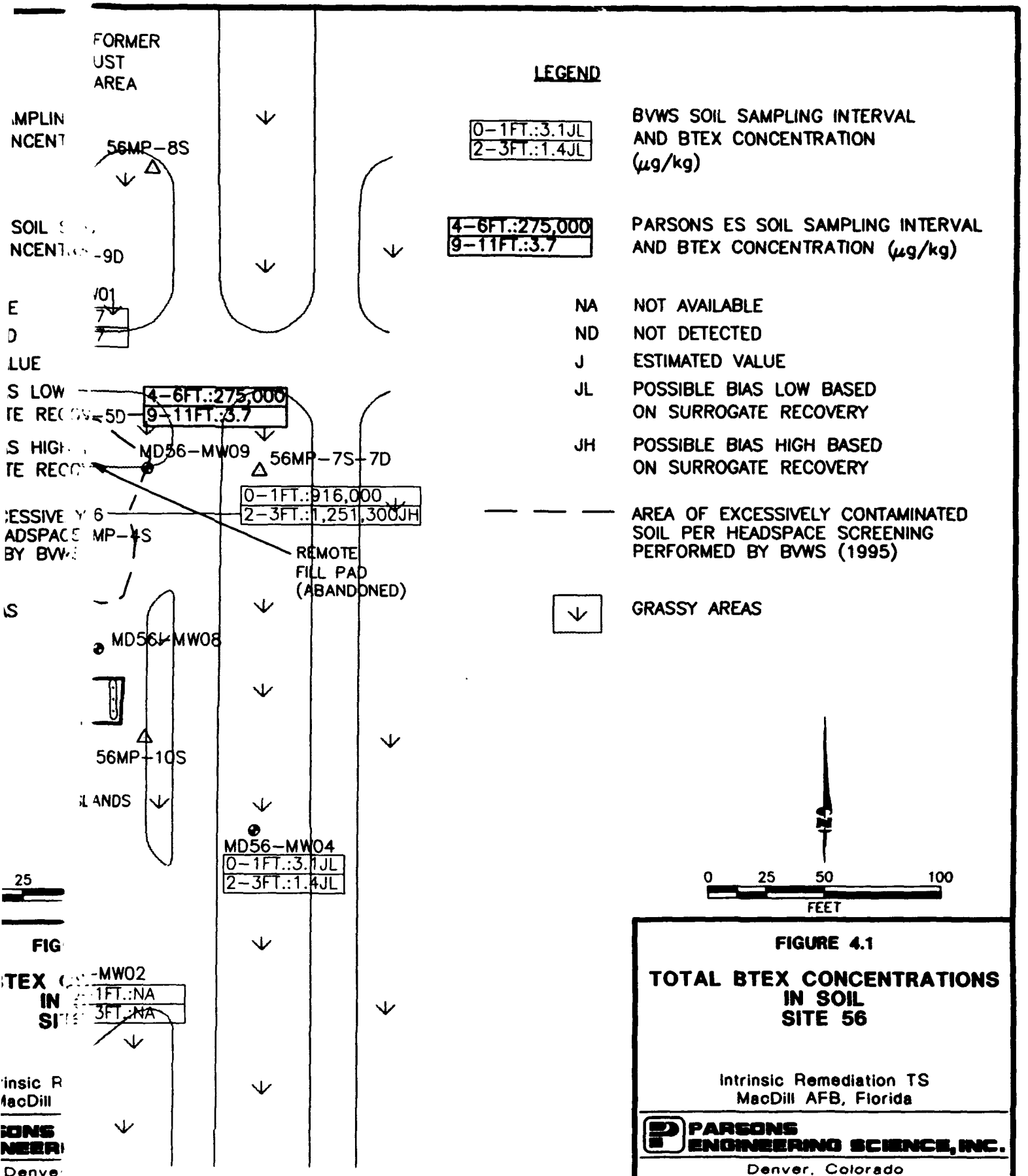


FIGURE 4.1

TOTAL BTEX CONCENTRATIONS IN SOIL SITE 56

Intrinsic Remediation TS
MacDill AFB, Florida

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

4.2.2 Magnitude and Extent of BTEX in Soil

During the BVWS (1995) investigation, a total of 14 soil samples from seven boreholes were analyzed for petroleum constituents at a laboratory. Eleven additional soil samples from five boreholes were collected by Parsons ES in March 1995 and chemically analyzed for petroleum constituents. Analytical results from the Parsons ES sampling are summarized in Table 4.1, and both BVWS and Parsons ES BTEX results are plotted in Figure 4.1.

Significantly elevated BTEX concentrations were detected in samples from MD56-MW06, MD56-MW07, and 56MP-5. The lateral distribution of these detections appears to indicate either the existence of multiple sources, or the past migration of free product on the groundwater surface. Such migration would have created a zone of residual light, nonaqueous-phase liquid (LNAPL) contamination bordering the water table. Residual LNAPL is defined as product that is trapped in the aquifer matrix by the processes of cohesion and capillarity, and therefore will not migrate within the aquifer or flow from the aquifer matrix into a well under the influence of gravity. The lack of significant BTEX detections in the remainder of the samples collected effectively bounds the contaminated area laterally.

The low BTEX detection in the 9- to 11-foot sample from 56MP-5D indicates that the contamination is restricted to the top 9 feet of the soil column. Assuming that the magnitude of seasonal groundwater level fluctuations does not exceed 2 feet, significant soil contamination is most likely limited to the uppermost 7 feet of the soil column. Attempts were made to obtain deeper samples at MD56-MW06 to assess the vertical extent of soil contamination, but the loose, saturated sand could not be retrieved in the core barrel.

4.2.3 Magnitude and Extent of Total Petroleum Hydrocarbons in Soil

Soil samples collected by BVWS (1995) were analyzed for total recoverable petroleum hydrocarbons (TRPH) using EPA Method 418.1. All samples collected by Parsons ES were analyzed for TVH using EPA Method 8015, modified (California Leaking Underground Fuel Tank Task Force, 1989), and most the of the samples were also analyzed for TEH using the same method. Analytical results for the Parsons ES samples are summarized in Table 4.1, and the BVWS results are contained in Appendix A.

The magnitude and distribution of significantly elevated TRPH, TVH, and TEH concentrations correlate well with the observed BTEX concentrations. Each of the three locations containing elevated BTEX levels, described in Section 4.2.2, was also characterized by elevated total petroleum hydrocarbon (TPH) levels. Similarly, TPH detections were relatively insignificant in the remainder of the samples analyzed for this parameter. Relatively elevated concentrations of both TVH [3,700 milligrams per kilogram (mg/kg)] and TEH (2,900 mg/kg) were detected in the 4- to 6-foot sample from 56MP-5. The hydrocarbons measured by the TEH analysis, which is designed to measure diesel-range organics, eluted early in the TEH chromatogram and are indicative of the heavy-end organic components of gasoline. The presence of gasoline is supported by the elevated TVH concentration.

TABLE 4.1
1995 SOIL DATA FOR BTEX AND TMB COMPOUNDS
SITE 56
INTRINSIC REMEDIATION TS
MACDILL AIR FORCE BASE, FLORIDA

Sample Location	Sample Date	Sample Interval (feet)	Benzene (µg/kg)[g/]	Toluene (µg/kg)	Ethylbenzene (µg/kg)	Total Xylenes (µg/kg)	Total BTEX (µg/kg)	TEH[a/] (mg/kg)	TVH[b/] (mg/kg)	Chloro-benzene (µg/kg)	1,3,5-TMB[c/] (µg/kg)	1,2,4-TMB[d/] (µg/kg)	1,2,3-TMB[e/] (µg/kg)	1,2,3,4 TMB[f/] (µg/kg)
56MP-1	3/17/95	4-6	ND[h/]	0.8J[i/]	ND	2.5J	3.3J	ND	ND	ND	ND	1.0J	ND	ND
56MP-1	3/17/95	8-10	ND	3.8J	ND	5.0J	8.8J	ND	ND	ND	ND	ND	ND	ND
56MP-2	3/17/95	6-8	ND	ND	ND	1.2J	1.2J	ND	ND	ND	ND	ND	ND	ND
56MP-2	3/17/95	13-15	ND	ND	ND	4.9JB[j/]	4.9JB	ND	ND	ND	ND	ND	ND	ND
56MP-3	3/17/95	4-6	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.6J	ND
56MP-3	3/17/95	11-13	ND	0.6J	ND	1.2JB	1.8JB	NA[k/]	ND	ND	ND	ND	ND	ND
56MP-5	3/20/95	4-6	ND	ND	15000	260,000	275,000	2,900	3,700E[l/]	11,000	380,000	520,000	260,000B	350,000
56MP-5	3/20/95	9-11	ND	0.6J	ND	3.1JB	3.7JB	NA	ND	ND	2.0J	1.7J	0.6J	4.8J
56MP-6	3/20/95	4-6	ND	3.8J	2.2J	4.0J	10	ND	ND	ND	2.4J	3.0J	ND	ND
56MP-6	3/20/95	10-11	ND	ND	ND	ND	ND	NA	ND	ND	1.7J	4.0J	2.6J	ND
56MP-16 dup	3/20/95	4-6	ND	0.9J	ND	1.0JB	1.9JB	ND	ND	ND	ND	ND	ND	0.5J
56SS-1[m/]	3/20/95	8-10	10J	4.9J	37	100B	151.9JB	NA	0.41	ND	42	140	15J	23J

a/ TEH = total extractable hydrocarbons.
b/ TVH = total volatile hydrocarbons.
c/ 1,3,5-TMB = 1,3,5 trimethylbenzene.
d/ 1,2,4-TMB = 1,2,4 trimethylbenzene.
e/ 1,2,3-TMB = 1,2,3 trimethylbenzene.
f/ 1,2,3,4-TMB = 1,2,3,4 tetramethylbenzene.
g/ µg/L = micrograms per liter.
h/ ND = not detected.
i/ J = laboratory estimate.
j/ B = compound detected in blank.
k/ NA = compound not analyzed for.
l/ E = laboratory-extrapolated value.
m/ Located adjacent to MD56-MW07.

Note: Analysis methods included SW8015M for TEH and TVH, and SW8020 for aromatic volatile organic compounds, including TMB compounds.

4.2.4 Total Organic Carbon

TOC concentrations are a measure of the amount of organic matter sorbed on soil particles or trapped in the interstitial passages of a soil matrix. The TOC concentration in the saturated zone is an important parameter used to estimate the amount of contaminant that potentially could be sorbed to the aquifer matrix. Sorption results in retardation of the contaminant plume migration relative to the average advective groundwater velocity.

Samples for TOC analysis were collected in sandy material in the vicinity of the water table at 56MP-3, 56MP-6, and 56SS-2 (Figure 4.1). To avoid interference from carbon present in fuel hydrocarbons, these samples were collected from locations where data indicated that little or no hydrocarbon contamination was present. The TOC content of the soil at these locations ranged from 0.10 percent to 0.44 percent (Table 4.2).

4.3 GROUNDWATER CHEMISTRY

Biodegradation of fuel hydrocarbons can occur when an indigenous population of hydrocarbon-degrading microorganisms is present in the aquifer and sufficient concentrations of electron acceptors and nutrients, including fuel hydrocarbons, are available to these organisms. Three lines of evidence can be used to document the occurrence of natural attenuation:

- Geochemical evidence;
- Documented loss of contaminant mass at the field scale; and
- Laboratory microcosm studies.

The first line of evidence (geochemical evidence) is used herein to support the occurrence of natural attenuation, as described in the following sections. Because this line of evidence strongly suggests that natural attenuation is occurring at this site, laboratory microcosm studies were not deemed necessary.

4.3.1 Dissolved Hydrocarbon Contamination

Laboratory analytical results for groundwater samples collected during previous site investigations (BVWS, 1995) revealed the presence of fuel hydrocarbon contamination in the shallow saturated zone. BVWS groundwater quality results are contained in Appendix A. Groundwater samples collected in March 1995 by Parsons ES personnel confirmed these results. Table 4.3 summarizes groundwater contaminant data for these samples. Mobile LNAPL, or free product, was not observed during any of the investigations.

4.3.1.1 Dissolved BTEX Contamination

Figure 4.2 is an isopleth map showing the distribution of total BTEX dissolved in groundwater in March 1995. Where nested monitoring points or wells were sampled,

TABLE 4.2
SOIL TOTAL ORGANIC CARBON RESULTS
SITE 56 & 32 - GASOLINE STATION
INTRINSIC REMEDIATION TS
MADILL AIR FORCE BASE, NEW YORK

Sample Location	Depth (feet bgs)	Total Organic Carbon[a/] (%)
56MP-3	4 - 6	0.44
56MP-3 dup	4 - 6	0.35
56MP-6	4 - 6	0.36
56SS-2	4 - 6	0.10
56SS-12 (dup)	4 - 6	0.10

a/ Moisture adjusted result.
NOTE: Analysis method was SW9060

TABLE 4.3
1995 GROUNDWATER QUALITY DATA FOR BTEX AND TMB COMPOUNDS
SITE 56
INTRINSIC REMEDIATION TS
MACDILL AIR FORCE BASE, FLORIDA

Sample Location	Sample Date	Benzene (µg/L)[j]	Toluene (µg/L)	Ethylbenzene (µg/L)	Total Xylenes (µg/L)	Total BTEX (µg/L)	TVH[a] (mg/L)[h]	TOC[b] (mgC/L)[i]	Chloro-Benzene (µg/L)	1,3,5-TMB[c] (µg/L)	1,2,4-TMB[d] (µg/L)	1,2,3-TMB[e] (µg/L)	1,2,3,4 TMB[f] (µg/L)
56MP-1S	3/28/95	ND[j]	7.2	ND	ND	7.2	ND	NA[k]	ND	ND	ND	1.3	ND
56MP-2S	3/29/95	ND	10B[l]	ND	ND	10B	ND	NA	ND	0.4	ND	ND	ND
56MP-3S	3/28/95	ND	11	ND	ND	11	ND	10.2	ND	ND	ND	ND	ND
56MP-3S dup	3/28/95	NA	NA	NA	NA	NA	NA	10.2	NA	NA	NA	NA	NA
56MP-3D	3/28/95	ND	ND	ND	1.4	1.4	ND	NA	0.5	0.7	ND	ND	ND
56MP-4S	3/27/95	4,500	11,936	2,200	11,000	29,636	94E[m]	NA	ND	720	2,300	560	140
56MP-4S dup	3/27/95	NA	NA	NA	NA	NA	93E	NA	NA	NA	NA	NA	NA
56MP-5S	3/27/95	100	120	75	1,100	1,395	8.6	NA	20	190	400	96	130
56MP-5D	3/27/95	ND	ND	ND	ND	ND	ND	NA	ND	1.5	0.7	0.9	30
56MP-15D (dup)	3/27/95	ND	ND	ND	ND	ND	0.2	NA	ND	0.8	0.6	0.9	29
56MP-6S	3/26/95	ND	18	ND	ND	18	ND	NA	ND	ND	ND	ND	0.7
56MP-6D	3/26/95	ND	ND	ND	ND	ND	ND	NA	ND	ND	ND	ND	ND
56MP-7S	3/29/95	ND	5.9B	ND	ND	5.9B	ND	ND	ND	ND	ND	ND	ND
56MP-7D	3/27/95	ND	0.4	ND	ND	0.4	ND	NA	ND	1.4	ND	ND	0.9
56MP-8S	3/26/95	ND	1.6	ND	ND	1.6	ND	NA	ND	ND	ND	ND	ND
56MP-10S	3/26/95	ND	7.3	ND	ND	7.3	ND	NA	ND	ND	ND	ND	ND
MD56-MW1	3/26/95	ND	ND	ND	ND	ND	ND	NA	ND	ND	ND	ND	ND
MD56-MW21 (dup)	3/26/95	ND	ND	ND	ND	ND	ND	NA	ND	ND	ND	ND	ND
MD56-MW2	3/26/95	ND	ND	ND	ND	ND	ND	NA	ND	ND	ND	ND	ND
MD56-MW4	3/29/95	ND	0.6B	ND	ND	0.6B	ND	10.5	ND	ND	ND	ND	ND
MD56-MW5	3/28/95	ND	ND	ND	1.5	1.5	ND	NA	ND	ND	ND	ND	ND
MD56-MW6	3/27/95	7,600	12722	1600	7,700	29,622	91E	NA	ND	490	1,500	310	ND
MD56-MW7	3/28/95	80	47B	81	98	306B	2.1	NA	2.5	33	32	19	15
MD56-MW8	3/26/95	1.1	ND	2	ND	3.1	0.2	NA	ND	ND	ND	ND	ND
MD56-MW9	3/27/95	ND	ND	ND	ND	ND	ND	NA	ND	ND	ND	ND	ND
MD56-MW10	3/27/95	18	43	77	880	1,018	5.1	NA	2.7	130	390	120	74

Site 56, MacDill AFB
Alternative 4 costs

Computed By: JRH, 8/4/95
Check by: [illegible] 8/18/95

COSTS FOR SOIL EXCAVATION (all Capital Costs)

Based on prior experience, assume ~ $60/ton for operator, backhoe, and soil disposal at off-Base thermal treatment facility. Also includes backfill,

Assume ~ 1.25 tons/cy

Assume excavated area approximates a circle w/ 100-ft diameter & depth = 4 feet

$V = \pi r^2 h = \pi(50\text{ft})^2(4\text{ft}) = 31{,}400\text{ft}^3$
$= 1{,}163\text{ yd}^3$
$= 1{,}454\text{ tons}$

1454 tons x $60/ton = $116,320

Add Compaction + piping = $ 5,000

Total $121,320

Does not include reseeding/Landscaping - Round to $125,000 to account for these considerations.

Present Worth Costs for Alternative 4 - Assume inflation factor = 5%/year

PW = Capital Costs + (Annual Costs x Present Worth Factor)

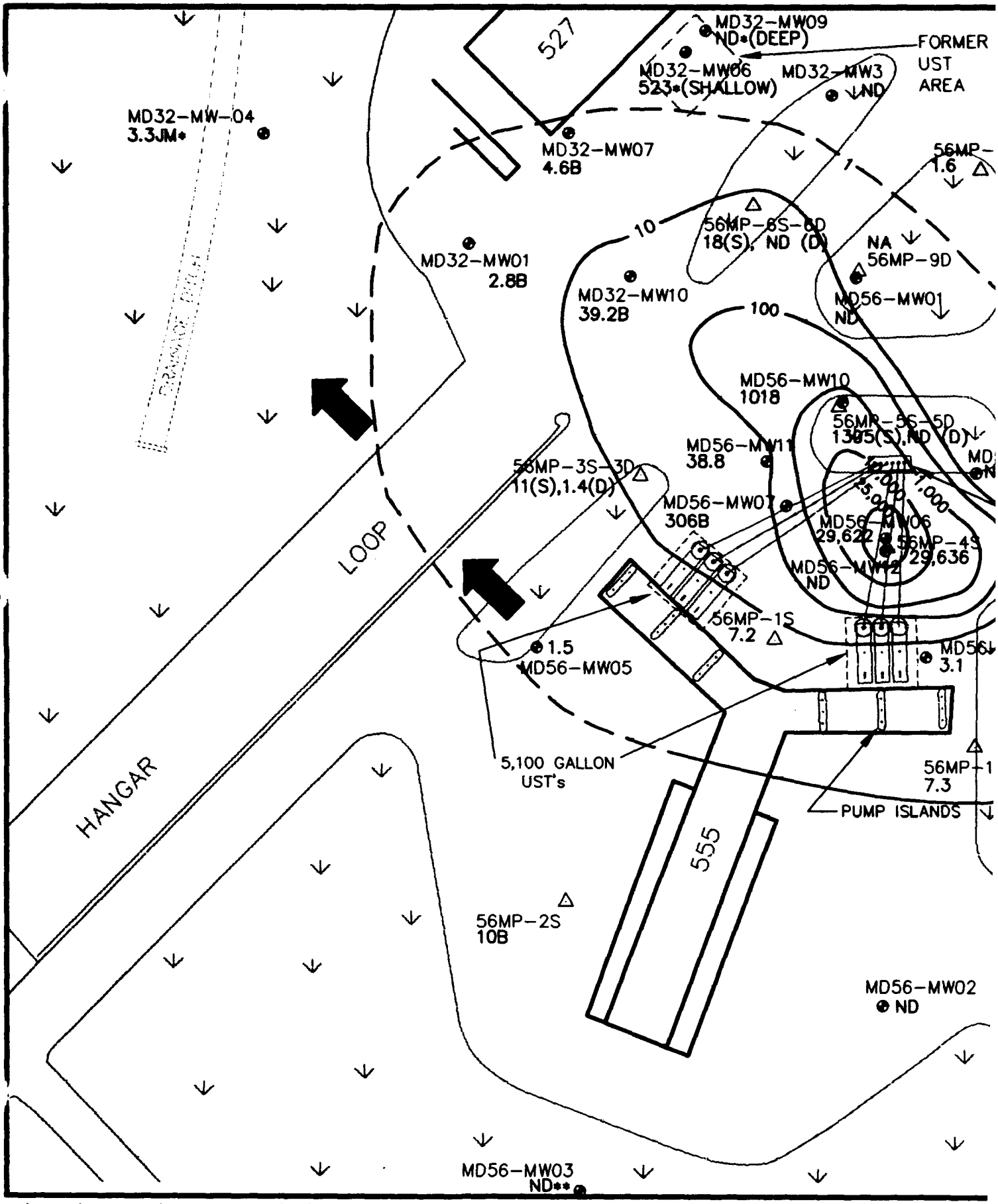
For LTM/Institutional Controls, PW = $208,031 (from Alternative 2)

Total PW = 125,000 + 208,031 = $333,031

TABLE 4.3 (Continued)
1995 GROUNDWATER QUALITY DATA FOR BTEX AND TMB COMPOUNDS
SITE 56
INTRINSIC REMEDIATION TS
MACDILL AIR FORCE BASE, FLORIDA

Sample Location	Sample Date	Benzene (µg/L)[g]	Toluene (µg/L)	Ethylbenzene (µg/L)	Total Xylenes (µg/L)	Total BTEX (µg/L)	TVH[a] (mg/L)[h]	TOC[b] (mgC/L)[i]	Chloro-Benzene (µg/L)	1,3,5-TMB[c] (µg/L)	1,2,4-TMB[d] (µg/L)	1,2,3-TMB[e] (µg/L)	1,2,3,4 TMB[f] (µg/L)
MD56-MW11	3/28/95	5.9	ND	29	3.9	38.8	0.5	NA	0.5	0.5	ND	0.4	11
MD56-MW12	3/27/95	ND	ND	ND	ND	ND	ND	NA	ND	ND	ND	ND	ND
56 - FIELD BLANK	3/28/95	0.6	0.8B	ND	1.3	2.7B	NA	NA	ND	ND	ND	ND	ND
56 - RINSATE BLANK	3/28/95	ND	0.5B	ND	1	1.5B	NA	NA	ND	0.5	ND	1.1	ND
MD32-MW1	3/28/95	ND	0.4B	0.5	1.9	2.8B	0.8	NA	1.2	1	ND	ND	ND
MD32-MW21 (dup)	3/28/95	ND	ND	0.6	2.5	3.1	1	NA	0.9	0.9	ND	ND	ND
MD32-MW3	3/24/95	ND	ND	ND	ND	ND	ND	8.55	ND	ND	ND	ND	ND
MD32-MW7	3/28/95	1.6	0.5B	ND	2.5	4.6	0.1	NA	5.5	1.5	0.9	ND	0.8
MD32-MW10	3/26/95	36	1.1	0.8	1.3B	39.2	1	NA	4.3	ND	ND	ND	1.8
MD32-MW10 dup	3/26/95	38	1.2	0.9	1.5B	41.6	NA	NA	5.9	ND	ND	ND	2

a/ TVH = total volatile hydrocarbons.
b/ TOC = total organic carbon.
c/ 1,3,5-TMB = 1,3,5 trimethylbenzene.
d/ 1,2,4-TMB = 1,2,4 trimethylbenzene.
e/ 1,2,3-TMB = 1,2,3 trimethylbenzene.
f/ 1,2,3,4-TMB = 1,2,3,4 tetramethylbenzene.
g/ µg/L = micrograms per liter.
h/ mg/L = milligrams per liter.
i/ mgC/L = milligrams of carbon per liter.
j/ ND = not detected.
k/ NA = compound not analyzed for.
l/ B = compound detected in blank.
m/ E = laboratory extrapolated value.
Note: Analysis methods included SW8015M for TEH and TVH, and SW8020 for aromatic volatile organic compounds, including TMB compounds.



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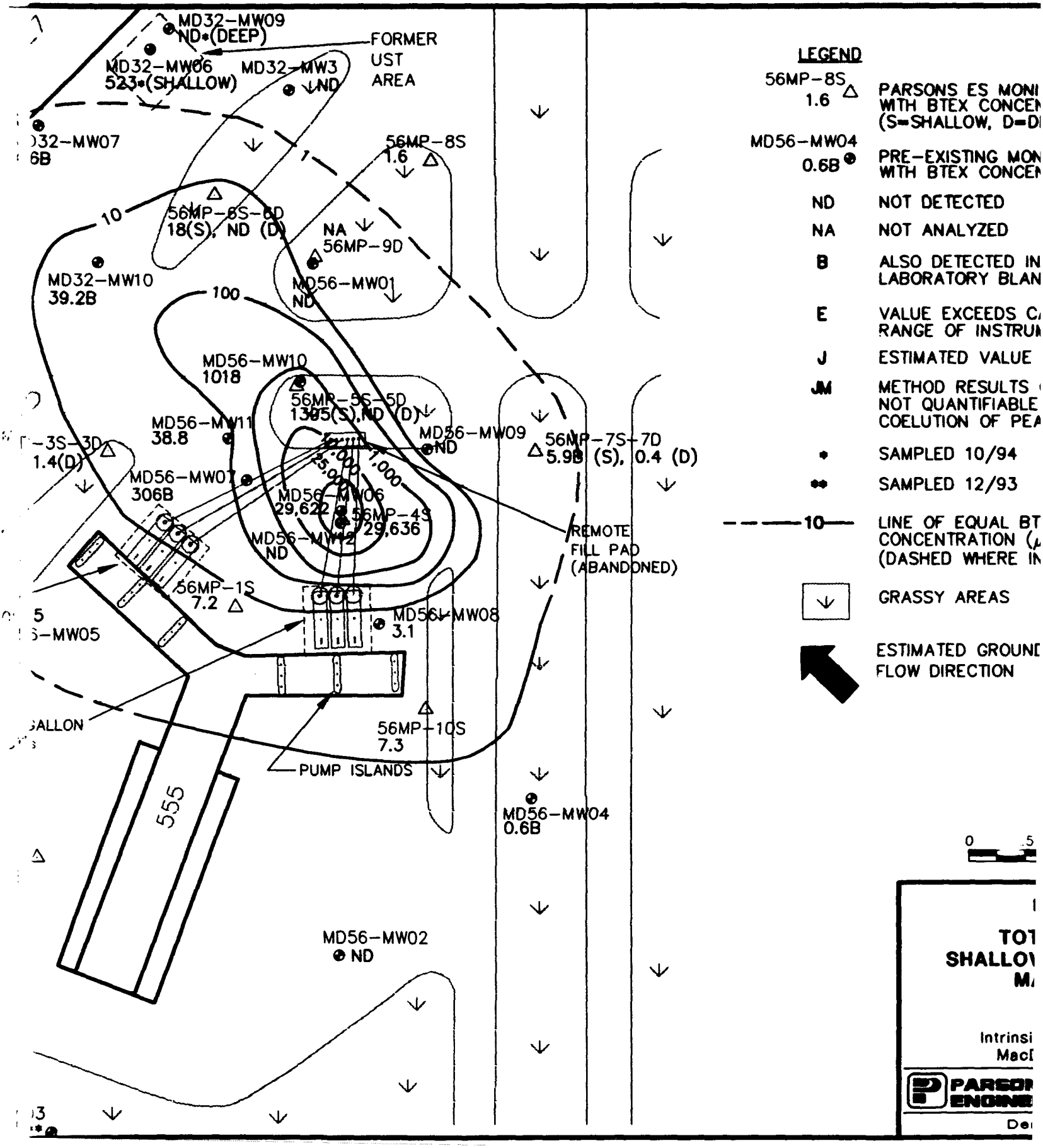
MD32-MW09
ND*(DEEP)
MD32-MW06
523*(SHALLOW)
MD32-MW3
ND
FORMER
UST
AREA
MD32-MW07
6B
56MP-8S
1.6
56MP-8S-6D
18(S), ND (D)
NA
56MP-9D
MD32-MW10
39.2B
MD56-MW01
ND
10
100
MD56-MW10
1018
56MP-5S-5D
1305(S), ND (D)
MD56-MW11
38.8
MD56-MW09
ND
56MP-7S-7D
5.9B (S), 0.4 (D)
-3S-3D
1.4(D)
MD56-MW07
306B
MD56-MW06
29,622
56MP-4S
29,636
MD56-MW12
ND
5,000
1,000
REMOTE
FILL PAD
(ABANDONED)
56MP-1S
7.2
MD56-MW08
3.1
5
S-MW05
GALLON
56MP-10S
7.3
PUMP ISLANDS
555
MD56-MW04
0.6B
MD56-MW02
ND
LEGEND
56MP-8S
1.6
PARSONS ES MONI
WITH BTEX CONCEN
(S=SHALLOW, D=DI
MD56-MW04
0.6B
PRE-EXISTING MON
WITH BTEX CONCEN
ND
NOT DETECTED
NA
NOT ANALYZED
B
ALSO DETECTED IN
LABORATORY BLAN
E
VALUE EXCEEDS C
RANGE OF INSTRUM
J
ESTIMATED VALUE
JM
METHOD RESULTS
NOT QUANTIFIABLE
COELUTION OF PEA
SAMPLED 10/94
SAMPLED 12/93
10
LINE OF EQUAL BT
CONCENTRATION (
(DASHED WHERE IN
GRASSY AREAS
ESTIMATED GROUND
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0
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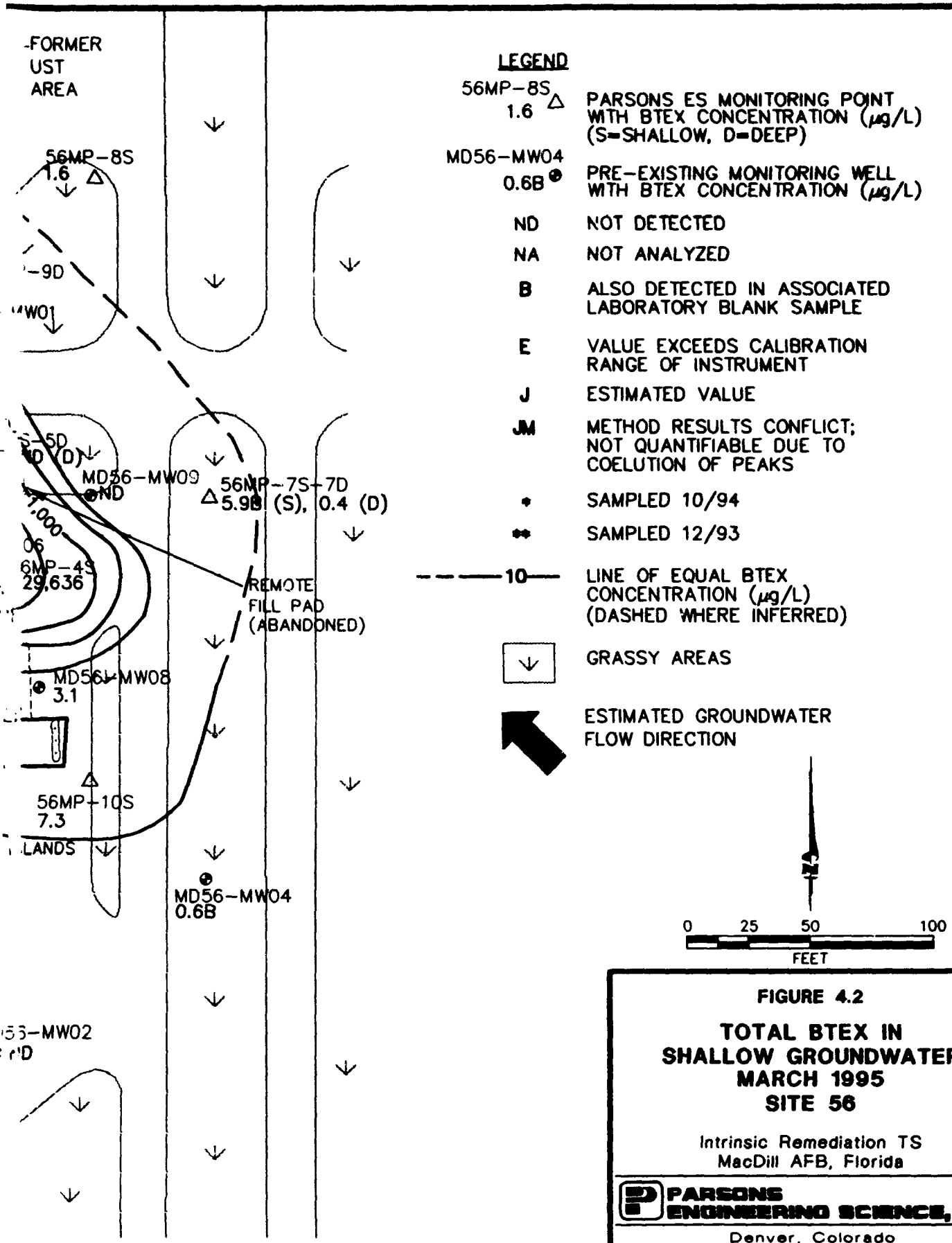

FIGURE 4.2

TOTAL BTEX IN SHALLOW GROUNDWATER MARCH 1995 SITE 56

Intrinsic Remediation TS
MacDill AFB, Florida

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Denver, Colorado

isopleths are drawn using the maximum concentration detected at that location. The maximum observed total BTEX concentrations were 29,636 µg/L at monitoring point 56MP-4S and 29,622 µg/L at adjacent well MD56-MW6. Elsewhere, the detected total BTEX concentrations ranged from 0.4 mg/L at monitoring point 56MP-7D to 1,395 µg/L at monitoring point 56MP-5S. The plume is elongated parallel to the direction of groundwater flow. The lack of significant BTEX detections in the two deeper wells (MD32-MW09 and MD56-MW12) and in the deeper monitoring points [identified with a "D" adjacent to the monitoring point number (e.g., 56MP-5D)], indicates that the dissolved hydrocarbons are primarily present in the sandy interval overlying the clay (see Section 3.5).

4.3.1.2 Dissolved TPH Contamination

Groundwater samples collected by BVWS (1995) were analyzed for TRPH using EPA Method 418.1 (see Appendix A for results). Samples collected by Parsons ES were analyzed for TVH using EPA Method SW8015, modified. TVH is a measure of the total volatile (gasoline-range) petroleum hydrocarbons (C_4 to C_{10}) present in the dissolved state in the sample. The TVH results correlate well with the BTEX results, with the maximum TVH concentration of 94E mg/L detected at monitoring point 56-MP4S, which also had the highest dissolved BTEX concentration (Table 4.3). The E qualifier indicates that the value exceeded the calibration range of the analytical instrument, and that it is a laboratory-extrapolated value. This monitoring point also had the highest dissolved BTEX concentration.

4.3.2 Halogenated Volatile Organic Compounds

Groundwater samples collected at Sites 56 and 32 were analyzed for selected halogenated VOCs at RSKERL using method RSKSOP-148 [Determination of Volatile Organic Compounds in Water by Automated Headspace Gas Chromatography/Mass Spectrometry (Saturn II Ion Trap Detector)]. The targeted compounds included tetrachloroethene (PCE), trichloroethene (TCE), 1,1-dichloroethene (1,1-DCE), trans-1,2-DCE, cis-1,2-DCE, and vinyl chloride. In addition, the samples were analyzed for ethylene using method RSKSOP-147. None of the targeted compounds were detected.

4.3.3 Surface Water and Sediment Quality

Surface water and sediment samples were not collected by Parsons ES. However, samples of both media were collected from the drainage ditch bordering Site 32 by BVWS (1995). Analytical results and sampling locations are contained in Appendix A. The majority of surface water samples did not contain detectable concentrations of BTEX. However, benzene and toluene each were detected in the surface water sample from the furthest downstream location at a concentration of 0.6J µg/L. The J qualifier indicates that the value is estimated. Methyl tert-butyl ether (MTBE) was detected in surface water at one station downgradient of Site 56 at a concentration of 52.8 µg/L which exceeds the Florida standard of 50 µg/L [Chapter 62-302, Florida Administrative Code (FAC)]. However, progressively lower concentrations of MTBE were detected in the downstream direction, most likely due to the effects of dilution and volatilization. Scattered, low-level BTEX concentrations were also detected in sediment samples. The highest BTEX detection was 105.6M µg/kg at the furthest

downstream sampling station. The M qualifier indicates that method results conflict, and that the result was not quantifiable due to coelution of peaks.

4.3.4 Inorganic Chemistry and Geochemical Indicators of Biodegradation

Microorganisms obtain energy for cell production and maintenance by catalyzing the transfer of electrons from electron donors to electron acceptors. This results in the oxidation of the electron donor and the reduction of the electron acceptor. Electron donors at Site 56 include natural organic carbon and fuel hydrocarbon compounds. Fuel hydrocarbons are completely degraded or detoxified if they are utilized as the primary electron donor for microbial metabolism (Bouwer, 1992). Electron acceptors are elements or compounds that occur in relatively oxidized states, and include DO, nitrate, ferric iron, sulfate, and carbon dioxide. Microorganisms preferentially utilize electron acceptors while metabolizing fuel hydrocarbons (Bouwer, 1992). DO is utilized first as the prime electron acceptor. After the DO is consumed, anaerobic microorganisms typically use electron acceptors (as available) in the following order of preference: nitrate, ferric iron hydroxide, sulfate, and finally carbon dioxide. Because the biodegradation of fuel hydrocarbons should deplete the concentrations of these electron acceptors, construction of isopleth maps depicting their concentrations can provide evidence of whether biodegration is occurring, and the degree to which it is occurring.

During anaerobic biodegradation, there is an increase in the concentrations of metabolic byproducts derived from the microbial degradation of fuel hydrocarbons. Metabolic byproducts include ferrous iron produced during iron reduction, and methane produced during methanogenesis. Therefore, isopleth maps depicting the concentrations of these byproducts provide additional evidence of biodegradation.

Depending on the types and concentrations of electron acceptors present (e.g., nitrate, ferric iron, sulfate, carbon dioxide), pH conditions, and redox potential, anaerobic biodegradation can occur by denitrification, ferric iron reduction, sulfate reduction, or methanogenesis. Other, less common anaerobic degradation mechanisms such as manganese reduction may dominate if the physical and chemical conditions in the subsurface favor use of these electron acceptors. Anaerobic destruction of BTEX compounds is associated with the accumulation of fatty acids, production of methane, solubilization of iron, and reduction of nitrate and sulfate (Cozzarelli *et al.*, 1990; Wilson *et al.*, 1990). Environmental conditions and microbial competition will ultimately determine which processes will dominate. Vroblesky and Chapelle (1994) show that the dominant terminal electron accepting process can vary both temporally and spatially in an aquifer with fuel hydrocarbon contamination.

Based on available data, biodegradation of fuel hydrocarbons at Site 56 is occurring, and concentrations of sulfate and methane indicate that sulfate reduction and methanogenesis are the primary pathways for biodegradation. Concentrations of DO and ferrous iron also support the occurrence of biodegradation, but the trends are less apparent. These parameters, and the distribution of dissolved BTEX in groundwater, are discussed in the following sections.

4.3.4.1 Dissolved Oxygen

DO concentrations were measured at monitoring wells and monitoring points in March 1995 (Table 4.4). Figure 4.3 is an isopleth map showing the distribution of DO concentrations in groundwater. The generally low DO concentrations both inside and outside of the contaminant plume indicate that the groundwater system is naturally low in DO, that DO is not an important electron acceptor at this site, and that the degradation mechanisms operating at the site are primarily anaerobic. Within the area characterized by substantially elevated BTEX concentrations (greater than 100 µg/L), DO concentrations generally are below 0.1 mg/L, and are as low as 0.02 mg/L (at MD56-MW06). DO levels measured outside or on the margin of the plume range from 0.02 mg/L to 0.81 mg/L. The relatively high DO concentration detected in groundwater from the deeper monitoring well MD56-MW12 (2.4 mg/L) indicates that DO concentrations increase with depth below the vertical extent of the BTEX plume in the surficial aquifer.

The following equations describe the overall stoichiometry of aromatic hydrocarbon mineralization caused by aerobic microbial biodegradation. In the absence of microbial cell production, the oxidation (mineralization) of benzene to carbon dioxide and water is given by:

$$C_6H_6 + 7.5O_2 \rightarrow 6CO_2 + 3H_2O$$

Therefore, 7.5 moles of oxygen are required to metabolize 1 mole of benzene. On a mass basis, the ratio of oxygen to benzene is given by:

Benzene	6(12) + 6(1) = 78 gm
Oxygen	7.5(32) = 240 gm

Mass Ratio of Oxygen to Benzene = 240/78 = 3.08:1

Therefore, in the absence of microbial cell production, 3.08 mg of oxygen are required to completely metabolize 1 mg of benzene.

Similar calculations can be completed for toluene (3.13 mg oxygen to 1 mg toluene), ethylbenzene (3.17 mg oxygen to 1 mg ethylbenzene), and the xylenes (3.17 mg oxygen to 1 mg xylene). The average mass ratio of oxygen to total BTEX is thus 3.14:1. This means that approximately 0.32 mg of BTEX is mineralized for every 1.0 mg of DO consumed. With a maximum probable background DO concentration of approximately 0.81 mg/L and a minimum observed DO concentration of 0.02 mg/L, the shallow groundwater at this site has the capacity to assimilate 0.25 mg/L (250 µg/L) of total BTEX through aerobic biodegradation. This is a conservative estimate of the assimilative capacity of DO because microbial cell mass production was not taken into account by the stoichiometry shown above.

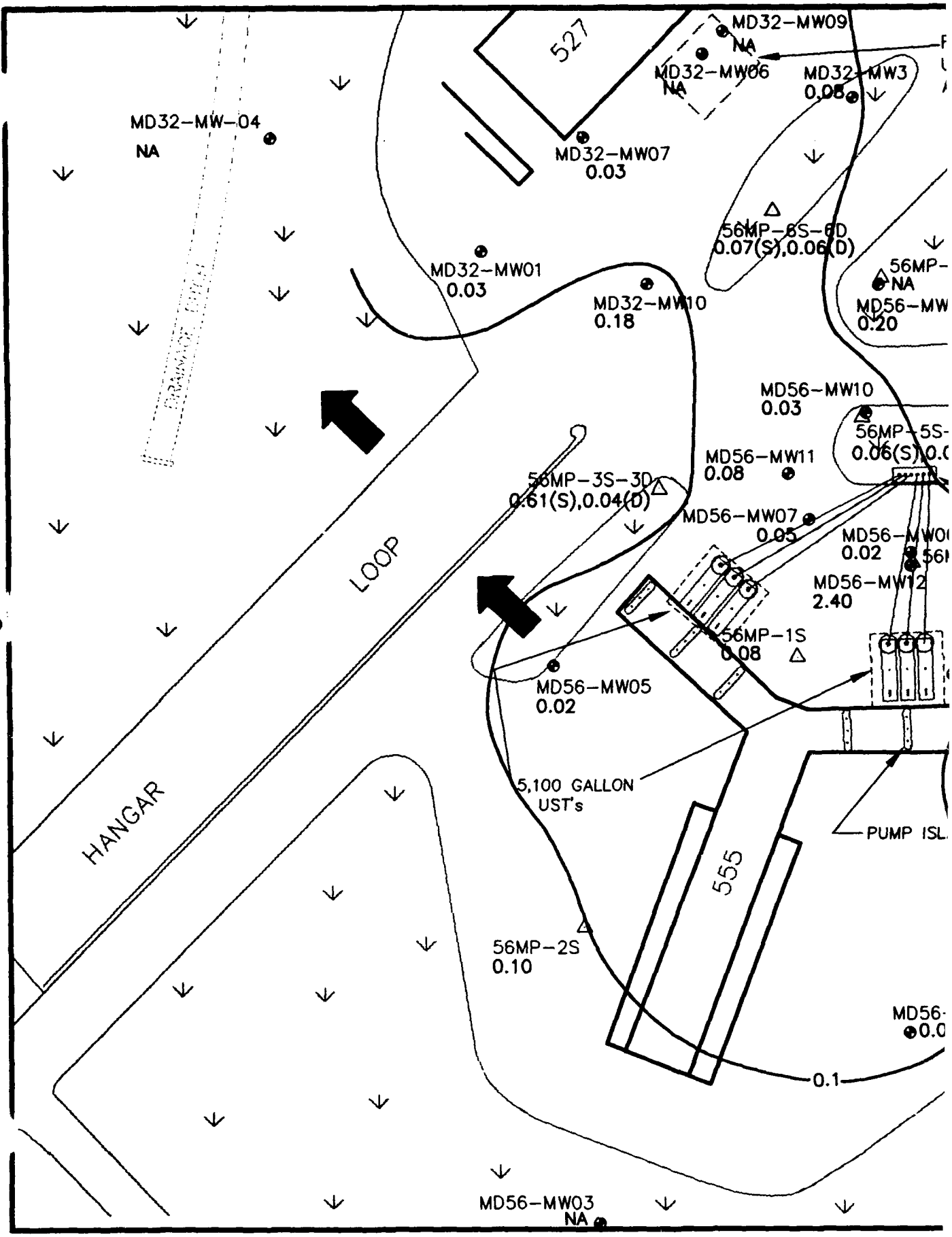
When cell mass production is accounted for, the mineralization of benzene to carbon dioxide and water is given by:

$$C_6H_6 + 2.5O_2 + HCO_3 + NH_4 \rightarrow C_5H_7O_2N + 2CO_2 + 2H_2O$$

TABLE 4.4
1995 GROUNDWATER GEOCHEMICAL DATA
SITE 56
INTRINSIC REMEDIATION TS
MACDILL AIR FORCE BASE, FLORIDA

Sample Location	Water Temp (°C)	pH	Conductivity (µs/cm)[a]	Dissolved Oxygen (mg/L)[b]	Redox Potential (mV)[c]	Total Alkalinity (mg/L)	Chloride (mg/L)	Ferrous Iron (mg/L)	Nitrate (mg/L)	Nitrite (mg/L)	Total Iron (mg/L)	Sulfate (mg/L)	Manganese (mg/L)	Sulfide (mg/L)	Ammonia (ppm)[d]	Carbon Dioxide (ppm)	Methane (ppm)
56MP-1S	26.2	6.55	1470	0.08	-145.1	460	34.7	5.08	ND[e]	ND	4.94	395	0.4	0.14	2	205	0.161
56MP-2S	24.4	6.34	1290	0.10	-39.0	420	45.3	0.66	ND	ND	0.77	331	ND	0.111	1	<100	0.03
56MP-3S	25.1	7.14	570	0.61	-147.1	260	18.3	2.49	ND	ND	2.44	31.6	ND	0.285	1	<100	0.092
56MP-3D	25.7	6.76	590	0.04	-224.9	220	30.5	0.23	ND	ND	0.19	51.7	0.2	8.9	10	175	1.069
56MP-4S	27.1	6.88	970	0.03	-168.7	520	15.3	0.09	ND	ND	0.02	0.395	ND	0.234I[f]	NA[g]	<100	8.968
56MP-5S	26.9	6.48	880	0.06	-209.6	460	10.7	0.36	0.08	ND	0.27	1.21	ND	1.285	10	225	13.574
56MP-5D	27.0	6.45	460	0.03	-235.2	160	16.9	0.34	ND	ND	0.25	50.4	0.3	3.135	4	128	0.568
56MP-6S	26.2	6.46	520	0.07	-193.0	180	27.5	0.18	ND	ND	0.12	67.3	ND	1.735	NA	<100	0.245
56MP-6D	25.0	6.87	830	0.06	-163.9	200	41.7	0.17	ND	ND	0.11	183	ND	0.458	1	<100	0.086
56MP-7S	22.5	6.28	600	0.16	-111.6	160	32.8	0.39	ND	ND	0.34	108	ND	1.025	2	120	NA
56MP-7D	24.0	6.76	460	0.06	-176.8	140	24.1	0.22	ND	ND	0.22	65.1	ND	0.32	1	<100	0.067
56MP-7D dup	24.0	6.76	460	0.06	-176.8	140	24	0.24	ND	ND	0.17	65.4	ND	0.055	1	<100	NA
56MP-8S	23.8	6.98	1070	0.44	-83.8	120	28.2	0.05	ND	ND	0.04	108	ND	0.053	0.4	<100	0.032
56MP-8S dup	NA	NA	NA	NA	NA	NA	28.5	NA	ND	ND	NA	107	NA	NA	NA	NA	NA
56MP-10S	28.6	6.93	540	0.81	-109.6	240	7.9	0.34	ND	ND	0.34	4.61	ND	0.675	0.8	<100	2.288
56-MP-15D	NA	NA	NA	NA	NA	NA	16.4	NA	ND	ND	NA	52.9	NA	NA	NA	NA	0.548
MD56-MW1	25.2	6.87	590	0.20	-121.5	200	28.3	0.15	0.992	ND	0.21	80	ND	0.555	1	<100	0.442
MD56-MW1 dup	25.2	6.87	590	0.20	-121.5	200	27.8	0.16	0.992	ND	0.17	79.4	ND	0.535	1	<100	NA
MD56-MW2	26.8	6.39	510	0.07	-142.8	200	24.7	0.05	ND	ND	0.03	46.3	0.2	1.88	2	120	0.492
MD56-MW4	23.3	6.78	610	0.81	-4.9	200	24.9	0.02	0.195	ND	0.59	104	ND	0.019	0.2	<100	0.034
MD56-MW4 dup	23.3	6.78	610	0.81	-4.9	180	NA	0.04	NA	NA	0.36	NA	ND	0.017	0.2	<100	NA
MD56-MW5	26.9	7.03	1410	0.02	-237.9	520	59	0.09	1.32	ND	0.07	194	ND	1.735	6	150	0.136
MD56-MW6	27.8	6.83	1040	0.02	-217.5	440	21.5	0.56	ND	ND	0.45	2.92	ND	2.29	10	155	6.324
MD56-MW7	26.7	7.01	660	0.05	-188.5	320	25.7	0.03	ND	ND	ND	2.64	0.4	4.688	8I	152	7.953
MD56-MW8	25.5	6.55	450	0.07	-126.7	180	10.8	0.13	ND	ND	0.11	29.7	ND	1.33	2	145	2.298
MD56-MW8 dup	25.5	6.55	450	0.07	-126.7	180	NA	0.16	NA	NA	0.1	NA	ND	0.91	2	142	NA
MD56-MW9	25.4	6.31	500	0.15	-48.8	200	17.6	0.65	0.608	ND	0.77	58.7	ND	0.079	2	130	0.739
MD56-MW10	27.1	6.37	590	0.03	-235.6	200	23.4	0.17	ND	ND	0.17	68.6	0.1	2.975	5	140	3.711
MD56-MW11	26.2	6.82	490	0.08	-126.8	220	37.8	0.03	ND	ND	ND	3.23	0.1	2.69	6I	152	5.279
MD56-MW12	28.3	7.32	980	2.40	-12.8	240	147	ND	0.394	ND	0.06	42.4	ND	0.012	0.1	<100	0.014
MD32-MW1	25.2	6.67	420	0.03	-228.9	200	17.1	0.04	ND	ND	ND	14.4	0.4	7.7125	7	180	2.634
MD32-MW21 (dup	NA	NA	NA	NA	NA	NA	15.8	NA	ND	ND	NA	15.3	NA	NA	NA	NA	NA
MD32-MW3	26.0	6.81	680	0.08	-146.9	180	32.8	0.13	ND	ND	0.14	99.2	ND	0.08	0.4	<100	0 137
MD32-MW3 dup	26.0	6.81	680	0.08	-146.9	180	NA	0.1	NA	NA	0.11	NA	0.1	0.055	0.4	<100	NA
MD32-MW7	25.8	6.62	570	0.03	-246.4	240	49.2	0.02	ND	ND	0.03	8.1	0.3	7.5625	3	160	4.749
MD32-MW10	25.5	6.36	440	0.18	-118.1	200	11.5	0.04	0.202	ND	0.03	17.8	0.1	1.155	4	125	NA

a/ µs/cm = microsemens per centimeter.
b/ mg/L = milligrams per liter.
c/ mV = millivolts.
d/ ppm = parts per million.
e/ ND = not detected.
f/ I = potential turbidity interference.
g/ NA = not analyzed for.
NOTE: See Table 2.2 for analysis methods



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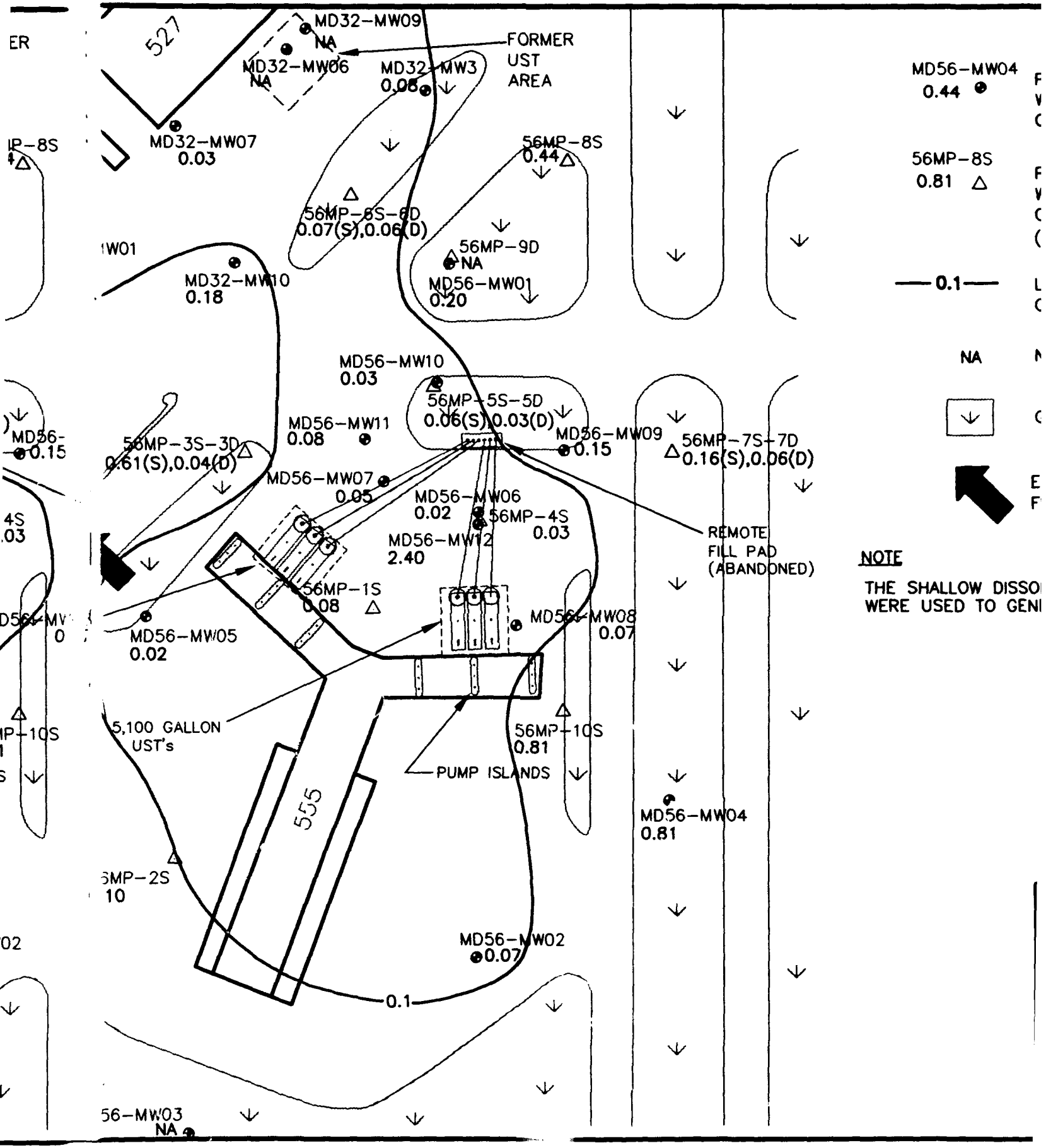
527
MD32-MW09
NA
FORMER
UST
AREA
MD32-MW06
NA
MD32-MW3
0.06
MD32-MW07
0.03
56MP-8S
0.44
56MP-6S-6D
0.07(S),0.06(D)
56MP-9D
NA
MD32-MW10
0.18
MD56-MW01
0.20
MD56-MW10
0.03
56MP-5S-5D
0.06(S),0.03(D)
MD56-MW11
0.08
MD56-MW09
0.15
56MP-7S-7D
0.16(S),0.06(D)
56MP-3S-3D
0.61(S),0.04(D)
MD56-MW07
0.05
MD56-MW06
0.02
56MP-4S
0.03
MD56-MW12
2.40
REMOTE
FILL PAD
(ABANDONED)
56MP-1S
0.08
MD56-MW08
0.07
MD56-MW05
0.02
5,100 GALLON
UST's
PUMP ISLANDS
56MP-10S
0.81
555
MD56-MW04
0.81
MD56-MW02
0.07
0.1
MD56-MW03
NA
MD56-MW04
0.44
56MP-8S
0.81
0.1
NA
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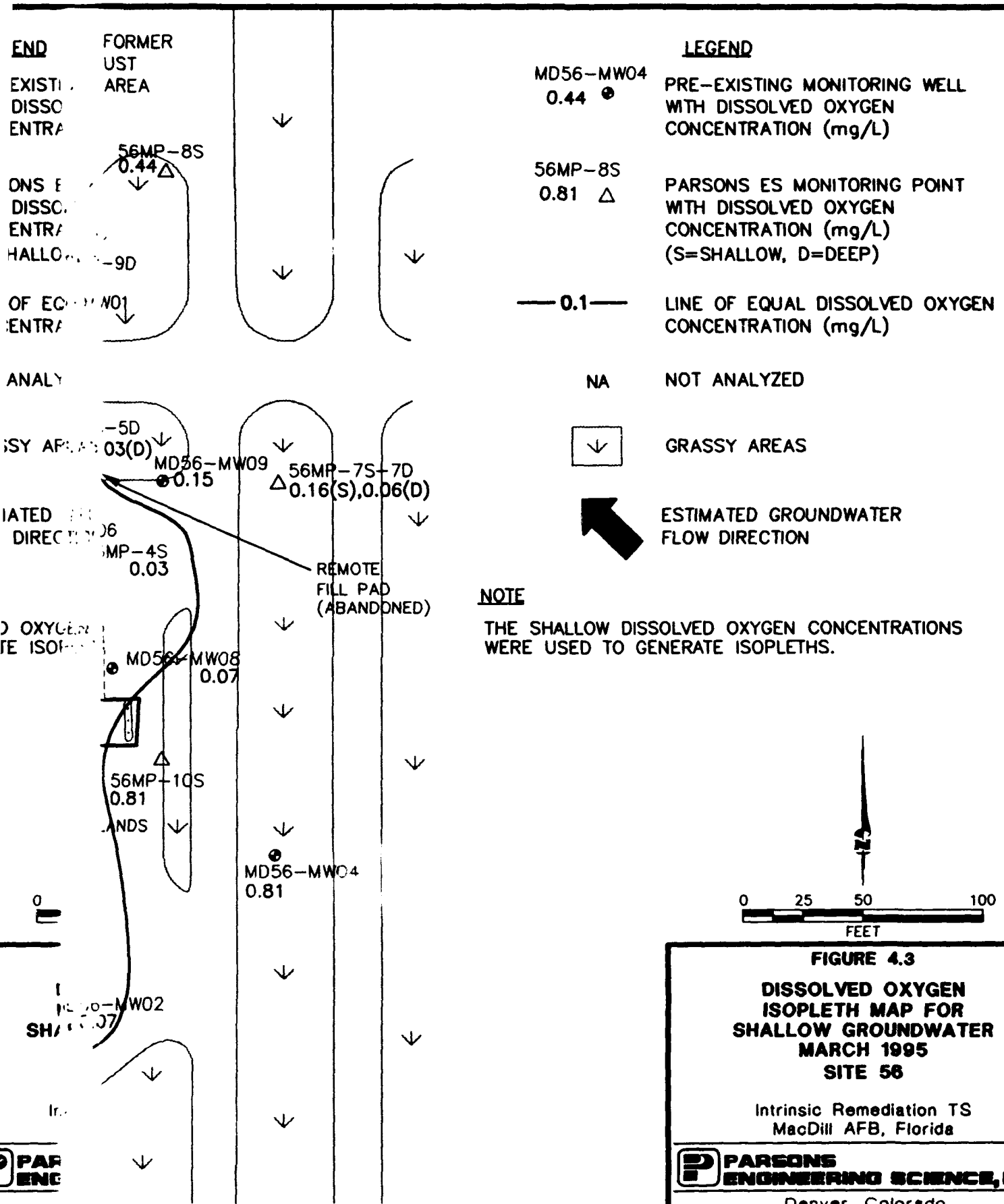
WERE USED TO GEN



LEGEND

MD56-MW04 0.44	PRE-EXISTING MONITORING WELL WITH DISSOLVED OXYGEN CONCENTRATION (mg/L)
56MP-8S 0.81 △	PARSONS ES MONITORING POINT WITH DISSOLVED OXYGEN CONCENTRATION (mg/L) (S=SHALLOW, D=DEEP)
—0.1—	LINE OF EQUAL DISSOLVED OXYGEN CONCENTRATION (mg/L)
NA	NOT ANALYZED
	GRASSY AREAS
	ESTIMATED GROUNDWATER FLOW DIRECTION

NOTE

THE SHALLOW DISSOLVED OXYGEN CONCENTRATIONS WERE USED TO GENERATE ISOPLETHS.

FIGURE 4.3

DISSOLVED OXYGEN ISOPLETH MAP FOR SHALLOW GROUNDWATER MARCH 1995 SITE 56

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Denver, Colorado

From this it can be seen that only 2.5 moles of DO are required to mineralize 1 mole of benzene when cell mass production is taken into account. On a mass basis, the ratio of DO to benzene is given by:

Benzene	6(12) + 6(1) = 78 gm
Oxygen	2.5(32)= 80 gm

Mass Ratio of Oxygen to Benzene = 80/78 = 1.03:1

On the basis of these stoichiometric relationships, 1.03 mg of oxygen is required to mineralize 1 mg of benzene. Similar calculations can be made for toluene, ethylbenzene, and the xylenes. Based on these calculations, approximately 0.97 mg of BTEX is mineralized to carbon dioxide and water for every 1.0 mg of DO consumed. With a maximum background DO concentration of approximately 0.81 mg/L, the shallow groundwater at this site has the capacity to assimilate 0.77 mg/L (770 µg/L) of total BTEX if microbial cell mass production is taken into account.

4.3.4.2 Nitrate/Nitrite

Concentrations of nitrate and nitrite were measured at groundwater monitoring wells in March 1995. Nitrite was not detected in site groundwater, and nitrate was detected in five samples at concentrations ranging from 0.08 mg/L to 1.32 mg/L (Table 4.4). As shown on Figure 4.4, nitrate was generally not detected in areas characterized by the presence of elevated BTEX concentrations. Nitrate was detected in samples from four monitoring wells that did not contain detectable BTEX concentrations, or that contained only trace levels of BTEX (MD56-MW01, MD56-MW09, MD56-MW04, and MD56-MW05) at an average concentration of 0.8 mg/L. Comparison of Figures 4.2 and 4.4 shows that areas with depleted nitrate concentrations coincide with areas of elevated BTEX concentrations. This relationship suggests that BTEX biodegradation is occurring through the microbially mediated process of denitrification.

In the absence of microbial cell production, the biodegradation of benzene via denitrification to carbon dioxide and water is given by:

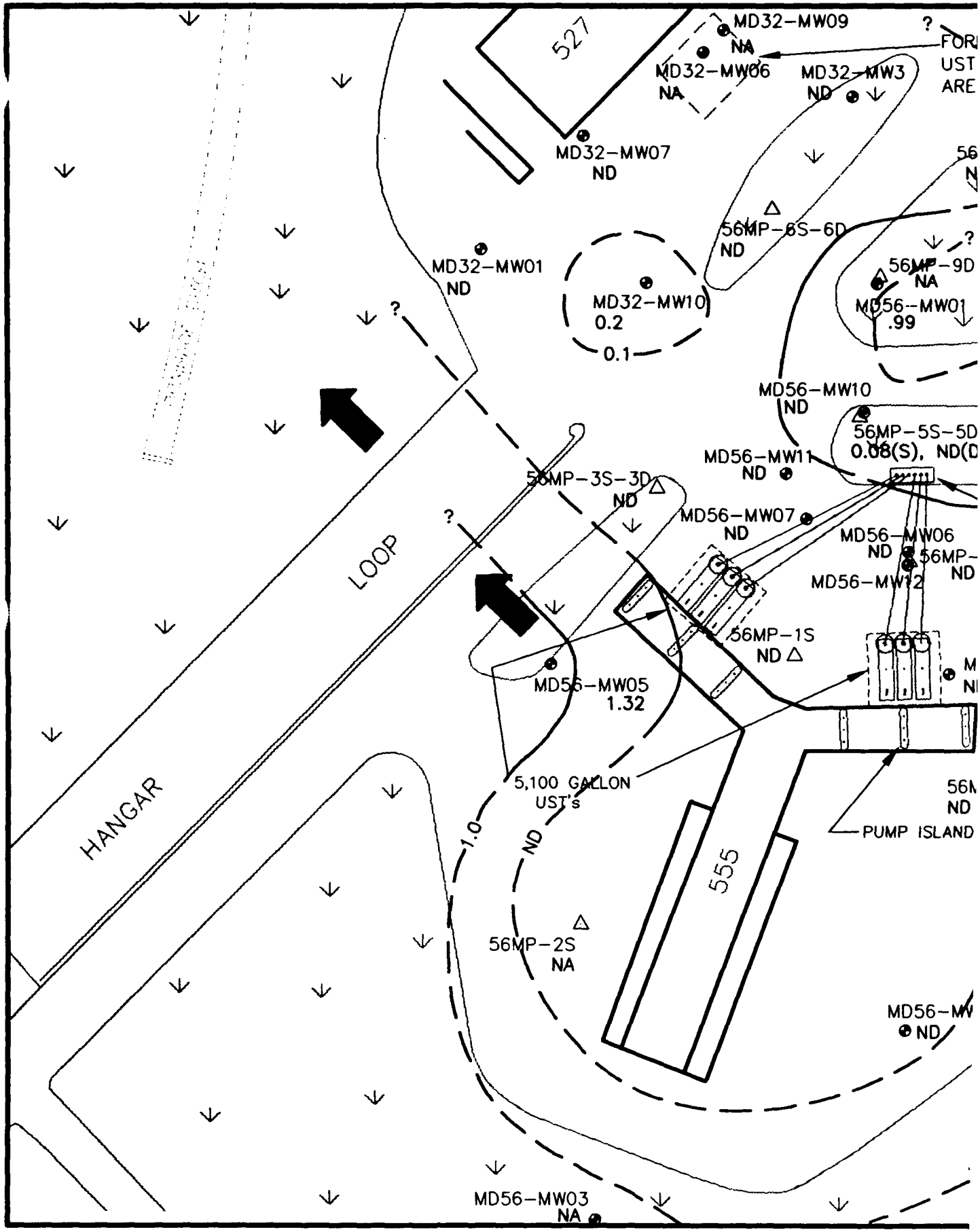
$$6NO_3^- + 6H^+ + C_6H_6 \rightarrow 6CO_{2(g)} + 6H_2O + 3N_{2(g)}$$

Based on this relationship, 6 moles of nitrate are required to mineralize 1 mole of benzene. On a mass basis, the ratio of nitrate to benzene is given by:

Benzene	6(12) + 6(1) = 78 gm
Nitrate	6(62) = 372 gm

Mass ratio of nitrate to benzene = 372/78 = 4.77:1

In the absence of microbial cell production, 4.77 mg of nitrate are required to completely mineralize 1 mg of benzene. Similar calculations can be completed for toluene (4.85 mg nitrate to 1 mg toluene), ethylbenzene (4.92 mg nitrate to 1 mg ethylbenzene), and the xylenes (4.92 mg nitrate to 1 mg xylene). The average mass



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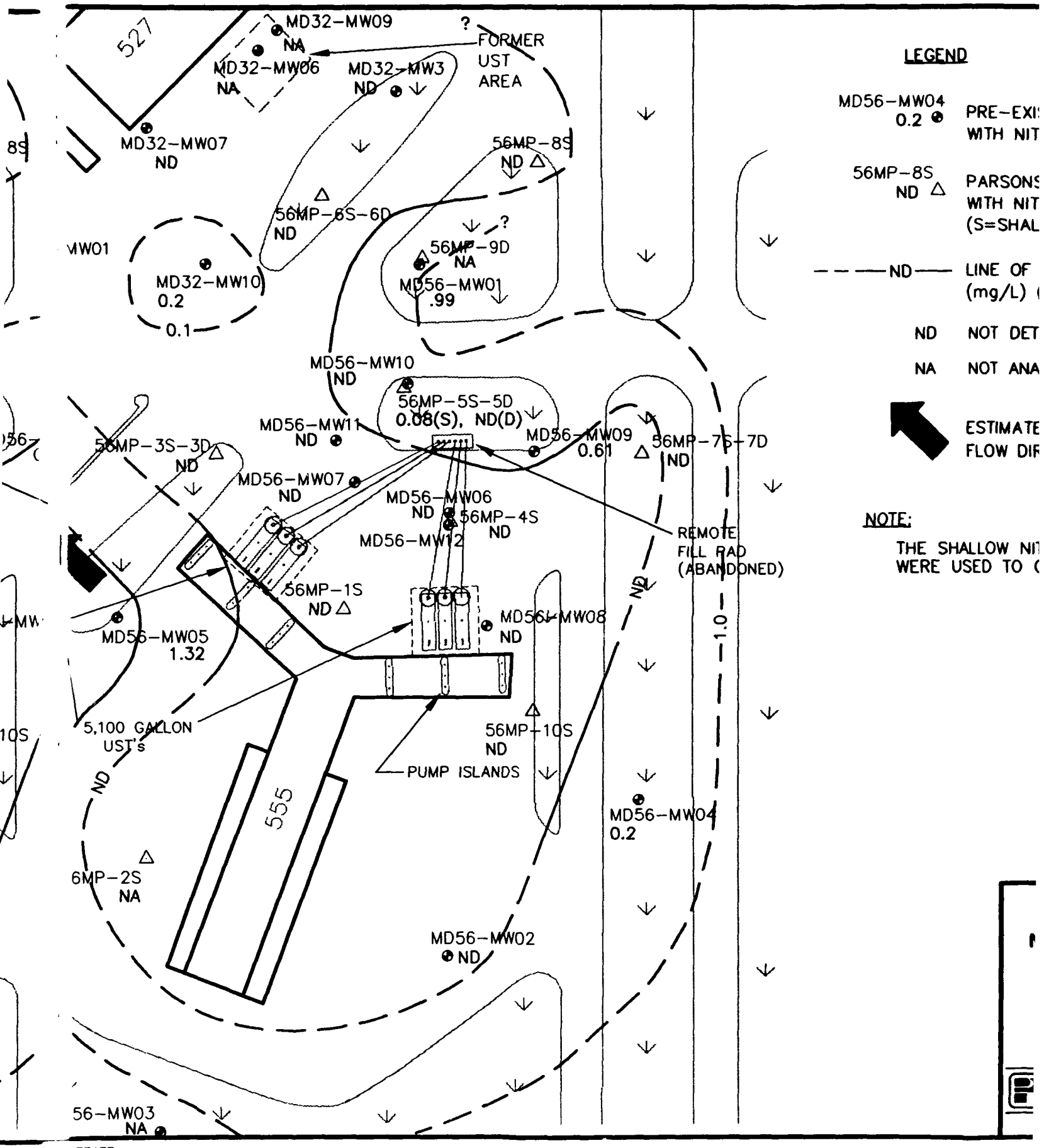
MD32-MW09
NA
?
FORMER
UST
AREA
MD32-MW06
NA
MD32-MW3
ND
MD32-MW07
ND
56MP-8S
ND
56MP-6S-6D
ND
?
56MP-9D
NA
MD56-MW01
.99
MD32-MW10
0.2
0.1
MD56-MW10
ND
56MP-5S-5D
0.08(S), ND(D)
MD56-MW11
ND
MD56-MW09
0.61
56MP-7S-7D
ND
56MP-3S-3D
ND
MD56-MW07
ND
MD56-MW06
ND
56MP-4S
ND
MD56-MW12
REMOTE
FILL PAD
(ABANDONED)
56MP-1S
ND
MD56-MW08
ND
MD56-MW05
1.32
5,100 GALLON
UST's
PUMP ISLANDS
56MP-10S
ND
MD56-MW04
0.2
6MP-2S
NA
MD56-MW02
ND
56-MW03
NA
ND
1.0
555
527
LEGEND
MD56-MW04
0.2
PRE-EXI
WITH NIT
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ND
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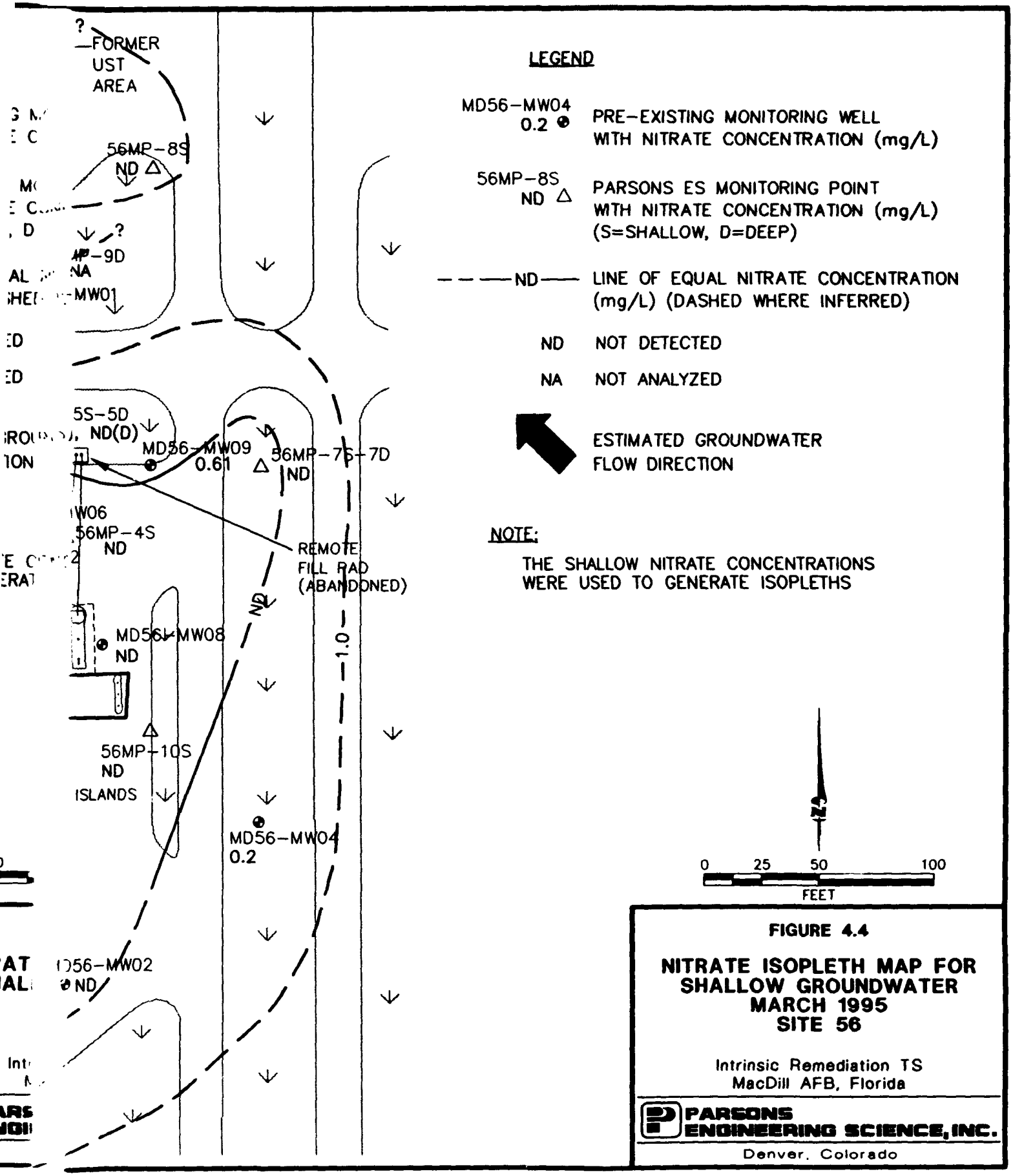

FIGURE 4.4

NITRATE ISOPLETH MAP FOR SHALLOW GROUNDWATER MARCH 1995 SITE 56

Intrinsic Remediation TS
MacDill AFB, Florida

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Denver, Colorado

ratio of nitrate consumed to total BTEX degraded is 4.9:1. This means that approximately 0.20 mg of BTEX is mineralized for every 1.0 mg of nitrate consumed. Assuming a background nitrate concentration of 0.8 mg/L, the shallow groundwater at this site has the capacity to assimilate 0.16 mg/L (160 µg/L) of total BTEX during denitrification. This is a conservative estimate of the assimilative capacity of nitrate because microbial cell mass production has not been taken into account by the stoichiometry shown above. These calculations indicate that anaerobic biodegradation of BTEX via the process of denitrification is not significant in the groundwater system at this site.

4.3.4.3 Ferrous Iron

Figure 4.5 is an isopleth map showing the distribution of ferrous iron in groundwater. Comparison of Figures 4.2 and 4.5 indicates that ferrous iron is being produced in the area of the BTEX plume via the reduction of ferric iron during anaerobic biodegradation of BTEX compounds. Ferrous iron concentrations detected within the area bounded by the 100-µg/L BTEX isopleth range from 0.03 mg/L at monitoring well MD56-MW07 to 0.57 mg/L at MD56-MW06 (Table 4.4). Background levels of ferrous iron, measured in wells that are hydraulically upgradient or crossgradient from the BTEX plume, ranged from 0.04 mg/L in MD56-MW04 to 0.66 mg/L in 56MP-2S. The majority of background concentrations range between 0.04 and 0.09 mg/L; the elevated value in 56MP-2S may be related to this monitoring point being downgradient from a waste oil UST.

The following equations describe the overall stoichiometry of benzene oxidation by iron reduction caused by anaerobic microbial biodegradation. In the absence of microbial cell production, the mineralization of benzene is given by:

$$60H^+ + 30Fe(OH)_{3,a} + C_6H_6 \rightarrow 6CO_2 + 30Fe^{2+} + 78H_2O$$

Therefore, 30 moles of ferric iron are required to metabolize 1 mole of benzene. On a mass basis, the ratio of ferric iron to benzene is given by:

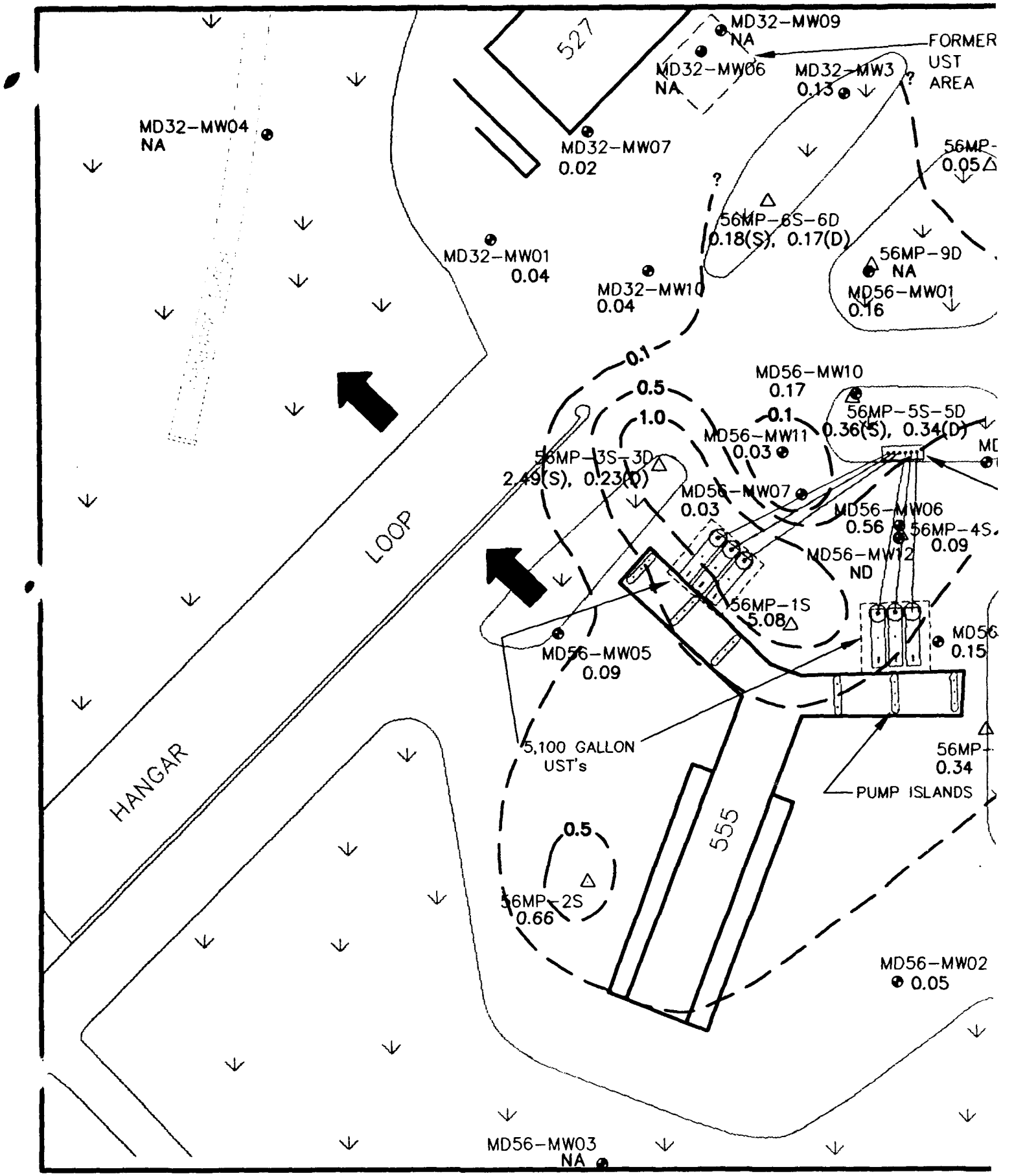
Benzene	6(12) + 6(1) = 78 gm
Ferric Iron	30(106.85) = 3205.41 gm

Mass ratio of ferric iron to benzene = 3205.41/78 = 41.1:1

Therefore, in the absence of microbial cell production, 41.1 mg of ferric iron are required to completely metabolize 1 mg of benzene. Conversely, the mass ratio of ferrous iron produced during respiration to benzene degraded can be calculated and is given by:

Benzene	6(12) + 6(1) = 78 gm
Ferrous Iron	30(55.85) = 1675.5 gm

Mass ratio of ferrous iron to benzene = 1675.5/78 = 21.5:1



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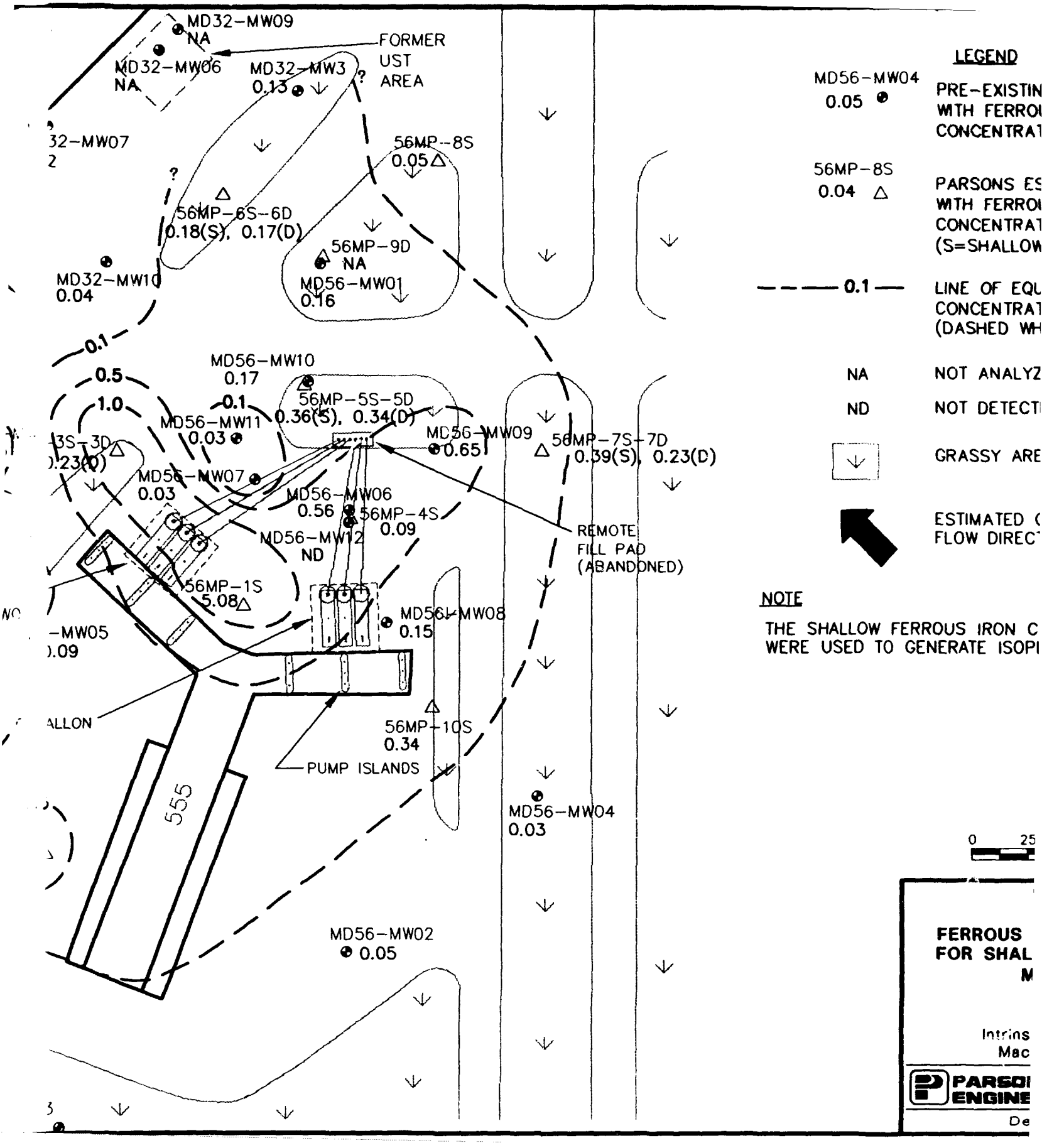
MD32-MW09
NA
FORMER
UST
AREA
MD32-MW06
NA
MD32-MW3
0.13
?
32-MW07
2
56MP--8S
0.05
?
56MP-6S-6D
0.18(S), 0.17(D)
56MP-9D
NA
MD32-MW10
0.04
MD56-MW01
0.16
0.1
0.5
1.0
MD56-MW10
0.17
0.1
56MP-5S-5D
0.36(S), 0.34(D)
MD56-MW11
0.03
MD56-MW09
0.65
56MP-7S-7D
0.39(S), 0.23(D)
3S-3D
).23(D)
MD56-MW07
0.03
MD56-MW06
0.56
56MP-4S
0.09
REMOTE
FILL PAD
(ABANDONED)
MD56-MW12
ND
56MP-1S
5.08
NO
-MW05
).09
MD56-MW08
0.15
ALLON
56MP-10S
0.34
PUMP ISLANDS
555
MD56-MW04
0.03
MD56-MW02
0.05
3
LEGEND
MD56-MW04
0.05
PRE-EXISTIN
WITH FERRO
CONCENTRAT
56MP-8S
0.04
PARSONS ES
WITH FERRO
CONCENTRAT
(S=SHALLOW
0.1
LINE OF EQU
CONCENTRAT
(DASHED WH
NA
NOT ANALYZ
ND
NOT DETECT
GRASSY ARE
ESTIMATED
FLOW DIREC
NOTE
THE SHALLOW FERROUS IRON C
WERE USED TO GENERATE ISOPI
0
25
FERROUS
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Intrins
Mac
PARSO
ENGINE
De

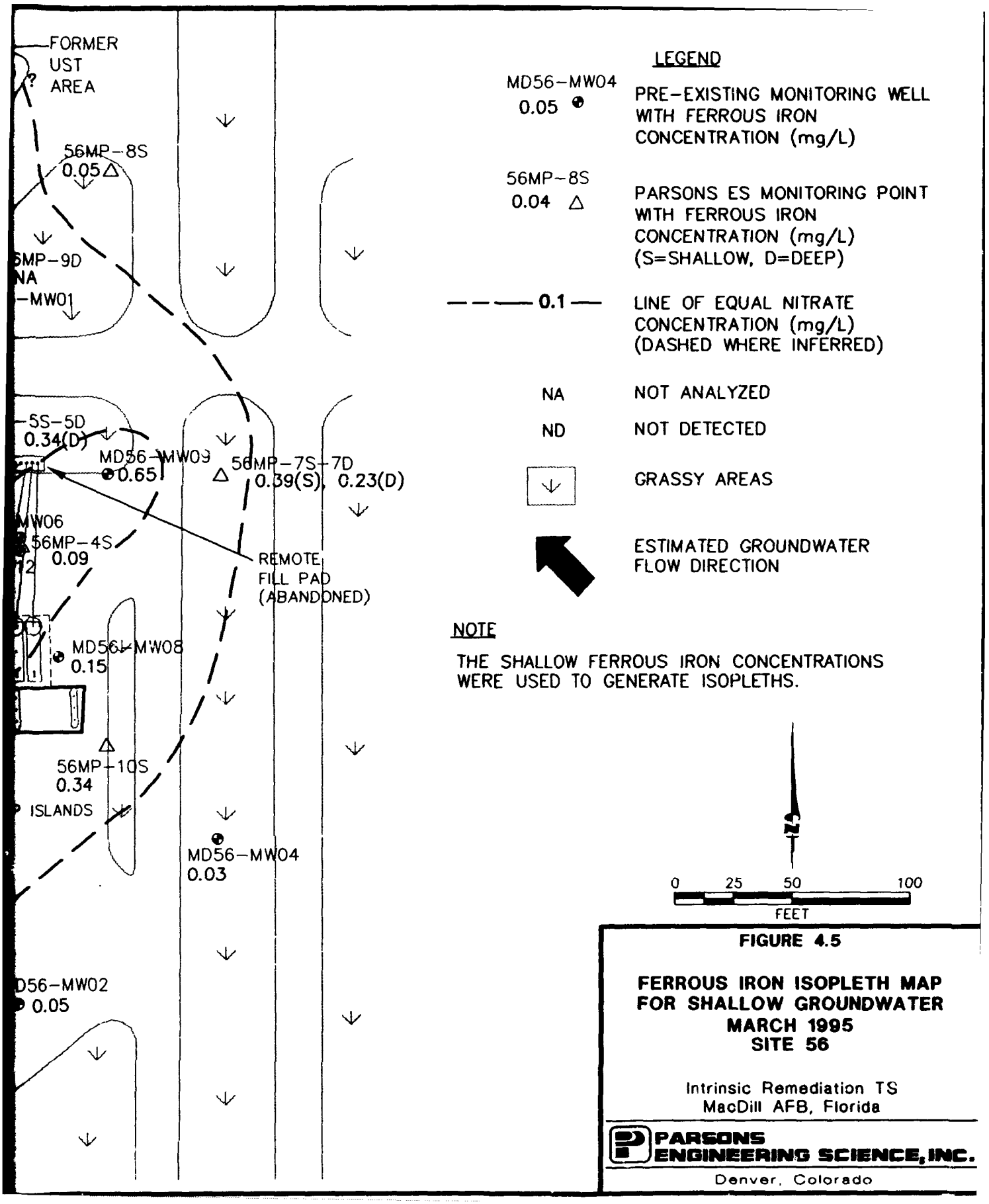


FIGURE 4.5

FERROUS IRON ISOPLETH MAP FOR SHALLOW GROUNDWATER MARCH 1995 SITE 56

Intrinsic Remediation TS
MacDill AFB, Florida

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

Therefore, 21.5 mg of ferrous iron (Fe^{2+}) are produced during mineralization of 1 mg of benzene.

Similar calculations can be completed for toluene (21.86 mg of Fe^{2+} produced during mineralization of 1 mg of toluene), ethylbenzene (22 mg of Fe^{2+} produced during mineralization of 1 mg of ethylbenzene), and the xylenes (22 mg of Fe^{2+} produced during mineralization of 1 mg of xylene). The average mass ratio of Fe^{2+} produced during total BTEX mineralization is thus 21.8:1. This means that approximately 1 mg of BTEX is mineralized for every 21.8 mg of Fe^{2+} produced. The highest measured Fe^{2+} concentration was 0.57 mg/L. Assuming an average background ferrous iron concentration of 0.09 mg/L, this suggests that the shallow groundwater at this site has the capacity to assimilate 0.02 mg/L (20 µg/L) of total BTEX during iron reduction. If the highest ferrous iron concentration detected in the vicinity of the BTEX plume is used (5.08 mg/L at 56MP-1S), then the assimilative capacity of the shallow groundwater during iron reduction is 0.23 mg/L (230 µg/L). These are conservative estimates of the assimilative capacity of iron because microbial cell mass production has not been taken into account by the stoichiometry shown above. In addition, this calculation is based on observed ferrous iron concentrations and not on the amount of ferric hydroxide available in the aquifer. Therefore, iron assimilative capacity could be much higher.

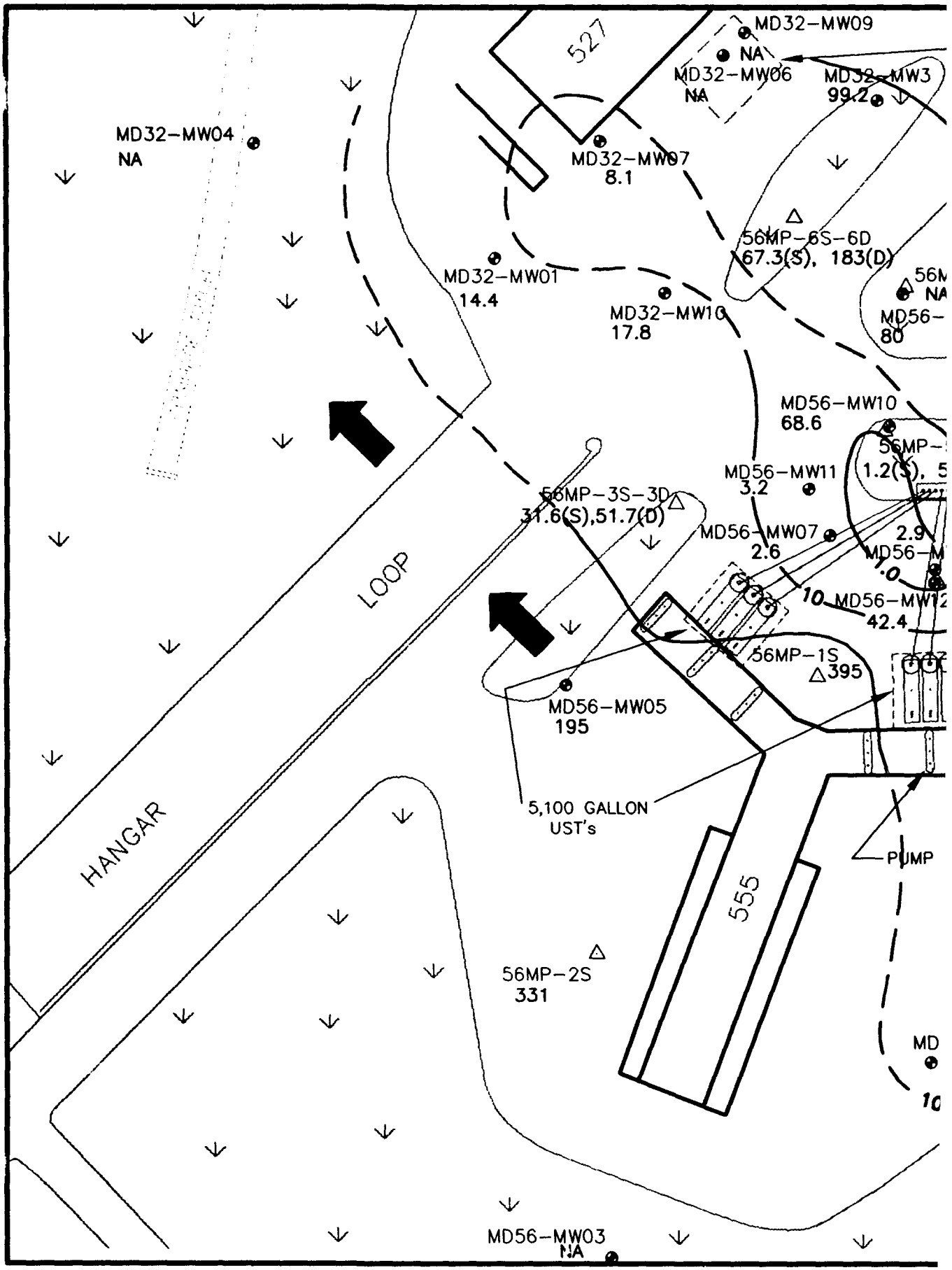
Recent evidence suggests that the reduction of ferric iron to ferrous iron cannot proceed at all without microbial mediation (Lovley and Phillips, 1988; Lovley *et al.*, 1991; Chapelle, 1993). None of the common organic compounds found in low-temperature, neutral, reducing groundwater could reduce ferric oxyhydroxides to ferrous iron under sterile laboratory conditions (Lovley *et al.*, 1991). This means that the reduction of ferric iron requires microbial mediation by microorganisms with the appropriate enzymatic capabilities. Because the reduction of ferric iron cannot proceed without microbial intervention, the elevated concentrations of ferrous iron that were measured in the contaminated groundwater at the site are indicators of microbial activity.

4.3.4.4 Sulfate

Sulfate concentrations in shallow groundwater at the site ranged from 0.4 mg/L to 395 mg/L (Table 4.4). Figure 4.6 is an isopleth map showing the distribution of sulfate in groundwater in March 1995. Comparison of Figures 4.2 and 4.6 shows graphically that areas with elevated total BTEX concentrations have depleted sulfate concentrations. This is a strong indication that anaerobic biodegradation of BTEX compounds is occurring at the site through the microbially mediated process of sulfate reduction.

The following equations describe the overall stoichiometry of BTEX oxidation by sulfate reduction caused by anaerobic microbial biodegradation. In the absence of microbial cell production, the biodegradation of benzene is given by:

$$7.5H^+ + 3.75SO_4^{2-} + C_6H_6 \rightarrow 6CO_{2(g)} + 3.75H_2S^\circ + 3H_2O$$



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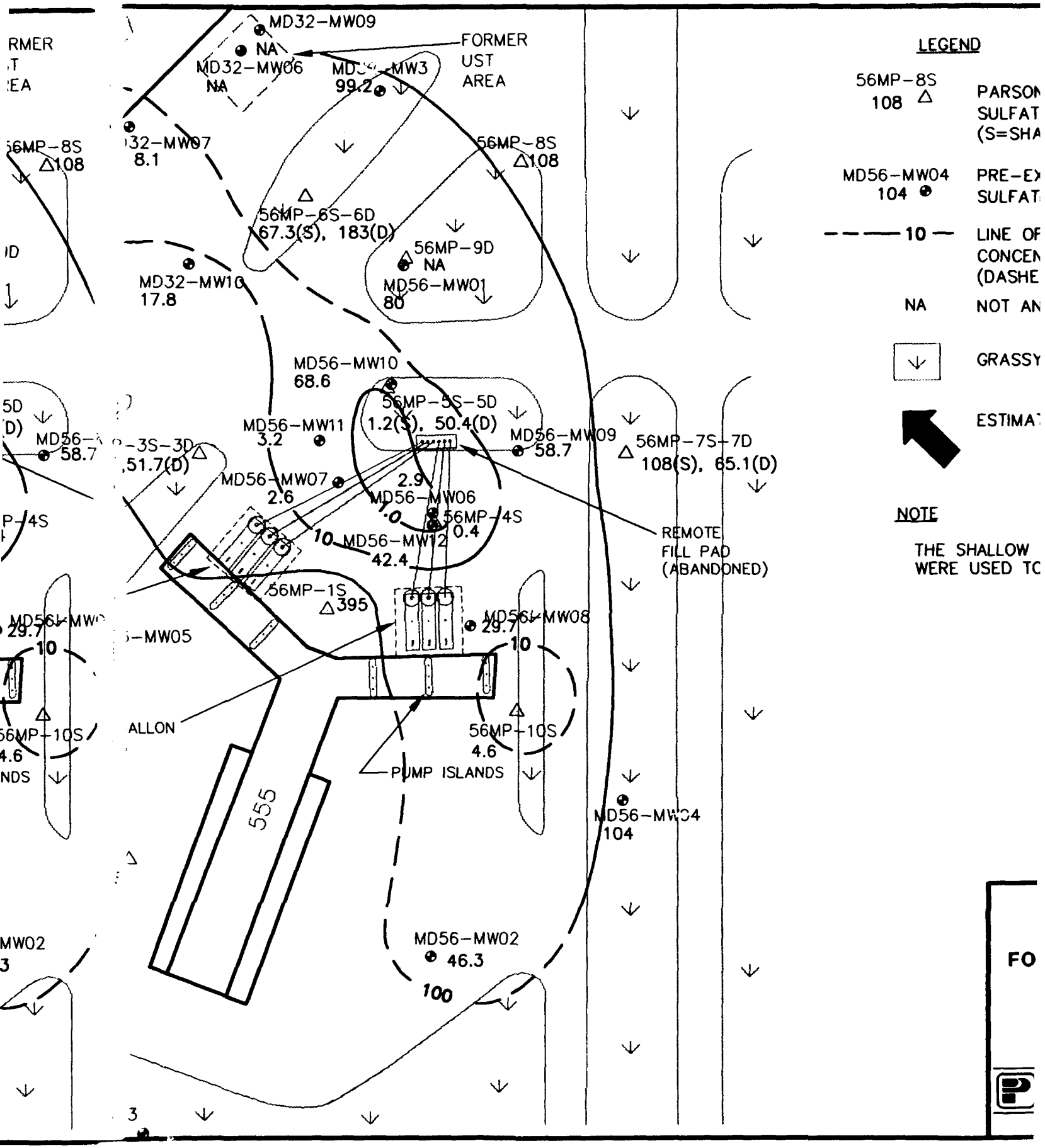
MD32-MW09
NA
FORMER
UST
AREA
MD32-MW06
NA
MD32-MW3
99.2
MD32-MW07
8.1
56MP-8S
108
56MP-6S-6D
67.3(S), 183(D)
56MP-9D
NA
MD32-MW10
17.8
MD56-MW01
80
MD56-MW10
68.6
56MP-5S-5D
1.2(S), 50.4(D)
MD56-MW11
3.2
MD56-MW09
58.7
56MP-7S-7D
108(S), 65.1(D)
MD56-MW07
2.6
2.9
MD56-MW06
1.0
56MP-4S
0.4
10
MD56-MW12
42.4
REMOTE
FILL PAD
(ABANDONED)
56MP-1S
395
MD56-MW08
29.7
10
MD56-MW05
ALLON
56MP-10S
4.6
PUMP ISLANDS
555
MD56-MW04
104
MD56-MW02
46.3
100
LEGEND
56MP-8S
108
PARSON
SULFAT
(S=SHA
MD56-MW04
104
PRE-EX
SULFAT
10
LINE OF
CONCEN
(DASHE
NA
NOT AN
GRASSY
ESTIMA
NOTE
THE SHALLOW
WERE USED TO
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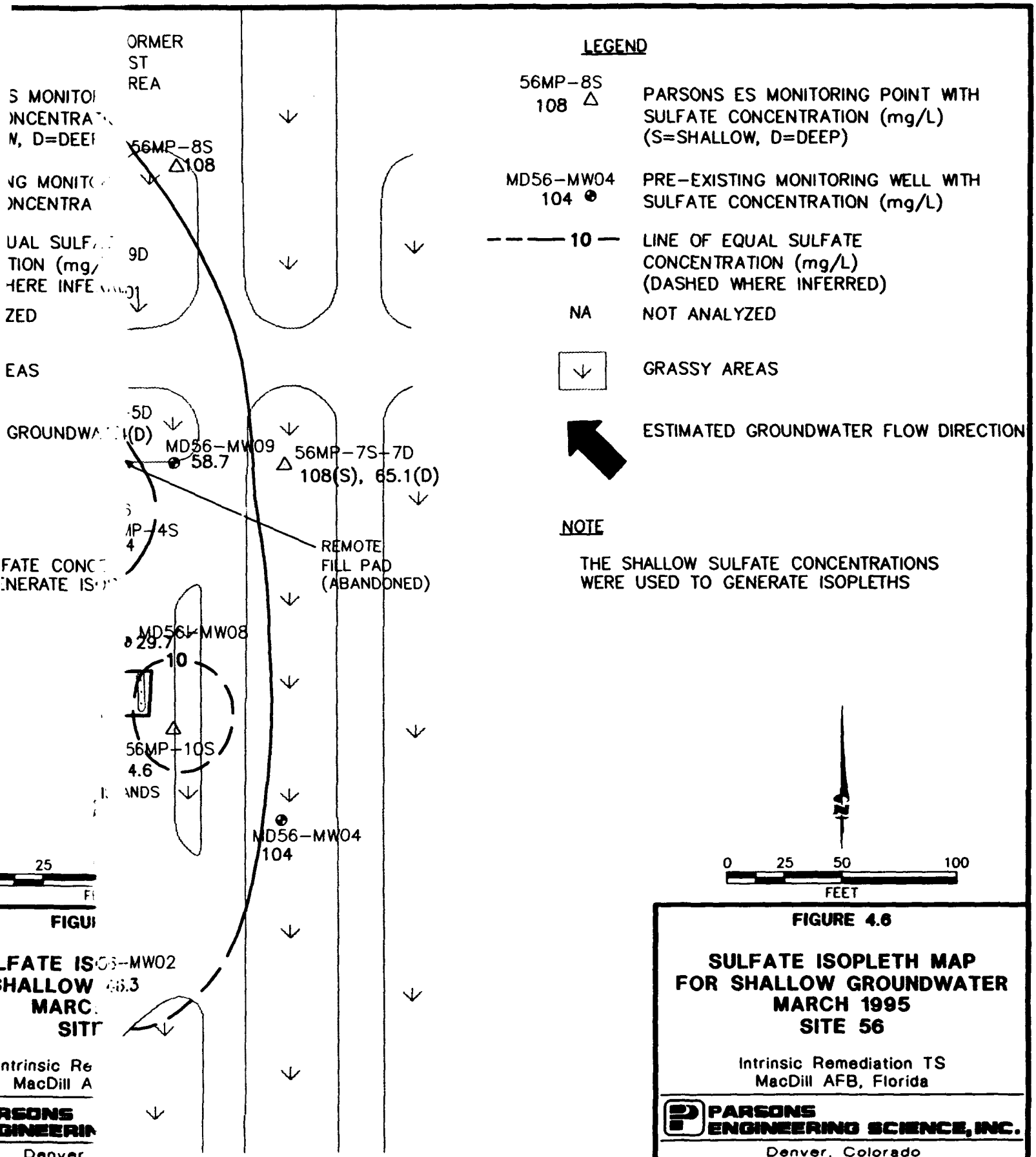


FIGURE 4.6

SULFATE ISOPLETH MAP FOR SHALLOW GROUNDWATER MARCH 1995 SITE 56

Intrinsic Remediation TS
MacDill AFB, Florida

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

Therefore, 3.75 moles of sulfate are required to mineralize 1 mole of benzene. On a mass basis, the ratio of sulfate to benzene is given by:

Benzene	6(12) + 6(1) = 78 gm
Sulfate	3.75(96) = 360 gm

Mass ratio of sulfate to benzene = 360/78 = 4.6:1

Therefore, in the absence of microbial cell production, 4.6 mg of sulfate are required to completely mineralize 1 mg of benzene. Similar calculations can be completed for toluene (4.7 mg sulfate to 1 mg toluene), ethylbenzene (4.75 mg sulfate to 1 mg ethylbenzene), and the xylenes (4.75 mg sulfate to 1 mg xylene). The average mass ratio of sulfate to total BTEX is thus 4.7:1. This means that approximately 0.21 mg of BTEX is mineralized for every 1.0 mg of sulfate consumed. Sulfate concentrations at six background locations outside or on the margins of the BTEX plume ranged from 46.3 mg/L to 331 mg/L (at MD56-MW05, 56MP-2S, MD56-MW02, MD56-MW04, 56MP-7S, and 56MP-8S). Five of the six background concentrations ranged from 104 to 331 mg/L. Assuming a minimum background sulfate concentration of 104 mg/L, the shallow groundwater at this site has the capacity to assimilate approximately 22 mg/L (22,000 µg/L) of total BTEX during sulfate reduction. This is a conservative estimate of the assimilative capacity of sulfate in the groundwater because microbial cell mass production has not been taken into account by the stoichiometry shown above.

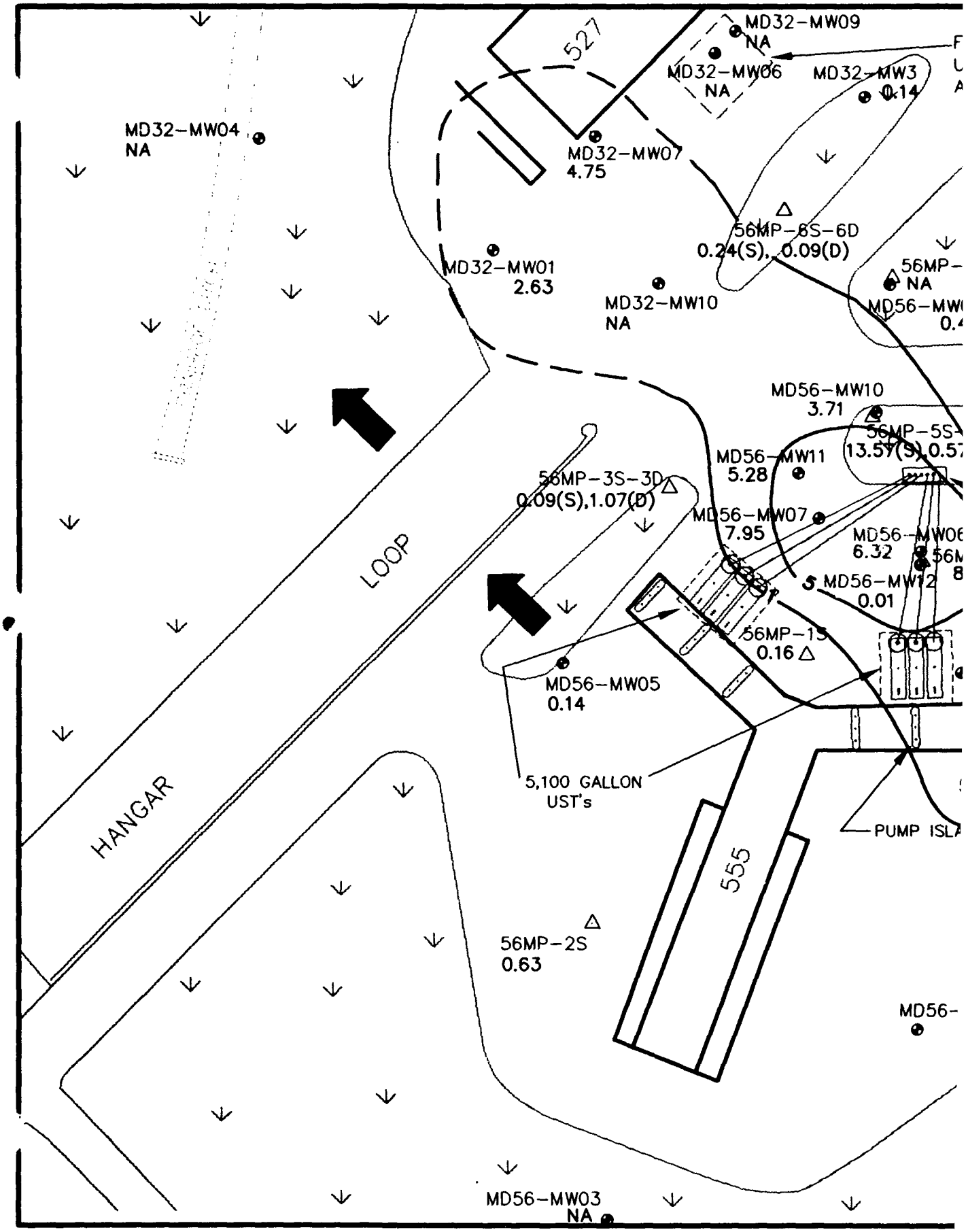
4.3.4.5 Methane

Figure 4.7 is an isopleth map showing the distribution of methane in groundwater. Comparison of Figures 4.2 and 4.7 shows graphically that areas with elevated total BTEX concentrations correlate with elevated methane concentrations. This is a strong indication that anaerobic biodegradation of the BTEX compounds by methanogenesis is occurring at the site.

Methane concentrations detected in shallow groundwater ranged from 0.03 mg/L to 13.57 mg/L (Table 4.4). Background levels of methane at wells outside of or on the margin of the BTEX plume (see the wells listed in Section 4.3.4.4 for sulfate) range from 0.03 to 0.49 mg/L. Samples collected from monitoring wells and monitoring points located near the areas with the highest BTEX concentrations contain the highest methane concentrations. In these locations (56MP-4S, MD56-MW06, MD56-MW07, MD56-MW11, 56MP-5S), methane concentrations range from 5.28 to 13.57 mg/L.

The following equations describe the overall stoichiometry of benzene oxidation by methanogenesis. In the absence of microbial cell production, the mineralization of benzene is given by:

$$C_6H_6 + 4.5H_2O \rightarrow 2.25CO_2 + 3.75CH_4$$



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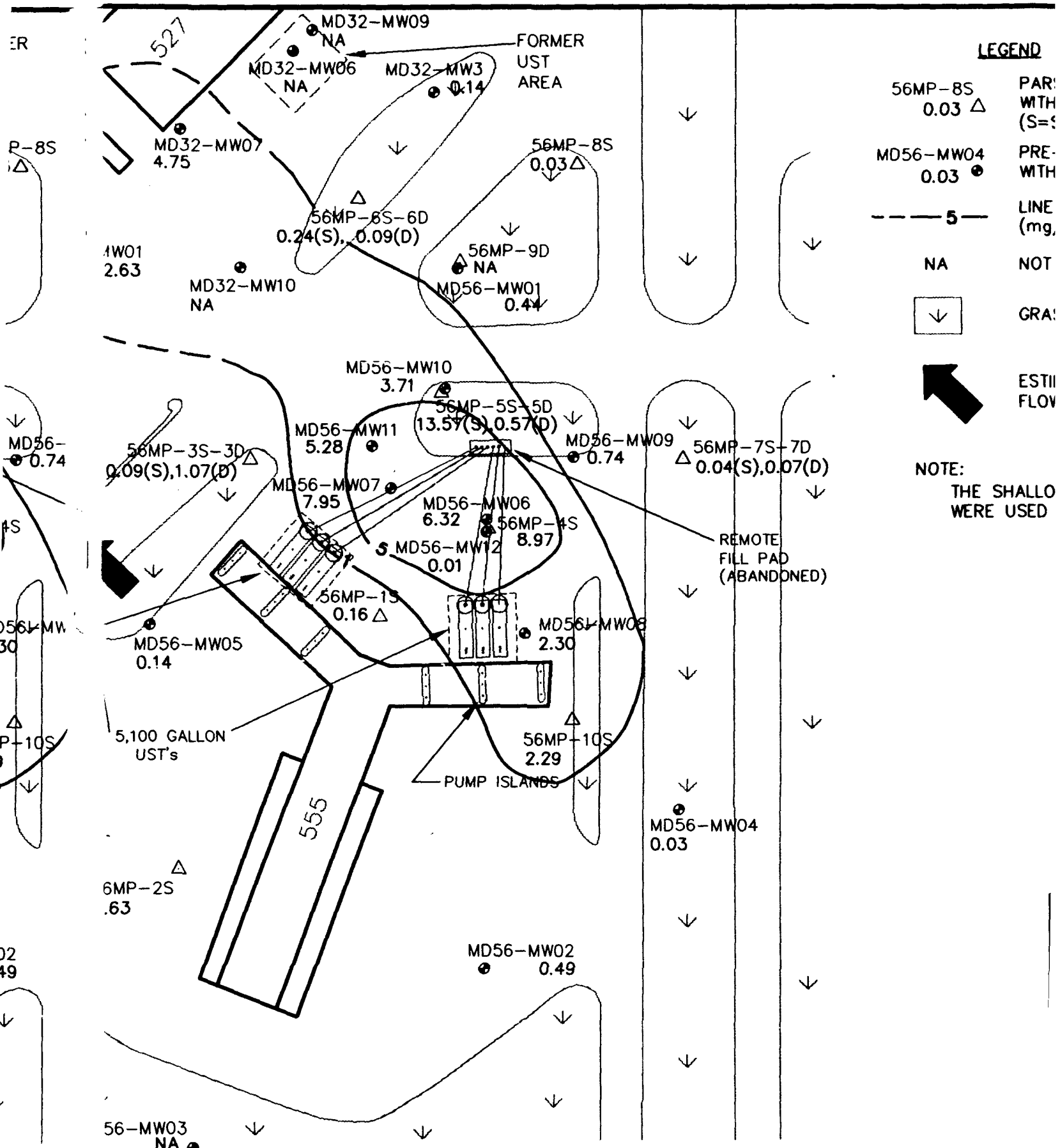

MD32-MW09
NA
FORMER
UST
AREA
MD32-MW06
NA
MD32-MW3
0.14
MD32-MW07
4.75
56MP-8S
0.03
56MP-6S-6D
0.24(S), 0.09(D)
56MP-9D
NA
MD32-MW10
NA
MD56-MW01
0.44
MD56-MW10
3.71
56MP-5S-5D
13.57(S),0.57(D)
MD56-MW11
5.28
MD56-MW09
0.74
56MP-7S-7D
0.04(S),0.07(D)
56MP-3S-3D
0.09(S),1.07(D)
MD56-MW07
7.95
MD56-MW06
6.32
56MP-4S
8.97
MD56-MW12
0.01
REMOTE
FILL PAD
(ABANDONED)
56MP-1S
0.16
MD56-MW05
0.14
MD56-MW08
2.30
5,100 GALLON
UST's
PUMP ISLANDS
56MP-10S
2.29
MD56-MW04
0.03
MD56-MW02
0.49
MD56-MW03
NA
527
556
LEGEND
56MP-8S
0.03
MD56-MW04
0.03
5
NA
NOTE:
THE SHALLO
WERE USED

ETHANE

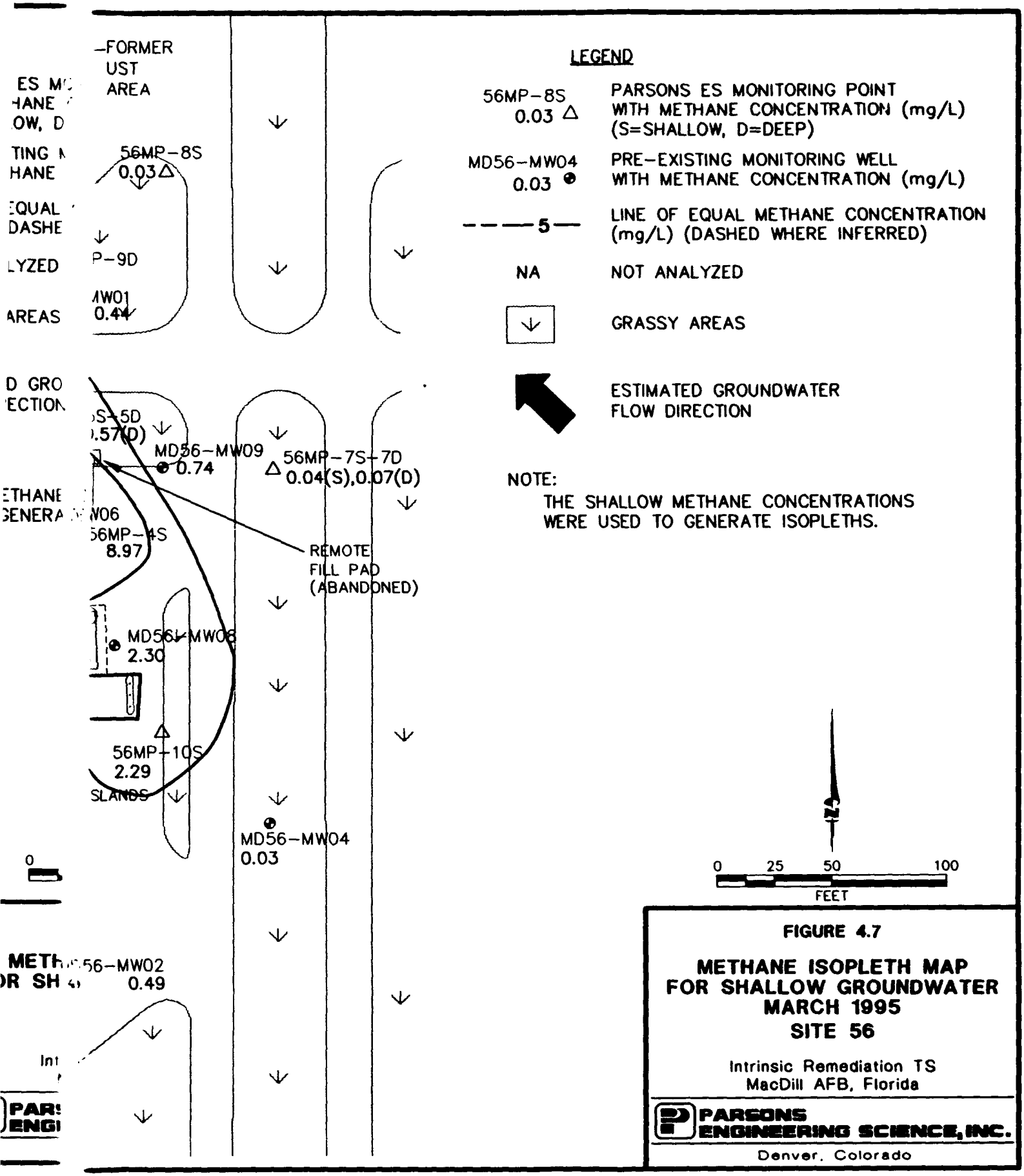


FIGURE 4.7

METHANE ISOPLETH MAP FOR SHALLOW GROUNDWATER MARCH 1995 SITE 56

Intrinsic Remediation TS
MacDill AFB, Florida

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

The mass ratio of methane produced during respiration to benzene degraded can be calculated and is given by:

Benzene	6(12) + 6(1) = 78 gm
Methane	3.75(16) = 60 gm

Mass ratio of methane to benzene = 60/78 = 0.77:1

Therefore, 0.77 mg of methane is produced during mineralization of 1 mg of benzene.

Similar calculations can be completed for toluene (0.78 mg of methane produced during mineralization of 1 mg of toluene), ethylbenzene (0.79 mg of methane produced during mineralization of 1 mg of ethylbenzene), and the xylenes (0.79 mg of methane produced during mineralization of 1 mg of xylene). The average mass ratio of methane produced during total BTEX mineralization is thus 0.78:1. This means that approximately 1 mg of BTEX is mineralized for every 0.78 mg of methane produced. The highest measured methane concentration was 13.57 mg/L. This suggests that the shallow groundwater at this site has the capacity to assimilate up to 17.4 mg/L (17,400 µg/L) of total BTEX during methanogenesis. Again, this is a conservative estimate of the assimilative capacity of methanogenesis because microbial cell mass production is not taken into account by the stoichiometry shown above. In addition, these calculations are based on observed methane concentrations and not on the amount of carbon dioxide (the electron acceptor in methanogenesis) available in the aquifer. Therefore, methanogenic assimilative capacity could be much higher.

4.3.4.6 Reduction/Oxidation Potential

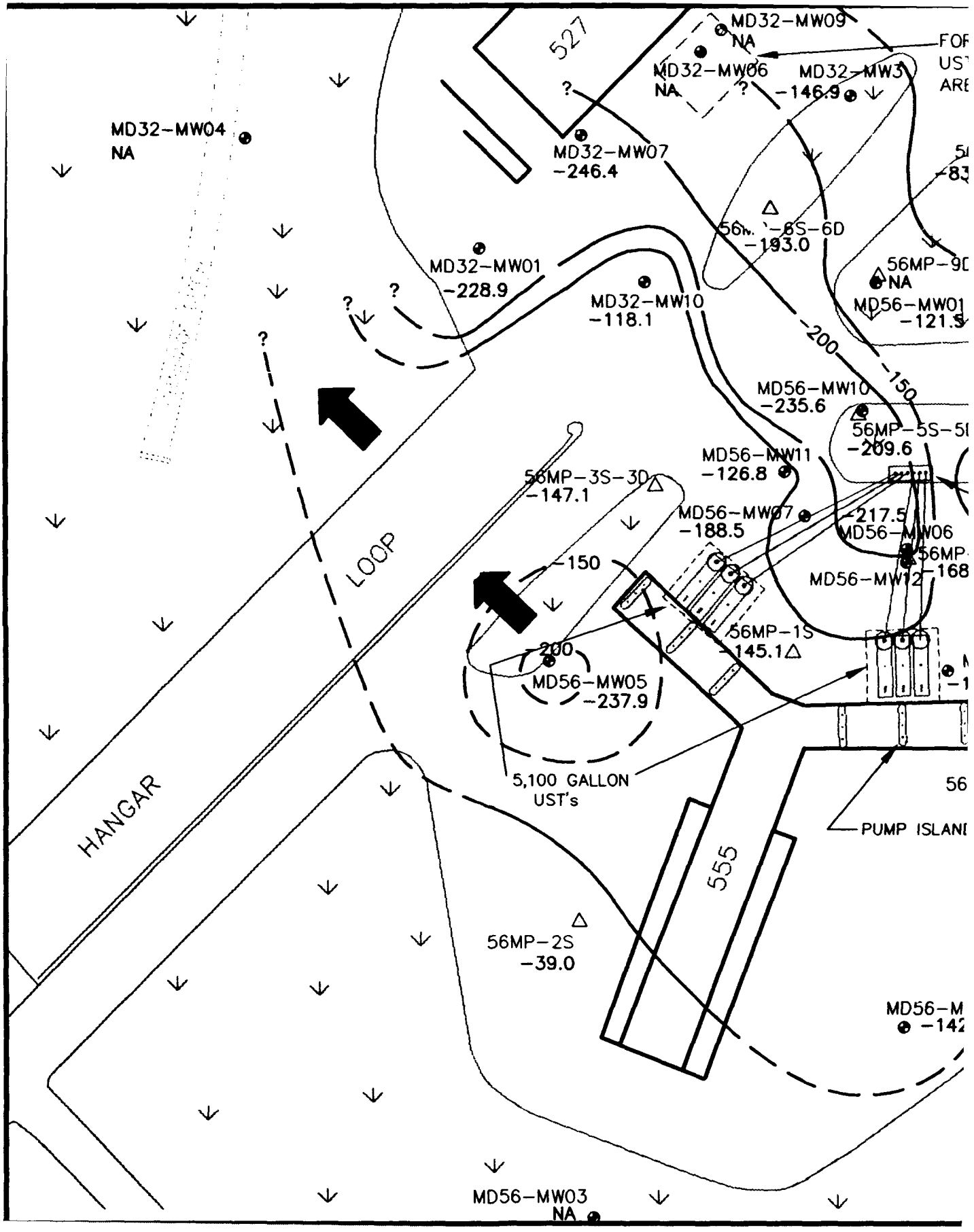
Redox potentials were measured at groundwater monitoring wells/points in March 1995. Redox potential is a measure of the relative tendency of a solution to accept or transfer electrons. The redox potential of a groundwater system depends on which electron acceptors are being reduced by microbes during BTEX oxidation. The redox potential at the site ranges from -4.9 millivolts (mV) at well MD56-MW04 to -246.4 mV at well MD32-MW07 (Table 4.4). As expected, there is a general tendency for the lowest redox potentials to occur along the flowpath of the BTEX plume (Figure 4.8).

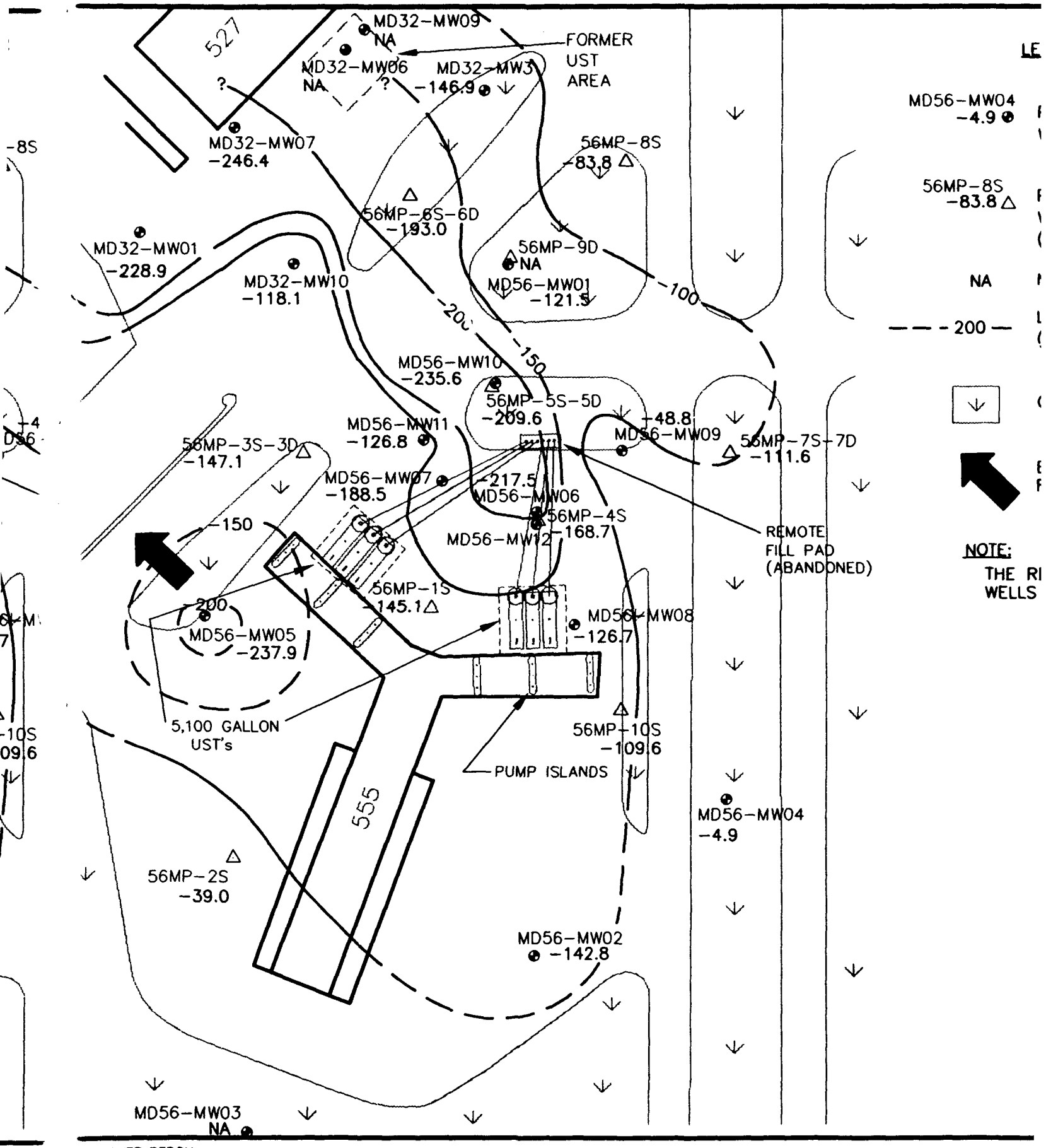
4.3.4.7 Alkalinity

Total alkalinity (as calcium carbonate) was measured at groundwater monitoring wells in March 1995 (Table 4.4). Alkalinity is a measure of a water's ability to buffer changes in pH caused by the addition of biologically generated acids. Total alkalinity at Sites 56 and 32 is in the moderate to high range for groundwater, varying from 120 mg/L at monitoring point 56MP-8S to 520 mg/L at 56MP-4S and MD56-MW5. This amount should be sufficient to buffer potential changes in pH caused by biologically mediated BTEX oxidation reactions.

4.3.4.8 pH

Measurements of groundwater pH made in March 1995 are summarized in Table 4.4. Measured pH values ranged from 6.28 to 7.32, which is within the optimal range for BTEX-degrading microbes of 6 to 8.


MD32-MW09
NA
MD32-MW06
NA
MD32-MW3
-146.9
MD32-MW04
NA
MD32-MW07
-246.4
527
MD32-MW01
-228.9
MD32-MW10
-118.1
56MP-6S-6D
-193.0
56MP-9D
NA
MD56-MW01
-121.5
200
150
MD56-MW10
-235.6
56MP-5S-5D
-209.6
MD56-MW11
-126.8
56MP-3S-3D
-147.1
MD56-MW07
-188.5
-217.5
MD56-MW06
MD56-MW12
-168
150
56MP-1S
-145.1
200
MD56-MW05
-237.9
LOOP
HANGAR
5,100 GALLON
UST's
PUMP ISLAN
555
56MP-2S
-39.0
MD56-M
-142
MD56-MW03
NA


MD32-MW09
NA
FORMER
UST
AREA
MD32-MW06
NA
MD32-MW3
-146.9
527
MD32-MW07
-246.4
56MP-8S
-83.8
56MP-6S-6D
-193.0
MD32-MW01
-228.9
56MP-9D
NA
MD32-MW10
-118.1
MD56-MW01
-121.5
-100
-200
-150
MD56-MW10
-235.6
56MP-5S-5D
-209.6
-48.8
MD56-MW09
56MP-7S-7D
-111.6
MD56-MW11
-126.8
56MP-3S-3D
-147.1
MD56-MW07
-188.5
-217.5
MD56-MW06
56MP-4S
-168.7
MD56-MW12
-150
REMOTE
FILL PAD
(ABANDONED)
56MP-1S
-145.1
-200
MD56-MW05
-237.9
MD56-MW08
-126.7
5,100 GALLON
UST's
56MP-10S
-109.6
PUMP ISLANDS
555
MD56-MW04
-4.9
56MP-2S
-39.0
MD56-MW02
-142.8
MD56-MW03
NA
MD56-MW04
-4.9
56MP-8S
-83.8
NA
200
NOTE:
THE RI
WELLS

LAYER: REDOX

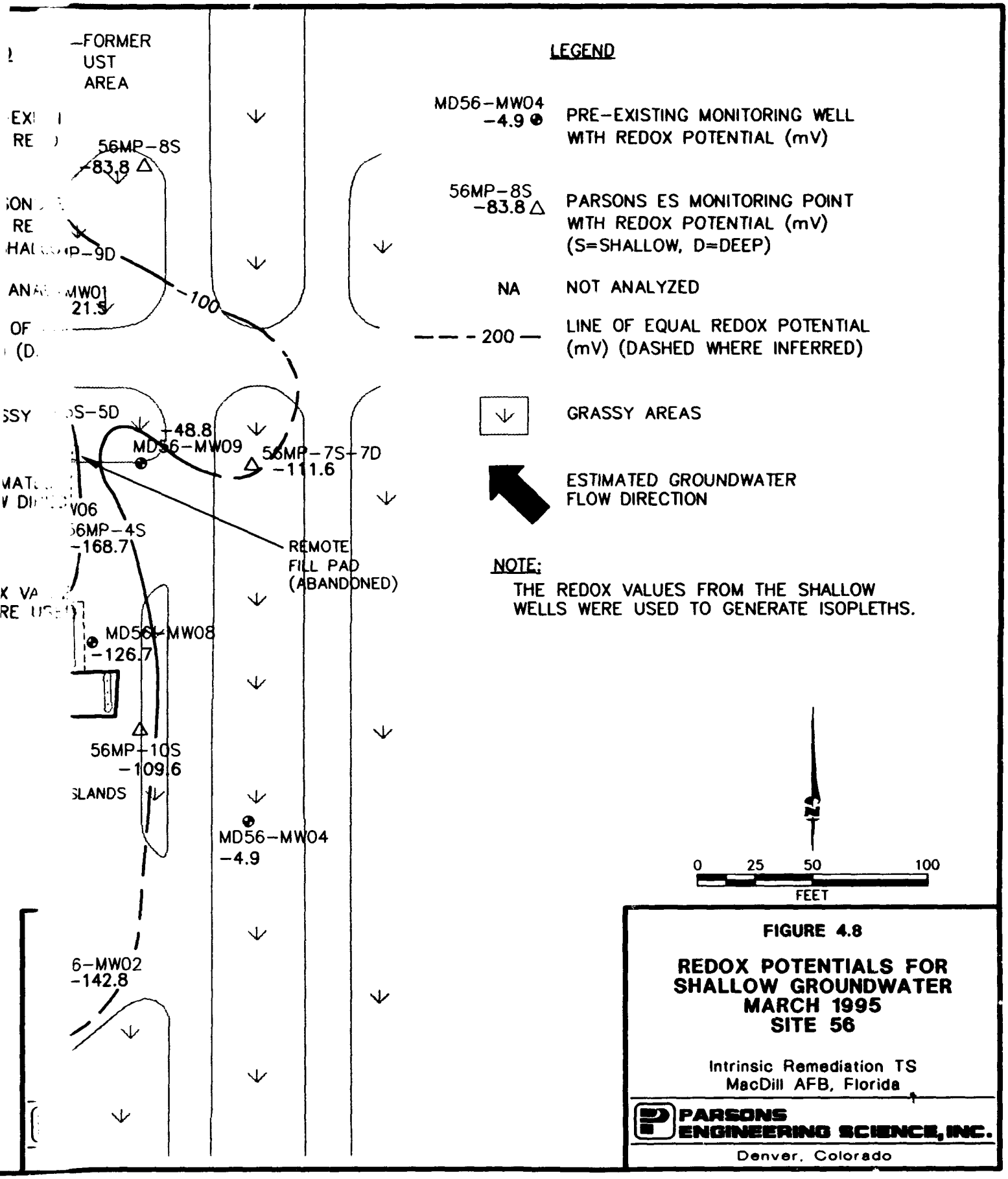


FIGURE 4.8

REDOX POTENTIALS FOR SHALLOW GROUNDWATER MARCH 1995 SITE 56

Intrinsic Remediation TS
MacDill AFB, Florida

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

4.3.4.9 Temperature

Groundwater temperature measurements made in March 1995 are summarized in Table 4.4. Temperature affects the types and growth rates of bacteria that can be supported in the groundwater environment, with high temperatures generally resulting in higher growth rates. For every 10 degrees Celsius (°C) increase in groundwater temperature, the biodegradation rate should approximately double. Temperatures in the shallow aquifer varied from 22.5°C to 28.6°C. These are relatively warm temperatures for shallow groundwater, suggesting that bacterial growth rates should be enhanced.

4.3.4.10 Total Assimilative Capacity

Comparison of BTEX, electron acceptor, and biodegradation byproduct isopleth maps for Site 56 provides strong qualitative evidence of biodegradation of BTEX compounds. The native organic carbon present in the aquifer most likely also acts as a nutrient source for microbial populations, perhaps accounting for the general oxygen-depleted nature of the surficial aquifer. However, anaerobic biodegradation processes appear to be most prominent in the electron-donor-rich environment of the dissolved BTEX plume. The presence of an areally extensive grassy area downgradient from the BTEX plume near the drainage ditch should allow infiltration of oxygenated precipitation. As a result, the concentrations of DO and other electron acceptors should be augmented in this area, stimulating biodegradation and possibly limiting plume migration toward or beyond the drainage ditch.

Based on the information presented above, the groundwater system at Site 56 has the capacity to assimilate (biodegrade) nearly 40,000 µg/L of total BTEX (Table 4.5). The maximum detected BTEX concentration in March 1995 was 29,636 µg/L. Therefore, groundwater at the site appears to have sufficient assimilative capacity to degrade the observed dissolved BTEX and limit plume migration.

A closed system with 2 liters of water can be used to help visualize the physical meaning of assimilative capacity. Assume that the first liter contains no fuel hydrocarbons, but it contains fuel degrading microorganisms and has an assimilative capacity of exactly "x" µg of fuel hydrocarbons. The second liter has no assimilative capacity; however, it contains fuel hydrocarbons. As long as these 2 liters of water are kept separate, biodegradation of the fuel hydrocarbons will not occur. If these 2 liters are combined in a closed system, biodegradation will commence and continue until the fuel hydrocarbons are depleted, the electron acceptors are depleted, or the environment becomes acutely toxic to the fuel-degrading microorganisms. Assuming a nonlethal environment, if fewer than "x" µg of fuel hydrocarbons were in the second liter, all of the fuel hydrocarbons will eventually degrade given a sufficient time; likewise, if greater than "x" µg of fuel hydrocarbons were in the second liter of water, only "x" µg of fuel hydrocarbons would ultimately degrade.

The groundwater beneath Sites 56 and 32 is an open system, which continually receives additional electron receptors from upgradient flow and the infiltration of precipitation. This means that the assimilative capacity is not a fixed entity as it is in a closed system, and therefore cannot be compared directly to contaminant concentration

TABLE 4.5
TOTAL ASSIMILATIVE CAPACITY OF SITE 56 GROUNDWATER
SITE 56
INTRINSIC REMEDIATION TS
MACDILL AIR FORCE BASE, FLORIDA

Electron Acceptor or Process	Expressed BTEX Assimilative Capacity (µg/L)
Dissolved Oxygen	250
Nitrate	260
Iron Reduction	20
Sulfate	22,000
Methanogenesis	17,400
Expressed Assimilative Capacity	39,930
Highest Observed Total BTEX Concentration	29,636

in the groundwater. Rather, the expressed assimilative capacity of groundwater is intended to serve as a qualitative tool. Although the expressed assimilative capacity at this site is greater than the highest measured total BTEX concentration, the fate of BTEX in groundwater and the potential impact to receptors is dependent on the relationship between the kinetics of biodegradation and the solute transport velocity (Chapelle, 1994). This significant expressed assimilative capacity is a strong indicator that biodegradation is occurring; however, it is not confirmation that biodegradation will proceed to completion before potential downgradient receptors are impacted.

SECTION 5

GROUNDWATER MODELING

5.1 GENERAL OVERVIEW AND MODEL DESCRIPTION

In order to help estimate degradation rates for dissolved BTEX compounds at Site 56 and to help predict the future migration of these compounds, Parsons ES modeled the fate and transport of the dissolved BTEX plume. The modeling effort had three primary objectives: 1) to predict the future extent and concentration of the dissolved contaminant plume by modeling the combined effects of advection, dispersion, sorption, and biodegradation; 2) to assess the potential for downgradient receptors to be exposed to contaminants at concentrations above levels of regulatory concern; and 3) to provide technical support for the natural attenuation remedial option at post-modeling regulatory negotiations. The model was developed using site-specific data and conservative assumptions about governing physical and chemical processes. Because of the conservative nature of model input, the observed reduction in contaminant mass caused by natural attenuation is expected to exceed model predictions. This analysis is not intended to represent a baseline assessment of potential risks posed by site contamination.

The Bioplume II code was used to estimate the potential for dissolved BTEX migration and degradation by naturally occurring mechanisms operating at a fuel-hydrocarbon-contaminated site. The Bioplume II model incorporates advection, dispersion, sorption, and biodegradation to simulate contaminant plume migration and degradation. The model is based upon the US Geological Survey (USGS) Method of Characteristics (MOC) two-dimensional (2-D) solute transport model of Konikow and Bredehoeft (1978). The model was modified by researchers at Rice University to include a biodegradation component that is activated by a superimposed DO plume. Based on the work of Borden and Bedient (1986), the model assumes a reaction between DO and BTEX that is instantaneous relative to the advective groundwater velocity. Bioplume II solves the USGS 2-D solute transport equation twice, once for hydrocarbon concentrations in the aquifer and once for a DO plume. The two plumes are combined using superposition at every particle move to simulate the instantaneous, biologically mediated, reaction between hydrocarbons and oxygen.

In recent years it has become apparent that anaerobic processes such as denitrification, iron reduction, sulfate reduction, and methanogenesis can be important BTEX degradation mechanisms (Grbic´-Galic´, 1990; Beller *et al.*, 1992; Edwards *et al.*, 1992; Edwards and Grbic´-Galic´, 1992; Grbic´-Galic´ and Vogel, 1987; Lovely *et al.*, 1989; Hutchins, 1991). Because there is evidence that anaerobic biodegradation processes are occurring at the site, these processes were accounted for during Bioplume

II modeling using a first order anaerobic decay coefficient. The following subsections discuss in more detail the model setup, input parameters and assumptions, model calibration, and simulation results.

5.2 CONCEPTUAL MODEL DESIGN AND ASSUMPTIONS

Prior to developing a groundwater model, it is important to determine if sufficient data are available to provide a reasonable estimate of aquifer conditions. In addition, it is important to ensure that any limiting assumptions can be justified. The most important assumption made when using the Bioplume II model is that oxygen-limited biodegradation is occurring at the site. The Bioplume II model assumes that the limiting factors for biodegradation are: 1) the presence of an indigenous hydrocarbon degrading microbial population, and 2) sufficient background electron acceptor concentrations. Data and information presented in Sections 3 and 4 suggest that sulfate and carbon dioxide (methanogenesis) are being used as the primary electron acceptors for anaerobic biodegradation at Site 56. To be conservative, only oxygen was used as an electron acceptor in the Bioplume II model presented herein. Anaerobic biodegradation of petroleum hydrocarbons was simulated using a first-order decay constant. Selection of this constant is discussed in Section 5.3.5.

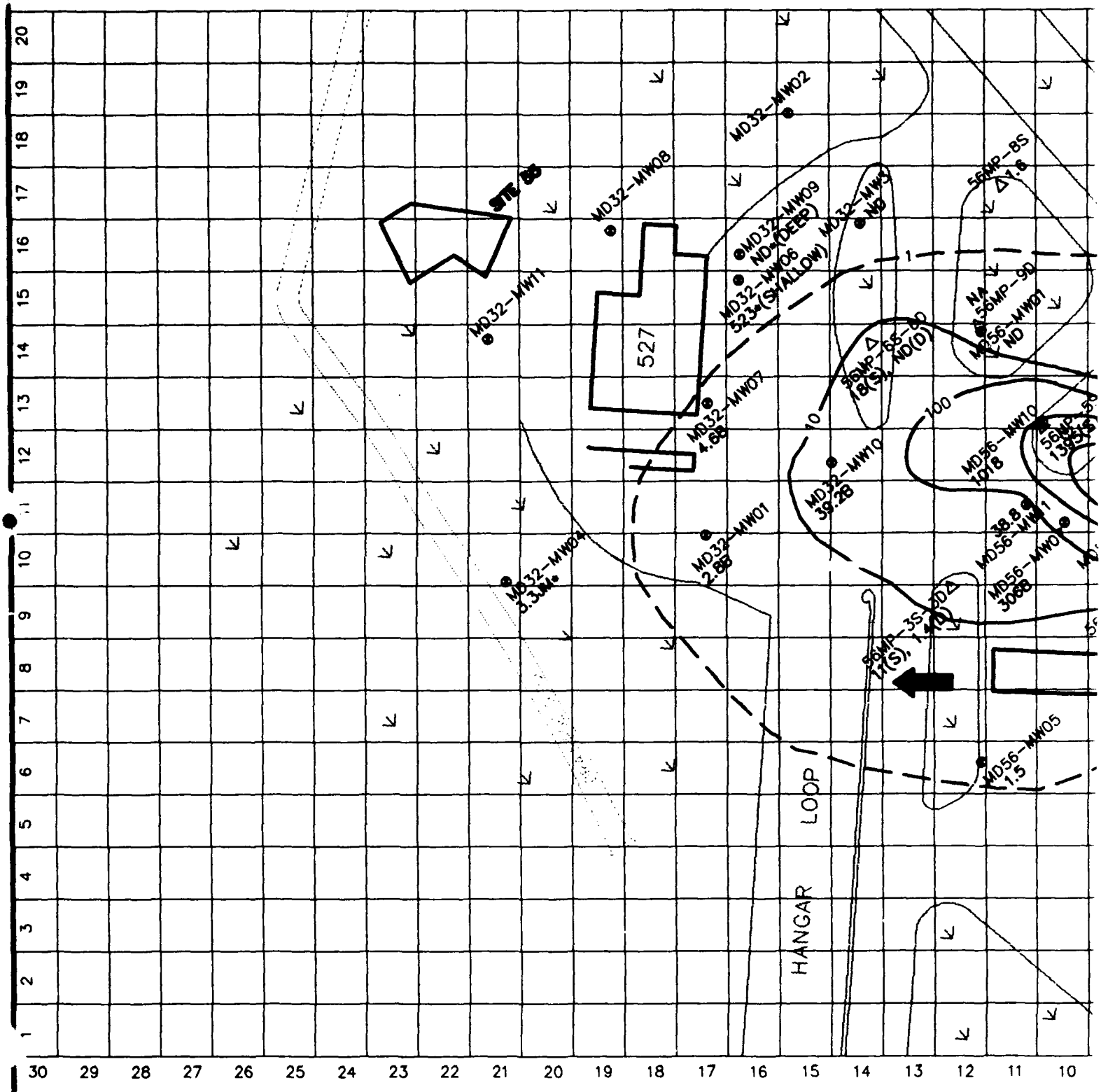
On the basis of the data pr[illegible] in Section 3, the shallow saturated zone was conceptualized and modeled a[illegible]low unconfined aquifer composed of fine- to medium-grained sand (Figures 3.2 [illegible] 3.3). The use of a 2-D model is appropriate at this site because the shallow sandy aquifer appears to be thin and relatively homogenous, and groundwater quality data suggest that the dissolved contamination has not migrated a significant distance vertically. Available evidence suggests that mobile LNAPL is not present at the site. However, continuing sources of dissolved BTEX contamination remain as residual LNAPL in the soil in the vicinity of the gasoline station.

5.3 INITIAL MODEL SETUP

Where possible, the initial setup for this model was based on existing site data. Where site-specific data were not available (e.g., for effective porosity), reasonable assumptions for the types of materials comprising the shallow aquifer were made based on widely accepted literature values. The following sections describe the basic model setup. Those Bioplume II model parameters that were varied during model calibration are discussed in Section 5.4.

5.3.1 Grid Design and Boundary Conditions

The maximum grid size for the Bioplume II model is limited to 20 columns by 30 rows. The dimension of each column and row can range from 0.1 to 999.9 feet. A 20- by 30-cell grid was used to model Site 56. Each grid cell was 25 feet long by 25 feet wide. The grid was oriented so that the longest dimension was parallel to the overall direction of groundwater flow. The full extent of the model grid is indicated on Figure 5.1.



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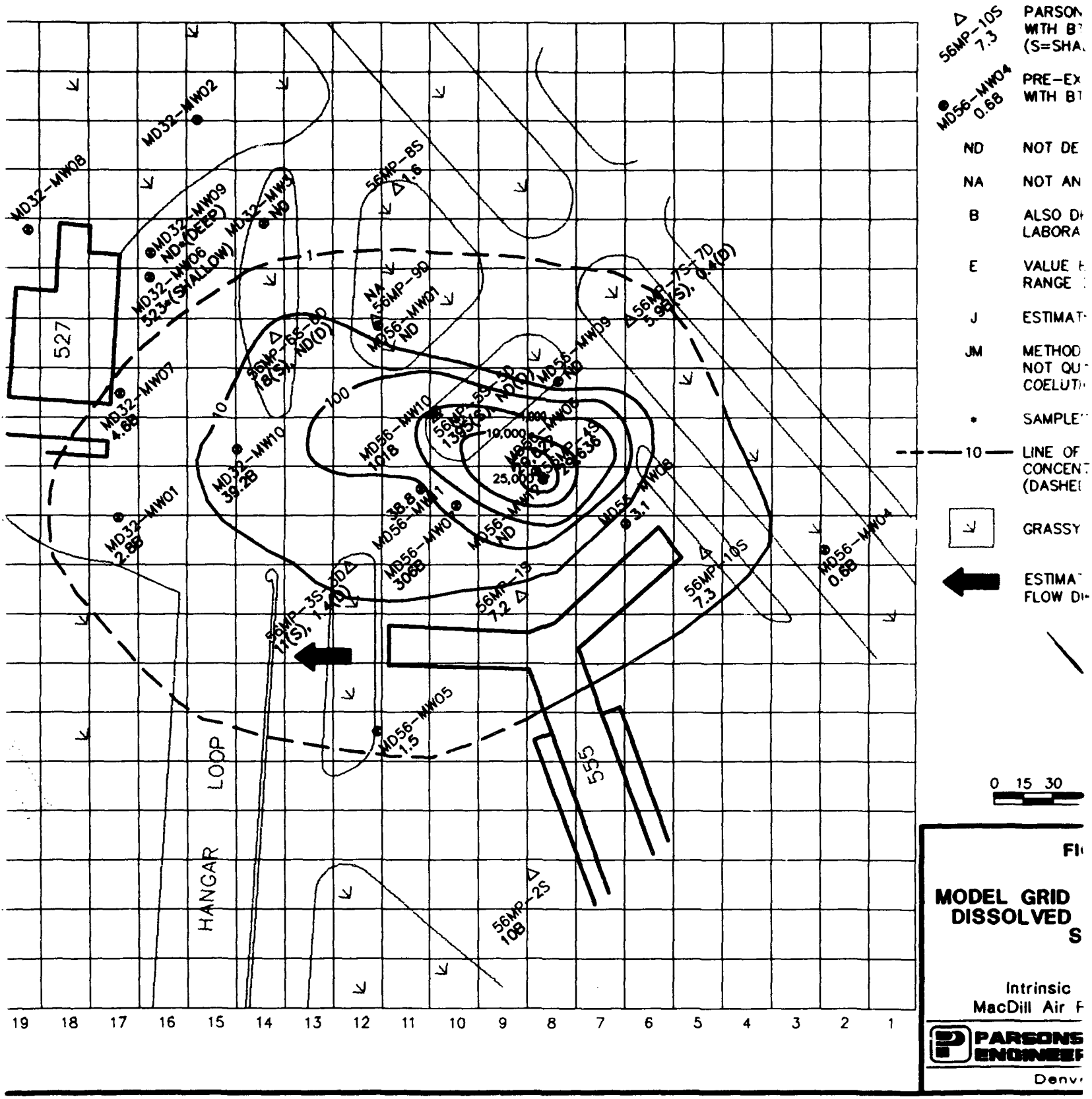
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MD32-MW09
ND-(DEEP)
MD32-MW06
523*(SHALLOW)
MD32-MW03
ND
MD32-MW07
4.6B
MD32-MW10
39.2B
MD32-MW01
2.8B
56MP-8S
1.6
56MP-9D
NA
MD56-MW01
ND
56MP-6S-6D
18(S), ND(D)
MD56-MW09
ND
56MP-7S-7D
3.9B(S), 0.4(D)
MD56-MW10
1018
56MP-5S-5D
1395(S), ND(D)
MD56-MW08
10,000
MD56-MW12
25,000
56MP-4S
2536
MD56-MW11
38.8
MD56-MW02
306B
MD56-MW03
ND
MD56-MW04
3.1
MD56-MW04
0.6B
56MP-10S
7.3
56MP-3S-3D
1*(S), 1.4(D)
56MP-1S
7.2
MD56-MW05
1.5
56MP-2S
10B
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555
LOOP
HANGAR
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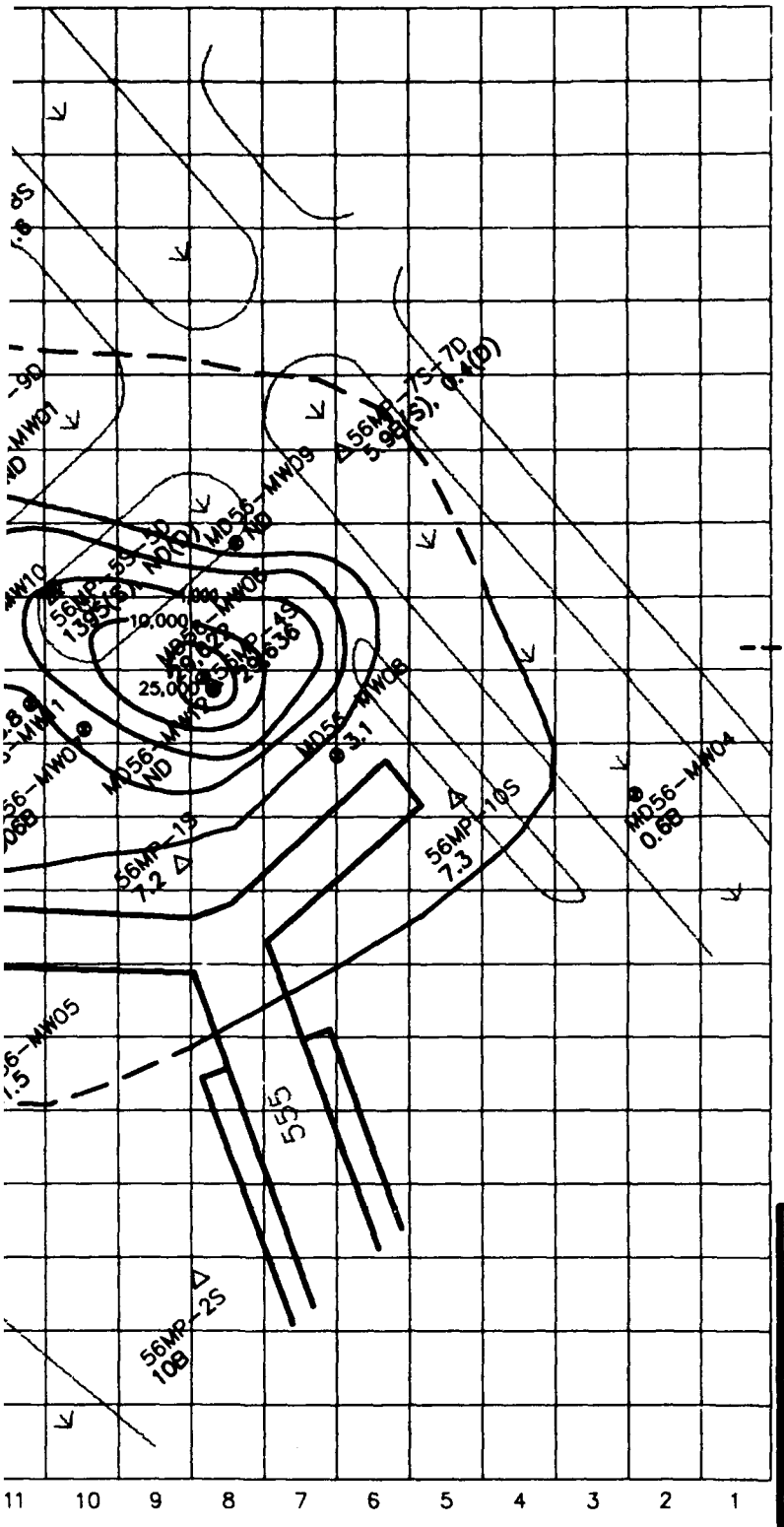


LEGEND

56MP-10S 7.3	PARSONS ES MONITORING POINT WITH BTEX CONCENTRATION (µg/L) (S=SHALLOW, D=DEEP)
MD56-MW04 0.68	PRE-EXISTING MONITORING WELL WITH BTEX CONCENTRATION (µg/L)
ND	NOT DETECTED
NA	NOT ANALYZED
B	ALSO DETECTED IN ASSOCIATED LABORATORY BLANK SAMPLE
E	VALUE EXCEEDS CALIBRATION RANGE OF INSTRUMENT
J	ESTIMATED VALUE
JM	METHOD RESULTS CONFLICT; NOT QUANTIFIABLE DUE TO COELUTION OF PEAKS
•	SAMPLED 10/94
10	LINE OF EQUAL BTEX CONCENTRATION (µg/L) (DASHED WHERE INFERRED)
	GRASSY AREAS
	ESTIMATED GROUNDWATER FLOW DIRECTION

0 15 30 60 120
FEET

FIGURE 5.1

MODEL GRID SUPERIMPOSED ON DISSOLVED BTEX ISOPLETHS SITE 56

Intrinsic Remediation TS
MacDill Air Force Base, Florida

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

Model boundaries are mathematical statements that represent hydrogeologic boundaries, such as areas of specified head (e.g., surface water bodies or contour lines of constant hydraulic head) or specified flux. Hydrogeologic boundaries are represented by three mathematical statements that describe the hydraulic head at the model boundaries. These include:

- Specified-head boundaries (Dirichlet condition) for which the head is determined as a function of location and time only. Surface water bodies exhibit constant head conditions. Specified-head boundaries are expressed mathematically as:

$$Head = f(x, y, z, t)$$

  where f is the function symbol, x, y, and z are position coordinates, and t is time.

- Specified-flow boundaries (Neumann conditions), for which the mathematical description of the flux across the boundary is given. The flux is defined as a volumetric flow rate per unit area (e.g., $ft^3/ft^2/day$). No-flow boundaries are a special type of specified-flow boundary and are set by specifying the flux to be zero. Examples of no-flow boundaries include groundwater divides and impermeable hydrostratigraphic units. Specified-flux boundaries are expressed mathematically as:

$$Flux = f(x, y, z, t)$$

- Head-dependent flow boundaries (Cauchy or mixed-boundary conditions) where the flux across the boundary is calculated from a given boundary head value. This type of flow boundary is sometimes referred to as a mixed-boundary condition because it is a combination of a specified-head boundary and a specified-flow boundary. Head-dependent flow boundaries are used to model leakage across semipermeable boundaries. Head-dependent flow boundaries are expressed mathematically as (Bear, 1979):

$$Flux = \frac{(H_0 - H)K'}{B'}$$

Where:
- H = Head in the zone being modeled (generally the zone containing the contaminant plume)
- H_0 = Head in external zone (separated from plume by semipermeable layer)
- K' = Hydraulic conductivity of semipermeable layer
- B' = Thickness of semipermeable layer.

Natural hydraulic boundaries are modeled using a combination of the three types of model boundary conditions listed above. When possible, hydrologic boundaries such as surface water bodies, groundwater divides, lines of equal groundwater potential, or hydrologic barriers should coincide with the perimeter of the model. In areas lacking obvious hydrologic boundaries, specified-head or specified-flux boundaries can be

specified at the model perimeter if the boundaries are far enough removed from the contaminant plume that transport calculations are not affected. Bioplume II requires the entire model domain to be bounded by zero-flux cells (also known as no-flow cells), with other boundary conditions established within the subdomain specified by the no-flow cells.

Specified-head boundaries for the model were set at the drainage ditch bordering Site 32 and on the southeastern perimeter of the model grid to simulate the northwesterly groundwater flow observed at the site. The hydraulic head along the drainage ditch was estimated to be 0.80 to 1.15 feet above msl. The hydraulic head at the southeastern model boundary was estimated to range from 2.63 to 2.76 feet above msl. These constant-head cells were placed far enough away from the BTEX plume to avoid potential boundary interferences. The area northwest of the drainage ditch was inactive (all cells assigned a no-flow status) in order to simulate the scenario where the groundwater discharged to the drainage ditch.

The northeastern and southwestern model boundaries were configured as no-flow (specified-flux) boundaries. In this case, the flux through these boundaries is assumed to be zero because flow is generally parallel to these boundaries. The base or lower boundary of the model is also assumed to be no-flow, and is assumed to be 10 feet below the water table (aquifer thickness equals 10 feet). The upper model boundary is defined by the simulated water table surface.

5.3.2 Groundwater Elevation and Gradient

The March 1995 water table elevation map presented in Figure 3.4 was used to define the starting heads input into the Bioplume II model. Groundwater flow in the vicinity of the site is to the northwest with an average gradient of approximately 0.002 ft/ft to 0.009 ft/ft. The hydraulic gradient between the southern edge of Building 527 and the drainage ditch was inferred using data collected by BVWS in August and December 1994. Data quantifying seasonal variations in groundwater flow direction and gradient at the site are not available, but previous groundwater flow data (BVWS, 1995) and the BTEX and electron acceptor plume configurations are consistent with the observed groundwater flow direction. As a result, it was assumed that the observed water levels were representative of steady-state conditions. As described in Section 5.4.1, the model was calibrated to the observed water table. Groundwater elevation measurements obtained during both low and high tides by BVWS (1995) indicates that the tidal influence on groundwater flow directions and hydraulic gradients beneath most of the site is minimal.

5.3.3 BTEX Concentrations

The total dissolved BTEX concentrations obtained from 1995 laboratory analytical results for each monitoring well and monitoring point location were used for model development. At nested monitoring points or wells, the highest BTEX concentration observed at that location was used. Table 4.2 presents dissolved BTEX concentration data for March 1995, and Figure 4.2 shows the areal distribution of dissolved BTEX compounds.

The BTEX plume observed in March 1995 covered an estimated area of approximately 80,000 square feet (1.8 acres). However, the majority of contaminant mass (within the 10 µg/L isopleth, Figure 4.2) is contained within an area of approximately 26,000 square feet (0.6 acre). The shape and distribution of the total BTEX plume is the result of advective-dispersive transport and biodegradation of dissolved BTEX contamination. As described in Section 5.4.2, the simulated BTEX plume was calibrated to resemble the observed BTEX plume.

5.3.4 Dissolved Oxygen

As discussed previously, the Bioplume II model assumes an instantaneous reaction between the BTEX plume and the DO plume. The discussion presented in Section 4 suggests that sulfate and carbon dioxide (methanogenesis) are being used as primary electron acceptors for biodegradation of BTEX compounds in groundwater at the site. The groundwater geochemical data indicate that nitrate, DO, and ferric iron are being used to a much lesser extent. To be conservative, the total BTEX plume at the site was modeled assuming that DO was the only electron acceptor being utilized at a rate that is instantaneous relative to the advective groundwater flow velocity for the biodegradation of the BTEX compounds. As described in Section 5.3.5, anaerobic biodegradation was accounted for using a first-order decay constant.

The DO concentration in groundwater samples collected directly upgradient from the contaminant plume approximated 0.8 mg/L (observed at 56MP-10S and MD56-MW04). Concentrations of DO in samples collected crossgradient from the plume (at 56MP-3S, MD56-MW05, 56MP-7S, MD56-MW09, MD56-MW01, and 56MP-8S) ranged from 0.02 mg/L to 0.61 mg/L, and averaged 0.26 mg/L. Within and directly downgradient from the BTEX plume, DO concentrations in shallow groundwater ranged from 0.02 mg/L to 0.18 mg/L, and averaged 0.06 mg/L. For model development, DO concentrations directly upgradient (southeast) of the plume were assumed to equal 0.8 mg/L. Crossgradient areas were assigned a DO concentration of 0.1 mg/L, and areas within and downgradient from the plume were assigned an initial DO concentration of 0.06 mg/L.

The upgradient constant-head cells in the Bioplume II model require DO concentrations to be input as constant concentrations to simulate incoming electron acceptors. A total of seven constant head cells, located in what was estimated to be a directly upgradient direction, were assigned a DO concentration of 0.8 mg/L. The remaining constant-head cells were assigned a DO value of 0.1 mg/L.

5.3.5 Anaerobic Degradation Rates

Available data strongly suggest that anaerobic degradation is occurring at the site, and that aerobic degradation processes are relatively insignificant (Table 4.5). Anaerobic degradation must therefore be simulated with Bioplume II to make predictions that are meaningful. The Bioplume II model simulates anaerobic biodegradation by assuming that such degradation follows first-order kinetics. As with a large number of biological processes, anaerobic biodegradation can generally be described using a first-order rate constant and the equation:

$$\frac{C}{C_0} = e^{-kt}$$

Where: C=Contaminant Concentration at Time t
C_0 = Initial Contaminant Concentration
k = Coefficient of Anaerobic Decay (anaerobic rate constant)
t = time

A convenient way of estimating biodegradation rate constants is to use compounds present in the dissolved contaminant plume that that are biologically recalcitrant. One such compound that is useful in some, but not all, groundwater environments is trimethylbenzene (TMB). The three isomers of this compound (*1,2,3*-TMB, *1,2,4*-TMB, and *1,3,5*-TMB) are generally present in sufficient quantities in fuel mixtures to be readily detectable when dissolved in groundwater. In addition, the TMB isomers are fairly recalcitrant to biodegradation under anaerobic conditions; however, the TMB isomers do not make good tracers under aerobic conditions (because they are readily biodegraded in aerobic environments). The degree of recalcitrance of TMB is site-specific, and the use of this compound as a tracer must be evaluated on a case-by-case basis. Another compound of potential use as a conservative tracer is tetramethylbenzene (tetraMB); however, detectable dissolved tetraMB concentrations are generally less common than detectable dissolved TMB concentrations.

An ideal tracer would have Henry's Law and soil sorption coefficients identical to the contaminant of interest; however, TMB and tetraMB are more hydrophobic than BTEX, chlorinated ethenes, and chlorinated ethanes, resulting in higher soil sorption coefficients. This causes preferential sorption of TMB and tetraMB, and an increase in the coefficients of retardation for these compounds in the aquifer. Therefore, for these compounds it is advisable to to account for the difference in contaminant and tracer velocity resulting from the higher soil sorption and consequent retardation of TMB and tetraMB. Otherwise, using TMB and tetraMB as tracers can be so conservative that estimated biodegradation rates can be negative.

The corrected concentration at point *i* can be represented by the following equation:

$$C_{i,corr} = C_{i-1,corr}\left(\frac{C_i}{C_{i-1}}\right)\left(\frac{1}{\left(1-\frac{R_c}{R_t}\left(1-\frac{T_i}{T_{i-1}}\right)\right)}\right)$$

where: $C_{i,corr}$ = corrected contaminant concentration at point *i*
$C_{i-1,corr}$ = corrected contaminant concentration at point *i*-1. (If point *i*-1 is the first or most upgradient point, $C_{i-1,corr}$ is equivalent to the oberved contaminant concentration.)

C_i=observed contaminant concentration at point i
C_{i-1}=observed contaminant concentration at point i-1
T_i=observed tracer concentration at point i
T_{i-1}=observed tracer concentration at point i-1
R_c, R_t = the coefficient of retardation for the contaminant and tracer, respectively
Note: This assumes that $R_t/R_c + T_i/T_{i-1} > 1$.

Alternatively, Buscheck and Alcantar (1995) derived a relationship that allows calculation of first-order decay rate constants for steady-state plumes. This method involves coupling the regression of contaminant concentration (plotted on a logarithmic scale) versus distance downgradient (plotted on a linear scale) to an analytical solution for one-dimensional, steady state, contaminant transport that includes advection, dispersion, sorption, and biodegradation.

Decay rate constants for Site 56 were calculated using TMB and tetraMB data. In addition, two decay constants were calculated using the method of Buscheck and Alcantar (1995). One constant was calculated using March 1995 data obtained by Parsons ES, and the second constant was calculated using September/October 1994 data from BVWS (1995). Chemical data from four monitoring wells/points located on or near the estimated centerline of the dissolved BTEX plume were used in these calculations. The magnitudes of the calculated constants were as follows:

Buscheck and Alcantar (1995) (March 1995 data)	0.002 day^{-1}
Buscheck and Alcantar (1995) (September/October 1994 data)	0.005 day^{-1}
Total TMB concentrations	0.0011 day^{-1}
TetraMB concentrations	0.0012 day^{-1}

An intermediate value of 0.003 day^{-1} was selected for use in the model for the following reasons:

- The selected value of 0.003 is less than decay constants frequently cited in the literature (Table 5.1). For example, Chapelle (1994) reported that at two different sites with anaerobic groundwater conditions the anaerobic rate constants were both approximately 0.01 day^{-1}. Wilson *et al.* (1994), report first-order anaerobic biodegradation rates of 0.05 to 1.3 $week^{-1}$ (0.007 to 0.185 day^{-1}). Stauffer *et al.* (1994) report rate constants of 0.01 and 0.018 day^{-1} for benzene and p-xylene, respectively;

- A decay rate constant of 0.009 day^{-1} was calculated for a site having similar hydrogeologic conditions at Eglin AFB in Florida (Parsons ES, 1995b).

- During plume calibration, the use of lower decay rates caused a general increase in dissolved BTEX concentrations throughout the plume, whereas what was needed to achieve the calibration was a lowering of the average BTEX levels.

TABLE 5.1
REPRESENTATIVE FIRST-ORDER RATE CONSTANTS
SITE 56
INTRINSIC REMEDIATION TS
MACDILL AIR FORCE BASE, FLORIDA

Reference	Decay Rate (day^{-1})
Chapelle (1994)	0.01[a/]
Buscheck *et al.* (1993)	0.001 to 0.01[a/]
Wiedemeier *et al.* (1995)	0.01 to 0.03[a/]
Wiedemeier *et al.* (1995)	0.03 to 0.04[b/]
Wiedemeier *et al.* (1995)	0.02 to 0.04[c/]
Wiedemeier *et al.* (1995)	0.01 to 0.03[d/]
Wiedemeier *et al.* (1995)	0.006 to 0.03[e/]
Stauffer *et al.* (1994)	0.01[b/] to 0.02[c/]
MacIntyre *et al.* (1993)	0.01 to 0.02[e/]
MacIntyre *et al.* (1993)	0.007 to 0.012[b/]
MacIntyre *et al.* (1993)	0.006 to 0.012[f/]
Barker *et al.* (1987)	0.007[b/]
Kemblowski *et al.* (1987)	0.0085[b/]
Chiang *et al.* (1989)	0.095[b/]
Wilson *et al.* (1990)	0.007 to 0.024[b/]
Howard *et al.* (1991)	0.009 to 0.069[b/]

a/ For total BTEX.
b/ For benzene.
c/ For toluene.
d/ Ethylbenzene.
e/ For xylene.
f/ For naphthalene.

For the reasons cited above, use of the smaller decay coefficients computed using the TMB and tetraMB methods was judged to be overly conservative.

5.4 MODEL CALIBRATION

Model calibration is an important component in the development of any numerical groundwater flow and solute transport model. Calibration of the flow model demonstrates that the model is capable of matching hydraulic conditions observed at the site; calibration of the solute transport model superimposed upon the calibrated flow model helps verify that contaminant loading and transport conditions are being appropriately simulated. The numerical flow model for Site 56 was calibrated by altering transmissivity and recharge in a trial-and-error fashion until simulated heads approximated values measured in March 1995 within a prescribed accuracy. After calibration of the flow model, the numerical transport model was calibrated by altering transport parameters and contaminant source term concentrations until the simulated BTEX plume approximated observed field values to the extent feasible. Table 5.2 lists input parameters used for the modeling effort. Model input and output are included in Appendix E.

5.4.1 Water Table Calibration

The shallow water table at Site 56 was assumed to be influenced by continuous recharge and discharge at the constant-head cells established at the upgradient and downgradient model boundaries. In addition, it was assumed that recharge entered the subsurface in the grassy areas scattered throughout the modeled area (Figure 5.1). According to BVWS (1995), the average annual precipitation in the vicinity of the Base is approximately 44 inches per year, and the average ET rate is 39 inches per year (89 percent of precipitation). However, ET rates can vary significantly with vegetation type. ET rates in grassy areas would be expected to be lower than in areas containing abundant trees or shrubs. Due to the presence of grass, the relatively flat surface topography (which tends to minimize surface runoff), the presence of sandy soils, and the shallow depth to groundwater, the recharge rates for the model were assumed to vary from 20 to 30 percent of precipitation (8.8 to 12.9 inches per year). During the model calibration process, the increased recharge rates were found to aid the calibration by generally raising the water table elevation within the modeled area.

Hydraulic conductivity is an important aquifer characteristic that determines the ability of the water-bearing strata to transmit groundwater. Transmissivity is the product of the hydraulic conductivity and the thickness of the aquifer. An accurate estimate of hydraulic conductivity is important to help quantify advective groundwater flow velocities and to define the flushing potential of the aquifer and the quantity of electron-acceptor-charged groundwater that is entering the site from upgradient locations. Based on the work of Rifai *et al.* (1988), the Bioplume II model is particularly sensitive to variations in hydraulic conductivity. Lower values of hydraulic conductivity result in a slower-moving plume that degrades more slowly because less oxygen, nitrate, iron, sulfate, and carbon dioxide are available for biodegradation. Higher values of hydraulic conductivity result in a faster-moving plume that degrades more rapidly because more electron acceptors are available for biodegradation.

TABLE 5.2
BIOPLUME II MODEL INPUT PARAMETERS
SITE 56
INTRINSIC REMEDIATION TS
MACDILL AIR FORCE BASE, FLORIDA

			Model Runs			
Parameter	Description	Calibrated Model Setup	56_A	56_B	56_C	56_D
NTIM	Maximum number of time steps in a pumping period	1	1	1	1	1
NPMP	Number of Pumping Periods	1	30	30	30	30
NX	Number of nodes in the X direction	20	20	20	20	20
NY	Number of nodes in the Y direction	30	30	30	30	30
NPMAX	Maximum number of Particles NPMAX=(NX-2)(NY-2)(NPTPND) + ($N_a^{[a]}$)(NPTPND) + 250	5236	5236	5236	5236	5236
NPNT	Time step interval for printing data	1	1	1	1	1
NITP	Number of iteration parameters	7	7	7	7	7
NUMOBS	Number of observation points	1	1	1	1	1
ITMAX	Maximum allowable number of iterations in ADIP [b]	100	100	100	100	100
NREC	Number of pumping or injection wells	17	17	17	17	17
NPTPND	Initial number of particles per node	9	9	9	9	9
NCODES	Number of node identification codes	2	2	2	2	2
NPNTMV	Particle movement interval (IMOV)	0	0	0	0	0
NPNTVL	Option for printing computed velocities	0	0	0	0	0
NPNTD	Option to print computed dispersion equation coefficients	0	0	0	0	0
NPDELC	Option to print computed changes in concentration	0	0	0	0	0
NPNCHV	Option to punch velocity data	0	0	0	0	0
NREACT	Option for biodegradation, retardation and decay	1	1	1	1	1
PINT	Pumping period (years)	0.5	1,2	1,2	1, 2	1, 2
TOL	Convergence criteria in ADIP	0.001	0.001	0.001	0.001	0.001
POROS	Effective porosity	0.25	0.25	0.25	0.25	0.25
BETA	Characteristic length (long. dispersivity; feet)	25	25	25	25	25
S	Storage Coefficient	0 (Steady-State)	0	0	0	0
TIMX	Time increment multiplier for transient flow	-	-	-	–	–
TINIT	Size of initial time step (seconds)	-	-	-	–	–
XDEL	Width of finite difference cell in the x direction (feet)	25	25	25	25	25
YDEL	Width of finite difference cell in the y direction (feet)	25	25	25	25	25
DLTRAT	Ratio of transverse to longitudinal dispersivity	0.1	0.1	0.1	0.1	0.1
CELDIS	Maximum cell distance per particle move	0.5	0.5	0.5	0.5	0.5

TABLE 5.2 (Continued)
BIOPLUME II MODEL INPUT PARAMETERS
SITE 56
INTRINSIC REMEDIATION TS
MACDILL AIR FORCE BASE, FLORIDA

			Model Runs			
Parameter	Description	Calibrated Model Setup	56_A	56_B	56_C	56_D
ANFCTR	Ratio of Tyy to Txx (1 = isotropic)	1	1	1	1	1
DK	Distribution coefficient	0.31	0.31	0.31	0.31	0.31
RHOB	Bulk density of the solid (grams/cubic centimeter)	1.7	1.7	1.7	1.7	1.7
THALF	Half-life of the solute	-	-	-	-	-
DEC1	Anaerobic decay coefficient (day^{-1})	0.003	0.003	0.003	0.003	0.003
DEC2	Reaeration coefficient (day^{-1})	0	0	0	0	0
F	Stoichiometric Ratio of Hydrocarbons to Oxygen	3.0	3.0	3.0	3.0	3.0

[a] Ns = Number of nodes that represent fluid sources (wells or constant head cells)

[b] ADIP = Alternating-direction implicit procedure (subroutine for solving ground water flow equation)

Saturated thickness data from previous reports, geologic logs, and water level measurements were used in conjunction with the average hydraulic conductivity as determined from slug tests (BVWS, 1995) to estimate an initial uniform transmissivity for the entire model domain. As stated in Section 3.5, hydraulic conductivities derived from slug tests performed in the shallow sandy aquifer at Sites 56 and 32 by BVWS (1995) and Parsons ES ranged from 7.5 ft/day to 25.9 ft/day. To better match heads in the model to observed values, the transmissivities were progressively varied in blocks and rows until the simulated water levels for cells corresponding to the selected well locations matched the observed water levels to an acceptable degree. Figure 5.2 shows the calibrated water table. Calibrated model hydraulic conductivities ranged between 11.2 ft/day and 30.2 ft/day. Simulated advective groundwater velocities were variable, but generally ranged from 0.09 to 0.30 ft/day. These velocities compare favorably with those estimated prior to the start of the modeling using BVWS data (0.14 to 0.23 ft/day).

Water level elevation data from 22 monitoring wells and monitoring points were used to compare measured and simulated heads for calibration. These monitoring wells/points included MD56-MW01, MD56-MW02, MD56-MW04, MD56-MW05, MD56-MW06, MD56-MW07, MD56-MW08, MD56-MW09, MD56-MW10, MD56-MW11, MD32-MW01, MD32-MW03, MD32-MW06, MD32-MW07, MD32-MW10, 56MP-1S, 56-MP2S, 56MP-3S, 56MP-6S, 56MP-7S, 56MP-8S, and 56MP-10S.

The root mean squared (RMS) error is commonly used to express the average difference between simulated and measured heads. RMS error is the average of the squared differences between measured and simulated heads, and can be expressed as:

$$RMS = \left[\frac{1}{n} \sum_{i=1}^{n} \left(h_m - h_s \right)_i^2 \right]^{0.5}$$

Where:

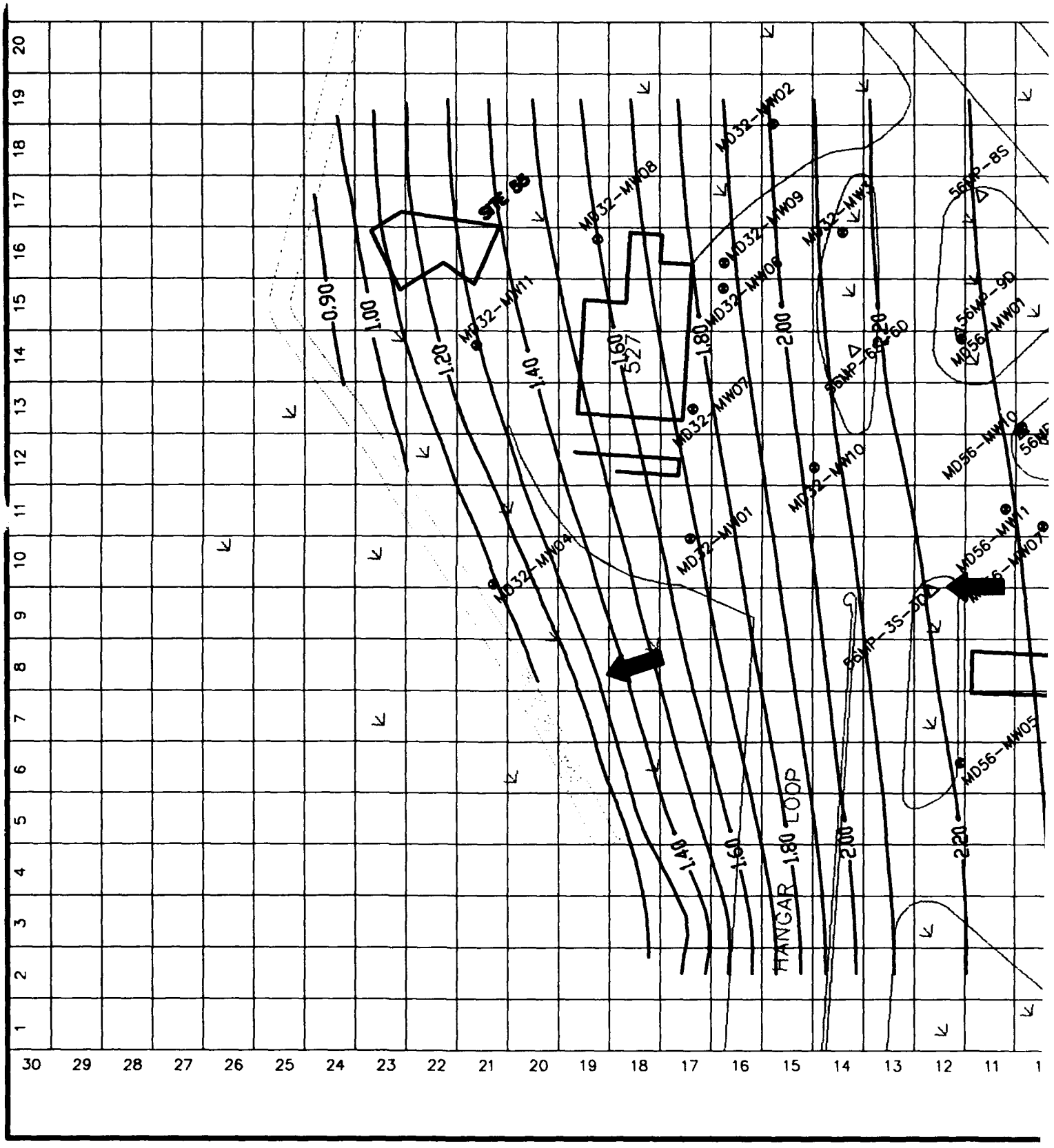
n = the number of points where heads are being compared

h_m = measured head value

h_s = simulated head value.

The RMS error between observed and calibrated values at the 22 comparison points was 0.071 foot, which corresponds to a calibration error of 3.7 percent (water levels dropped about 1.9 feet over the length of the model grid). RMS calculations are provided in Appendix D.

In solving the groundwater flow equation, Bioplume II establishes the water table surface and calculates an overall hydraulic balance that accounts for the numerical difference between flux into and out of the system. The hydraulic mass balance for the calibrated model was good, with 99.96 percent of the water flux into and out of the system being numerically accounted for (i.e., a 0.04 percent error). According to Anderson and Woessner (1992), a mass balance error of around 1 percent is acceptable, while Konikow (1978) indicates an error of less than 0.1 percent is ideal.



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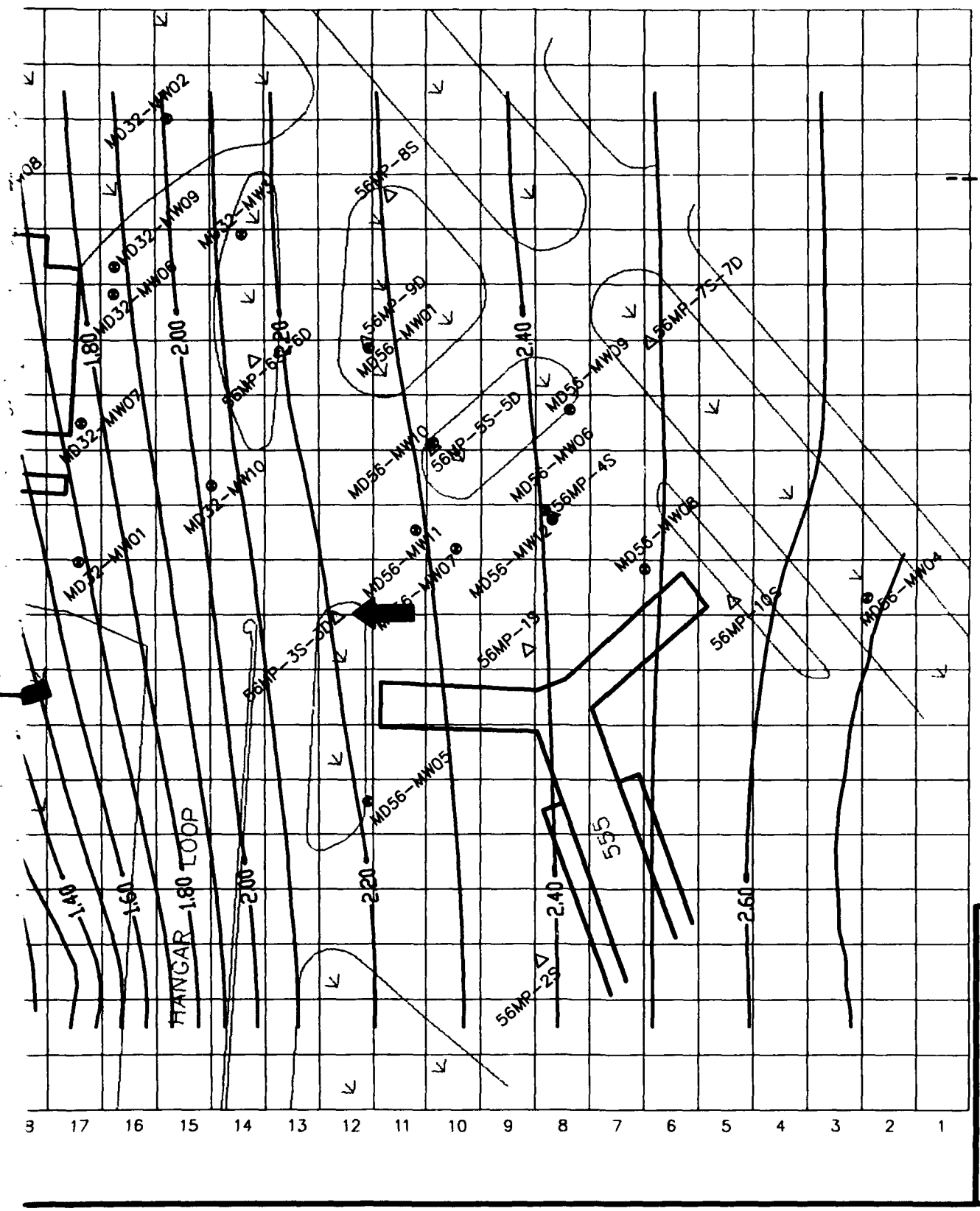


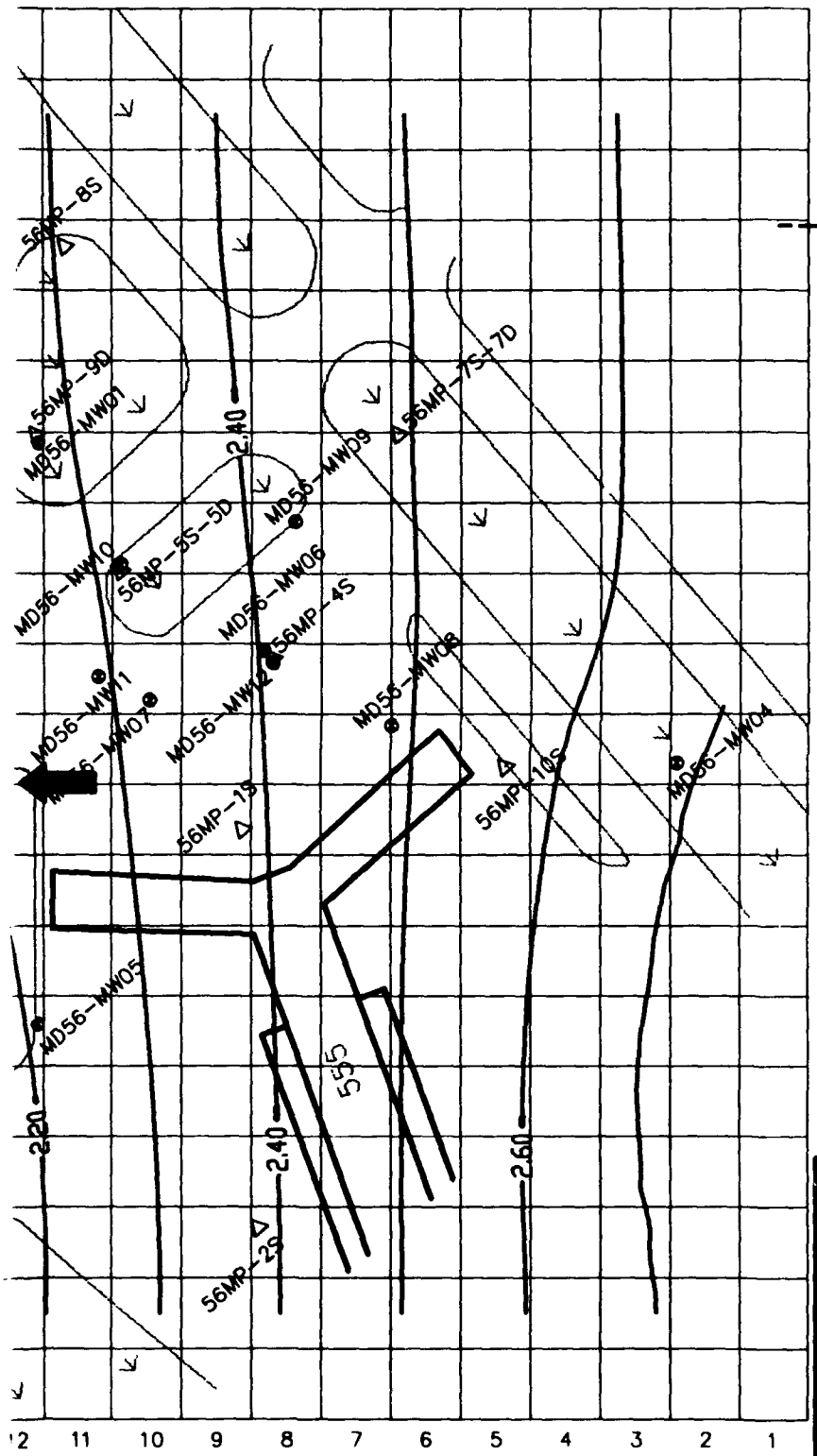
FIGURE

**CALIBRA
GROUNDWATER
SITE**

Intrinsic Remed
MacDill Air Force

PARSONS ENGINEERING

Denver, C



LEGEND

56MP-10S — PARSONS ES MONITORING POINT

MD56-MW04 — PRE-EXISTING MONITORING WELL

2.20 — LINE OF EQUAL SIMULATED GROUNDWATER ELEVATION (FT msl)

GRASSY AREAS

GROUNDWATER FLOW DIRECTION

CONTOUR INTERVAL = 0.1 FOOT

0 15 30 60 120
FEET

FIGURE 5.2

CALIBRATED GROUNDWATER SURFACE SITE 56

Intrinsic Remediation TS
MacDill Air Force Base, Florida

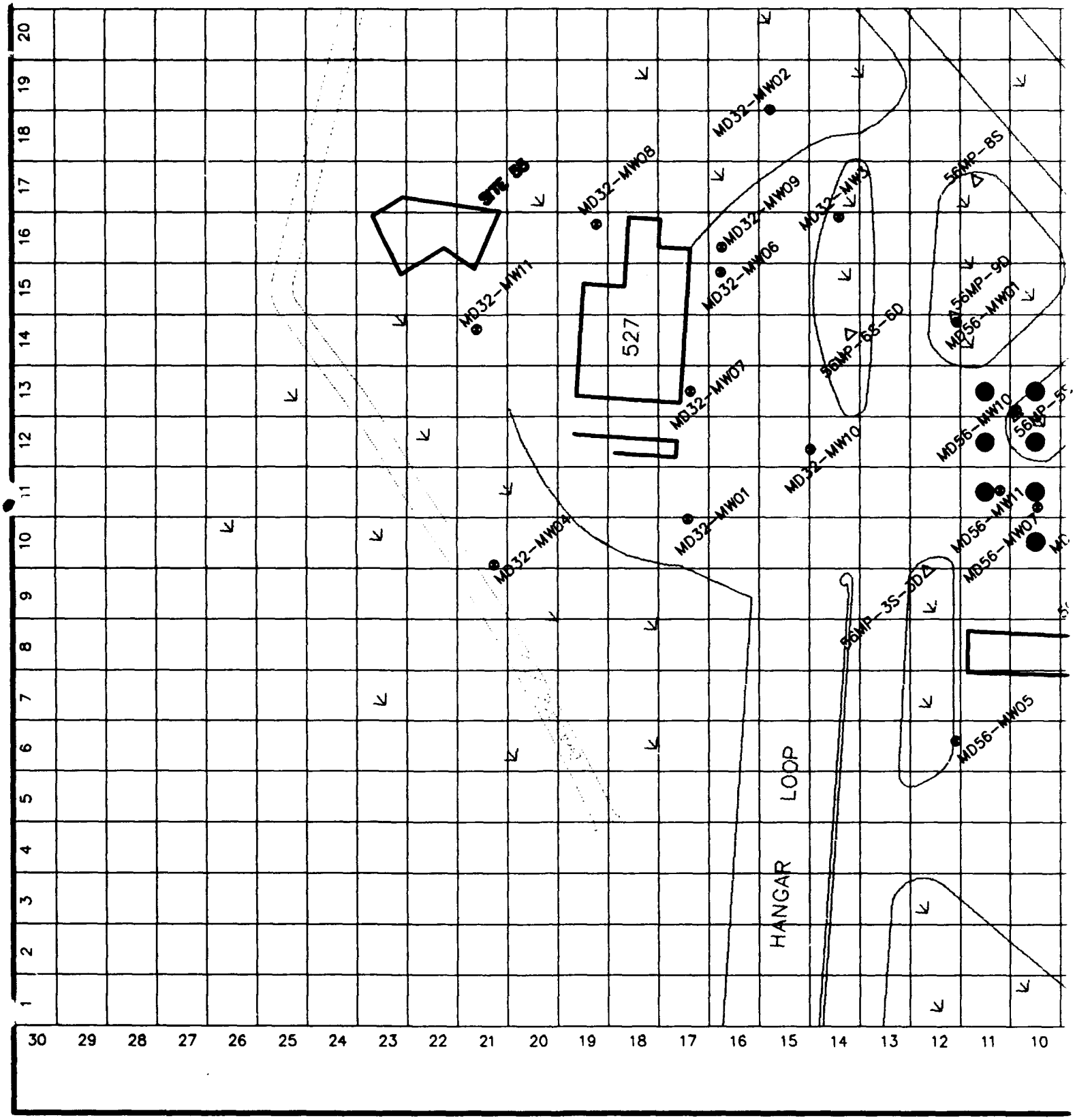
PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

5.4.2 BTEX Plume Calibration

Model input parameters affecting the distribution and concentration of the simulated BTEX plume were modified so that model predictions resembled dissolved total BTEX concentrations observed in March 1995 to a reasonable degree. To accomplish this, model runs were made using the calibrated steady-state hydraulic parameters. Calibration of the fate and transport portion of a Bioplume model generally requires that the contaminant distribution be known for two different times. Therefore, BTEX concentrations measured in groundwater during September/October 1994 by BVWS (1995) were input as initial conditions, and the model was run for a period of 6 months to obtain a March 1995 plume. In addition, because residual LNAPL is present in the vicinity of the water table at Site 56 (Section 4.2), it was necessary to include simulated injection wells to model partitioning of BTEX compounds from the residual LNAPL into the groundwater. The locations of the injection wells are shown on Figure 5.3. Locations of injection wells were based on the soil quality data obtained by BVWS (1995) and Parsons ES (Section 4.2).

While the term "injection well" suggests that contaminants are being introduced at a point, Bioplume II assumes that contamination introduced at a well instantly equilibrates throughout the entire cell in which the well is located. The injection rate for the cells was set at 1×10^{-5} cubic foot per second (ft^3/sec), a value low enough that the flow calibration and water balance were not affected. The injected BTEX concentrations were proportional to the groundwater BTEX concentrations measured in March 1995, with the maximum injected BTEX concentration occurring in the vicinity of the highest detected dissolved BTEX concentrations. The injected BTEX concentrations were proportionately reduced in other areas where the measured BTEX concentrations in groundwater were lower. Due to the low DO concentrations measured in groundwater, the injected water was assumed to be oxygen-free. By varying the injection well concentrations, the coefficient of retardation, dispersivity, and the anaerobic decay coefficient, the BTEX plume was calibrated reasonably well to the existing plume in terms of plume extent and BTEX concentrations in the source areas. The calibrated plume configuration is shown on Figure 5.4.

The calibrated BTEX plume calculated by the model (Figure 5.4) is similar, but not identical, to the observed (March 1995) BTEX plume (Figure 4.2). A portion of the difference between the two plumes results from variations in groundwater quality between the two sampling rounds (September/October 1994 and March 1995). Specifically, the measured total BTEX concentration in well MD56-MW10 in 1994 was 3,514 µg/L, and in March 1995 a concentration of 1,018 µg/L was obtained. This difference caused the simulated BTEX concentrations near and downgradient from this well to be elevated above levels measured in March 1995, and this difference could not be completely overcome by reasonable manipulation of injected BTEX concentrations or contaminant transport parameters. In addition, the measured total BTEX concentration at monitoring well MD56-MW08 in September/October 1994 was 92.6 µg/L. In March 1995, a value of 3.1 µg/L was obtained. This difference caused the simulated BTEX concentration contours to be elongated in the upgradient direction (southeast), and again, the difference could not be completely overcome by reasonable manipulation of model input parameters. The differences between the measured September/October 1994 and March 1995 BTEX plumes may be attributable more to



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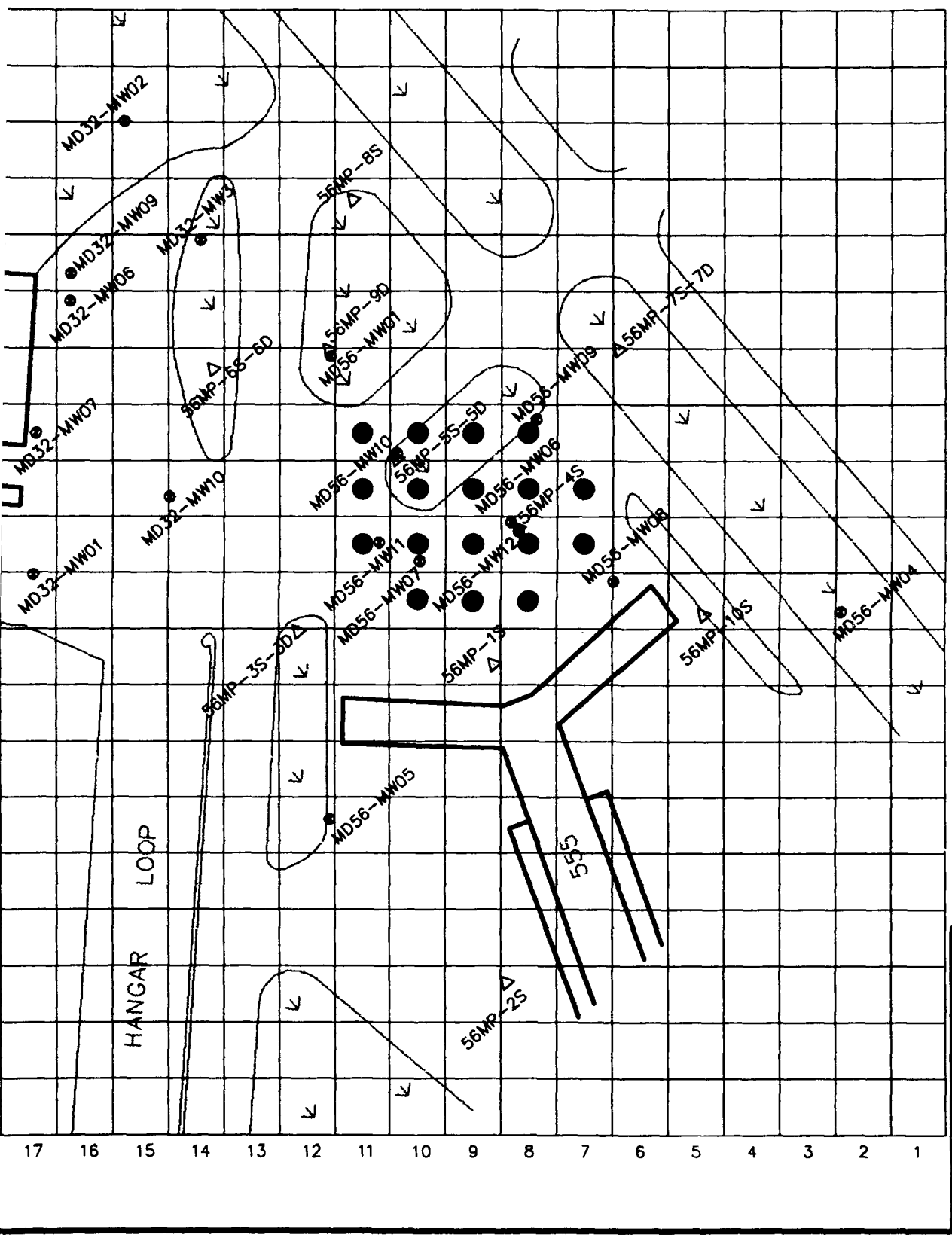


LEGEND

56MP-10S PARSONS ES MON
(S=SHALLOW, D=D

MD56-MW04 PRE-EXISTING MO

LOCATION OF SIMU
BTEX INJECTION W

0 15 30 60
FEET

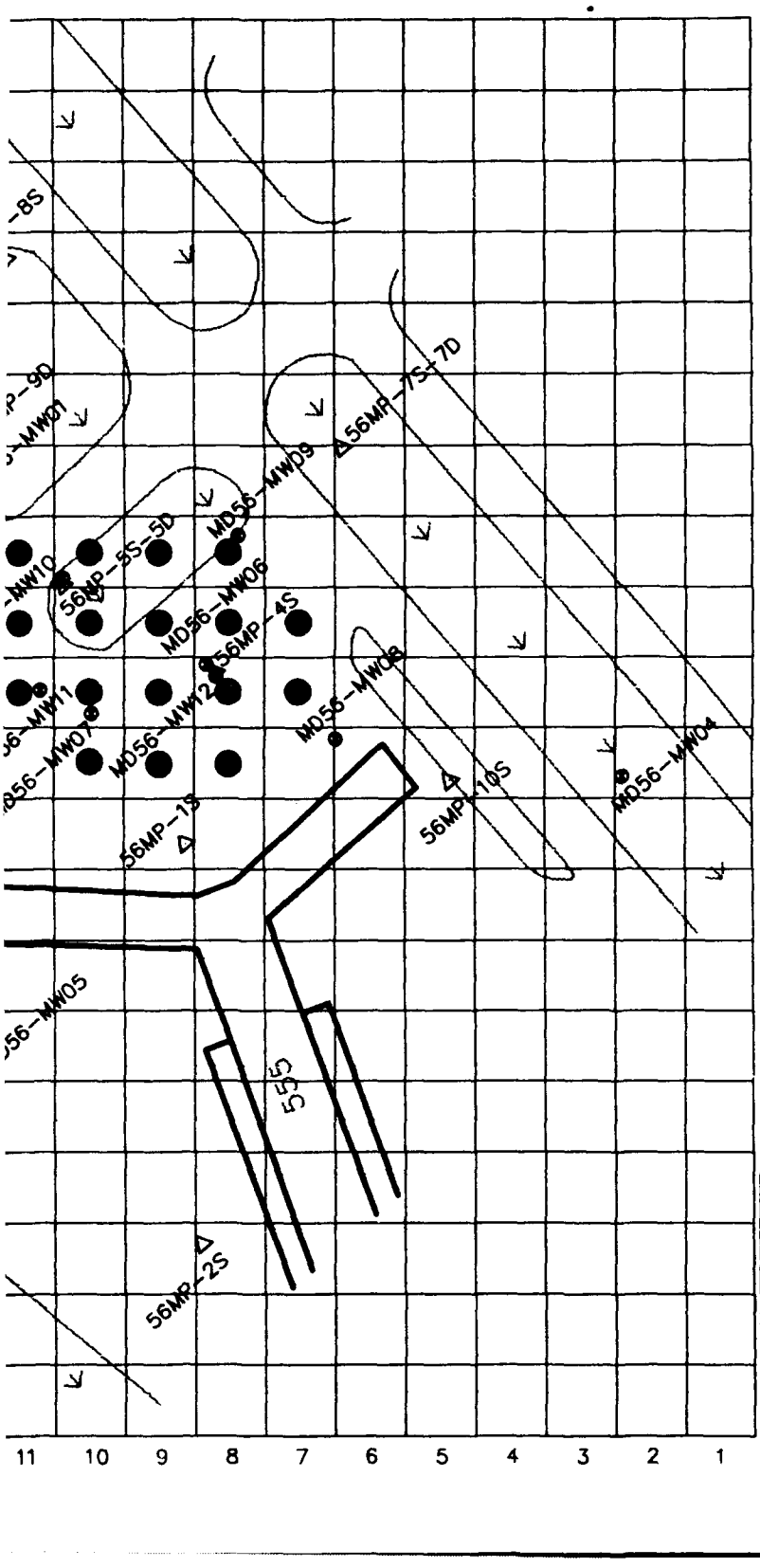
FIGURE 5.3

**LOCATIONS
SIMULATED INJECTI
SITE 56**

Intrinsic Remediat
MacDill Air Force Ba

PARSONS
ENGINEERING SC

Denver, Color



LEGEND

56MP-10S — PARSONS ES MONITORING POINT (S=SHALLOW, D=DEEP)

MD56-MW04 — PRE-EXISTING MONITORING WELL

LOCATION OF SIMULATED BTEX INJECTION WELL

0 15 30 60 120

FEET

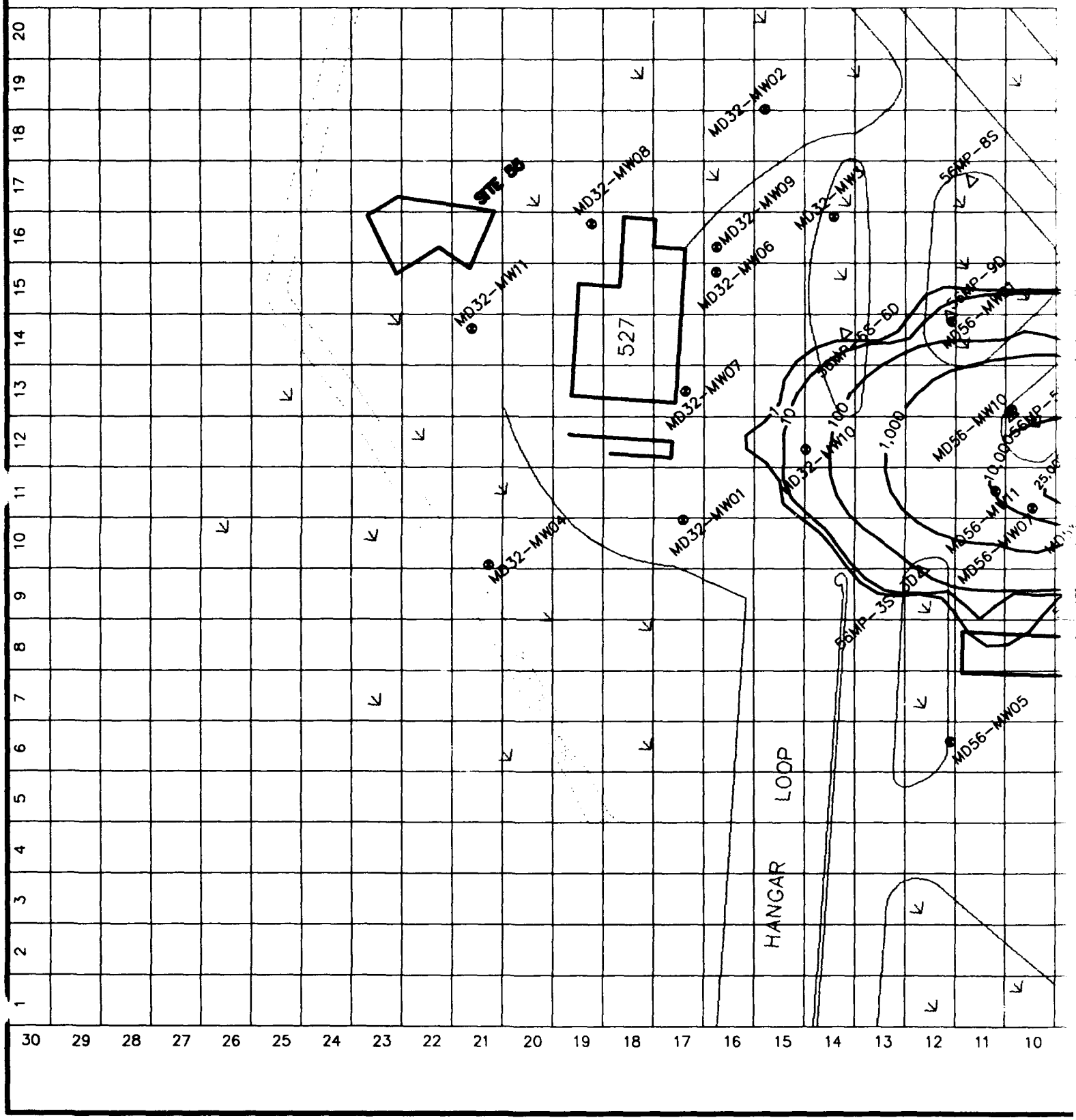
FIGURE 5.3

LOCATIONS OF SIMULATED INJECTION WELLS SITE 56

Intrinsic Remediation TS
MacDill Air Force Base, Florida

PARSONS ENGINEERING SCIENCE, INC.

Denver, Colorado



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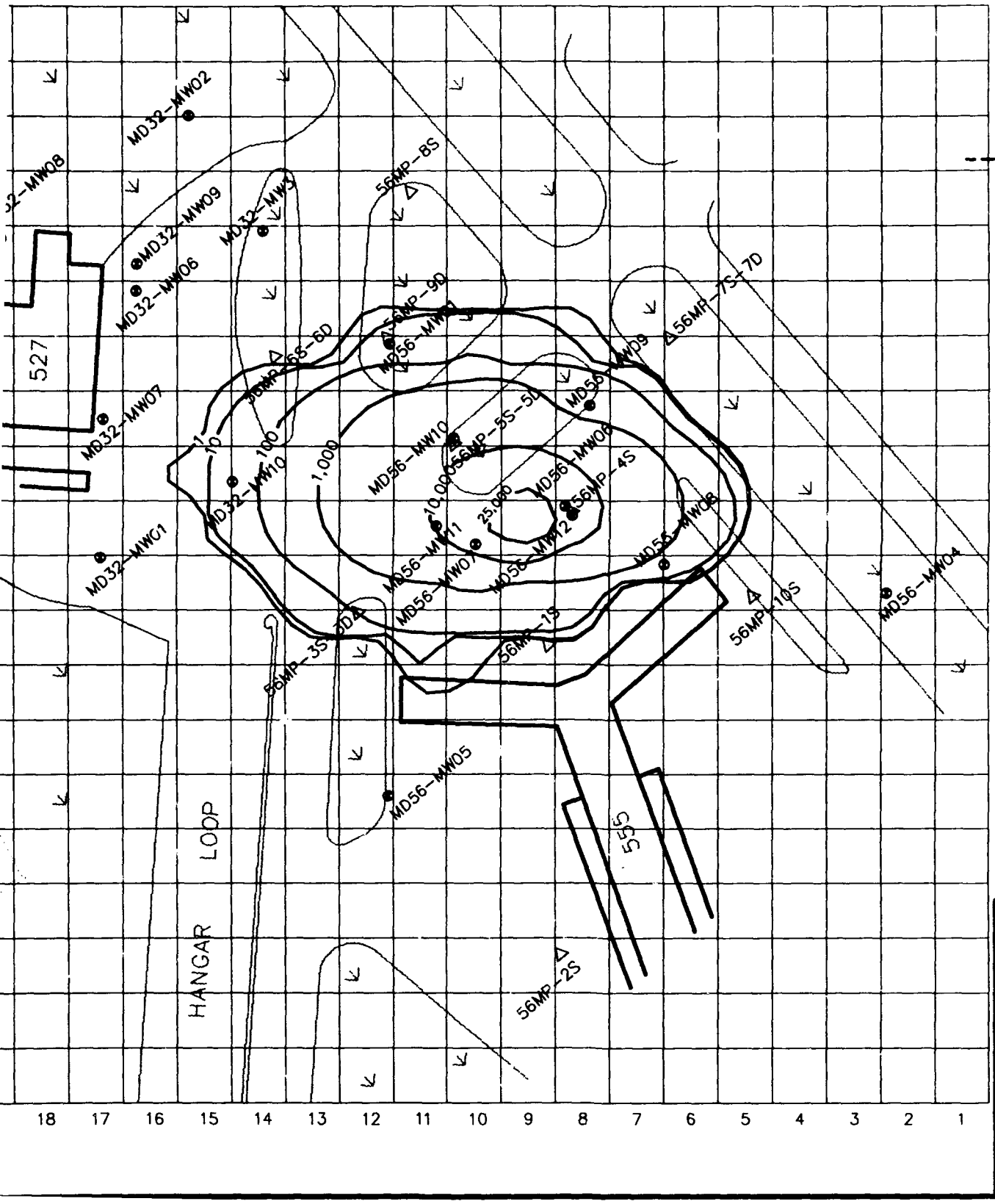
LEGEND
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MD32-MW08
MD32-MW09
MD32-MW03
MD32-MW06
MD32-MW07
MD32-MW10
MD32-MW01
56MP-8S
56MP-9D
56MP-6S-6D
56MP-7S-7D
56MP-5S-5D
56MP-4S
56MP-3S-3D
56MP-1S
56MP-10S
56MP-2S
MD56-MW09
MD56-MW10
MD56-MW08
MD56-MW11
MD56-MW12
MD56-MW06
MD56-MW07
MD56-MW04
MD56-MW05
1
10
100
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10,000
25,000
527
555
HANGAR LOOP
18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1
0 15 30 6
FE
FIGUR
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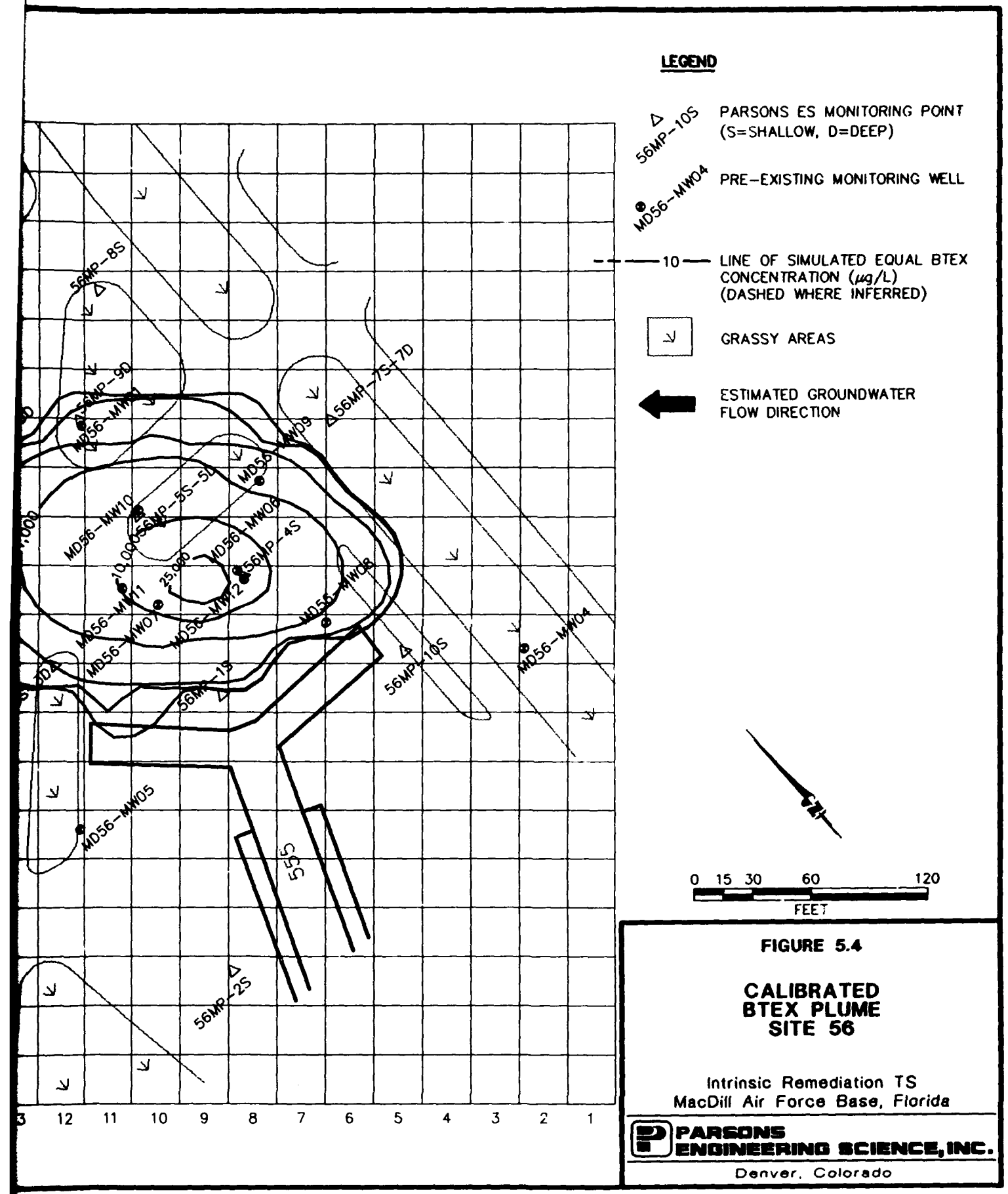


FIGURE 5.4

CALIBRATED BTEX PLUME SITE 56

Intrinsic Remediation TS
MacDill Air Force Base, Florida

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

differences in sampling techniques and/or laboratory variability than to actual temporal differences in BTEX concentrations.

Another difference between the simulated and measured March 1995 plumes was the position of the 1-µg/L BTEX contour. Low (less than 10 µg/L) BTEX concentrations were measured at several outlying wells in March 1995. Despite a reduction in crossgradient DO concentrations in the Bioplume input file, and manipulation of other contaminant transport parameters within reasonable limits, these low BTEX concentrations fringing the main portion of the plume could not be reproduced in the simulated plume. Due to the low magnitude of the concentrations however, this difference is considered to be relatively insignificant.

The maximum simulated total BTEX concentration was 26,966 µg/L for cell 9,11 in the vicinity of MD56-MW06 and 56MP-4S. The computed plume does not have concentrations as high as the concentrations measured at these locations (up to 29,636 µg/L). However, the maximum measured concentration is representative of a point concentration, while the model associates the computed concentration with the entire cell volume (25 feet wide by 25 feet long by 10 feet thick).

The simulated plume represents a greater total mass of BTEX because many concentrations are higher than those observed. This difference contributes to the conservative nature of this model.

5.4.2.1 Discussion of Parameters Varied During Plume Calibration

As noted previously, the transport parameters varied during calibration were dispersivity, the anaerobic decay coefficient, and the coefficient of retardation. These parameters were varied with the intent of limiting plume migration to the observed extents, because original estimates for the parameters resulted in a calculated BTEX plume distribution that did not reproduce the original plume. While these parameters were varied with this common intent, each had a slightly different impact on the size and shape of the simulated plume.

Dispersivity. Much controversy surrounds the concepts of dispersion and dispersivity. Longitudinal dispersivity values for sediments similar to those found at the site range from 0.1 to 200 feet (Walton, 1988). Longitudinal dispersivity for the Site 56 model was initially estimated as 30 feet, which is approximately one-tenth the estimated distance between the plume source area and the downgradient plume boundary, as defined by the 1-µg/L BTEX isopleth. Transverse dispersivity values generally are estimated as one-tenth of the longitudinal dispersivity values (Domenico and Schwartz, 1990). This ratio was maintained for the Site 56 Bioplume II model.

During plume calibration, longitudinal dispersivity was varied between 15 and 30 feet, and a final value of 25 feet was used in the model. Use of this value shortened the overall plume slightly, which aided the calibration, and also resulted in a simulated BTEX concentration in the vicinity of downgradient well MD32-MW10 that was similar to the measured concentration in that well.

Anaerobic Decay Coefficient. As discussed in Section 5.3.5, the anaerobic decay coefficient was originally estimated to be 0.003 day^{-1}. This value was varied during plume calibration, but the calibrated model used the original estimate. Use of this value prevented the plume from migrating too far in the calibration run, and at the same time prevented contaminant concentrations in the central portion of the plume from being excessively high. The results of the calibration runs suggested that a slightly larger decay coefficient may be more realistic for this site; however, the original estimate was retained as a conservative estimate.

Coefficient of Retardation. Retardation of the BTEX compounds relative to the advective velocity of the groundwater occurs when BTEX molecules are sorbed to the aquifer matrix. Based on measured TOC concentrations near the water table at three locations, an assumed bulk density of 1.7 grams/cubic centimeter (typical for sediments of this type), and published values of the soil sorption coefficient (K_{oc}) for the BTEX compounds (as listed in Wiedemeier *et al.*, 1995), the coefficients of retardation for the BTEX compounds were calculated. The results of these calculations are summarized in Table 5.3. The lower the assumed coefficient of retardation, the farther the BTEX plume will migrate downgradient. To be conservative, the minimum range of retardation coefficients calculated for the BTEX compounds (1.54 to 3.15, for benzene) was used as a constraint for model input.

The coefficient of retardation initially used as model input was 2.50. During the plume calibration, the coefficient of retardation was gradually increased to 3.1. This variable was altered in response to model predictions of higher-than-measured BTEX concentrations downgradient from the source area (i.e., in the vicinity of wells MD56-MW10 and MD32-MW10). Raising the coefficient of retardation caused a contraction of the plume and aided the calibration.

5.5 SENSITIVITY ANALYSIS

The purpose of the sensitivity analysis is to determine the effect of varying model input parameters on model output. Based on the work of Rifai *et al.* (1988), the Bioplume II model is typically most sensitive to changes in the coefficient of reaeration, the coefficient of anaerobic decay, and the hydraulic conductivity of the media, and is less sensitive to changes in the retardation factor, porosity, and dispersivity. The sensitivity analysis for this model was conducted by varying transmissivity, the coefficient of retardation, the coefficient of anaerobic decay, and the dispersivity.

To perform the sensitivity analyses, individual runs of the plume calibration model were made with the same input as the calibrated model, except that one of the aforementioned parameters was varied. The models were run for a 6-month period, as was the calibrated model, so that the independent effect of each variable could be assessed. As a result, eight sensitivity runs of the calibrated model were made, with the following variations:

1) Transmissivity uniformly increased by a factor of 5;

2) Transmissivity uniformly decreased by a factor of 5;

TABLE 5.3
CALCULATION OF RETARDATION COEFFICIENTS
SITE 56
INTRINSIC REMEDIATION TS
MACDILL AIR FORCE BASE, FLORIDA

Compound	K_{oc} (L/kg [a/])	Maximum Fraction Organic Carbon [b/]	Minimum Fraction Organic Carbon [b/]	Average Fraction Organic Carbon [b/]	Distribution Coefficient K_d (L/kg) Maximum[c1/]	Minimum[c2/]	Average[c3/]	Bulk Density (kg/L)[d/]	Effective Porosity [e/]	Coefficient of Retardation Maximum	Minimum	Average
Benzene	79	0.004	0.001	0.0028	0.316	0.079	0.221	1.70	0.25	3.15	1.54	2.50
Toluene	190	0.004	0.001	0.0028	0.760	0.190	0.532	1.70	0.25	6.17	2.29	4.62
Ethylbenzene	468	0.004	0.001	0.0028	1.872	0.468	1.310	1.70	0.25	13.73	4.18	9.91
m-xylene	405	0.004	0.001	0.0028	1.620	0.405	1.134	1.70	0.25	12.02	3.75	8.71
o-xylene	422	0.004	0.001	0.0028	1.688	0.422	1.182	1.70	0.25	12.48	3.87	9.03
p-xylene	357	0.004	0.001	0.0028	1.428	0.357	1.000	1.70	0.25	10.71	3.43	7.80

NOTES:

[a/] From technical protocol (Wiedemeier *et al.*, 1995)

[b/] From laboratory analyses of site soil samples

[c1/] K_d = Maximum Fraction Organic Carbon x K_{oc}

[c2/] K_d = Minimum Fraction Organic Carbon x K_{oc}

[c3/] K_d = Average Fraction Organic Carbon x K_{oc}

[d/] From laboratory analyses of moisture content, and assumed porosity and specific gravity.

[e/] Literature value (Johnson, 1967).

3) Coefficient of retardation increased from 3.1 to 5.0;

4) Coefficient of retardation decreased from 3.1 to 1.0;

5) Coefficient of anaerobic decay increased by a factor of 5;

6) Coefficient of anaerobic decay decreased by a factor of 5;

7) Longitudinal dispersivity increased by a factor of 2; and

8) Longitudinal dispersivity decreased by a factor of 2.

The results of the sensitivity analyses are shown graphically in Figures 5.5, 5.6, 5.7, and 5.8. These figures display the modeled BTEX concentrations versus distance along the approximate centerline of the plume (i.e., the eleventh model column). This manner of displaying data is useful because BTEX concentrations are either highest or second-highest in the eleventh model column, the plume is relatively symmetrical, and the plume migrates in a direction approximately parallel to the model grid. Furthermore, the figures allow easy visualization of the changes in BTEX concentration caused by varying model input parameters.

The effects of varying transmissivity are shown in Figure 5.5. Uniformly increasing the transmissivity by a factor of five increased the biodegradation rate and spreading of the plume such that the maximum observed concentrations in the source cell area were only 11,169 µg/L, compared to the calibrated maximum of 26,966 µg/L. In addition, the leading edge of the BTEX plume was approximately 130 feet farther downgradient than in the calibrated model. Increased biodegradation results from a greater flux of water through the model area bringing a greater mass of DO and other electron acceptors into contact with the plume, increasing both aerobic and anaerobic degradation rates. Also, the faster groundwater velocity produced by the higher transmissivity initially results in greater plume travel rates and distances, spreading out and further exposing the BTEX plume to electron acceptors. In contrast, decreasing the transmissivity by a factor of five slowed overall plume migration, which shortened the plume to an excessive degree, and in turn caused an increase in maximum BTEX levels (maximum concentration of 40,264 µg/L). Increased BTEX concentrations in the plume area are caused by reductions in the plume travel rate and the amount of electron acceptors being brought into contact with the contaminants from upgradient locations.

The effects of varying the coefficient of retardation (R) are shown in Figure 5.6. Increasing R to 5.0 from the value of 3.1 used in the calibrated model resulted in a plume configuration that was not greatly different than the observed plume. However, the maximum BTEX concentration decreased by approximately 3,000 µg/L, and the plume was approximately 50 feet shorter than in the calibrated model. The simulated BTEX concentration in the vicinity of monitoring well MW32-MW10 was zero, whereas this well had a detected BTEX concentration of 40 µg/L in March 1995. This discrepancy indicates that the higher R value did not allow the plume to travel sufficiently far to the northwest. On the other hand, decreasing R to 1.0 (no retardation) produced a plume that extended about 50 feet further downgradient than

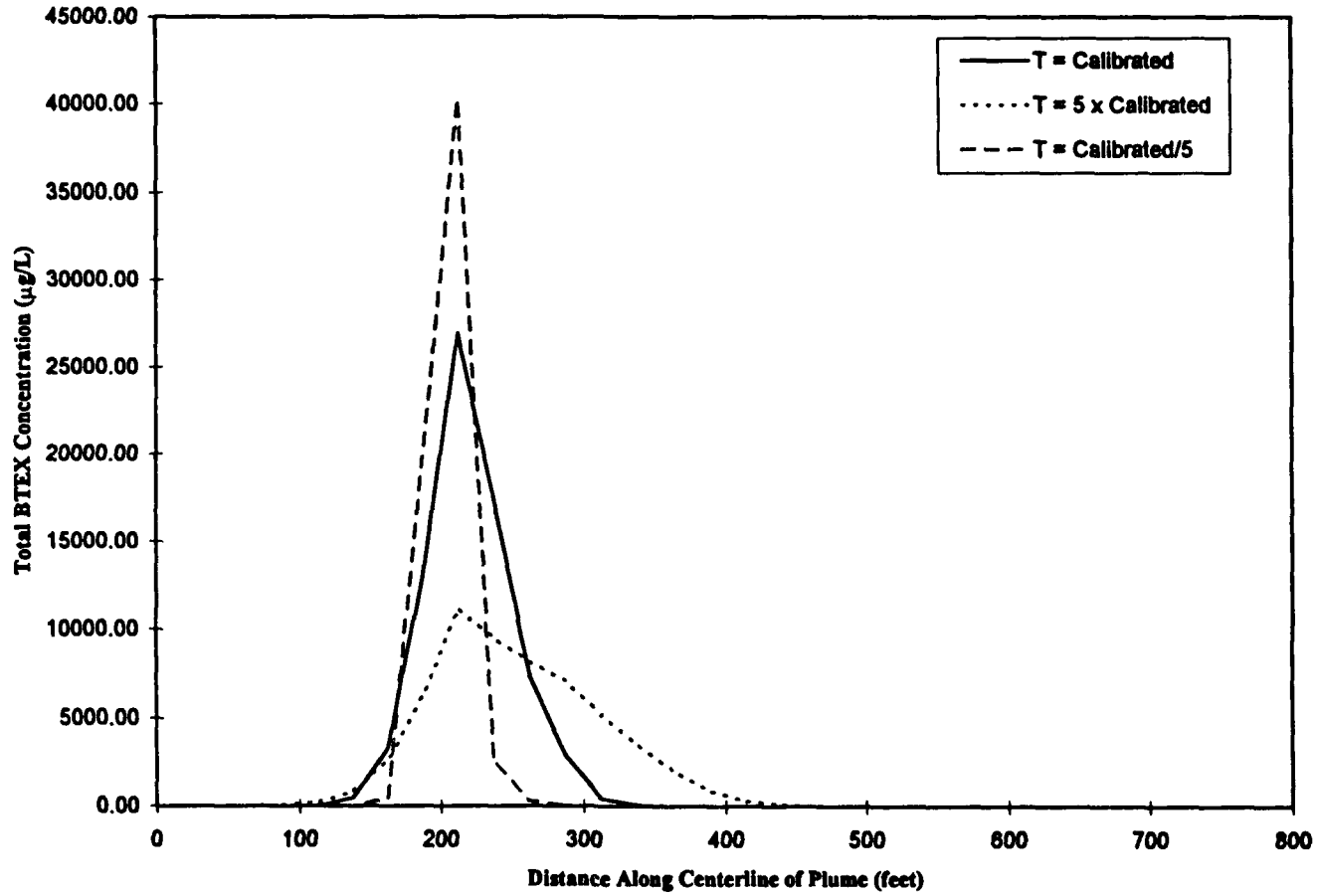


FIGURE 5.5

CONCENTRATION DISTRIBUTIONS FOR VARIOUS VALUES OF TRANSMISSIVITY (T) SITE 56

Intrinsic Remediation TS
MacDill Air Force Base, Florida

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

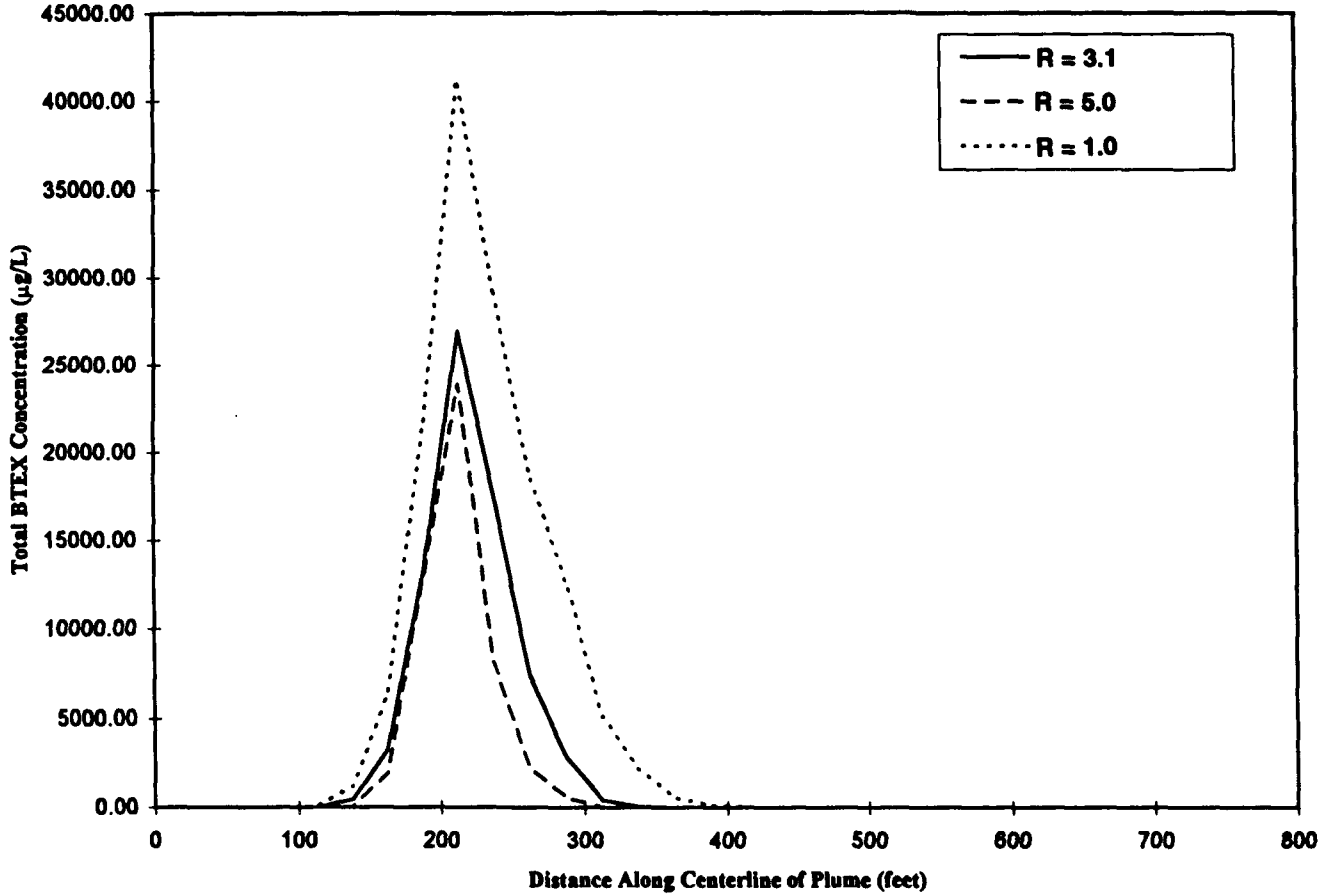


FIGURE 5.6

CONCENTRATION DISTRIBUTIONS FOR VARIOUS VALUES OF RETARDATION (R) SITE 56

Intrinsic Remediation TS
MacDill Air Force Base, Florida

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

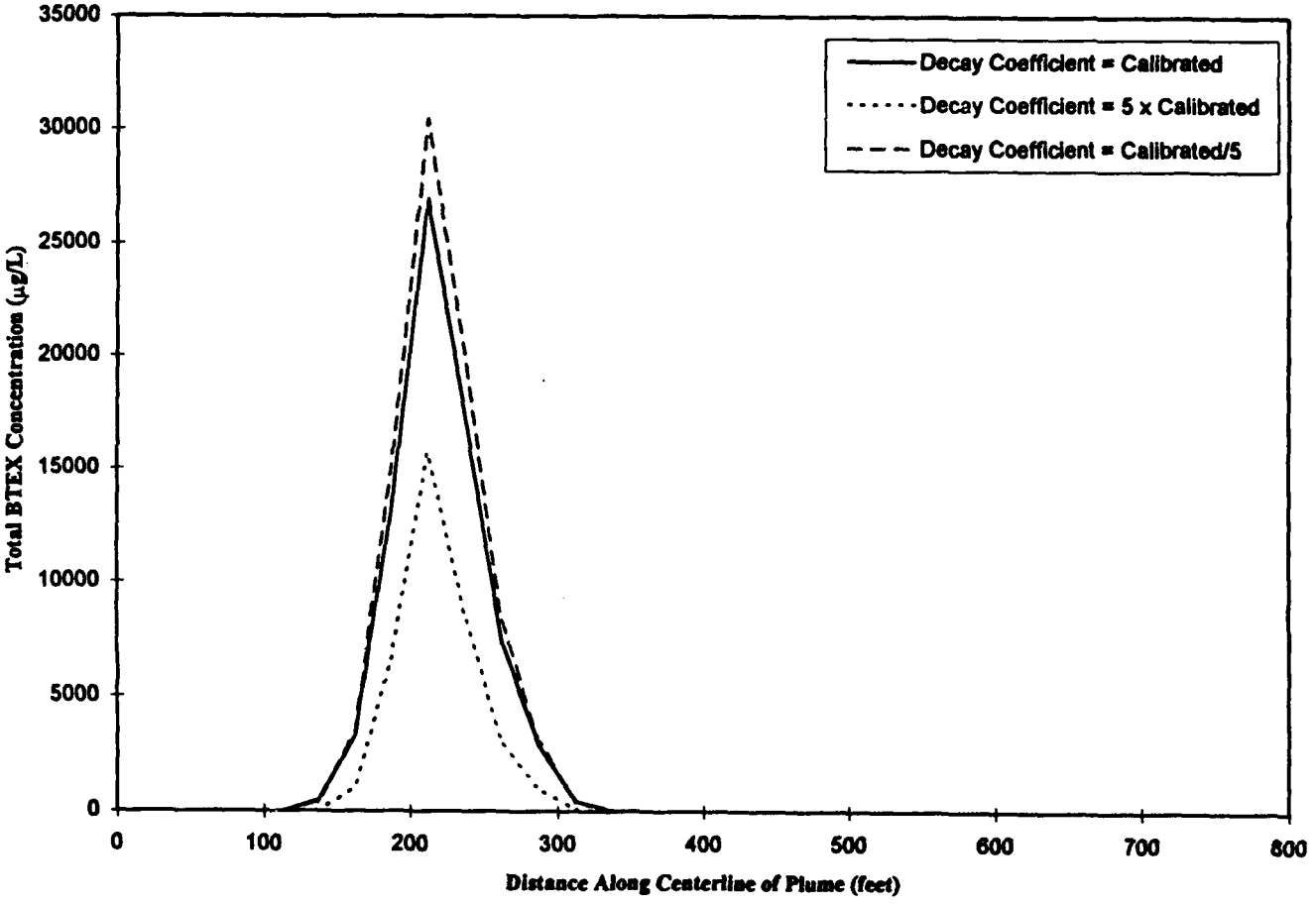


FIGURE 5.7

CONCENTRATION DISTRIBUTIONS FOR VARIOUS ANAEROBIC *DECAY COEFFICIENTS*
SITE 56

Intrinsic Remediation TS
MacDill Air Force Base, Florida

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

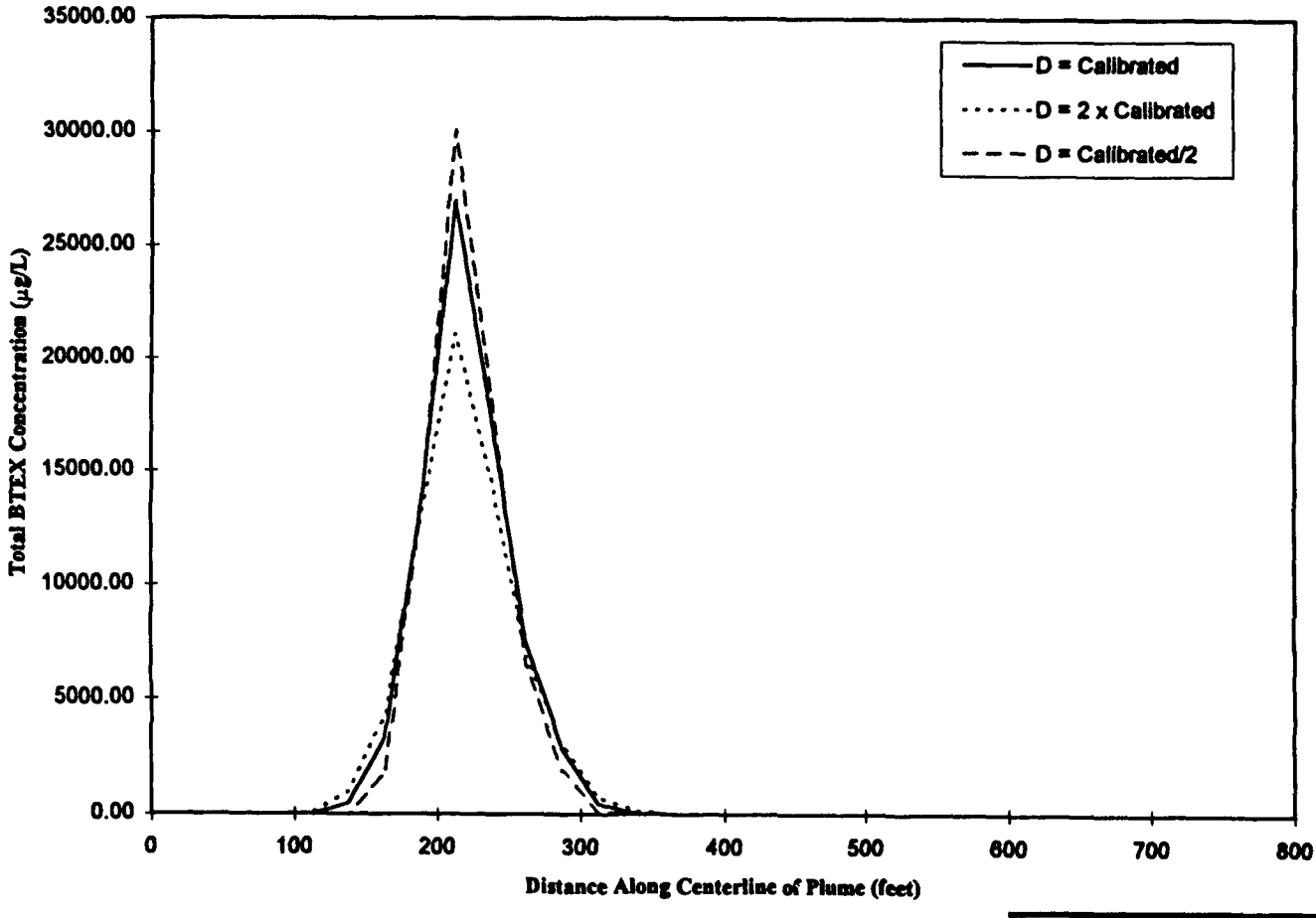


FIGURE 5.8

CONCENTRATION DISTRIBUTIONS FOR VARIOUS VALUES OF DISPERSION (D) SITE 56

Intrinsic Remediation TS
MacDill Air Force Base, Florida

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

the calibrated model plume, and that was characterized by substantially elevated BTEX concentrations and a higher maximum concentration in the source area (41,206 µg/L). The excessive plume travel distance in the downgradient direction using the reduced R value is demonstrated by comparing the simulated BTEX concentration at downgradient well MW32-MW10 (approximately 1,000 µg/L) to the measured concentration (40 µg/L). Based on these analyses, the R value used in the calibrated model appears to be a reasonably conservative value.

Figure 5.7 shows the effects of varying the anaerobic decay coefficient. Increasing this parameter by a factor of five resulted in rapid degradation of dissolved BTEX. The significant reduction in contaminant mass is the result of the large increase in the decay rate caused by increasing the coefficient, because the anaerobic decay coefficient is exponentiated in the equation expressing the decay rate (see Section 5.3.5). The BTEX concentrations in the source area were substantially below observed concentrations. Conversely, decreasing the anaerobic decay coefficient by a factor of five greatly decreased the rate of degradation, resulting in an overall increase in the computed BTEX concentrations within the plume to levels that were substantially greater than observed concentrations. Therefore, the model also is sensitive to this coefficient, and the value used in the calibrated model appears to be reasonable.

The effects of varying dispersity are illustrated by Figure 5.8. Both longitudinal and transverse dispersivity were varied for this analysis, as the ratio of the two values was kept constant at 0.1. Increasing the dispersivity by a factor of two resulted in unacceptably low maximum BTEX concentrations (21,045 µg/L) in the source area, and an increase in concentrations upgradient from the source area above observed concentrations. In addition, peripheral BTEX concentrations near the plume perimeter increased above observed values. Decreasing dispersivity by a factor of two produced a slightly smaller plume with higher BTEX concentrations (maximum of 30,068 µg/L). The resulting plume did not extend sufficiently far to the northwest, as evidenced by the simulated BTEX concentration at well MD32-MW10 (less than 10 µg/L). The measured BTEX concentration in this well was 40 µg/L. The model does not appear to be extremely sensitive to dispersivity within the range of reasonable values evaluated for this site. As a result of observing the model responses to variations in dispersivity, the dispersivity in the calibrated model used to project the plume configuration into the future was raised from 20 to 25 feet to better simulate the northwesterly extent of the plume.

The results of the sensitivity analysis suggest that the calibrated model used for this report is reasonable. The calibrated model is most sensitive to transmissivity, the anaerobic decay coefficient, and the coefficient of retardation. Increasing or decreasing the transmissivity substantially diminishes or enhances the simulated BTEX concentrations, and lengthens or shortens the plume relative to the plume configurations measured in September/October 1994 (BVWS, 1995) and March 1995. Significant increases or decreases in the anaerobic decay coefficient also alters the contaminant mass in the plume to an unacceptable degree. The sensitivity analysis results suggest that use of a larger retardation factor would improve the plume calibration by reducing the amount of northwesterly plume migration. However, the value used in the model was intentionally conservative and representative of benzene in order to simulate the migration of this compound rather than of all of the BTEX compounds. The model is

relatively insensitive to dispersivity, and reasonable changes in the value of this parameter over the value used in the calibrated model would most likely not improve the model calibration significantly.

5.6 MODEL RESULTS

To predict fate and transport of dissolved BTEX compounds at Site 56, four Bioplume II simulations were run under steady-state conditions. The first simulation, termed 56_A, was based on the assumption that the rates at which BTEX were introduced to the aquifer through injection wells decreased by 10 percent per year (injected BTEX concentrations were decreased by 10 percent from the concentration used for the previous year due to natural weathering of fuel residuals). Discharge of groundwater to the drainage ditch was assumed in this model. The second simulation, termed 56_B, incorporated the same BTEX injection assumptions described above for model 56_A, but migration of groundwater and the BTEX plume beneath the drainage ditch was simulated. The third and fourth simulations, termed 56_C and 56_D, were identical to simulations 56_A and 56_B, with the exception that they incorporated a greater reduction in BTEX loading rates based on the assumption that the source area soils would be remediated over a period of 3 years (45 percent reduction in contaminant concentrations during both years 1 and 2, with the remaining 10 percent disappearing by the end of year 3). Complete input and output files are presented in Appendix E. Model results are described in the following sections.

5.6.1 Simulation of Intrinsic Remediation Alone (Models 56_A, and 56_B)

To predict fate and transport of dissolved BTEX compounds at Site 56, model 56_A was run for a period of 50 years. The concentrations of BTEX introduced into the shallow aquifer at the 17 injection well locations shown on Figure 5.3 were decreased at a rate of 10 percent per year (each concentration was decreased by 10 percent over the concentration used for the previous year) in order to simulate the natural degradation and volatilization of BTEX that would occur over time. These BTEX reduction rates are probably conservatively low based on a comparison to calculated BTEX reduction rates for a site at Eglin AFB, Florida that also is characterized by sandy soils. At the Eglin site, nearly 100 percent of the BTEX in the vadose zone soils disappeared within approximately 10 years (Parsons ES, 1995b).

The calibrated model was run for a period of 50 years beyond 1995 to simulate the migration of the BTEX plume. The maximum dissolved BTEX concentrations in the source area and at the drainage ditch are shown in Figures 5.9 and 5.10, respectively. As shown in Figure 5.9, maximum source area BTEX concentrations peak at 31,656 µg/L after 2 years of simulation time, and then steadily decrease in subsequent years, reaching 218 µg/L after 50 years of simulation time. Figure 5.10 indicates that maximum BTEX concentrations at the drainage ditch will peak at 266 µg/L after 9 years (year 2004), and then steadily decrease in subsequent years. After 50 years, the maximum BTEX concentration in the groundwater at the drainage ditch is 4 µg/L.

Plume isopleth maps for 10 years, 30 years, and 50 years are shown in Figures 5.11, 5.12, and 5.13, respectively. At 10 years, the plume is near its maximum downgradient extension. In subsequent years, the plume recedes toward the source

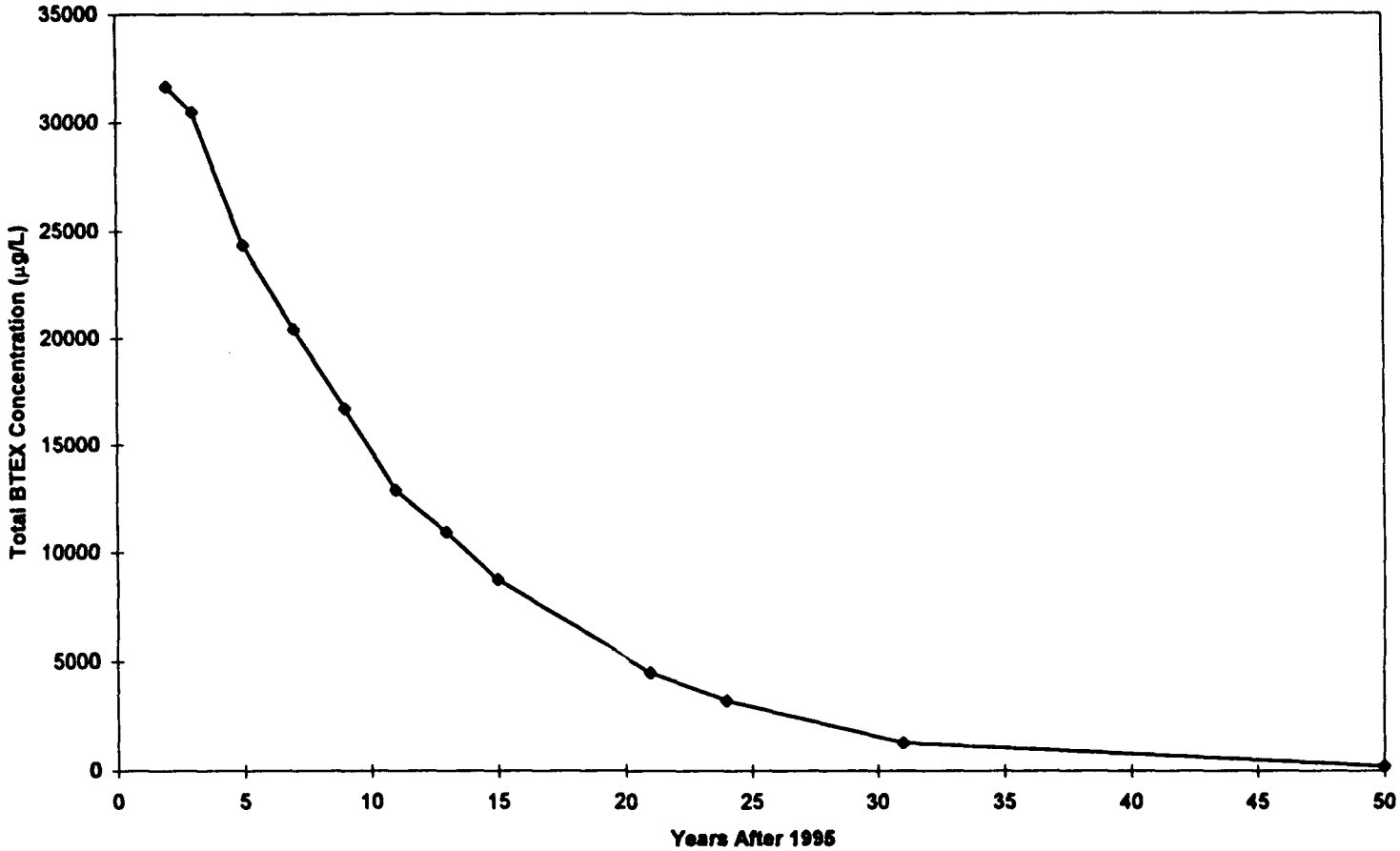


FIGURE 5.9
SIMULATED MAXIMUM BTEX CONCENTRATIONS IN PLUME SOURCE AREA MODEL 56_A SITE 56

Intrinsic Remediation TS
MacDill Air Force Base, Florida

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

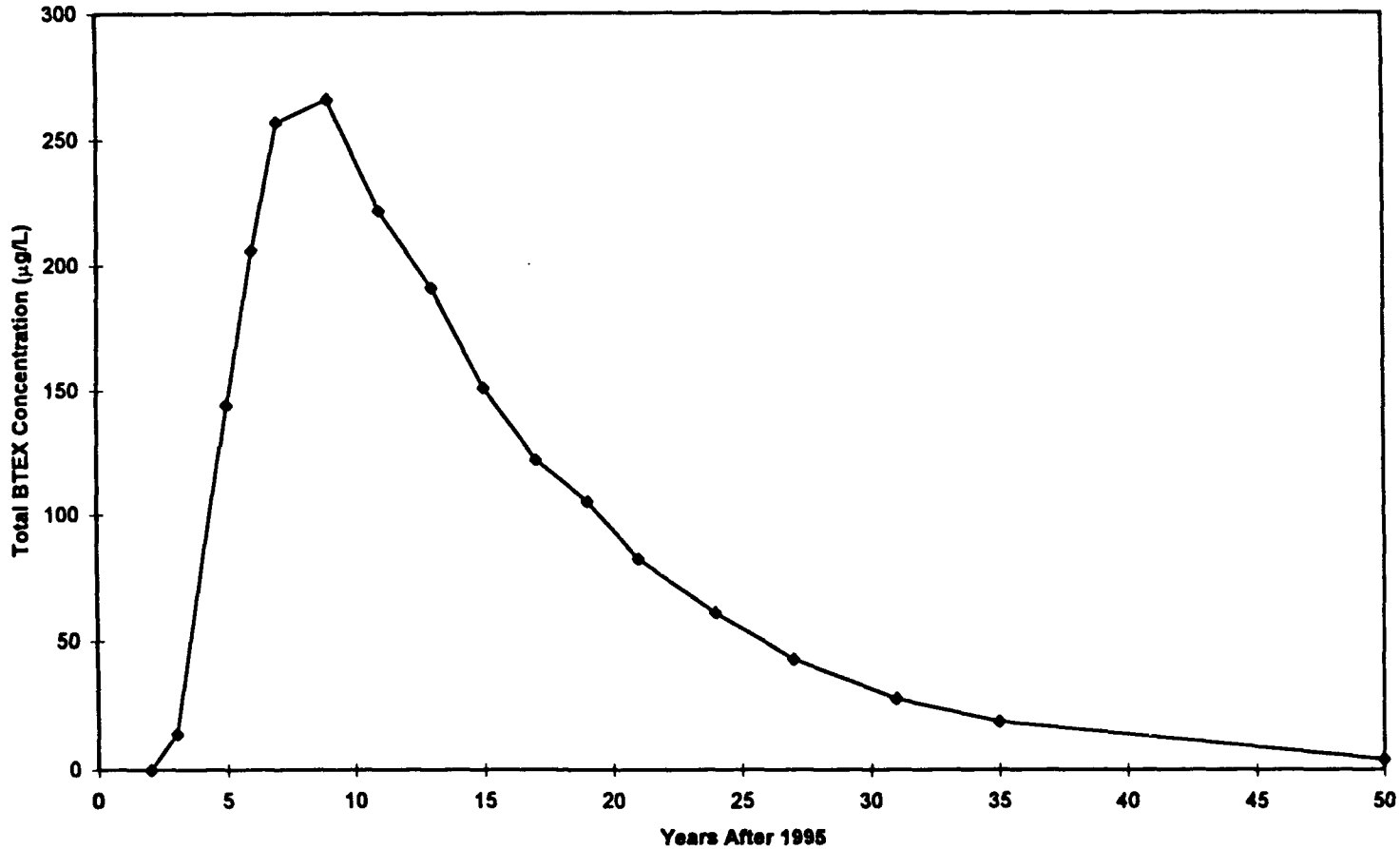
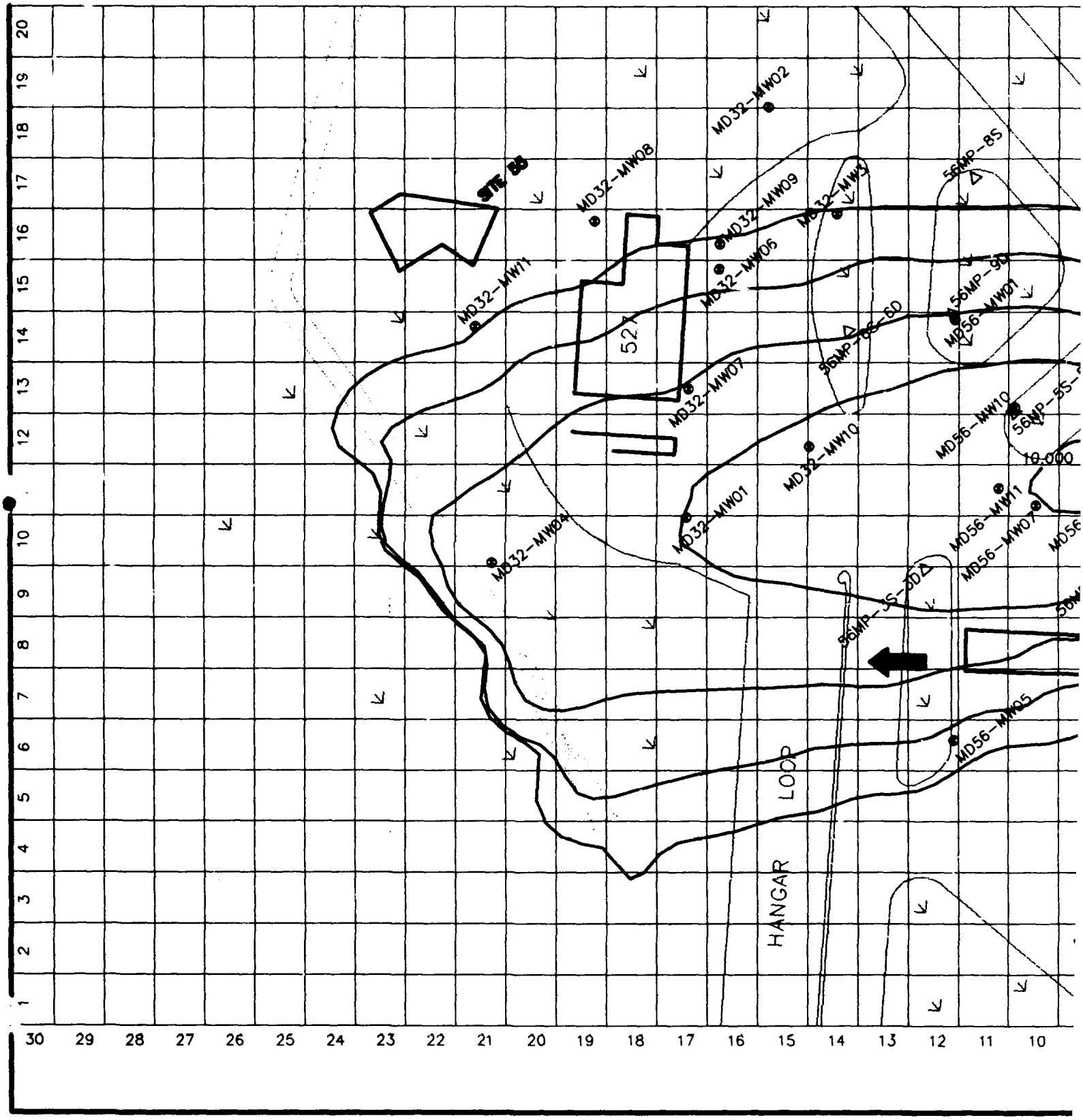


FIGURE 5.10
SIMULATED MAXIMUM BTEX CONCENTRATIONS AT DRAINAGE DITCH MODEL 56_A SITE 56

Intrinsic Remediation TS
MacDill Air Force Base, Florida

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado



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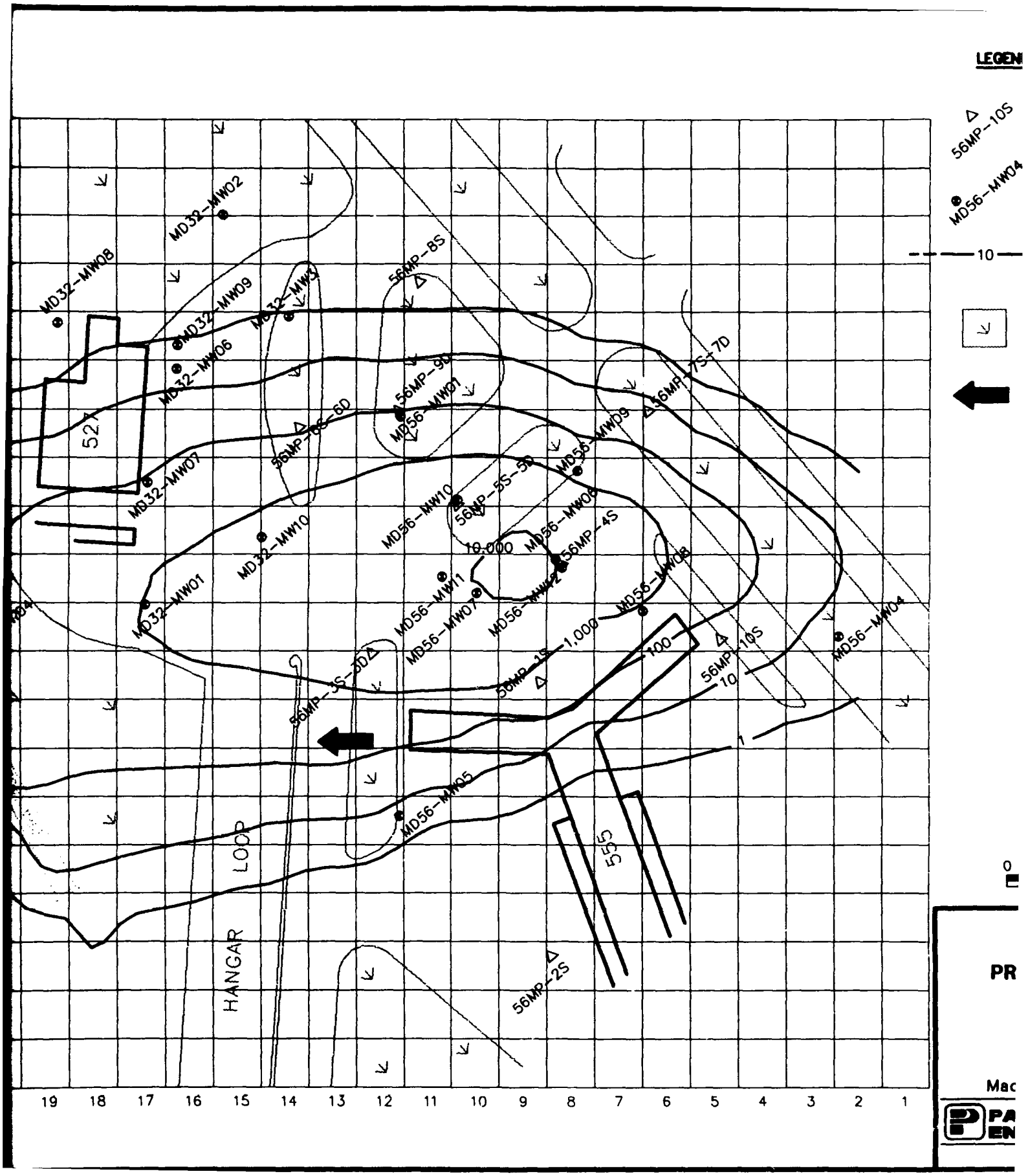
LEGEN
56MP-10S
MD56-MW04
10
MD32-MW02
MD32-MW08
MD32-MW09
MD32-MW03
56MP-8S
MD32-MW06
56MP-9S
MD56-MW01
56MP-7S+7D
56MP-6S-6D
MD56-MW09
MD32-MW07
MD56-MW10
56MP-5S-5D
MD56-MW08
MD32-MW10
10,000
MD56-MW02
56MP-4S
MD32-MW01
MD56-MW11
MD56-MW07
MD55-MW08
1,000
100
56MP-1S
56MP-3S-3D
10
1
MD56-MW05
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LOOP
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HANGAR
56MP-2S
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PR
Mac

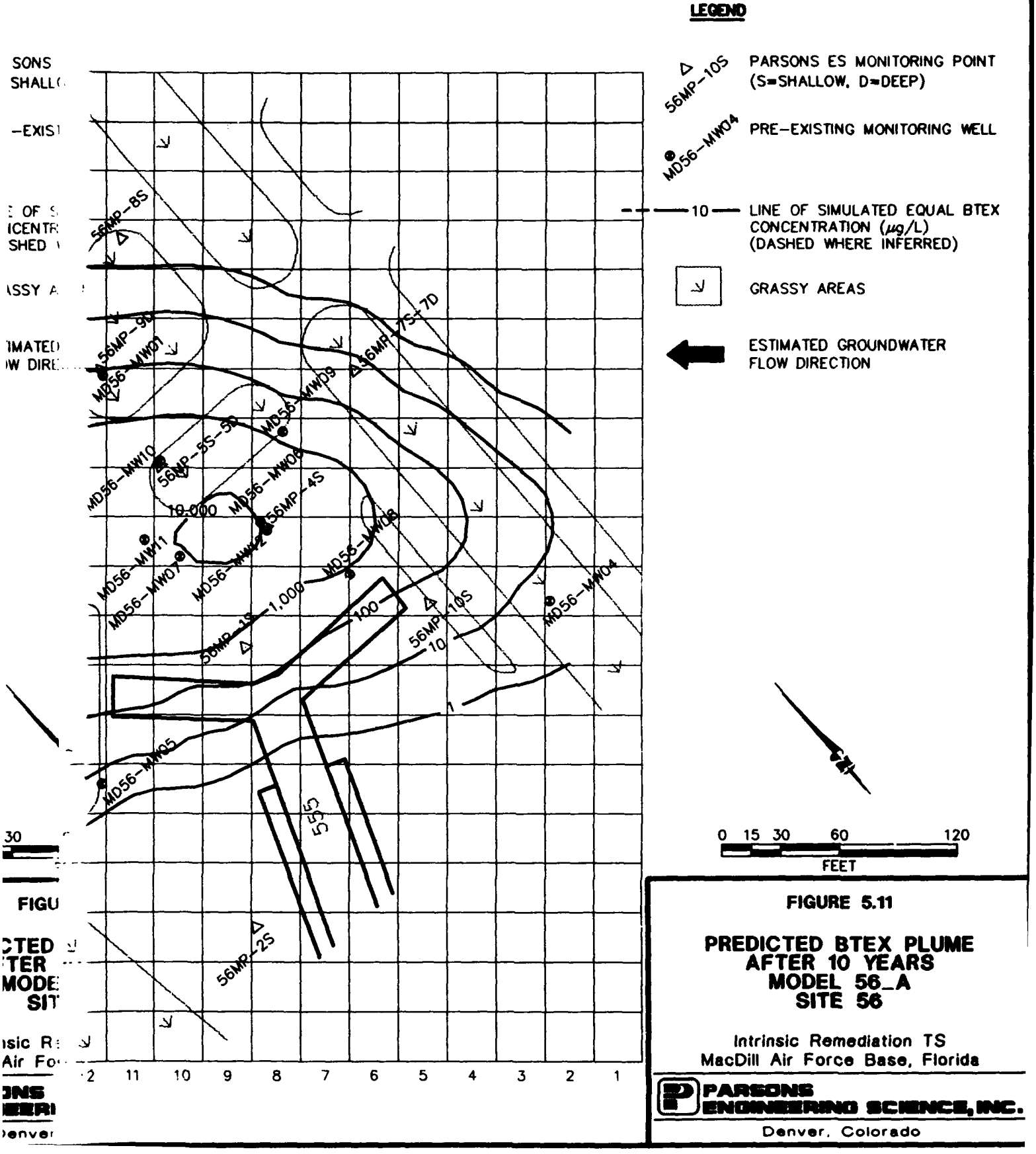
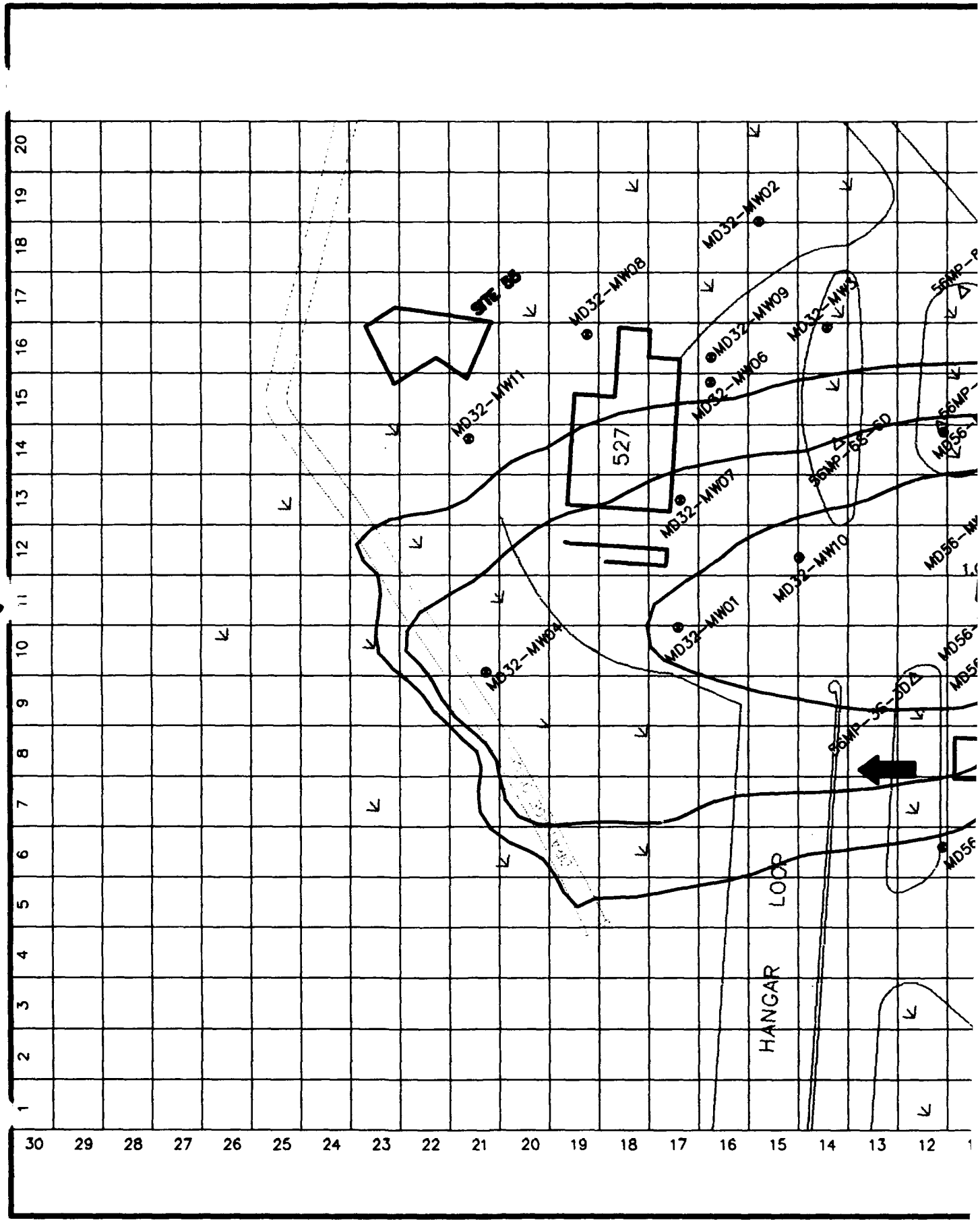


FIGURE 5.11

PREDICTED BTEX PLUME AFTER 10 YEARS MODEL 56_A SITE 56

Intrinsic Remediation TS
MacDill Air Force Base, Florida

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado



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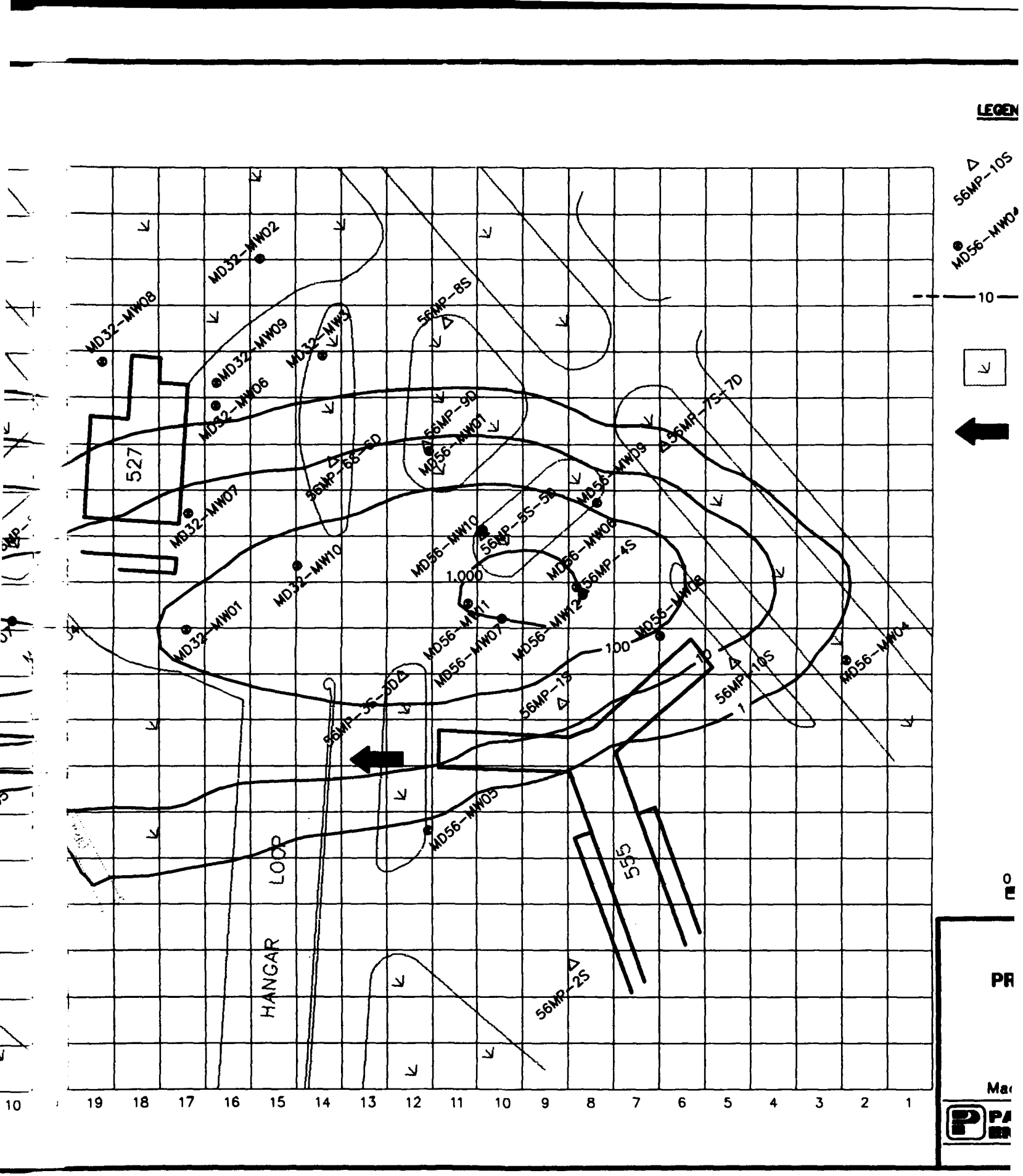
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MD56-MW04
10
MD32-MW02
MD32-MW08
MD32-MW09
MD32-MW03
56MP-8S
MD32-MW06
56MP-9D
MD56-MW01
56MP-7S-7D
56MP-6S-6D
MD56-MW09
527
MD32-MW07
MD56-MW10
56MP-5S-5D
MD56-MW08
MD32-MW10
1,000
56MP-4S
MD32-MW01
MD56-MW11
MD56-MW12
MD56-MW07
MD56-MW06
100
10
56MP-10S
MD56-MW04
56MP-1S
56MP-3S-3D
1
MD56-MW05
555
HANGAR LOOP
56MP-2S
19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1

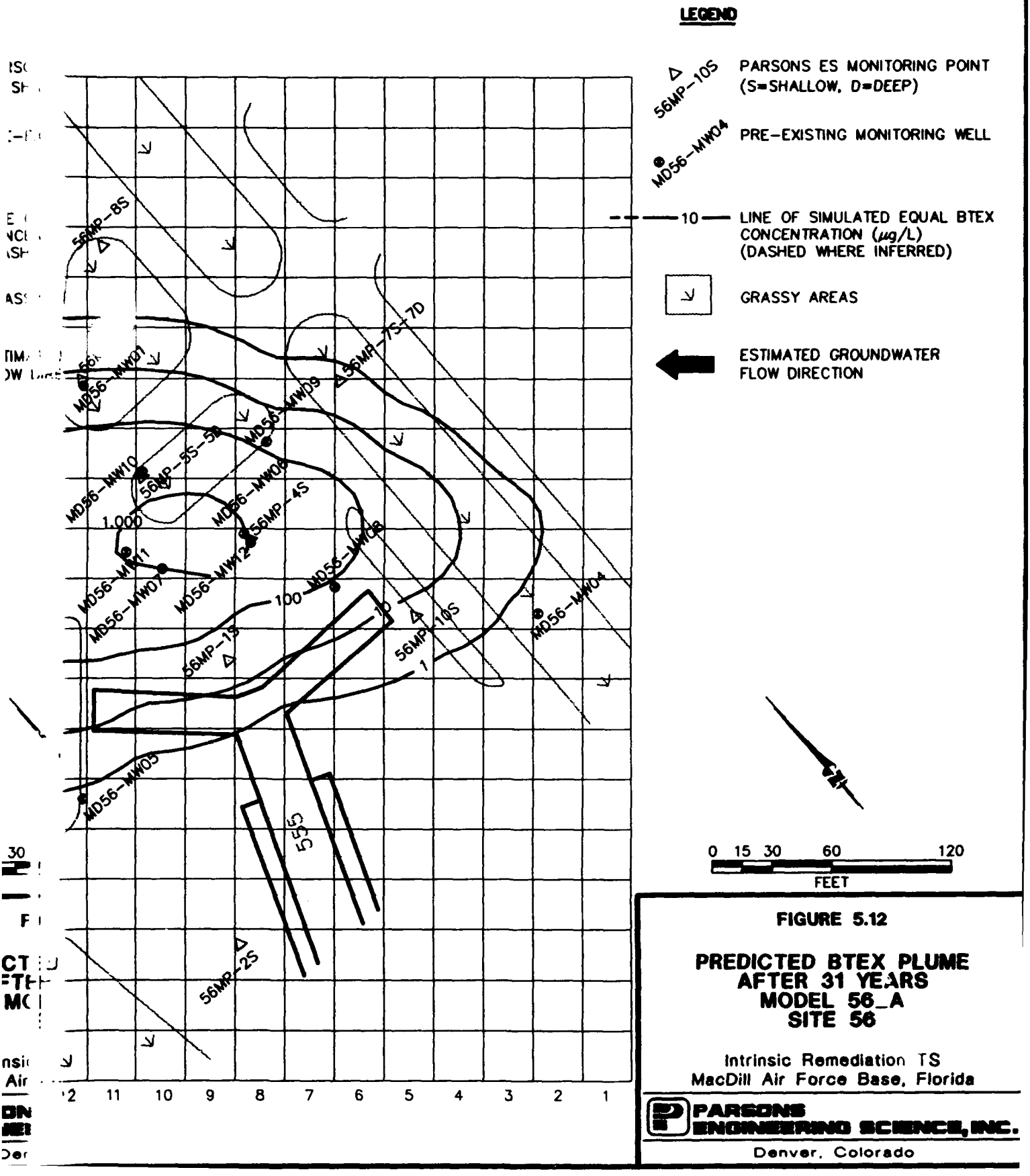
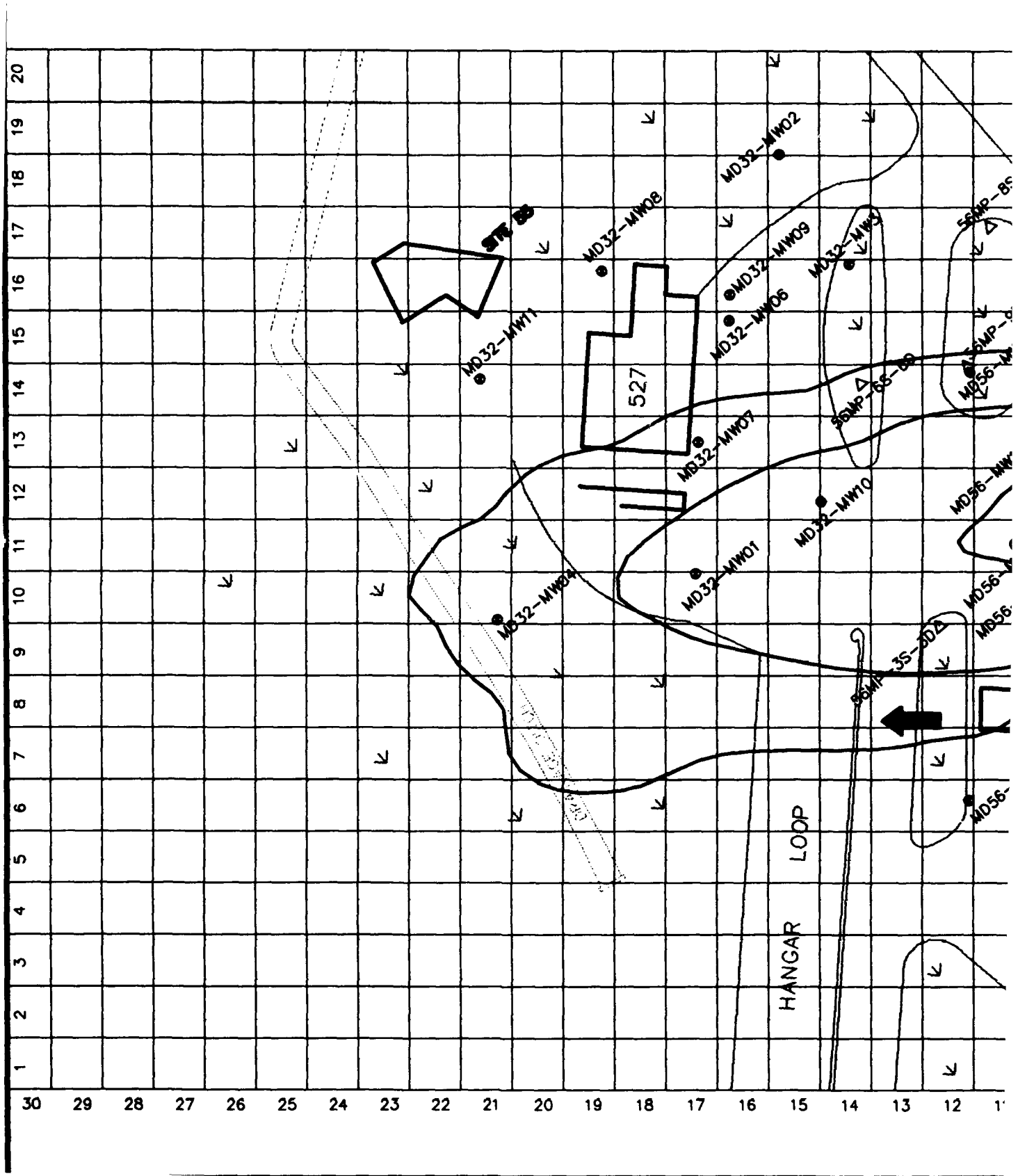


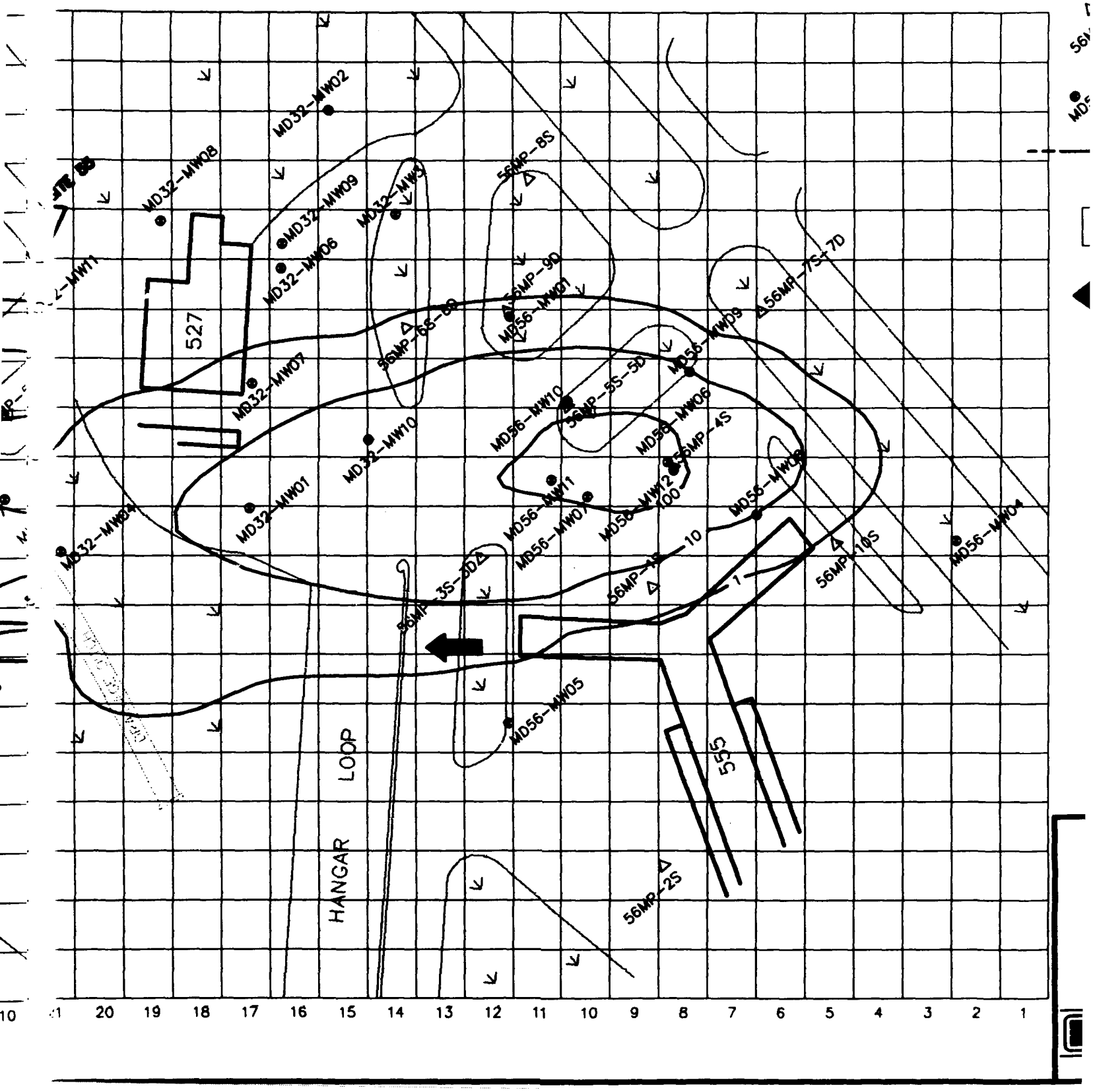
FIGURE 5.12

PREDICTED BTEX PLUME AFTER 31 YEARS MODEL 56_A SITE 56

Intrinsic Remediation TS
MacDill Air Force Base, Florida

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado


MD32-MW02
MD32-MW08
MD32-MW09
MD32-MW03
MD32-MW06
MD32-MW11
527
MD32-MW07
MD32-MW10
MD32-MW01
MD32-MW04
HANGAR LOOP


MD32-MW02
MD32-MW08
MD32-MW09
MD32-MW03
MD32-MW06
MD32-MW07
MD32-MW10
MD32-MW01
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56MP-8S
56MP-9D
MD56-MW01
56MP-6S-6D
56MP-7S-7D
MD56-MW09
56MP-5S-5D
MD56-MW10
MD56-MW06
56MP-4S
MD56-MW11
MD56-MW12
MD56-MW07
MD56-MW08
MD56-MW04
56MP-3S-3D
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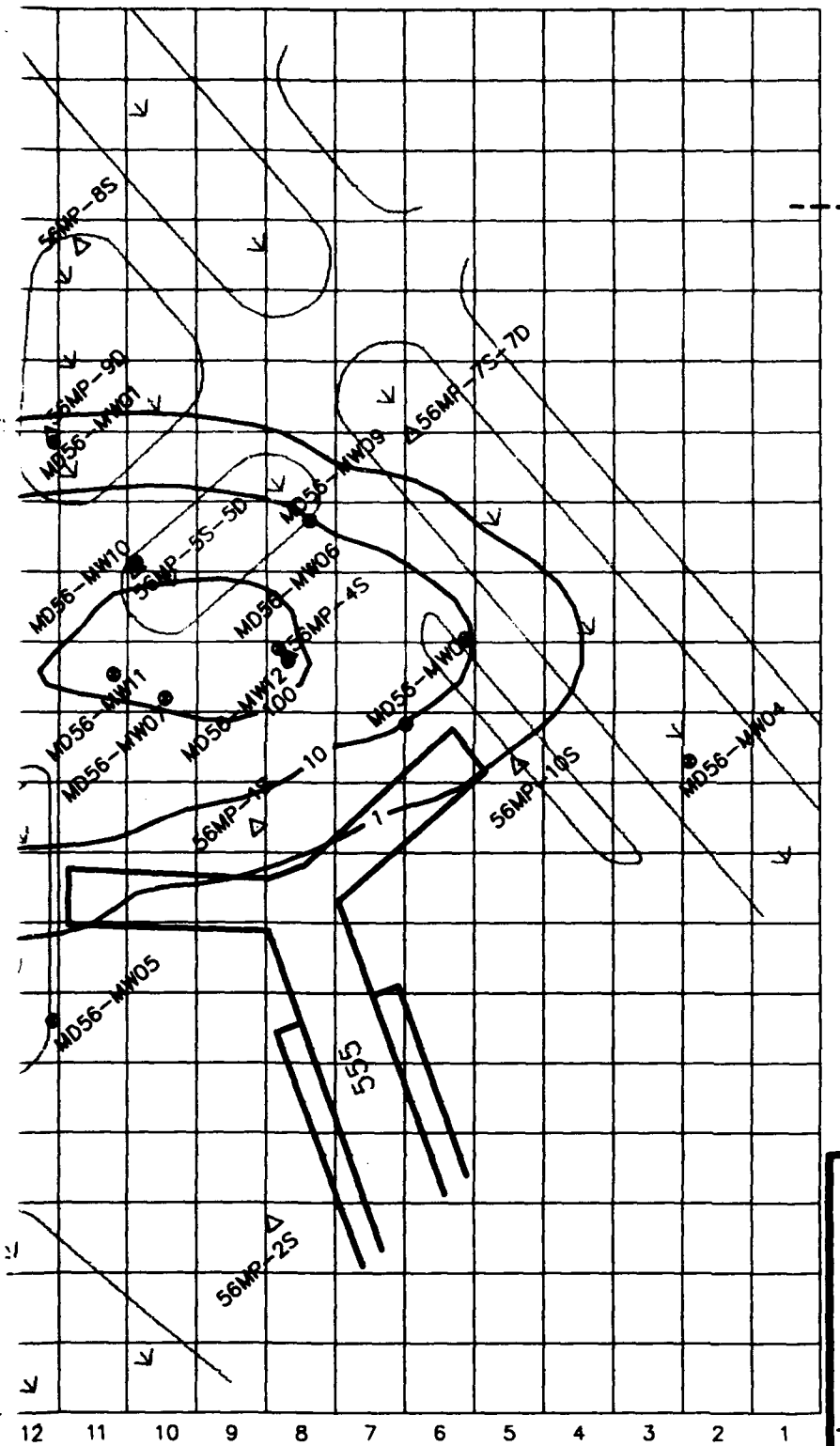
MD56-MW05
56MP-2S
527
555
HANGAR
LOOP
10
1
100



LEGEND

- 56MP-10S — PARSONS ES MONITORING POINT (S=SHALLOW, D=DEEP)
- MD56-MW04 — PRE-EXISTING MONITORING WELL
- 10 — LINE OF SIMULATED EQUAL BTEX CONCENTRATION (µg/L) (DASHED WHERE INFERRED)
- GRASSY AREAS
- ESTIMATED GROUNDWATER FLOW DIRECTION

0 15 30 60 120
FEET

FIGURE 5.13

PREDICTED BTEX PLUME AFTER 51 YEARS MODEL 56_A SITE 56

Intrinsic Remediation TS
MacDill Air Force Base, Florida

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

area and BTEX concentrations decrease. Because the model assumes that groundwater discharges to the drainage ditch, the plume cannot migrate past the ditch.

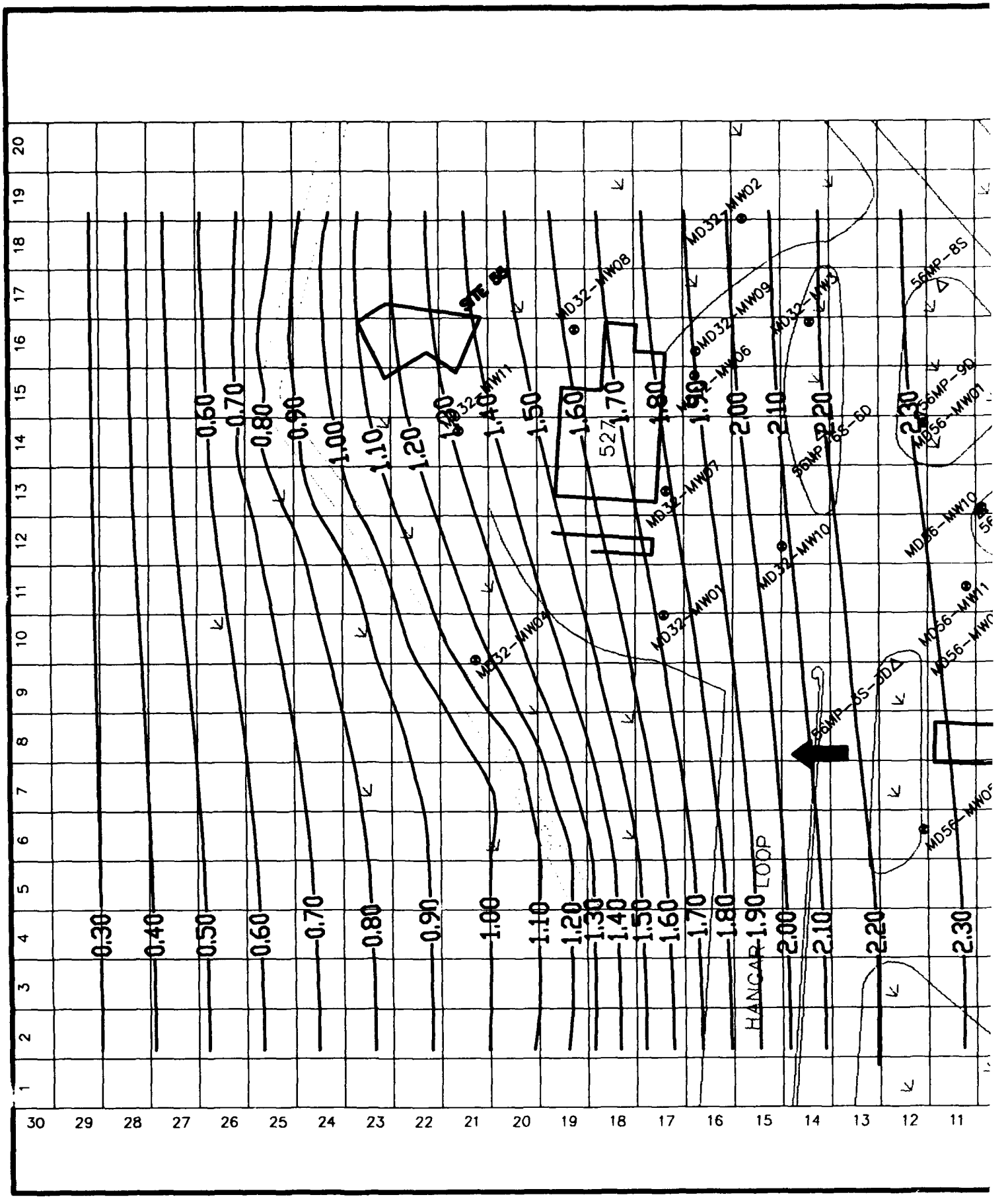
As described above, the assumption that contaminant underflow beneath the drainage ditch does not occur was incorporated in model 56-A by inactivating the model grid cells northwest of the ditch. Following the 50-year simulation described above, the grid cells northwest of the ditch were activated in order to simulate the scenario where no discharge to the ditch occurs, and 100 percent of the plume migrates beneath the ditch, behaving as though the ditch was not there. To accomplish this, a constant-head boundary was established in the furthest downgradient row of grid cells (row 29 on Figure 5.13). This simulation was termed 56_B. The resulting water table map is shown in Figure 5.14. Groundwater is simulated to migrate approximately parallel to the long axis of the grid with an estimated lateral hydraulic gradient of 0.004 ft/ft. Simulated advective groundwater velocities in the newly activated portion of the grid generally ranged from 0.25 to 0.35 ft/day; advective flow velocities southeast of the ditch generally ranged from 0.17 to 0.28 ft/day.

This revised model (56_B) was run for a period of 50 years to assess the extent to which the BTEX plume would migrate past the drainage ditch assuming that discharge did not occur. The maximum simulated BTEX concentration at the downgradient model boundary (row 29) is depicted on Figure 5.15. BTEX concentrations peak at 14 µg/L after 12 years (year 2007), and then decrease steadily, until the modeled concentration is zero at year 47. BTEX isopleth maps for simulation years 10, 30, and 50 are shown in Figures 5.16, 5.17, and 5.18, respectively.

5.6.2 Engineered Source Reduction (Models 56_C and 56_D)

To illustrate the impact of engineered source reduction activities upon dissolved BTEX migration, models 56_C and 56_D incorporated more rapidly decreasing BTEX loading rates, assuming that bioventing or a similar *in situ* method would be used to remediate the source areas. Bioventing is an *in situ* process in which low-flow air injection is used to enhance the aerobic biodegradation of organic contaminants in subsurface soils by supplying oxygen to indigenous microbes. Both of the models referenced above assumed complete remediation of vadose zone soils in the source area after 3 years. Bioventing pilot tests at the Patrick AFB, Florida BX Service Station resulted in a BTEX removal rate of over 95 percent during the first year of testing (Parsons ES, 1995c). Similar to model 56_A, model 56_C assumes that the shallow groundwater discharges to the drainage ditch, and the portion of the model gridnorthwest of the ditch was inactive. Model 56_D assumes that the dissolved BTEX plume migrates beneath the ditch; therefore, the portion of the model grid northwest of the ditch was activated as described for model 56_B in Section 5.6.1.

The results of model 56_C suggests that implementation of bioventing would decrease the maximum dissolved BTEX concentration entering the drainage ditch by approximately one-half (Figure 5.19). In this case, the predicted BTEX plume reaches its maximum extent after approximately 6 years. After reaching that extent, model 56_C suggests that the combination of source reduction and natural attenuation causes the plume to rapidly shrink back to the source area in the vicinity of the AAFES Service Station. As shown on Figure 5.20, model 56_C predicts that maximum



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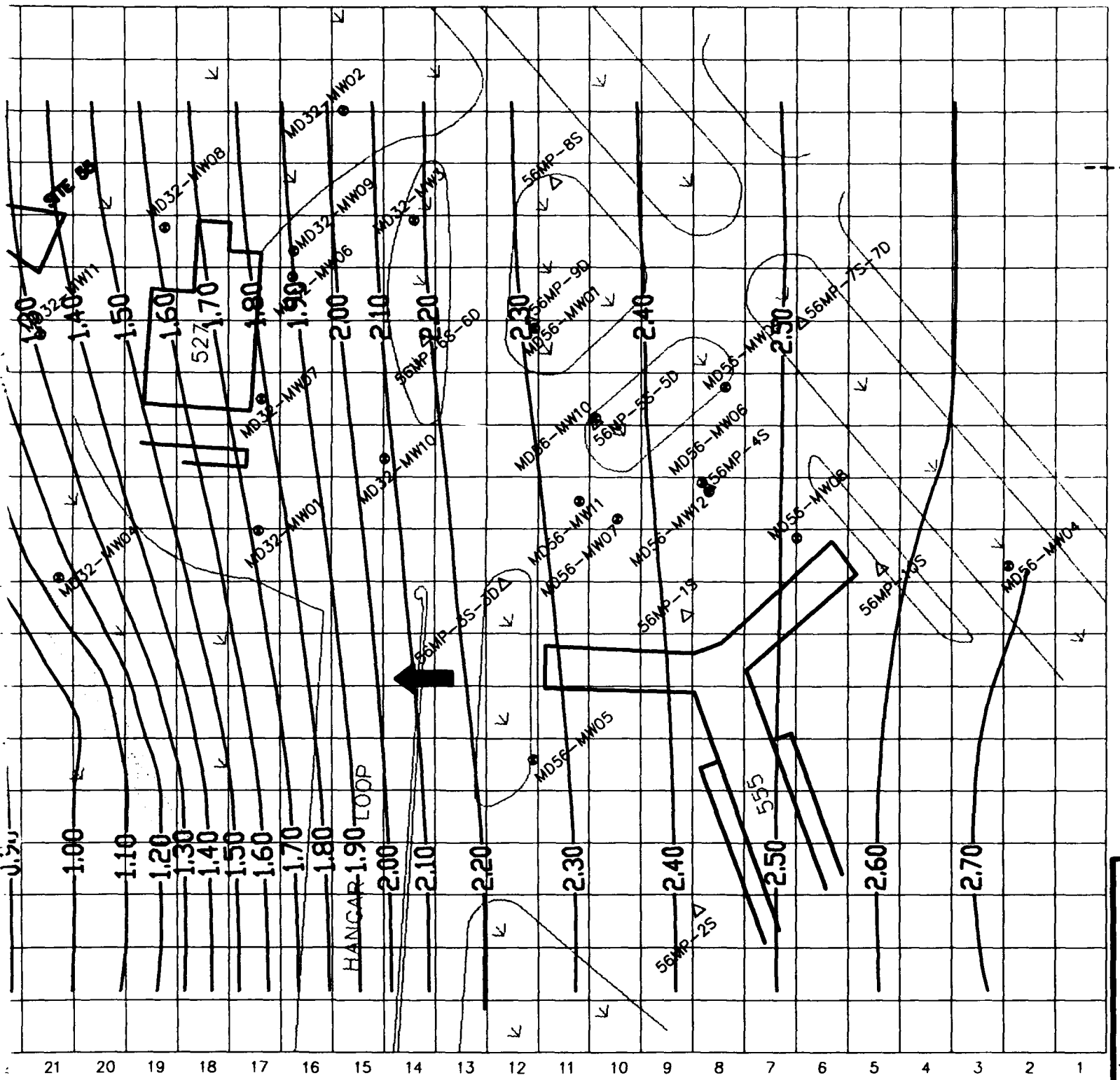
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MD32-MW08
MD32-MW09
MD32-MW06
MD32-MW03
MD32-MW11
MD32-MW07
MD32-MW10
MD32-MW01
MD32-MW04
56MP-8S
56MP-9D
56MP-7S-7D
56MP-6S-6D
MD56-MW07
MD56-MW10
56MP-5S-5D
MD56-MW02
MD56-MW06
56MP-4S
MD56-MW12
MD56-MW11
MD56-MW08
MD56-MW04
56MP-1S
56MP-3S-3D
MD56-MW05
56MP-2S
HANGAR LOOP
527
555
1.00
1.10
1.20
1.30
1.40
1.50
1.60
1.70
1.80
1.90
2.00
2.10
2.20
2.30
2.40
2.50
2.60
2.70
21
20
19
18
17
16
15
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13
12
11
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8
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6
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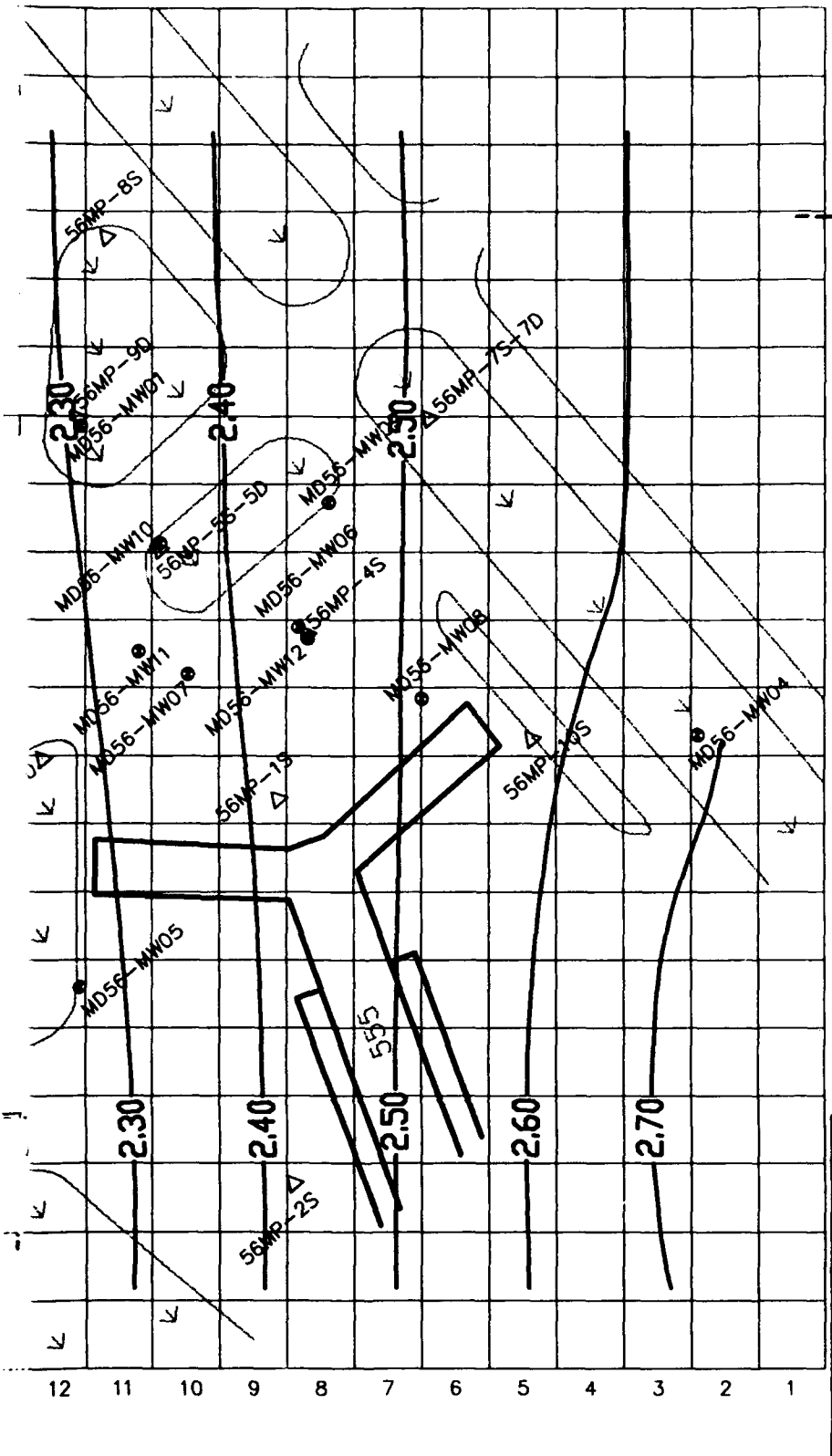
4
3
2
1



LEGEND

56MP-10S — PARSONS ES MONITORING POINT

MD56-MW04 — PRE-EXISTING MONITORING WELL

2.20 — LINE OF EQUAL SIMULATED GROUNDWATER ELEVATION (FT msl)

GRASSY AREAS

GROUNDWATER FLOW DIRECTION

CONTOUR INTERVAL = 0.1 FEET

0 15 30 60 120

FEET

FIGURE 5.14

SIMULATED GROUNDWATER SURFACE MODEL 56_B SITE 56

Intrinsic Remediation TS
MacDill Air Force Base, Florida

PARSONS ENGINEERING SCIENCE, INC.

Denver, Colorado

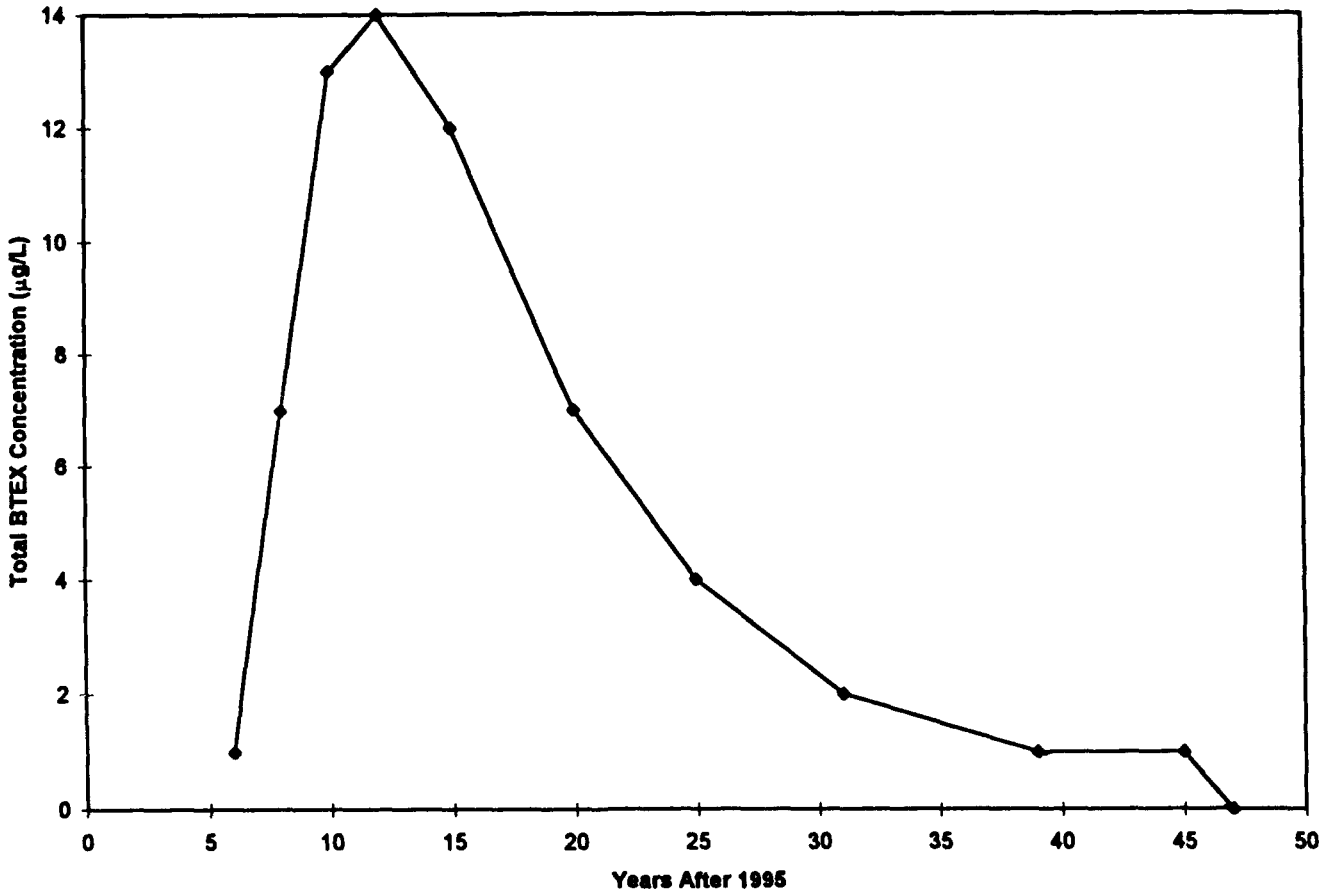
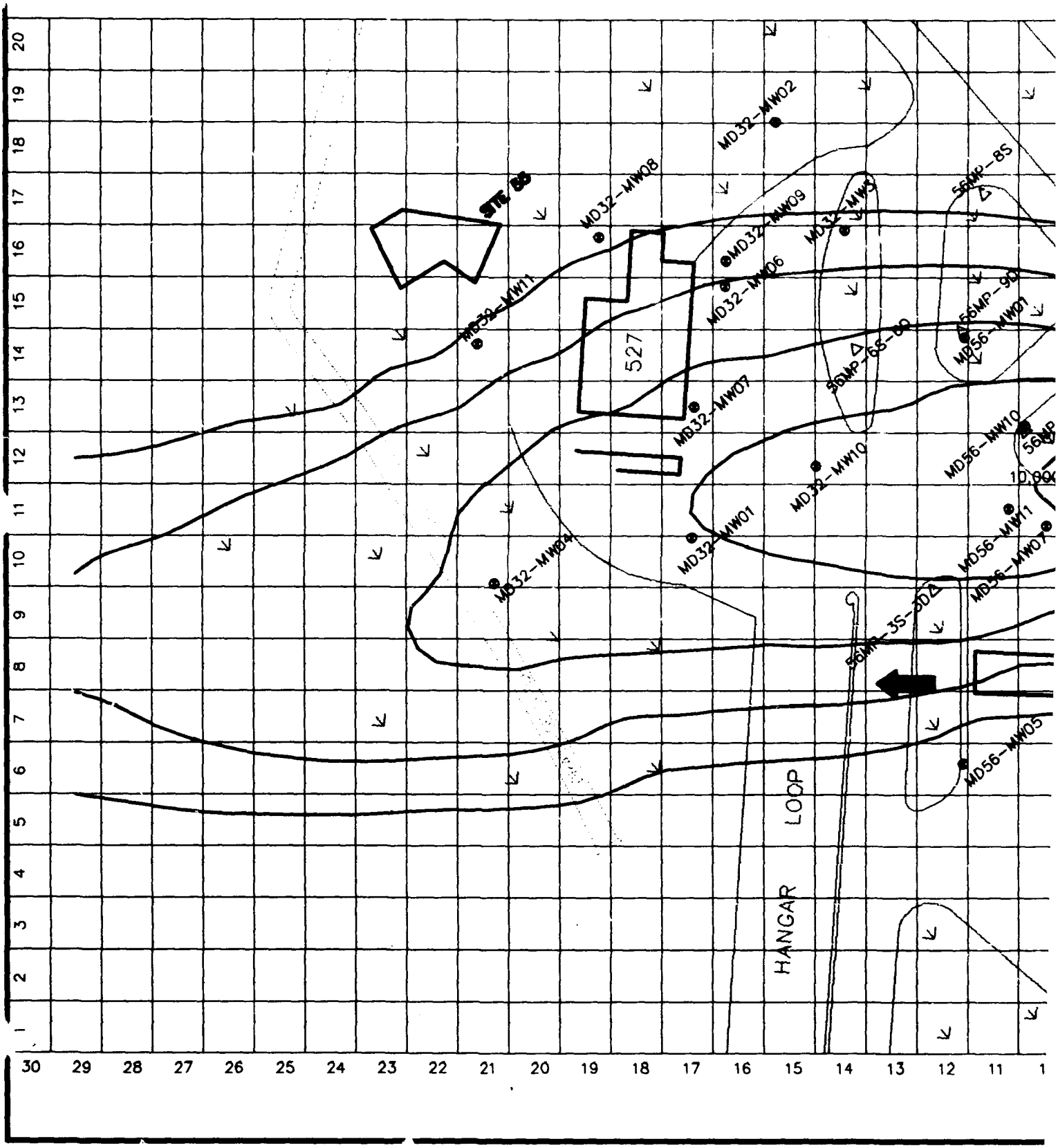


FIGURE 5.15
SIMULATED MAXIMUM BTEX CONCENTRATIONS AT DOWNGRADIENT MODEL BOUNDARY
MODEL 56_B
SITE 56

Intrinsic Remediation TS
MacDill Air Force Base, Florida

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado



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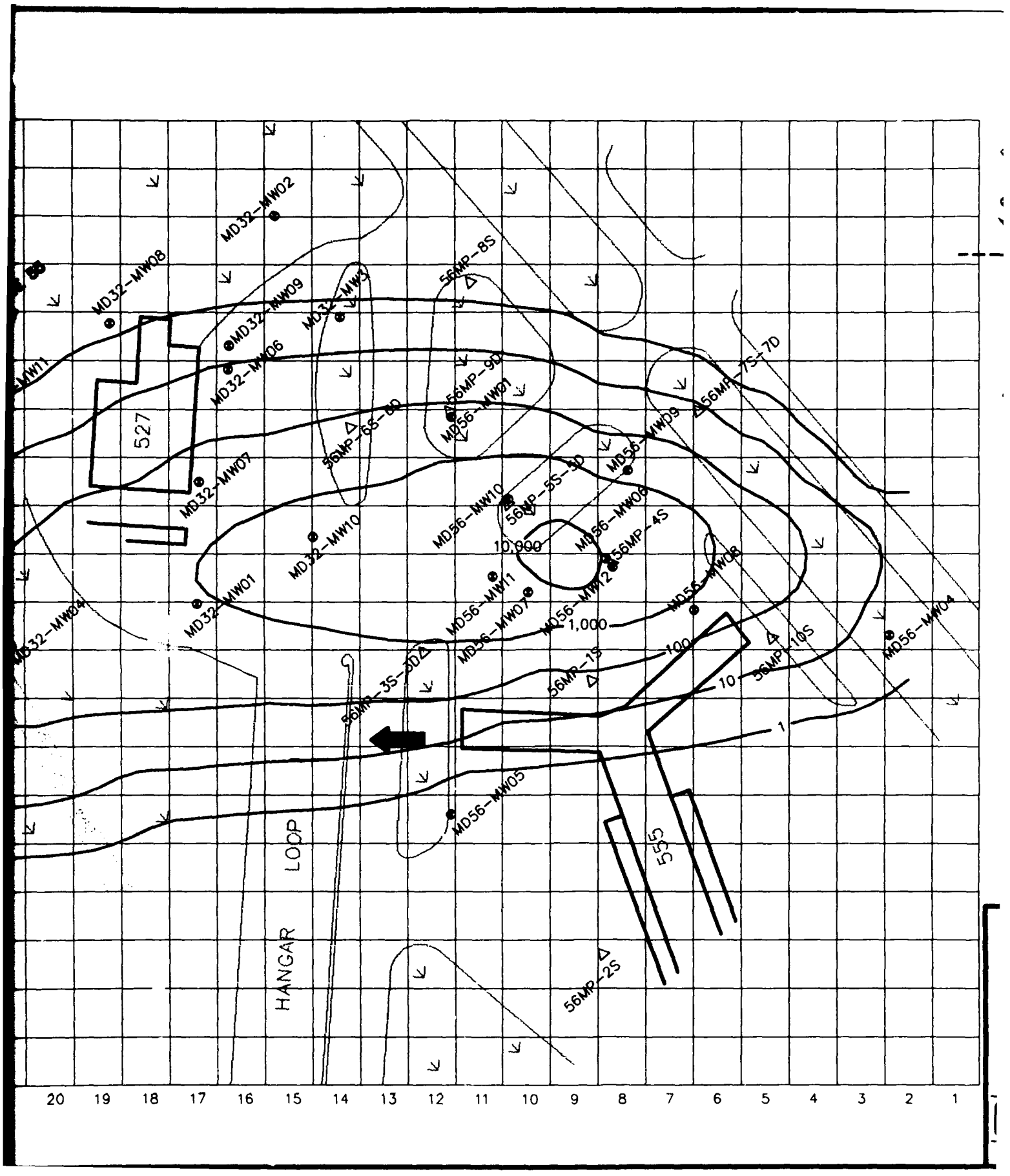
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MD32-MW08
MD32-MW09
MD32-MW03
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MD32-MW06
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MD56-MW01
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56MP-6S-6D
MD56-MW09
527
MD32-MW07
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MD56-MW04
100
56MR-1S
56MP-10S
56MR-3S-3D
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MD56-MW05
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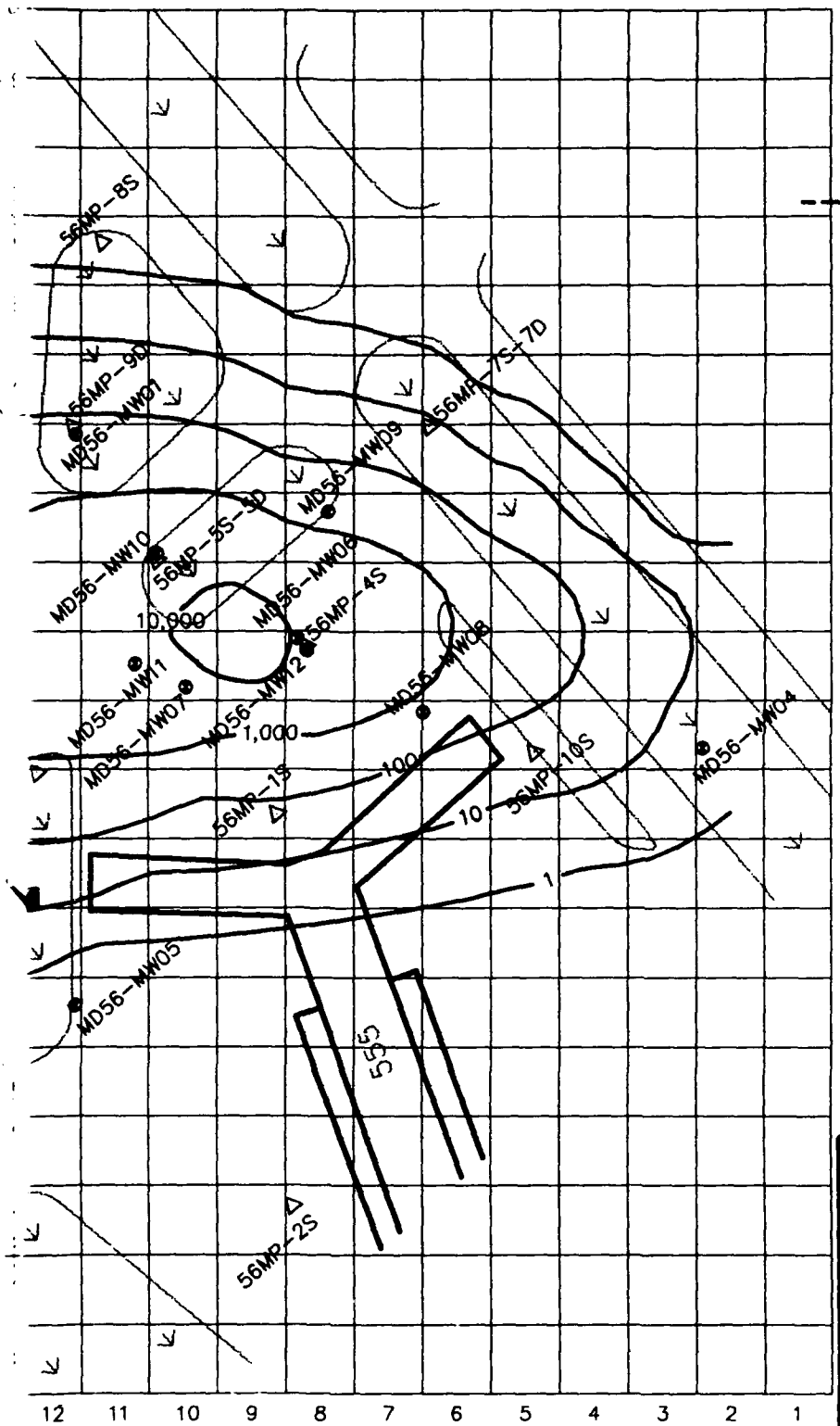
HANGAR LOOP
56MP-2S
20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1



LEGEND

- 56MP-10S — PARSONS ES MONITORING POINT (S=SHALLOW, D=DEEP)
- MD56-MW04 — PRE-EXISTING MONITORING WELL
- 10 — LINE OF SIMULATED EQUAL BTEX CONCENTRATION (µg/L) (DASHED WHERE INFERRED)
- GRASSY AREAS
- ESTIMATED GROUNDWATER FLOW DIRECTION

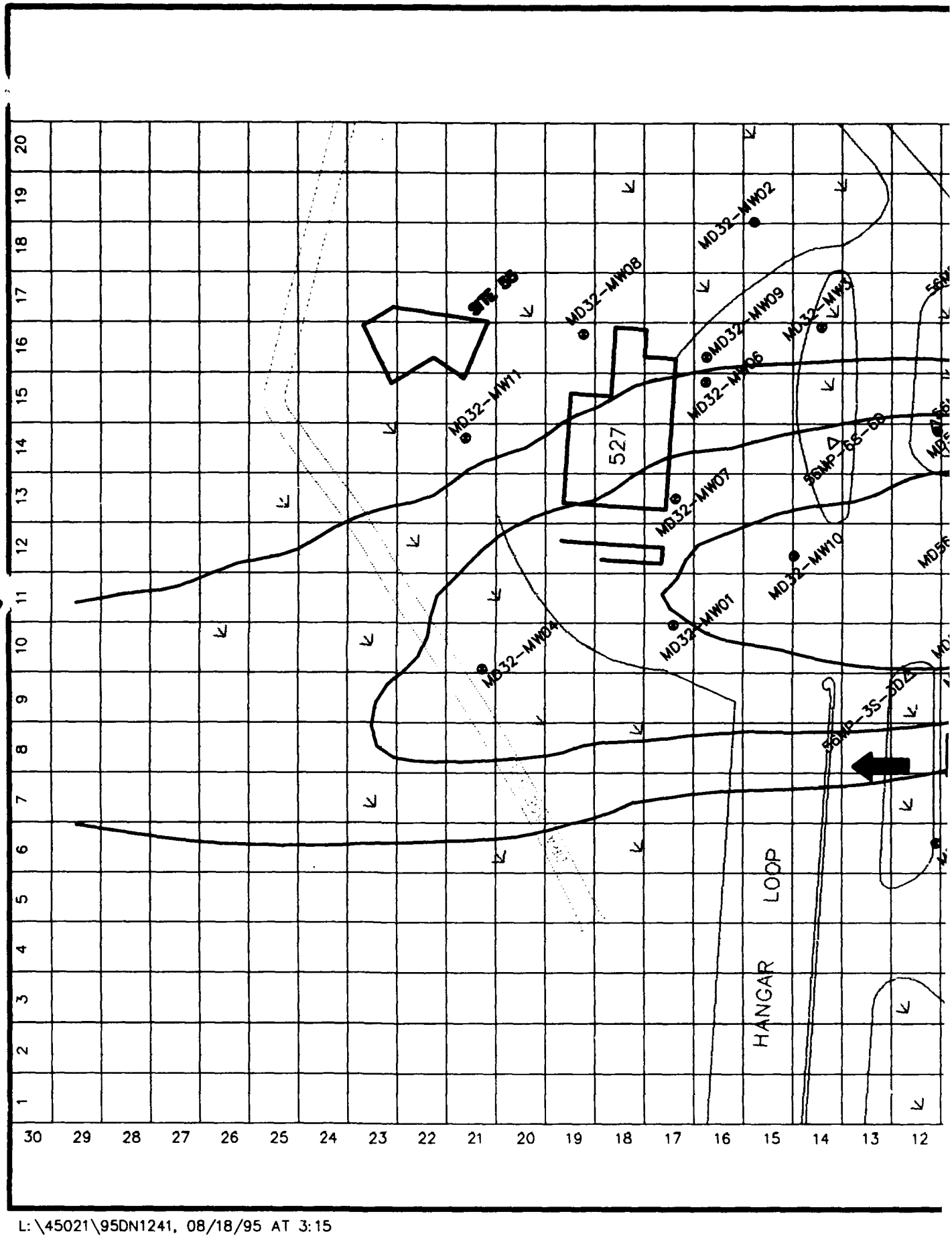
0 15 30 60 120
FEET

FIGURE 5.16

SIMULATED BTEX PLUME AFTER 10 YEARS MODEL 56_B SITE 56

Intrinsic Remediation TS
MacDill Air Force Base, Florida

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado



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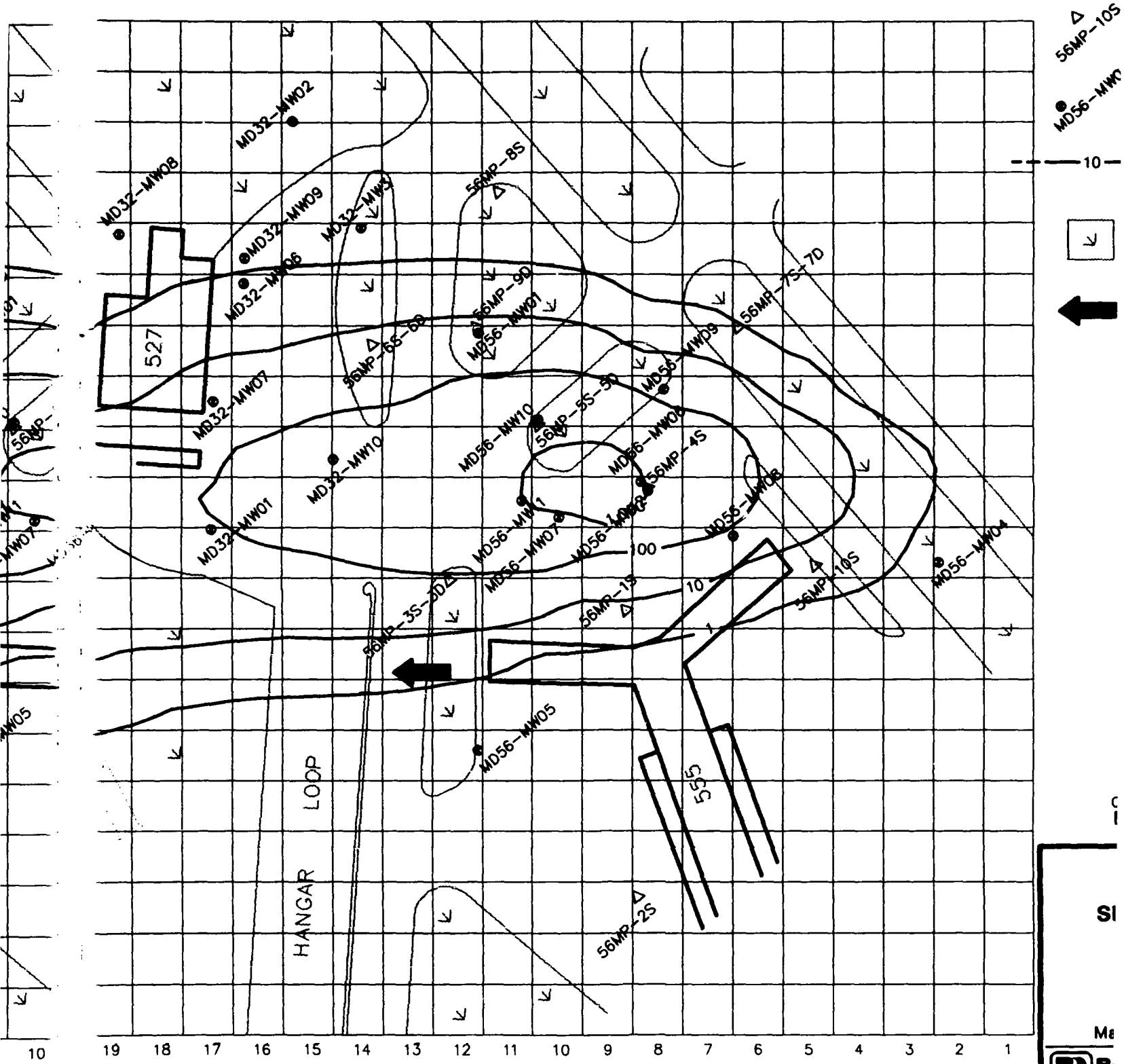
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MD32-MW08
MD32-MW09
MD32-MW03
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MD32-MW07
MD32-MW10
MD32-MW01
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56MP-9D
56MP-6S-6D
56MP-7S-7D
56MP-5S-5D
56MP-4S
56MP-1S
56MP-3S-3D
56MP-2S
MD56-MW01
MD56-MW09
MD56-MW10
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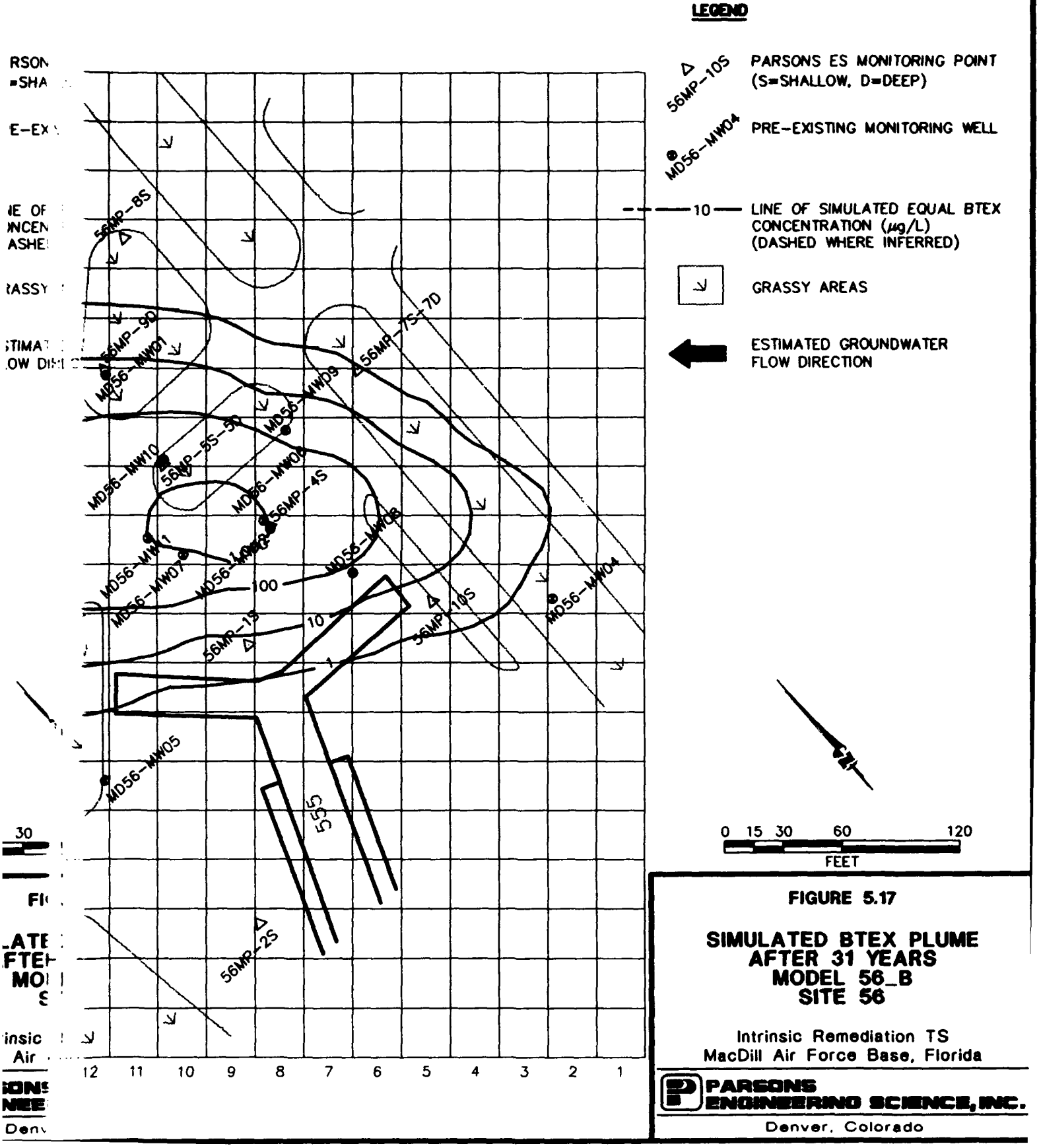


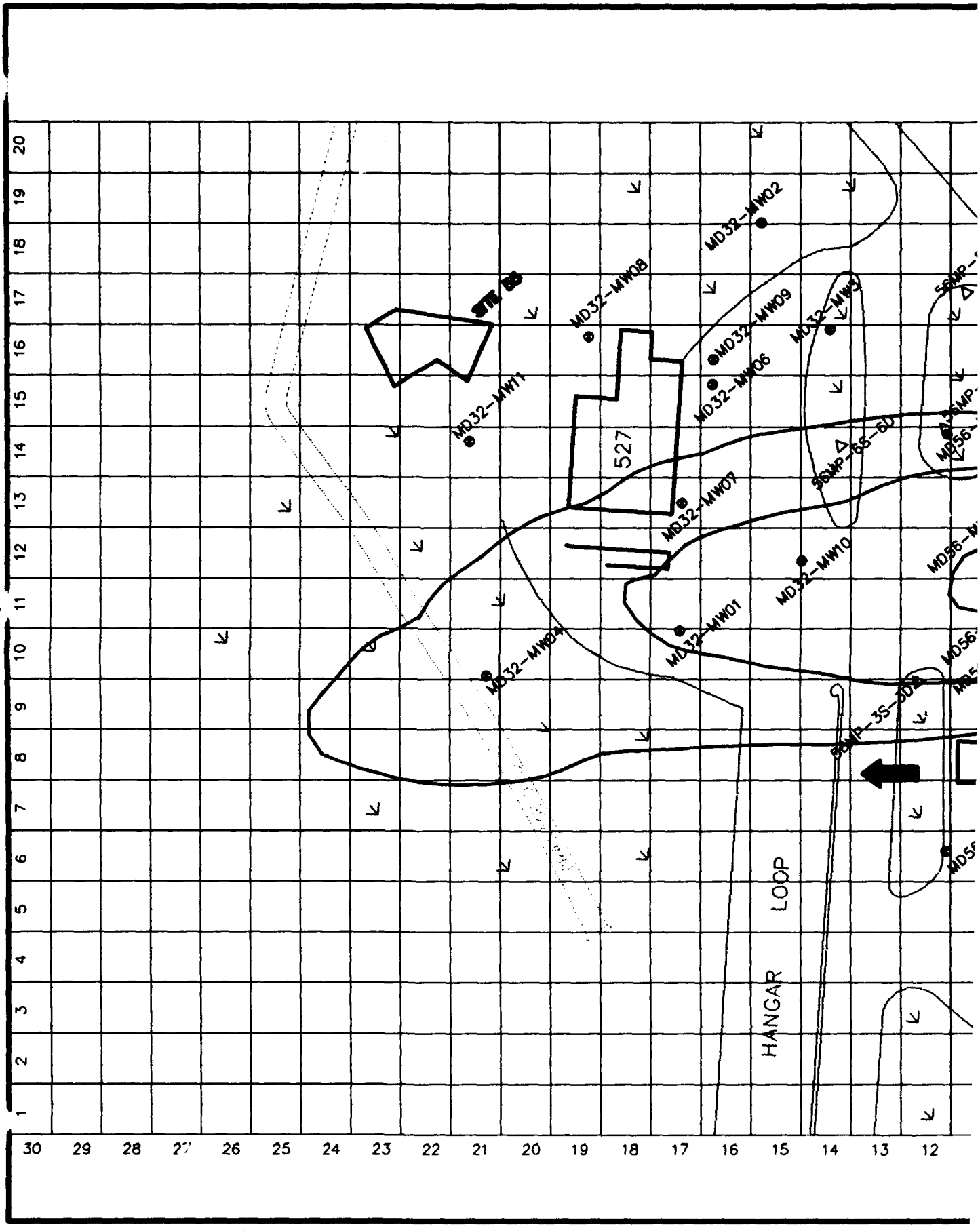
FIGURE 5.17

SIMULATED BTEX PLUME AFTER 31 YEARS MODEL 56_B SITE 56

Intrinsic Remediation TS
MacDill Air Force Base, Florida

PARSONS ENGINEERING SCIENCE, INC.

Denver, Colorado



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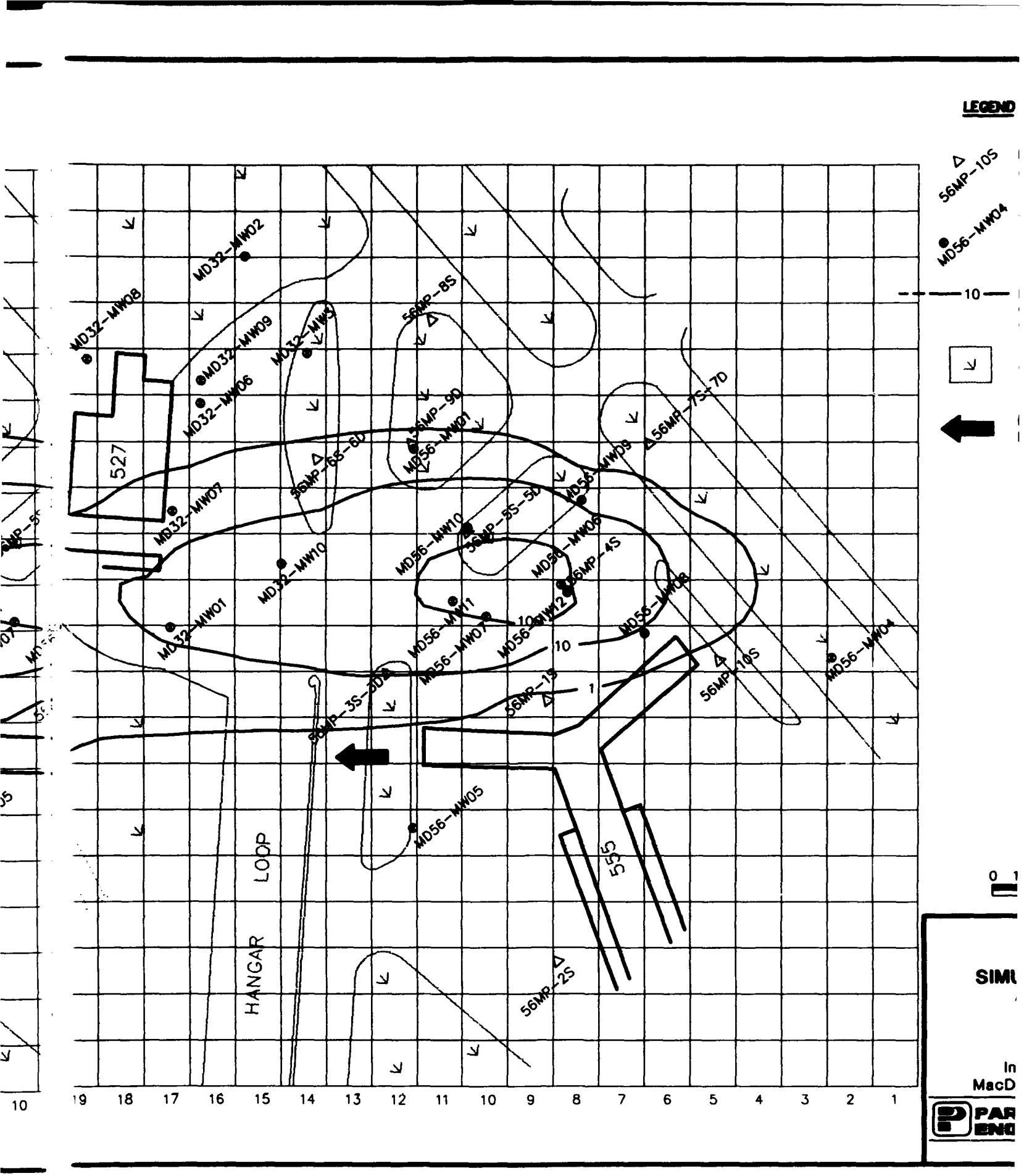
LEGEND
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MD56-MW04
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MD32-MW02
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MD32-MW09
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56MP-8S
MD32-MW06
56MP-9D
56MP-6S-6D
MD56-MW01
56MP-7S-7D
MD56-MW09
527
MD32-MW07
56MP-5S-5D
MD56-MW10
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MD56-MW11
MD56-MW12
MD56-MW08
MD32-MW01
MD56-MW07
10
56MP-3S-3D
56MP-1S
1
56MP-10S
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MD56-MW05
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HANGAR
LOOP
56MP-2S
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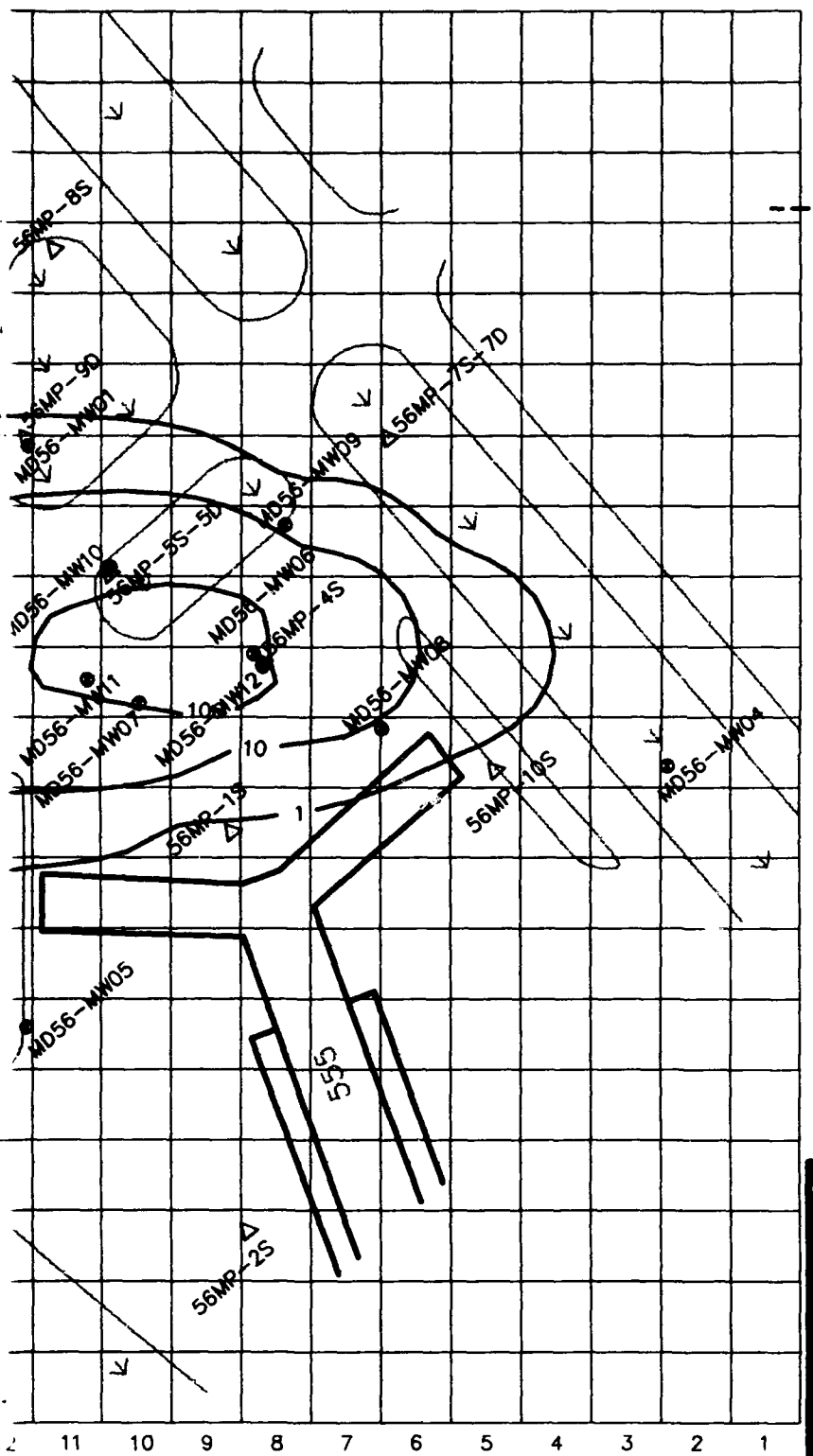

LEGEND

- PARSONS ES MONITORING POINT (S=SHALLOW, D=DEEP) — 56MP-10S
- PRE-EXISTING MONITORING WELL — MD56-MW04
- 10 — LINE OF SIMULATED EQUAL BTEX CONCENTRATION (µg/L) (DASHED WHERE INFERRED)
- GRASSY AREAS
- ESTIMATED GROUNDWATER FLOW DIRECTION

0 15 30 60 120
FEET

FIGURE 5.18

SIMULATED BTEX PLUME AFTER 51 YEARS MODEL 56_B SITE 56

Intrinsic Remediation TS
MacDill Air Force Base, Florida

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

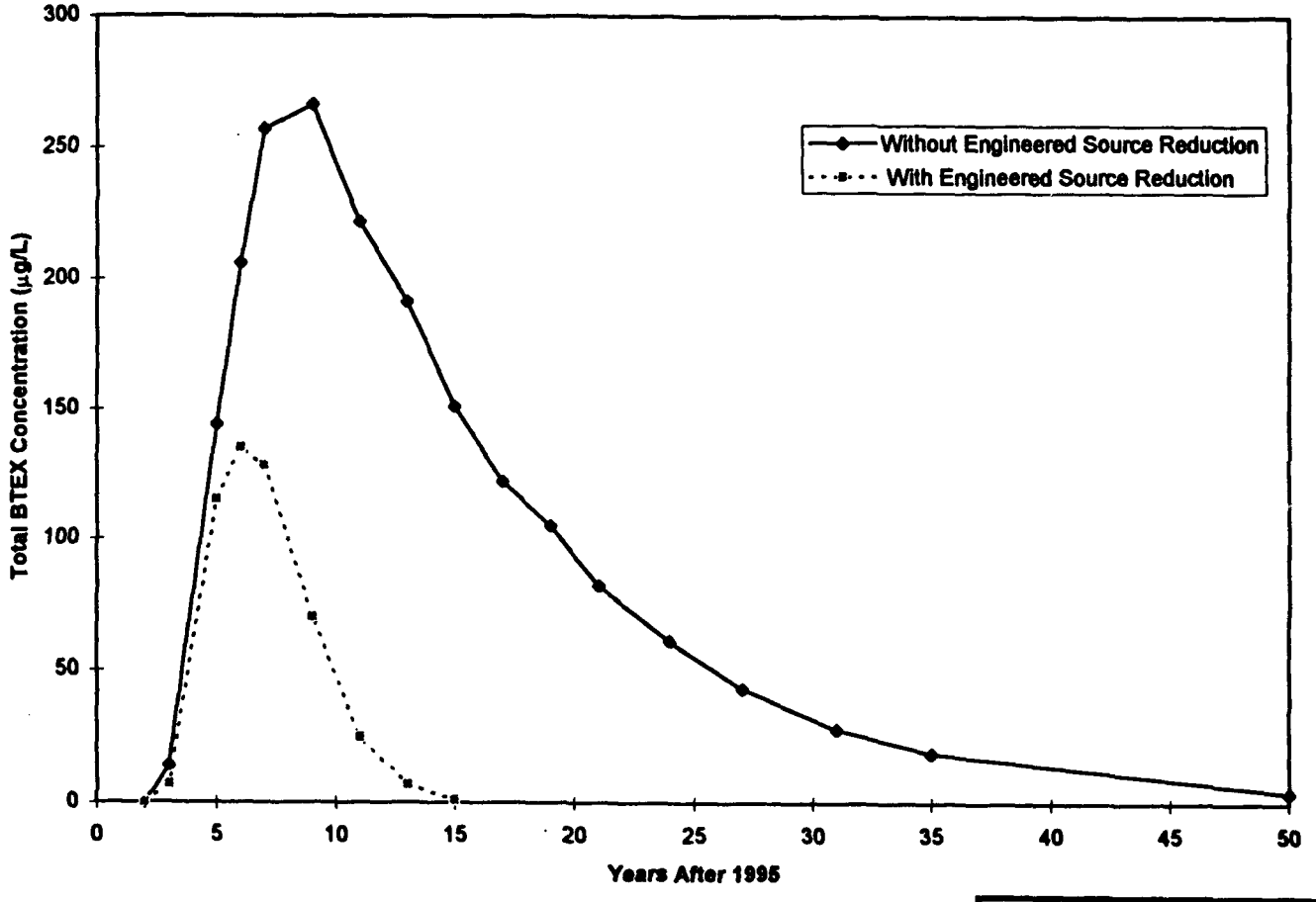

FIGURE 5.19
COMPARISON OF SIMULATED MAXIMUM BTEX CONCENTRATIONS AT DRAINAGE DITCH MODELS 56_A AND 56_C SITE 56

Intrinsic Remediation TS
MacDill Air Force Base, Florida

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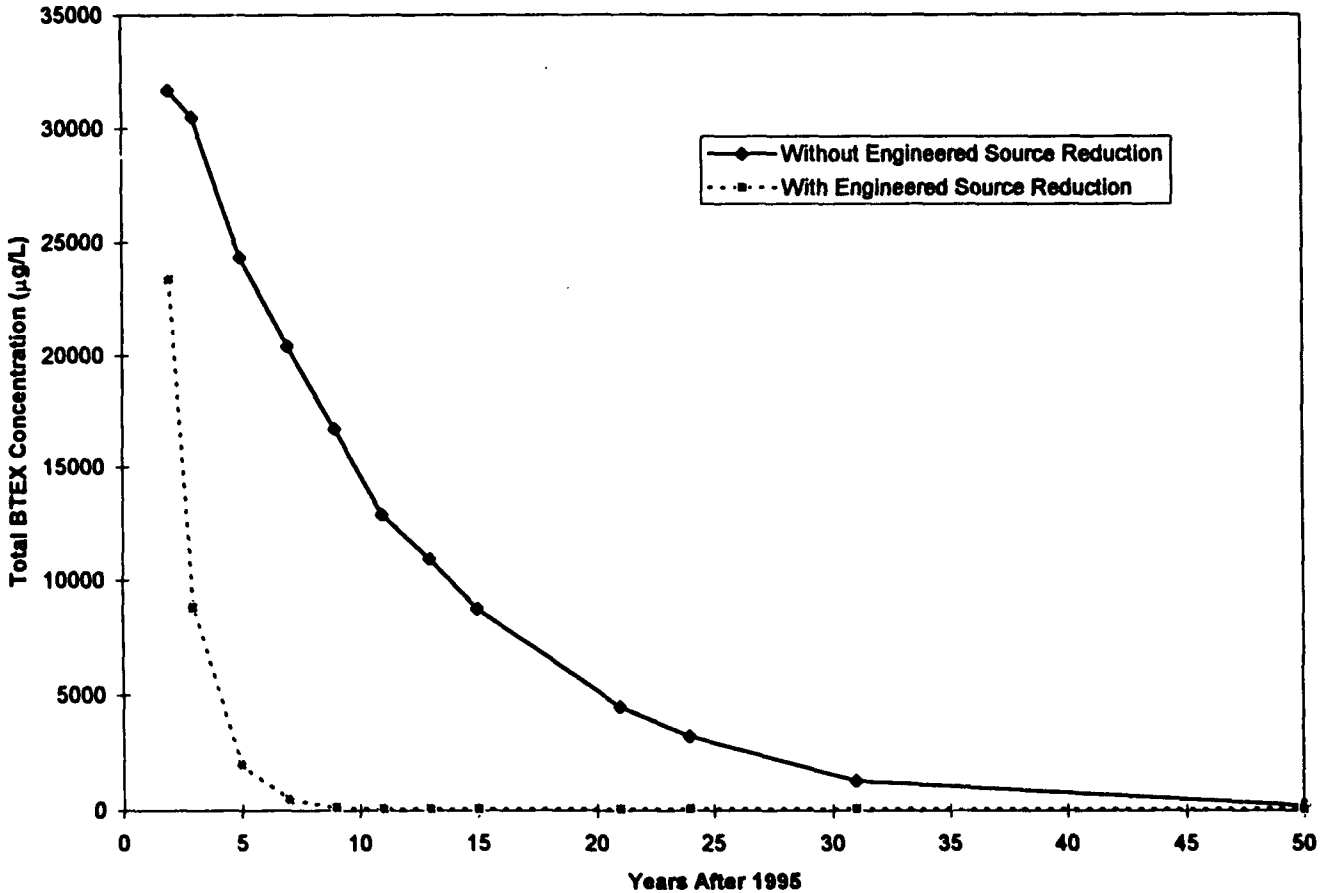

FIGURE 5.20

COMPARISON OF SIMULATED MAXIMUM SOURCE AREA BTEX CONCENTRATIONS MODELS 56_A AND 56_C SITE 56

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dissolved BTEX concentrations in source area groundwater would decrease dramatically following remediation of source area soils, declining to below 100 µg/L after 10 years.

The results of model 56_D also suggest that the dissolved BTEX concentration reaching the downgradient model boundary would decrease by nearly one-half if bioventing was implemented in the source area (Figure 5.21). This model predicts that the maximum downgradient extent of the plume would occur after approximately 10 years, with BTEX concentrations at the downgradient model boundary ranging from 1 to 8 µg/L. The small magnitude of these concentrations suggests that the downgradient edge of the BTEX plume would not extend more than 100 feet past the downgradient model boundary.

5.7 CONCLUSIONS AND DISCUSSION

Four model simulations were run to simulate a variety of conditions. Model 56_A assumed natural attenuation of BTEX in source areas soils and discharge of groundwater to the drainage ditch. Model 56_B differed from 56_A in that groundwater and dissolved contamination was allowed to migrate past the ditch. Models 56_C and 56_D were identical to 56_A and 56_B, respectively, except that they simulated the effects of rapid remediation of source area soils through bioventing or another *in situ* method.

The results of the four Bioplume II model simulations described in Section 5.6 suggest that the majority of the dissolved BTEX contamination will remain in the immediate vicinity of the AAFES Service Station, and will not discharge to the drainage ditch located at Site 32. If underflow of contaminants beneath the ditch occurs, models 56_B and 56_D indicate that the BTEX will not travel a significant distance beyond the ditch, and will be nearly completely attenuated by the time the downgradient model boundary is reached. The modeling suggests that remediation of source area soils would further restrict the downgradient migration of the dissolved BTEX plume, and promote a relatively rapid decrease in dissolved BTEX concentrations

The removal of BTEX compounds predicted by the simulations is largely a function of anaerobic biodegradation and sorption. Influxes of fresh groundwater enhance biodegradation by flushing water containing electron acceptors through the BTEX plume, which is retarded with respect to the advective groundwater velocity. As a result, biodegradation processes are maintained due to the continuous influx of electron acceptors. This is further enhanced by the additional influxes of electron acceptors in the grassy areas where recharge of the groundwater system by precipitation occurs.

In all cases, the model simulations are conservative for several reasons, including:

- Aerobic respiration, denitrification, iron reduction, sulfate reduction, and methanogenesis are all occurring at this site; however, only DO is considered as an electron acceptor during model simulations, and the anaerobic decay coefficient used in the calibrated model is lower than common literature values (Chapelle, 1994; Wilson *et al.*, 1994; Wiedemeier *et al.*, 1995).

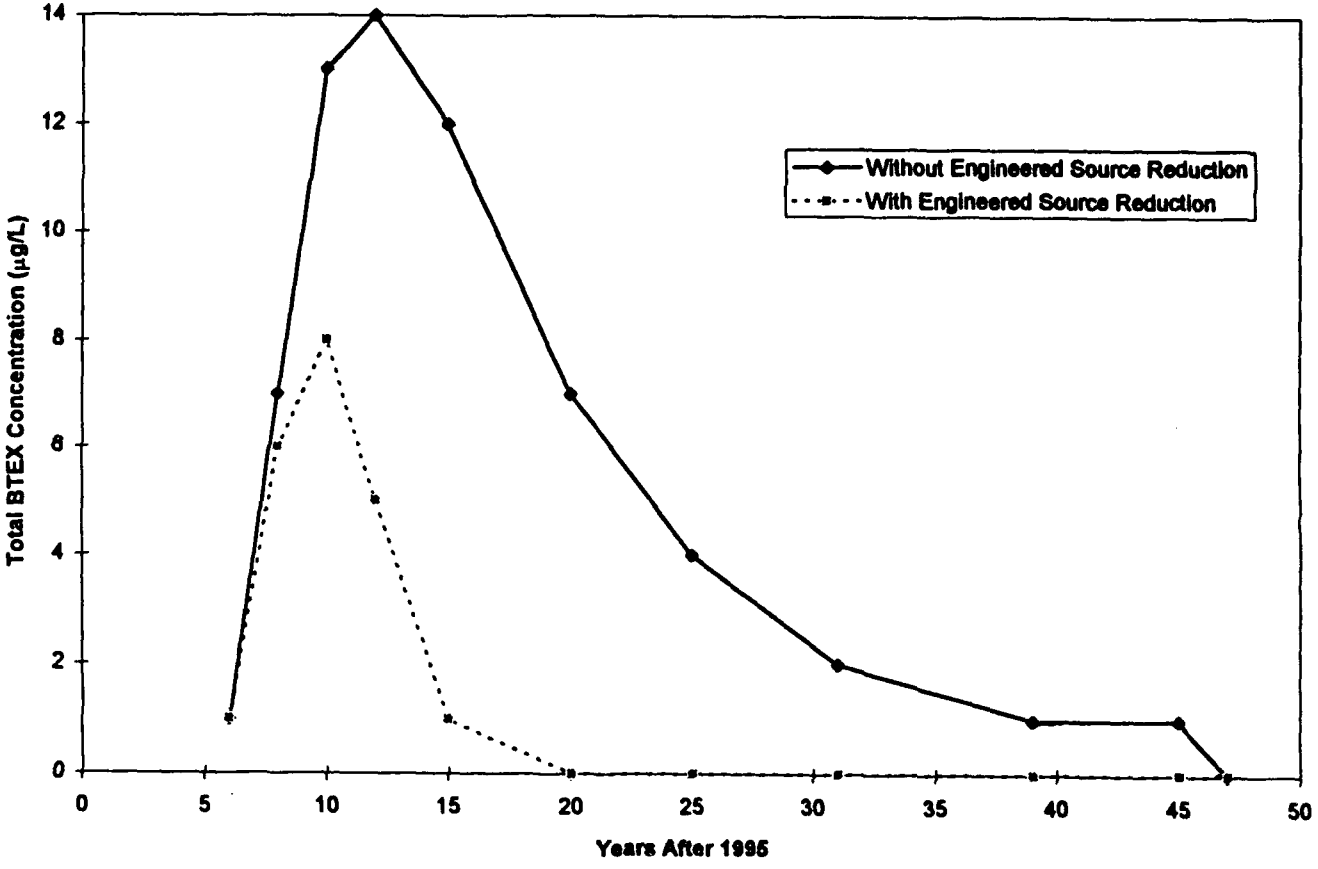

FIGURE 5.21
COMPARISON OF SIMULATED MAXIMUM BTEX CONCENTRATIONS AT DOWNGRADIENT MODEL BOUNDARY MODELS 56_B AND 56_D SITE 56

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- The stoichiometry used to determine the ratio between DO and total BTEX assumed that no microbial cell mass was produced during the reaction. As discussed in Section 4.3.4.1, this approach may be too conservative by a factor of three;

- The model assumes that infiltrating precipitation does not add any oxygen to the groundwater system;

- A maximum coefficient of retardation for benzene (3.10) was used for model simulations. Average retardation coefficients for the other BTEX compounds range from 4.62 to 9.91, and average 7.68. The use of the low coefficient of retardation tends to increase the distance traveled by the simulated BTEX plume, but may provide a more accurate estimate of benzene transport.

- The simulated 6-month BTEX plume, which was the starting point for subsequent simulations, contained a greater contaminant mass than was observed in either September/October 1994 or March 1995.

- The BTEX source reduction rate used in the models 56_C and 56_D was probably low as described in Section 5.6.1.

In summary, the strong geochemical evidence of anaerobic biodegradation, and the reasonably conservative nature of the Bioplume II models, indicate that natural attenuation will substantially reduce dissolved BTEX concentrations and limit plume migration. It should be noted that the modeled scenarios incorporate the assumption that the contaminant source (leaking USTs and/or pipelines) is not continuous, but that any leaks have been remedied. The simulated injection wells are intended to represent continuing partitioning of BTEX from measured concentrations of residual LNAPL into the groundwater.

SECTION 6

COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES

This section presents the development and comparative analysis of four groundwater remedial alternatives for Site 56 at MacDill AFB. The intent of this evaluation is to determine if intrinsic remediation is an appropriate and cost-effective remedial approach to consider when developing final remedial strategies for the site, especially when combined with other innovative and conventional remedial technologies

Section 6.1 presents the evaluation criteria used to evaluate groundwater remedial alternatives. Section 6.2 discusses the development of remedial alternatives considered as part of this demonstration project. Section 6.3 provides a brief description of each of these remedial alternatives. Section 6.4 provides a more detailed analysis of the remedial alternatives using the defined remedial alternative evaluation criteria. The results of this evaluation process are summarized in Section 6.5.

6.1 REMEDIAL ALTERNATIVE EVALUATION CRITERIA

The evaluation criteria used to identify appropriate remedial alternatives for shallow groundwater contamination at the site were adapted from those recommended by USEPA (1988) for selecting remedies for Superfund sites [Office of Solid Waste and Emergency Response (OSWER) Directive 9355.3-01]. These criteria included (1) long-term effectiveness and permanence, (2) technical and administrative implementability, and (3) relative cost. The following sections briefly describe the scope and purpose of each evaluation criterion. This report focuses on the potential use of intrinsic remediation and source reduction technologies to reduce BTEX concentrations within the shallow groundwater to levels that meet regulatory action levels.

6.1.1 Long-Term Effectiveness and Permanence

Each remedial approach or remedial alternative (which can be a combination of remedial technologies such as intrinsic remediation and institutional controls) was analyzed to determine how effectively it will minimize groundwater plume expansion so that applicable groundwater quality standards can be achieved at a downgradient point of compliance (POC). The expected technical effectiveness based on case histories from other sites with similar conditions also is evaluated. The ability to minimize potential impacts to surrounding facilities and operations is considered. Also, the ability of each remedial alternative to protect both current and potential future receptors from potential risks associated with site-related contamination in shallow groundwater is qualitatively assessed by conservatively estimating if a potential

exposure pathway involving groundwater could be completed, either now or in the future. This evaluation criterion also included permanence and the ability to reduce contaminant mass, toxicity, and volume. Time to implementation and time until protection is achieved are described. Long-term reliability for providing continued protection, including an assessment of potential for failure of the technology and the potential threats resulting from such a failure, also is evaluated.

6.1.2 Implementability

The technical implementation of each remedial technology or remedial alternative was evaluated in terms of technical feasibility and availability. Potential shortcomings and difficulties in construction, operations, and monitoring are presented and weighed against perceived benefits. Requirements for any post-implementation site controls such as long-term monitoring (LTM) and land or groundwater use restrictions are described. Details on administrative feasibility in terms of the likelihood of public acceptance and the ability to obtain necessary approvals are discussed.

6.1.3 Cost

The total cost (present worth) of each remedial alternative was estimated for relative comparison following EPA (1988) guidance. An estimate of capital costs, and operations and post-implementation costs for site monitoring and controls is included. An annual inflation factor of 5 percent was assumed in discounted present worth calculations.

6.2 FACTORS INFLUENCING ALTERNATIVES DEVELOPMENT

Several factors were considered during the identification and screening of remedial technologies for addressing shallow groundwater contamination at the site. Factors considered included the objectives of the natural attenuation demonstration program; contaminant, groundwater, and soil properties; present and future land use; and potential receptors and exposure pathways. The following section briefly describes each of these factors and how they were used to narrow the list of potentially applicable remedial technologies to the final remedial alternatives considered for the site.

6.2.1 Program Objectives

The intent of the intrinsic remediation demonstration program sponsored by AFCEE is to develop a systematic process for scientifically investigating and documenting naturally occurring subsurface attenuation processes that can be factored into overall site remediation plans. The objective of this program and the specific Site 56 study is to provide substantive evidence of intrinsic remediation of dissolved fuel hydrocarbons so that this information can be used to develop an effective groundwater remediation strategy. A secondary goal of this multi-site initiative is to provide a series of regional case studies that demonstrate that natural processes of contaminant degradation can often reduce contaminant concentrations in groundwater to below acceptable cleanup standards before completion of potential exposure pathways.

Because the objective of this program is to study natural processes in the saturated zone rather than all contaminated media (soil, soil gas, etc.), technologies have been evaluated based primarily on their potential impact on shallow groundwater and phreatic soils. Technologies that can reduce vadose zone contamination and partitioning of contaminants into groundwater also have been evaluated. Many of the source removal technologies evaluated in this section will reduce soil and soil gas contamination, but it is important to emphasize that the remedial alternatives developed in this document are not intended to remediate all contaminated media. Additional program objectives set forth by AFCEE include cost effectiveness and minimization of waste. Technologies that may meet these criteria include institutional controls, soil vapor extraction, bioventing, biosparging, groundwater pump and treat, and intrinsic remediation. Soil excavation, slurry walls, sheet piling, carbon adsorption, *ex situ* biological or chemical treatment, and onsite/offsite disposal are generally not attractive technology candidates under this program. However, soil excavation and *ex situ* treatment were considered for Site 56 in light of the potential closure of this site and removal of the USTs in 1997.

6.2.2 Contaminant Properties

The site-related contaminants considered as part of this demonstration at Site 56 are the BTEX compounds. The source of this contamination is gasoline present as residual LNAPL contamination in capillary fringe and saturated soil in the vicinity of the AAFES Service Station. The physiochemical characteristics of gasoline and the individual BTEX compounds will greatly influence the effectiveness and selection of a remedial technology.

Petroleum hydrocarbon mixtures, such as gasoline, are composed of over 300 compounds with different physiochemical characteristics. Gasoline is classified as an LNAPL with a liquid density of 0.68 to 0.76 gram per cubic centimeter (g/cc) at 20°C. Many compounds in gasoline sorb very well to soil and are concentrated in the capillary fringe because the mixture is less dense than water. Gasoline is slightly soluble in water, with a maximum solubility of approximately 200 mg/L. Gasoline is also a primary substrate for biological metabolism. Simultaneous biodegradation of aliphatic, aromatic, and alicyclic hydrocarbons has been observed. In fact, mineralization rates of hydrocarbons in mixtures such as gasoline may be faster than mineralization of the individual constituents as a result of cometabolic pathways (Jamison *et al.*, 1975; Perry, 1984).

The BTEX compounds are generally volatile, highly soluble in water, and adsorb less strongly to soil than other hydrocarbons in a petroleum mixture. These characteristics allow the BTEX compounds to leach more rapidly from contaminated soil into groundwater, and to migrate as dissolved contamination (Lyman *et al.*, 1992). All of the BTEX compounds are highly amenable to *in situ* degradation by both biotic and abiotic mechanisms.

Benzene is very volatile, with a vapor pressure of 76 millimeters of mercury (mm Hg) at 20°C and a Henry's Law Constant of approximately 0.0054 atmosphere-cubic meters per mole (atm-m^3/mol) at 25°C (Hine and Mookerjee, 1975; Jury *et al.*, 1984). The solubility of pure benzene in water at 20°C has been reported to be 1,780 mg/L

(Verschueren, 1983). Benzene is normally biodegraded to carbon dioxide, with catechol as a short-lived intermediate (Hopper, 1978; Ribbons and Eaton, 1992).

Toluene is also volatile, with a vapor pressure of 22 mm Hg at 20°C and a Henry's Law Constant of about 0.0067 atm-m^3/mol at 25°C (Pankow and Rosen, 1988; Hine and Mookerjee, 1975). Toluene sorbs more readily to soil media relative to benzene, but still is very mobile. The solubility of pure toluene in water at 20°C is approximately 515 mg/L at 20°C (Verschueren, 1983). Toluene has been shown to degrade to pyruvate, acetaldehyde, and completely to carbon dioxide via the intermediate catechol (Hopper, 1978; Wilson *et al.*, 1986; Ribbons and Eaton, 1992).

Ethylbenzene has a vapor pressure of 7 mm Hg at 20°C and a Henry's Law Constant of 0.0066 atm-m^3/mol (Pankow and Rosen, 1988; Valsaraj, 1988). Ethylbenzene sorbs more strongly to soils than benzene but less strongly than toluene (Abdul *et al.*, 1987). Pure ethylbenzene is also less soluble than benzene and toluene in water at 152 mg/L at 20°C (Verschueren, 198 *al.*, 1985). Ethylbenzene ultimately degrades to carbon dioxide via its intermediate 3-ethylcatechol (Hopper, 1978; Ribbons and Eaton, 1992).

The three isomers of xylene have vapor pressures ranging from 7 to 9 mm Hg at 20°C and Henry's Law Constants of between 0.005 and 0.007 atm-m^3/mol at 25°C (Mackay and Wolkoff, 1973; Hine and Mookerjee, 1975; Pankow and Rosen, 1988). Of all of the BTEX compounds, xylenes sorb most strongly to soil, but still can leach from soil into the groundwater (Abdul *et al.*, 1987). Pure xylenes have water solubilities of 152 to 160 mg/L at 20°C (Bohon and Claussen, 1951; Mackay and Shiu, 1981; Isnard and Lambert, 1988). Xylenes can degrade to carbon dioxide via pyruvate carbonyl intermediates (Hopper, 1978; Ribbons and Eaton, 1992).

On the basis of these physiochemical characteristics, intrinsic remediation, soil vapor extraction, bioventing, biosparging, groundwater extraction, and air stripping technologies could all be effective options for collecting, destroying, and/or treating BTEX contaminants at Site 56.

6.2.3 Site-Specific Conditions

Two general categories of site-specific characteristics were considered when identifying remedial technologies for comparative evaluation as part of this demonstration project. The first category was physical characteristics such as groundwater depth, gradient, flow direction, and soil type, which influence the types of remedial technologies most appropriate for the site. The second category involved assumptions about future land use and potential receptors and exposure pathways. Each of these site-specific characteristics have influenced the selection of remedial alternatives included in the comparative evaluation.

6.2.3.1 Groundwater and Soil Characteristics

Site geology and hydrogeology will have a profound effect on the transport of contaminants and the effectiveness and scope of required remedial technologies at a given site. Hydraulic conductivity is perhaps the most important aquifer parameter

governing groundwater flow and contaminant transport in the subsurface. The velocity of the groundwater and dissolved contamination is directly related to the hydraulic conductivity of the saturated zone. Slug testing conducted in the vicinity of the site indicates a moderate conductivity within the sand unit present in the vicinity of the source area and dissolved plume. Estimated conductivity values ranged from 8.0 to 25.9 ft/day, characteristic of sand or silty sand. The hydraulic conductivity at this site directly influences the fate and transport of contaminants. The shallow groundwater migrates to the northwest, increasing the extent of contamination (i.e., the plume has expanded) but decreasing the average concentration within the aquifer through dilution and biodegradation.

Although higher hydraulic conductivities can result in plume expansion and migration, this same characteristic also will enhance the effectiveness of other remedial technologies, such as groundwater extraction, biosparging, and intrinsic remediation. For example, it should be less expensive and time-consuming to capture and treat the contaminant plume using a network of extraction wells in areas of high hydraulic conductivity. Contaminant recovery may also be maximized when contaminants are not significantly sorbed to and retarded by phreatic soil. The effectiveness of biosparging may also be increased in highly conductive aquifers because of reduced entry pressures and increased mixing of sparge air and groundwater. Greater hydraulic conductivity would also increase the amount of contaminant mass traveling through a biosparging network. The DO introduced through biosparging can also enhance aerobic degradation of the dissolved contaminant mass, particularly at a site such as the AAFES Service Station, where oxygen-deficient groundwater predominates.

The movement of contaminants within the subsurface away from the source also will increase the effectiveness of natural biodegradation processes by distributing the contaminant mass into areas enriched with electron acceptors. In addition, because BTEX compounds are retarded relative to the advective flow velocity, relatively fresh groundwater containing DO and other electron acceptors will migrate through the plume area, further increasing biodegradation.

To satisfy the requirements of indigenous microbial activity and intrinsic remediation, the aquifer also must provide an adequate and available carbon or energy source, electron acceptors, essential nutrients, proper ranges of pH, temperature, and redox potential. Data collected as part of the field work phase of this demonstration project, and described in Sections 3 and 4 of this TS, indicate that this site is characterized by adequate and available carbon/energy sources and electron acceptors to support measurable biodegradation of fuel hydrocarbon contamination by indigenous microorganisms. Sulfate and carbon dioxide (which is utilized during methanogenesis) represent primary sources of electron acceptor capacity for the biodegradation of BTEX compounds at the site. Relatively minor electron acceptors include DO, nitrate, and ferric iron. Further, because fuel-hydrocarbon-degrading microorganisms have been known to thrive under a wide range of temperature and pH conditions (Freeze and Cherry, 1979), the physical and chemical conditions of the groundwater and phreatic soil at the site are not likely to inhibit microorganism growth.

Fuel hydrocarbon-degrading microorganisms are ubiquitous, and as many as 28 hydrocarbon-degrading isolates (bacteria and fungi) have been discovered in different

soil environments (Davies and Westlake, 1977; Jones and Eddington, 1968). Indigenous microorganisms have a distinct advantage over microorganisms injected into the subsurface to enhance biodegradation because indigenous microorganisms are well adapted to the physical and chemical conditions of the subsurface in which they reside (Goldstein *et al.*, 1985). Therefore, microbe addition was not considered a viable remedial technology for this site.

6.2.3.2 Potential Exposure Pathways

A pathways analysis identifies the potential human and ecological receptors that could potentially come into contact with site-related contamination and the pathways through which these receptors might be exposed. To have a completed exposure pathway, there must be a source of contamination, a potential mechanism(s) of release, a pathway of transport to an exposure point, an exposure point, and a receptor. If any of these elements do not exist, the exposure pathway is considered incomplete, and receptors will not come into contact with site-related contamination. Evaluation of the potential long-term effectiveness of any remedial technology or remedial alternative as part of this demonstration project includes determining if the approach will be sufficient and adequate to minimize plume expansion so that potential exposure pathways involving shallow groundwater are incomplete.

Assumptions about current and future land uses at a site form the basis for identifying potential receptors, potential exposure pathways, reasonable exposure scenarios, and appropriate remediation goals. USEPA (1991) advises that the land use associated with the highest (most conservative) potential level of exposure and risk that can reasonably be expected to occur should be used to guide the identification of potential receptors and exposure pathways and to determine the level to which the site must be remediated. The source areas consist of the gasoline USTs and related pipelines at the AAFES Service Station.

Site 56 is surrounded by flight aprons, taxiways, parking lots, roads, and non-residential Base buildings. Site 32, a former service station, is located immediately downgradient from Site 56, and the drainage ditch referred to in this report as a potential groundwater discharge point bounds Site 32 on the northwest (Figure 5.14). The groundwater plume originating from Site 56 has migrated beneath a portion of Site 32, but does not appear to have reached the drainage ditch. Site 55, an active fuel storage area consisting of eight USTs, is located directly north of Site 32. The north apron of the flightline (Site 57) is located approximately 1,000 feet west of Sites 32 and 56. Solid Waste Management Unit (SWMU) 29, the AGE Vinyl Chloride Site, is located between the flightline and Site 32. Therefore, the current land use within and downgradient of the contaminant plume is entirely commercial/industrial. Hillsborough Bay is located approximately 800 feet northeast of Site 56.

Under reasonable current land use assumptions, potential receptors include onsite workers, downgradient receptors, biota in the drainage ditch, and biota in Hillsborough Bay, which receives discharge from the ditch. Discharge of contaminated groundwater into the drainage ditch provides a potential pathway for BTEX compounds to contact aquatic organisms and animals drinking these waters or ingesting aquatic organisms. MTBE and low levels of BTEX were detected in the ditch surface water and sediment

by BVWS (1995) near and downgradient from the site (see Section 4.3.3 and Appendix A). Human contact is unlikely because the ditch is not a source of drinking water and is not used for swimming. However, the ditch supports a fish population, and recreational fishing in the ditch has been reported. Workers could be exposed to site-related contamination in phreatic soils or shallow groundwater if these materials are removed or exposed during future construction excavations or remedial activities. Groundwater from the shallow aquifer is not currently used to meet any demands at MacDill AFB. All Base potable water is supplied by the city of Tampa. There are no private wells located on the Base, and the Hillsborough County designated Wellhead Protection Area nearest to Site 56 is located approximately 13 miles north of the Base. The nearest private well is reportedly located approximately 0.6 miles north of the site and is used for irrigation (BVWS, 1995). Exposure pathways involving other environmental media such as shallow soils and soil gas in the source area were not considered as part of this project, but should be considered in overall site remediation decisions.

Assumptions about hypothetical future land uses must also be made to ensure that the remedial technology or alternative considered for shallow groundwater at the site is adequate and sufficient to provide long-term protection. The AAFES Service Station is tentatively scheduled to be closed in 1997. The future use of this property is not known, but it would no longer host a service station. However, given the surrounding land use, a continuing industrial land use assumption is considered to be appropriate. Thus, potential future receptors include those listed as current receptors in the preceding paragraph. The potential future exposure pathways involving workers would be identical to those under current conditions provided shallow groundwater is not used to meet industrial water demands. In summary, the use of the intrinsic remediation technology at this site will require that the source area be maintained as industrial property and that restrictions on shallow groundwater and surface water (in the drainage ditch) use be enforced in areas downgradient of the site until natural attenuation reduces contaminants to levels that pose no risk. If source removal technologies such as soil vapor extraction, bioventing, biosparging, or groundwater pump and treat are implemented, they will have some impact on the short- and long-term land use options and will require some level of institutional control and worker protection during remediation.

6.2.3.3 Remediation Goals for Shallow Groundwater

The results of model 56_B suggest that BTEX compounds are not likely to migrate more than 150 feet downgradient from the downgradient model boundary (or approximately 700 feet downgradient from the source area). Therefore, an area approximately 150 feet beyond the downgradient model boundary has been identified as the POC for groundwater remedial activities because this appears to be the maximum extent of future contaminant migration. This is a suitable location for monitoring and for demonstrating compliance with protective groundwater quality standards.

This remedial strategy assumes that compliance with promulgated, single-point remediation goals is not necessary if site-related contamination does not pose a threat to human health or the environment (i.e., the exposure pathway is incomplete). Thus, the magnitude of required remediation in areas that can and will be placed under

institutional control is different from the remediation that is required in areas that may be available for unrestricted use. The primary RAO for shallow groundwater at and downgradient from Site 56 is limited plume expansion to prevent exposure of downgradient receptors to concentrations of BTEX (and other gasoline-related contaminants) in groundwater or surface water at levels that exceed regulatory standards or guidelines. This means that viable remedial alternatives must be able to achieve concentrations that minimize plume migration and/or expansion. The ultimate RAO for shallow groundwater at the POC is attainment of no-further-action guidelines for G-II groundwater in an area where there are no drinking water wells within 0.25-mile of the site, and no public water supply wells within .50-mile of the site. These guidelines are contained in *No Further Action and Monitoring Only Guidelines for Petroleum Contaminated Sites* [Florida Department of Environmental Regulation (DER), 1990)], and are summarized in Table 6.1. The RAO for surface water in the drainage ditch is attainment of surface water quality standards presented in Chapter 62-302, FAC (Table 6.1). An interim RAO for attainment of "monitoring only" status for shallow groundwater are the "monitoring only" guidelines presented in Florida DER (1990). These interim guidelines could preliminarily be used to determine when to discontinue an active remedial action such as source removal via bioventing or a groundwater pump-and-treat system and allow intrinsic remediation with monitoring to remediate to no-further-action levels.

In summary, available data suggest that, with the exception of groundwater discharge to the drainage ditch, there is no complete potential exposure pathway involving shallow groundwater under current conditions. Moreover, it is likely that no additional potential exposure pathways involving shallow groundwater would be complete under future land use assumptions, provided use of shallow groundwater as a potable or industrial source of water is prohibited by institutional controls within the plume area and within an area approximately 150 feet downgradient from the downgradient model boundary. Thus, institutional controls are likely to be a necessary component of any groundwater remediation strategy for this site. The required duration of these institutional controls may vary depending on the effectiveness of the selected remedial technology at reducing contaminant mass and concentrations in the groundwater.

6.2.4 Summary of Remedial Technology Screening

Several remedial approaches and technologies have been identified and screened for use in treating the shallow groundwater at the site. Table 6.2 identifies the initial remedial options considered as part of this demonstration and those retained for detailed comparative analysis. Screening was conducted systematically by considering the program objectives of the AFCEE intrinsic remediation demonstration, physiochemical properties of the BTEX compounds, and other site-specific characteristics such as hydrogeology, land use assumptions, potential exposure pathways, and appropriate remediation goals. All of these factors will influence the technical effectiveness, implementation, and relative cost of technologies for remediating shallow groundwater underlying and migrating from the site. The remedial technologies retained for development of remedial alternatives and comparative analysis include institutional controls, intrinsic remediation combined with LTM, soil vapor extraction, biosparging, bioventing, and groundwater extraction and treatment. Excavation and *ex situ*

TABLE 6.1
POINT-OF-COMPLIANCE REMEDIATION GOALS FOR GROUNDWATER AND SURFACE WATER
SITE 56
INTRINSIC REMEDIATION TS
MACDILL AIR FORCE BASE, FLORIDA

Compound	Groundwater RAO[a/] (µg/L)[b/]	Interim Groundwater RAO (µg/L)	Surface Water RAO (µg/L)
	(no further action)	(monitoring only)	
Benzene	50	50 (perimeter) 500 (source area)	≤71.28
Total BTEX [c/]	50	50 (perimeter) 1,000 (source area)	NC[d/]
MTBE [e/]	NA	NA	50
LEAD	50	50 (perimeter) 1,000 (source area)	5,600
1,2-Dibromoethane (EDB)	0.02		NC

a/ RAO = remedial action objective for G-II groundwater with no nearby wells.
b/ µg/L = micrograms per liter.
c/ BTEX = benzene, toluene, ethylbenzene, and xylenes.
d/ NC = no criterion available.
e/ MTBE = methyl tert-butyl ether.
Source: Florida Department of Environmental Regulation, 1990.
Note: EDB and 1,2-dichloroethane were analyzed for in site groundwater samples by BVWS (1995), but were not detected.

TABLE 6.2
INITIAL TECHNICAL IMPLEMENTABILITY SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS FOR GROUNDWATER REMEDIATION
SITE 56
INTRINSIC REMEDIATION
MACDILL AIR FORCE BASE, FLORIDA

General Response Action	Technology Type	Process Option	Implementability	Retain
Long-Term Monitoring	Periodic Surface Water/Groundwater Monitoring	Confirmation Wells	Many existing wells are available to confirm the progress of remediation. Surface water monitoring in drainage ditch is feasible.	Yes
		Point-of-Compliance Wells	Sufficient distance exists between the plume and point-of-compliance to locate several wells.	Yes
Institutional Controls	Groundwater and Surface Water Use Control	Land Use Control/Regulate Well Permits	Plume area is currently within the Base boundary and land, surface water, and ground water use are under Base jurisdiction.	Yes
		Seal/Abandon Existing Wells	No production wells are known to exist in the existing or predicted plume area.	No
		Point-of-Use Treatment	No shallow ground water is extracted from the plume area for any use.	No
	Public Education	Meetings/ Newsletters	Base public relations and environmental management offices have many information avenues to workers and residents.	Yes
Containment of Plume	Hydraulic Controls	Passive Drain Collection	Hydraulic conductivity of site soils favors pumping. Passive collection could feasibly be implemented, but would not accelerate site closure appreciably.	No
		Minimum Pumping/Gradient Control	Hydraulic conductivities of site soils are moderate to high and would allow extraction of sufficient volumes. Treatment of extracted water would probably be necessary.	Yes
	Physical Controls	Slurry Walls/Grout Curtains	Requires significant disruption of Base operating area. Limited effectiveness.	Yes
		Sheet Piling	Requires significant disruption of base operating area. Limited effectiveness.	No
	Reactive/Semi-Permeable Barriers	Biologically Active Zones	Natural biodegradation of BTEX compounds can be stimulated by allowing contaminated ground water to flow through an aquifer zone which has enhanced oxygen and nutrient conditions. A new, unproven technology.	No

TABLE 6.2 (Continued)
INITIAL TECHNICAL IMPLEMENTABILITY SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS FOR GROUNDWATER REMEDIATION
SITE 56
INTRINSIC REMEDIATION
MACDILL AIR FORCE BASE, FLORIDA

General Response Action	Technology Type	Process Option	Implementability	Retain
In Situ Treatment	Biological	Oxygen and/or Nutrient Enhanced Biodegradation (Biosparging)	Differs from biologically active zone in that oxygen and/or nutrients are injected downgradient of plume to limit plume migration by enhancing biodegradation and reducing BTEX concentrations as the plume moves downgradient from the source area.	Yes
	Chemical/Physical	Intrinsic Remediation	A combination of natural biological, chemical, and physical removal mechanisms which occur to varying degrees on every site. Groundwater sampling at Site 56 indicates that this is a major, ongoing remediation process.	Yes
		Air Sparging (Volatilization)	Injection of air into contaminated aquifer creating a mass transfer of BTEX into air bubbles and into vadose zone. Limited radius of influence and short-circuiting are common problems.	No
Aboveground Groundwater Treatment	Groundwater Extraction	Vertical Pumping Wells	Groundwater plume "hot spot" is pumped by installing wells with submersible pumps. Option is implementable, and would constitute an aggressive remedial option.	Yes
		Downgradient Horizontal Drains	See Passive Drain Collection.	No
	Biological	Bioreactors	High flow rates require excessive retention times and large reactors. BTEX is often volatilized in these systems.	No
	Chemical/Physical	Air Stripping	Cost-effective technology for removing varying concentrations of BTEX at higher flow rates.	Yes
		Activated Carbon	Cost prohibitive for more concentrated BTEX or long system operation times. Creates a carbon disposal problem. Carbon is also used to treat off-gas from air strippers.	No
		UV/Ozone Reactors	High flow rates require excessive retention times and large, expensive reactors.	No

TABLE 6.2 (Continued)
INITIAL TECHNICAL IMPLEMENTABILITY SCREENING OF
TECHNOLOGIES AND PROCESS OPTIONS FOR GROUNDWATER REMEDIATION
SITE 56
INTRINSIC REMEDIATION
MACDILL AIR FORCE BASE, FLORIDA

General Response Action	Technology Type	Process Option	Implementability	Retain
Aboveground Treatment	Direct Discharge to Industrial Waste Water Treatment Plant (IWWTP)		Viable option when an IWWTP is readily available and capable of handling BTEX and hydraulic loading. IWWTP not readily available.	No
Treated Ground Water Disposal	Discharge to IWWTP or Sanitary Sewer	IWWTP	Viable option when an IWTTP is readily available and capable of handling BTEX. IWWTP not readily available.	No
		Sanitary Sewer	Viable option when access to sanitary sewer exists and hydraulic loading is acceptable.	Yes
	Treated Ground Water Reinjection	Vertical Injection Wells	Not recommended due to clogging and high maintenance.	No
		Injection Trenches	Require large trenches and can be subject to injection well permitting.	No
	Discharge to Surface Waters	Storm Drains	Viable option but generally requires NPDES or other discharge permit.	Yes
Source Removal/Soil Remediation	Excavation/ Treatment	Biological Landfarming	Excavation may be feasible at this site. Soil remediation may not be necessary for groundwater remediation.	Yes
		Thermal Desorption	Offsite thermal treatment potentially implementable. Soil remediation may not be necessary for groundwater remediation.	Yes
	In Situ	Bioventing	Air injection to stimulate biodegradation of fuel residuals. Soils in source areas should not limit effectiveness.	Yes
		Soil Vapor Extraction	Vapor extraction has been successfully implemented at other sites. Requires source definition and off-gas treatment. Bioventing is preferred, but vapor extraction may be necessary before bioventing can be implemented.	Yes

treatment of contaminated vadose zone soil also was retained in light of the potential closure of the AAFES Service Station in 1997.

6.3 BRIEF DESCRIPTION OF REMEDIAL ALTERNATIVES

This section describes how remedial approaches/technologies retained from the screening process were combined into four remedial alternatives for Site 56. Sufficient information on each remedial alternative is provided to facilitate a comparative analysis of effectiveness, implementability, and cost in Section 6.4.

6.3.1 Alternative 1--Intrinsic Remediation and Institutional Controls with Long-Term Groundwater and Surface Water Monitoring

Intrinsic remediation is achieved when naturally occurring attenuation mechanisms bring about a reduction in the total mass of a contaminant in the soil or dissolved in groundwater. Intrinsic remediation results from the integration of several subsurface attenuation mechanisms that are classified as either destructive or nondestructive. Destructive attenuation mechanisms include biodegradation, abiotic oxidation, and hydrolysis. Nondestructive attenuation mechanisms include sorption, dilution (caused by dispersion and infiltration) and volatilization. In some cases, intrinsic remediation will reduce dissolved contaminant concentrations below numerical concentration goals intended to be protective of human health and the environment. As indicated by the existing evidence of intrinsic remediation described in Section 4, these processes are occurring in the vicinity of Site 56 and will continue to reduce contaminant mass in the plume area.

Results of the Bioplume II modeling suggest that the dissolved BTEX concentrations at the drainage ditch should peak after 9 years, and that concentrations at the downgradient boundary of the model should peak after 12 years if substantial contaminant underflow beneath the ditch occurs. In subsequent years, the model predicts that intrinsic remediation within the BTEX plume and along the plume margins will prevent further plume migration, assuming BTEX loading in the source area decreases at a rate of 10 percent per year, as described in Section 5.6. The model indicates that if all of the dissolved contamination migrates beyond the drainage ditch, the downgradient edge of the plume will not migrate further than approximately 150 feet beyond the downgradient model boundary, as described in Section 5.6. The maximum simulated BTEX concentration at the downgradient model boundary is 14 µg/L, which is well below the groundwater RAOs (Table 6.1). An extended run of model 56_A for a total of 75 years also indicates that total dissolved BTEX concentrations in source area groundwater will be reduced to below 50 µg/L after approximately 52 years.

Implementation of Alternative 1 would require the use of institutional controls such as land use restrictions and LTM. Land use restrictions may include placing long-term restrictions on soil excavation in the source area and long-term restrictions on groundwater well installations within and downgradient from the plume area. In addition, restriction of surface water uses in the drainage ditch may be required. The intent of these restrictions would be to reduce potential receptor exposure to

contaminants by legally restricting activities within areas affected by site-related contamination.

At a minimum, groundwater monitoring within the plume area and surface water monitoring in the ditch downgradient from the site would be conducted biannually as part of the implementation of this remedial alternative to evaluate the progress of natural attenuation processes. Based on the potential plume migration suggested by the modeling, it is unlikely that benzene concentrations exceeding the most stringent Florida groundwater standard of 1 µg/L [Chapter 62-770.600(8), FAC] would be present more than approximately 450 feet downgradient from the 1995 plume front (approximately 150 feet downgradient from the model boundary). This would be true even if it were assumed that simulated contaminant concentrations consist entirely of benzene rather than a mixture of the BTEX compounds. It is unlikely that benzene and dissolved BTEX concentrations exceeding the no-further-action guideline of 50 µg/L (Table 6.1) would be present more than approximately 200 feet downgradient from the 1995 plume front. The recommended components of LTM, including both groundwater and surface water quality monitoring, are described in Section 7.2.

Public education on the selected alternative would be developed to inform Base personnel and residents of the scientific principles underlying source reduction and intrinsic remediation. This education could be accomplished through public meetings, presentations, press releases, and posting of signs where appropriate. Periodic site reviews could also be conducted using data collected from the LTM program. The purpose of these reviews would be to evaluate the extent of contamination, assess contaminant migration and attenuation through time, document the effectiveness of source removal and/or institutional controls at the site, and reevaluate the need for additional remedial actions at the site.

6.3.2 Alternative 2--Soil Vapor Extraction and Bioventing/Biosparging in Source Area, Intrinsic Remediation, and Institutional Controls with Long-Term Groundwater and Surface Water Monitoring

This alternative is identical to Alternative 1 except that bioventing would be used to enhance the biodegradation of organic contaminants in subsurface soils by supplying oxygen to indigenous microbes using low-flow air extraction/injection in the vicinity of the AAFES Service Station. Bioventing is preferred over soil vapor extraction (SVE) because bioventing uses a low rate of air injection that significantly reduces emissions into the atmosphere while maximizing *in situ* biodegradation. However, bioventing using standard air injection techniques could create uncontrolled migration of potentially combustible vapors within the vadose zone. Therefore, the bioventing should be preceded by approximately 3 to 6 months of SVE to reduce VOC concentrations in the soil vapor.

Given the presence of pavement at this site, which would prevent short-circuiting of air flow to the surface, one horizontal air injection well installed in a shallow trench within the area of contaminated vadose zone soils should be sufficient to remediate the entire volume of contaminated vadose zone soils. The length of the well would be approximately 80 feet. Approximately four shallow vapor monitoring points also would be installed to allow measurement of the effectiveness of the injection well.

Parsons ES has installed a similar bioventing system at the BX Service Station at Patrick AFB, Florida, where subsurface conditions are nearly identical to those encountered at Site 56 (Parsons ES, 1995b).

A bioventing system should remove at least 95 percent of residual soil BTEX compounds within 1 to 3 years. Operation of the bioventing system during a relatively dry year, when water levels are low, may be required to substantially decrease residual BTEX concentrations in the capillary fringe. The effect of this relatively rapid source removal on the migration of the groundwater BTEX plume was evaluated using the Bioplume II model, as described in Section 5.6.2. Simulations 56_C and 56_D assume that such a decrease in soil concentrations would produce a similar decrease in BTEX dissolution into the groundwater. Simulation 56_C assumes that the shallow groundwater discharges to the drainage ditch, and the portion of the model grid northwest of the ditch was inactive. Simulation 56_D assumes that the dissolved BTEX plume migrates beneath the ditch; therefore, the portion of the model grid northwest of the ditch was activated as described in Section 5.6. The results of these models suggest that remediation of source area soils would further restrict the downgradient migration of the dissolved BTEX plume, and promote a relatively rapid decrease in dissolved BTEX concentrations.

An alternative design option would be to inject air several feet below the groundwater surface and allow the air (oxygen) to move upward through the capillary fringe and into the contaminated vadose zone. This process, known as biosparging, also would increase the DO content of the groundwater and promote more rapid degradation of dissolved BTEX compounds in the plume.

As with Alternative 1, institutional controls and LTM would be required. POC and LTM wells would be installed in the same locations indicated in Section 7.2. As a minimum, groundwater and surface water monitoring would be conducted annually as part of this remedial alternative to evaluate the progress of natural attenuation processes.

6.3.3 Alternative 3--Groundwater Extraction and Treatment, Soil Vapor Extraction and Bioventing, Intrinsic Remediation, and Institutional Controls with Long-Term Groundwater and Surface Water Monitoring

This option would include the scenarios described for Alternatives 1 and 2 above, but also would include groundwater pumping in the most concentrated areas of the plume. The objective of the pumping would be to reduce dissolved benzene and total BTEX concentrations in the source area to below 500 µg/L and 1,000 µg/L, respectively, which are the levels that could trigger a "monitoring only" status for the site (Table 6.1). Any remaining contaminant mass would be allowed to naturally attenuate. Groundwater pumping in the source area would depress groundwater levels and allow the bioventing system to oxygenate the newly exposed interval, resulting in more effective remediation of residual NAPL in source area soils. The extracted groundwater could be treated onsite and discharged to the sanitary sewer, or piped to an operational treatment system at the nearby Site 38.

The analytical groundwater model *Quickflow* (Geraghty & Miller, 1991) was used to evaluate extraction well spacings and pumping rates. Based on this modeling, a total of two extraction wells, each pumping 2 gallons per minute (gpm), would adequately capture the dissolved BTEX plume in and immediately downgradient from the source area. Output from the *Quickflow* model is contained in Appendix F.

6.3.4 Alternative 4--Soil Excavation and *Ex Situ* Treatment, Intrinsic Remediation, and Institutional Controls with Long-Term Groundwater and Surface Water Monitoring

This option would include the scenario described for Alternative 1 above, but would also include excavation and above-ground treatment of contaminated vadose zone soils. This option may be preferable over source removal via bioventing (Alternative 2) if the service station is closed in 1997 and the pavement is removed in conjunction with closure. As with Alternative 2, model simulations 56_C and 56_D suggest that removal of contaminated source area soils would further restrict the downgradient migration of the dissolved BTEX plume, and promote a relatively rapid decrease in dissolved BTEX concentrations. Excavated soils could be remediated on-Base in an above-ground landfarm, or off-Base at a thermal treatment facility.

6.4 EVALUATION OF ALTERNATIVES

This section provides a comparative analysis of each of the remedial alternatives based on the effectiveness, implementability, and cost criteria. A summary of this evaluation is presented in Section 6.5.

6.4.1 Alternative 1--Intrinsic Remediation and Institutional Controls with Long-Term Groundwater and Surface Water Monitoring

6.4.1.1 Effectiveness

Section 5 of this document presents the results of the Bioplume II modeling completed to support the intrinsic remediation alternative at Site 56. Simulation 56_A assumed that the shallow groundwater and the dissolved BTEX plume discharge to the downgradient drainage ditch, and simulation 56_B assumed that groundwater and contaminant underflow beneath the ditch occurs.

Model results predicted that natural attenuation mechanisms will significantly limit contaminant migration and reduce contaminant mass and toxicity. The Bioplume II model is based upon numerous conservative assumptions, as described in Section 5.7. Groundwater monitoring at the LTM and POC wells and surface water monitoring in the ditch will ensure the protectiveness of this alternative. While this alternative would not cease to be protective if the BTEX plume was intercepted by the POC wells, such an instance would indicate that site conditions should be reevaluated.

The effectiveness of this remedial alternative requires that excavations or drilling within the source area be conducted only by properly protected site workers. Reasonable land use assumptions for the plume area indicate that worker exposure is unlikely unless excavation or drilling activities bring saturated soil to the surface.

Long-term land use restrictions will be required to ensure that shallow groundwater will not be pumped or removed for potable use within, and approximately 500 feet in all directions from, the existing BTEX plume. In addition, restrictions on recreational use of the drainage ditch may be required. Existing health and safety plans should be enforced to reduce risks from additional excavation or from installing and monitoring additional POC wells.

Compliance with program goals is one component of the long-term effectiveness evaluation criterion. Alternative 1 will satisfy program objectives designed to promote intrinsic remediation as a component of site remediation and to scientifically document naturally occurring processes. This alternative also satisfies program goals for cost effectiveness and waste minimization.

Alternative 1 is based on the effectiveness of enhanced naturally occurring processes that minimize contaminant migration and reduce contaminant mass over time, and the effectiveness of institutional controls. As described earlier, an investigation of the potential effectiveness of naturally occurring processes at Site 56 using field data and the Bioplume II model demonstrated that the BTEX plume migration will be significantly limited.

Apart from the administrative concerns associated with enforcement of long-term land use restrictions and long-term groundwater and surface water monitoring programs, this remedial alternative should provide reliable, continued protection. It is assumed for cost comparison purposes that dissolved benzene concentrations will exceed state guidelines throughout the plume for approximately 52 years under Alternative 1, and that sampling will be performed biannually (every other year). An additional 4 years of annual sampling will be required to demonstrate that intrinsic remediation has uniformly reduced BTEX concentrations to below applicable guidelines. Dilution and volatilization calculations (Appendix D) suggest that if groundwater discharge to the drainage ditch occurs, the resulting benzene concentration in the surface water will not exceed the RAO for this compound (Table 6.1). Surface water monitoring will demonstrate this compliance. BVWS (1995) surface water quality data presented in Appendix A indicates that dilution and volatilization of MTBE in the downstream direction is occurring. Biannual collection of surface water samples for 26 years is assumed for cost comparison purposes.

6.4.1.2 Implementability

Alternative 1 is not technically difficult to implement. Installation of LTM and POC wells and periodic groundwater and surface water monitoring are standard procedures. Long-term management efforts would be required to ensure proper sampling procedures are followed. Periodic site reviews should be conducted to confirm the adequacy and completeness of LTM data and to verify the effectiveness of this remediation approach. There may also be administrative concerns associated with long-term enforcement of groundwater use restrictions. Future land use within the source area may be impacted by leaving contaminated soil and groundwater in place. Regulators and the public will have to be informed of the benefits and limitations of the intrinsic remediation option, but educational programs are not difficult to implement.

6.4.1.3 Cost

The cost of Alternative 1 is summarized in Table 6.3. Capital costs are limited to the construction of three new POC wells and one new LTM well. Included in the $250,076 total present worth cost estimate for Alternative 1 are the costs of maintaining institutional controls and long-term groundwater monitoring for a total of 56 years. Cost calculations are contained in Appendix F.

6.4.2 Alternative 2 - SVE and Bioventing/Biosparging in Source Area, Intrinsic Remediation, and Institutional Controls with Long-Term Groundwater Monitoring

6.4.2.1 Effectiveness

Addition of oxygen to vadose zone soil in the source areas will stimulate biodegradation of BTEX compounds and reduce the mass of BTEX that dissolves into site groundwater. The application of bioventing for one year at the Patrick AFB, Florida BX gasoline station resulted in a 95 percent reduction in the total BTEX in soil residuals impacting groundwater. Given the Bioplume II model results discussed in Section 5.6, reduction in the mass of BTEX compounds that dissolve into groundwater should further limit plume migration and ultimately reduce the extent of the dissolved BTEX plume. As with Alternative 1, this alternative would require long-term land use restrictions, as well as enforcement of health and safety plans to reduce risks to workers during installation of the bioventing system and installation and monitoring of LTM and POC wells.

Alternative 2 should provide reliable, continuous protection with little risk from temporary system failures. This alternative also complies with the program goals because intrinsic remediation remains the predominant remedial method for the site. However, this remedial alternative will result in the generation of additional drill cuttings and other wastes requiring treatment and/or disposal.

It is assumed that dissolved benzene and total BTEX concentrations will exceed applicable state guidelines for no further action (Table 6.1) throughout the plume for approximately 10 years under Alternative 2. An additional 4 years of annual groundwater monitoring will be required to ensure that intrinsic remediation has uniformly reduced all BTEX compounds to levels below state guidelines. Surface water monitoring in the drainage ditch would be desirable to ensure that applicable water quality standards are not exceeded.

6.4.2.2 Implementability

Installing and operating a bioventing system to reduce source area BTEX concentrations at Site 56 will present additional implementability concerns. Installation involves shallow excavation for well installation, piping, and manifold connections. Implementation in and around Site 56 could be disruptive to fueling operations. Bioventing equipment is readily available and the technology used to construct the system is proven and reliable. The technical and administrative implementability concerns associated with the intrinsic remediation and LTM component of this remedial

TABLE 6.3
ALTERNATIVE 1 - COST ESTIMATE
SITE 56
INTRINSIC REMEDIATION TS
MACDILL AIR FORCE BASE, FLORIDA

Capital Costs	Cost
Design/Construct Three POC Wells and One LTM Well	$9,833
Operation, Maintenance and Monitoring Costs (Annual)	**Annual Cost**
Conduct Biannual Groundwater Monitoring of 8 Wells (56 years) and Surface Water Sampling at 3 Stations (26 years)	$6,270
Maintain Institutional Controls/Public Education (56 years)	$5,000
Project Management and Reporting (56 years)	$8,750
Present Worth of Alternative 1 [a/]	**$250,076**

[a/] Based on an annual inflation (discount) factor of 5 percent.

NOTE: Costs assume that well installation and LTM is performed by Tampa-area personnel.

alternative are similar to those discussed in Alternative 1. Installation and operation of a full-scale bioventing system would require an increased commitment of man-hours and other resources to maintain and monitor the system. Public acceptance of this alternative is expected to be more positive than Alternative 1 because source removal actions would be implemented.

6.4.2.3 Cost

The estimated capital and operating costs of Alternative 2 are shown in Table 6.4. The total present worth cost of Alternative 2 is $348,111. The cost of Alternative 2 will be increased from the costs of Alternative 1 by the addition of bioventing. Costs for installation of the bioventing system are based on the conceptual design discussed in Section 6.3.2. It is assumed that the bioventing system will operate for a total of 3 years. Annual LTM would continue for 14 years to ensure that intrinsic remediation is reducing BTEX concentrations below RAOs throughout the plume and in the drainage ditch, and to verify that contamination above RAOs does not reach the POC wells or the ditch.

6.4.3 Alternative 3-Groundwater Extraction; SVE and Bioventing/Biosparging in Source Areas; Intrinsic Remediation; and Institutional Controls with Long-Term Groundwater Monitoring

6.4.3.1 Effectiveness

This alternative is identical to Alternative 2, with the addition of limited groundwater extraction at and immediately downgradient from the source area. The effectiveness of bioventing, intrinsic remediation, institutional controls, and LTM were described in Section 6.4.2. Groundwater extraction and treatment is an established technology for reducing source contamination and controlling plume migration. The goal of groundwater extraction would be to target the removal of dissolved BTEX so that intrinsic remediation of contaminants beyond the source area could proceed without the introduction of additional contaminant concentrations. The models 56_C and 56_D suggest that reduction of the source by bioventing would expedite the decrease in the size of the BTEX plume.

A two-well groundwater extraction system would be constructed along the plume centerline between monitoring wells MD56-MW06 and MD56-MW10. This is the most contaminated area of the site, and is the primary source of BTEX that is migrating downgradient. Slug testing at Sites 56 and 32 has indicated that a 2-gpm per well extraction rate would capture the portion of the plume containing the highest BTEX concentrations. The resulting influx of clean groundwater also would accelerate the partitioning of BTEX from saturated soils. Results of simple batch-flushing calculations (Appendix D) indicate that this pumping should reduce source area dissolved BTEX levels to below applicable guidelines (1,000 µg/L total BTEX and 500 µg/L benzene per Table 6.1) within approximately 5 to 6 years.

TABLE 6.4
ALTERNATIVE 2 - COST ESTIMATE
SITE 56
INTRINSIC REMEDIATION
MACDILL AIR FORCE BASE, FLORIDA

Capital Costs	Cost
Design/Construct Three POC Wells and One LTM Well	$9,833
Design/Construct Bioventing System, Including Manifolding and Blowers (assuming 1 horizontal well 80 feet long)	$70,000
Operation, Maintenance and Monitoring Costs (Annual)	**Annual Cost**
Operate and Maintain Bioventing System (3 years)	$25,860
Conduct Annual Monitoring of 8 wells and 3 Surface Water Stations (14 years)	$6,270
Maintain Institutional Controls/Public Education (14 years)	$5,000
Project Management and Reporting (14 years)	$8,750
Present Worth of Alternative 2 [a/]	**$348,111** [b/]

[a/] Based on an annual inflation (discount) factor of 5 percent.
[b/] Cost could be reduced by $10,400 to $337,711 if weekly bioventing system checks were performed by Base personnel.
NOTE: Costs assume that LTM and bioventing system maintenance are performed by Tampa-area personnel.

Extracted groundwater would likely require treatment prior to discharge. Air stripping is an effective technology for the removal of volatile constituents from water. Activated carbon treatment was investigated, but was determined to not be cost competitive with air stripping due to the relatively high volume of carbon that would be required throughout the duration of the extraction system operation. A portable air stripper could be set up onsite, or the extracted groundwater could be piped to an operating air stripper at the nearby Site 38. It is likely that air emissions controls would be required for the air stripper offgas, at least during the initial extraction phase when extracted BTEX concentrations are highest. A surface water discharge or reinjection permit would likely be required for the treated groundwater.

Alternative 3 should provide reliable, continuous protection with little risk from temporary system failures. This alternative also complies with program goals because intrinsic remediation remains an important remediation method for the site. However, this remedial alternative will result in the generation of drill cuttings, groundwater, and other wastes requiring treatment and/or disposal.

It is assumed for cost comparison purposes that dissolved BTEX will exceed applicable guidelines throughout the plume for approximately 6 years under Alternative 3. Furthermore, it is assumed that sampling will be performed annually at a total of eight LTM and POC wells and three surface water stations in the drainage ditch. Four additional annual groundwater sampling rounds will be required to demonstrate that intrinsic remediation has uniformly reduced all BTEX concentrations to levels below regulatory criteria, resulting in a total of 10 years of LTM.

6.4.3.2 Implementability

The implementability considerations described for bioventing in Section 6.4.2.2 would also be applicable to Alternative 3. Installing and operating a groundwater extraction system to reduce source area dissolved BTEX concentrations in groundwater at Site 56 could present additional implementability concerns if the service station is operating. Installation involves standard drilling practices for wells, downhole pump installation, limited shallow excavation for piping connections and electrical conduit, and installation of an air stripper. Groundwater extraction pumps and air stripping equipment are readily available, and the technology used to construct the system is proven and reliable. Discharge of treated water to the Base sanitary sewer system should not present significant implementability problems. The technical and administrative implementability concerns associated with the intrinsic remediation and LTM component of this remedial alternative are similar to those discussed for Alternative 1 (Section 6.4.1.2). Installation and operation of a groundwater extraction system would require a significant commitment of man-hours and other resources to maintain and monitor the system.

6.4.3.3 Cost

The estimated capital and operating costs of Alternative 3 are shown in Table 6.5. The total present worth cost of Alternative 3 is $488,305. The cost of Alternative 3 is increased from the costs of Alternative 2 by the addition of groundwater extraction and treatment. It is assumed that the groundwater extraction system would operate for 5

TABLE 6.5
ALTERNATIVE 3 - COST ESTIMATE
SITE 56
INTRINSIC REMEDIATION TS
MACDILL AIR FORCE BASE, FLORIDA

Capital Costs	Cost
Design/Construct 4 LTM/POC Wells	$9,833
Design/Construct Groundwater Extraction System, Including 2 Extraction Wells, Submersible Pumps, Piping, and Air Stripper Treatment System	$56,363
Design/Construct Bioventing System	$70,000
Water Discharge Permitting	$5,000
Operation, Maintenance and Monitoring Costs	**Annual Cost**
Operate and Maintain Bioventing and Groundwater Extraction Systems (3 years)	$24,464
Operate and Maintain Groundwater Extraction System (2 years)	$20,299
Monthly and Annual Performance Reports (3 years) (Bioventing/GW Extraction)	$10,310
Monthly and Annual Performance Reports (2 years) (GW Extraction)	$8,470
Annual Testing of Bioventing System Performance (3 years)	$15,435
Conduct Annual Sampling at 8 Wells and 3 Surface Water Stations (10 years)	$6,270
Maintain Institutional Controls/Public Education (cost per event) (10 years)	$5,000
LTM Project Management and Reporting (cost per event) (10 years)	$8,750
Present Worth of Alternative 3 [a/]	**$485,829** [b/]

[a/] Based on an annual inflation (discount) factor of 5 percent.
[b/] Cost could be reduced if weekly system checks were performed by Base personnel.

NOTE: Costs assume that LTM and bioventing/groundwater extraction system maintenance are performed by Tampa-area personnel

years after installation. LTM would continue for 5 years after system shutdown to ensure that intrinsic remediation is reducing remaining BTEX concentrations below regulatory criteria throughout the plume and to verify that excessive contamination does not reach the POC wells or the ditch.

6.4.4 Alternative 4- Soil Excavation and *Ex Situ* Treatment, Intrinsic Remediation, and Institutional Controls with Long-Term Groundwater and Surface Water Monitoring

6.4.4.1 Effectiveness

The effectiveness of intrinsic remediation and institutional controls with LTM was discussed for Alternative 1 in Section 6.4.1.1. Excavation and *ex situ* treatment of contaminated vadose zone soils would eliminate the possibility of additional contamination from these soils migrating into the groundwater. Given the Bioplume II model results discussed in Section 5.6, reduction in the mass of BTEX compounds that dissolve into groundwater should further limit plume migration and ultimately reduce the extent of the dissolved BTEX plume. There is a greater risk of exposure to fuel hydrocarbons to workers during excavation of the contaminated soils. Therefore, this alternative would require enforcement of health and safety plans to reduce risks from exposure to contaminated soils and, possibly, shallow groundwater, during the excavation process.

Alternative 4 should provide reliable, continuous protection with no risk from system failures due to the lack of mechanical systems. The alternative does not comply with program goals to the extent that the other three alternatives do due to the generation of an estimated 1,200 cubic yards of soil requiring treatment and/or disposal.

As with Alternative 2, it is assumed that dissolved benzene and total BTEX will exceed applicable state groundwater quality guidelines throughout the plume for approximately 10 years under Alternative 4. An additional 4 years of groundwater monitoring will be required to ensure that intrinsic remediation has uniformly reduced all BTEX compounds to levels below state guidelines.

6.4.2.2 Implementability

Excavation and *ex situ* treatment of the hydrocarbon contaminated soils is a technically feasible alternative if it is implemented during removal of the USTs after closure of the service station. If the service station is operational, then this option would severely disrupt fueling operations, and would probably not be implementable without a temporary shutdown of the service station. The technical and administrative implementability concerns associated with the intrinsic remediation and LTM component of this remedial alternative are similar to those discussed for Alternative 1 in Section 6.1.2.2.

6.4.2.3 Cost

The estimated capital and operating costs of Alternative 4 are shown in Table 6.6. The total present worth cost of Alternative 4 is $333,000. The cost of Alternative 4 would be increased from the costs of Alternative 1 by the addition of soil excavation and offsite treatment/disposal. Annual LTM would be performed for 14 years to ensure that intrinsic remediation is reducing BTEX concentrations below applicable guidelines throughout the plume and to verify that excessive contamination does not reach the POC wells or the ditch.

6.5 RECOMMENDED REMEDIAL APPROACH

Four remedial alternatives have been evaluated for remediation of the shallow groundwater at Site 56. Components of the alternatives evaluated include groundwater extraction, soil vapor extraction, bioventing, intrinsic remediation with LTM, institutional controls, and soil excavation/*ex situ* treatment. Table 6.7 summarizes the results of the evaluation based upon effectiveness, implementability, and cost criteria.

Alternative 1 makes maximum use of intrinsic remediation mechanisms to reduce plume migration and toxicity. Alternatives 2, 3, and 4 would provide additional protection against further plume migration, but would still rely on intrinsic remediation mechanisms to reduce plume toxicity in the downgradient portions of the affected area. Implementation of Alternative 2, 3, or 4 would decrease the time frame for remediation, but would require a greater capital expenditure.

Alternatives 1, 2, and 3 are readily implementable, and would effectively reduce potential hydrocarbon migration and toxicity. Alternative 4 would be implementable if the service station is closed, allowing excavation activities to proceed. Each of the alternatives should be acceptable to the public and regulatory agencies because they are protective of human health and the environment and reduce soil and groundwater contamination to regulatory cleanup levels. However, Alternatives 2 and 4 provide the best combination of regulatory and public acceptance at the most reasonable cost. Implementation of any of the alternatives will require land use and groundwater/surface water use controls to be enforced for between 10 and 56 years, depending on the alternative selected and its effectiveness. Groundwater and surface water monitoring would be required for the same period.

On the basis of this evaluation, the Air Force recommends Alternative 2 as achieving the best combination of risk reduction and cost effectiveness. If Alternative 2 can be implemented and a bioventing system installed in 1996, the source removal process could be well underway by the time that Alternative 4 could be implemented. However, if bioventing implementation is delayed, and if removal of the pavement at the site is planned in conjunction with closure of the service station, Alternative 4 may be most appropriate.

Other potential chemicals of concern at Site 56 include polynuclear aromatic hydrocarbons (PAHs), lead, and MTBE. PAHs are biodegradable, and concentrations of these compounds could also be reduced by bioventing, thereby decreasing the mass of these compounds leaching into the groundwater. The heaviest molecular weight

TABLE 6.6
ALTERNATIVE 4 - COST ESTIMATE
SITE 56
INTRINSIC REMEDIATION TS
MACDILL AIR FORCE BASE, FLORIDA

Capital Costs	Cost
Design/Construct Three POC Wells and One LTM Well	$9,833
Perform Soil Excavation, Backfill, and Repaving [a/]	$125,000
Operation, Maintenance and Monitoring Costs (Annual)	**Annual Cost**
Conduct Annual Monitoring of 8 Wells and 3 Surface Water Stations (14 years)	$6,270
Maintain Institutional Controls/Public Education (14 years)	$5,000
Project Management and Reporting (14 years)	$8,750
Present Worth of Alternative 4 [b/]	**$333,000**

a/ Includes soil disposal at off-Base thermal treatment facility.
b/ Based on an annual inflation (discount) factor of 5 percent.

TABLE 6.7
SUMMARY OF REMEDIAL ALTERNATIVES EVALUATION
GROUNDWATER REMEDIATION
SITE 56
INSTRINSIC REMEDIATION TS
MACDILL AIR FORCE BASE, FLORIDA

Remedial Alternative	Effectiveness	Implementability	Present Worth Cost Estimate
Alternative 1			
- Intrinsic Remediation - Long-Term Monitoring - Institutional Conrols	Contaminant mass, volume, and toxicity will be significantly reduced and plume migration should be halted. Groundwater and surface water quality guidelines for BTEX not likely to be exceeded at POC wells or in drainage ditch.	Readily implementable. Long-term management, groundwater use controls, and monitoring required for an estimated 56 years. Minimal exposure of site workers if excavation is carefully controlled in source area. If water quality guidelines are exceeded at POC wells or in drainage ditch, additional remedial work may be required.	$250,000
Alternative 2			
- Bioventing/Biosparging - Soil Vapor Extraction (SVE) - Intrinsic Remediation - Long-Term Monitoring - Institutional Controls	Similar to Alternative 1, with the addition of a SVE/bioventing system (with or without biosparging) to address residual LNAPL in soil. Contaminant mass, volume, and toxicity will be reduced more rapidly than in Alternative 1. Less likely that groundwater or surface water quality guidelines will be exceeded at POC wells or in drainage ditch.	Readily implementable. Installation of a bioventing system should pose no problems. Bioventing estimated to continue for 3 years. Long-term site management, groundwater controls, and monitoring required for an estimated 14 years. If water quality standards are exceeded at POC wells or in drainage ditch, additional remedial work may be required.	$348,000
Alternative 3			$486,000
- Groundwater Extraction - Bioventing/Biosparging - Intrinsic Remediation - Long-Term Monitoring	Similar to Alternative 2, with the addition of a groundwater extraction system to remove dissolved BTEX in groundwater. Contaminant mass, volume, and toxicity will be reduced more rapidly than in Alternatives 1 and 2. Less likely that groundwater or surface water quality guidelines will be exceeded at POC wells or in drainage ditch compared to Alternatives 1 and 2.	Readily implementable, but would require additional disruption of service station operations. Groundwater extraction estimated to continue for 5 years. Long-term management, groundwater controls, and monitoring required for an estimated 10 years. If water quality standards are exceeded at POC wells or in drainage ditch, additional remedial work may be required.	
Alternative 4			$333,000
- Soil Excavation - Intrinsic Remediation - Long-Term Monitoring	Similar to Alternative 2. Contaminant mass, volume, and toxicity will be reduced at a similar rate to Alternative 2. Less likely that groundwater or surface water quality guidelines will be exceeded at POC wells or in drainage ditch than with Alternative 1.	Readily implementable if service station closes, allowing significant disturbance of the site. Not readily implementable if service station remains operational. Long-term management, groundwater controls, and monitoring required for an estimated 14 years. If water quality standards are exceeded at POC wells or in drainage ditch, additional remedial work may be required.	

PAHs in gasoline are naphthalenes, which can be biodegraded more rapidly than higher molecular weight PAHs such as pyrenes. Therefore, although the rate of naphthalene removal would be slower than that of BTEX, concentrations of these constituents can still be reduced substantially within a period of a few years. Lead would not be biodegraded by the bioventing system; however, elevated lead concentrations in groundwater currently appear to be restricted to the source area as a result of the low solubility of this constituent, and significant downgradient migration may not occur. MTBE is relatively resistant to biodegradation, and therefore would also not be substantially affected by bioventing. It is very soluble and not readily sorbed, so it dilutes relatively rapidly if ample groundwater movement exists. The distribution of MTBE depicted on Figure 2-20 of BVWS (1995) suggests that the detections of this compound near the drainage ditch may be sourced primarily at Site 32 rather than Site 56.

The final evaluation criterion used to compare each of the two remedial alternatives was cost. It is the opinion of the Air Force that the additional cost of Alternative 2 over Alternative 1 is justified by the significant decrease in remediation time resulting from implementation of source removal activities. The substantial additional costs required to implement Alternative 3 (groundwater extraction) would not significantly shorten remediation times, and therefore this alternative is not recommended. The projected present worth costs to implement Alternatives 2 and 4 are roughly equivalent; therefore, the choice between these alternatives may be governed by the future land use at this site. As described in Section 6.3.2, an alternative remedial option for Alternative 2 would be to replace bioventing with biosparging. In either case, the performance of soil vapor extraction during the initial 60 to 90 days is highly recommended. Regardless of the alternative selected, removal of easily excavatable contaminated soils should be performed when the USTs are eventually removed. If groundwater and surface water monitoring indicates that, despite the implementation of Alternative 2, levels of contamination discharging to the ditch are unacceptably high, then additional remedial measures, such as installation of an air sparging curtain along the upgradient bank of the ditch, could be implemented.

SECTION 7

LONG-TERM MONITORING PLAN

7.1 OVERVIEW

In keeping with the requirements of the preferred remedial alternative for Site 56 (bioventing in source area with intrinsic remediation and LTM), a long-term groundwater and surface water monitoring plan must be developed. The purpose of this component of the preferred remedial alternative for the site is to assess site conditions over time, confirm the effectiveness of naturally occurring processes at reducing contaminant mass and minimizing contaminant migration, and evaluate the need for additional remediation. The results of LTM can be used to validate model predictions and to assure compliance with regulatory guidelines at the POC.

The LTM plan consists of identifying the location of two separate groundwater monitoring networks and a surface water monitoring network, and developing a groundwater/surface water sampling and analysis strategy to demonstrate attainment of site-specific remediation goals (Table 6.1) and to verify the predictions of the Bioplume II model developed for Site 56. The strategy described in this section is designed to monitor plume migration over time and to verify that intrinsic remediation is occurring at rates sufficient to protect potential receptors. In the event that data collected under this LTM program indicate that naturally occurring processes are insufficient to protect human health and the environment, contingency controls to augment the beneficial effects of intrinsic remediation would be necessary.

7.2 MONITORING NETWORKS

7.2.1 *Groundwater Monitoring*

Two separate sets of wells will be utilized at the site as part of the intrinsic remediation with LTM remedial alternative. The first set will consist of five LTM wells located in, upgradient, and downgradient of the observed BTEX plume to verify the results of the Bioplume II modeling effort and to ensure that natural attenuation is occurring at rates sufficient to minimize plume expansion (i.e., meet the monitoring-only state concentration goals listed in Table 6.1). This network of wells will consist of four existing wells and one proposed well screened within the shallow aquifer to provide short-term confirmation and verification of the quantitative groundwater modeling results. The second set of three groundwater monitoring wells will be located along a line perpendicular to the direction of groundwater flow approximately 450 feet downgradient from the March 1995 plume front (the POC for this demonstration project). The purpose of the POC wells is to verify that no BTEX concentrations exceeding state groundwater quality guidelines migrate beyond the

area under institutional control. Model results suggest that the plume front should migrate less than 450 feet downgradient from the March 1995 plume front. This network will consist of three groundwater monitoring wells screened across the upper 8 feet of the shallow aquifer. The LTM and POC wells will be sampled for analysis of the parameters listed in Tables 7.1 and 7.2, respectively.

7.2.1.1 Long-Term Monitoring Wells

At five locations, groundwater wells within, upgradient from, and downgradient from the existing BTEX contaminant plume will be used to monitor the effectiveness of intrinsic remediation in reducing total contaminant mass and minimizing contaminant migration at Site 56. One well upgradient from the existing plume (MD56-MW04) will be monitored. The remaining four LTM wells are located within the plume along its axis (MD56-MW06 and MD32-MW10), and downgradient from the plume along the anticipated migration pathway (MD32-MW04 and one well to be installed in the uppermost 8 feet of the saturated zone northwest of the drainage ditch). The locations of these wells are shown on Figure 7.1. Monitoring of MD32-MW04 will enable assessment of contaminant concentrations entering the drainage ditch, assuming that groundwater discharge to the ditch occurs. Installation of one new well approximately 180 feet northwest of the ditch will enable assessment of whether contamination is migrating beneath the ditch.

This network will supplement the POC wells to provide early confirmation of model predictions and to allow additional response time if necessary. The new LTM well will be constructed with a 10-foot screen, with approximately 8 feet of the screen below the water table. All LTM wells will be sampled and analyzed for the parameters listed in Table 7.1 to verify the effectiveness of the intrinsic remediation remedial alternative.

7.2.2 Point-of-Compliance Wells

Three POC monitoring wells will be installed approximately 450 feet downgradient from the leading edge of the existing BTEX plume (Figure 7.1). The purpose of the POC wells is to verify that no contaminated groundwater exceeding state guidelines for G-II groundwater at petroleum-contaminated sites migrates beyond the area under institutional control. Although model results suggest that the contaminant plume will not migrate beyond this location at concentrations exceeding applicable guidelines, these POC wells are the technical mechanisms used to demonstrate protection of human health and the environment and compliance with site-specific numerical remediation goals. These wells will be installed and monitored for the parameters listed in Table 7.2 to assure that the selected remedy is providing the anticipated level of risk reduction and remediation at the site.

As with the LTM wells, the POC wells also will be screened in the same hydrogeologic unit as the contaminant plume. Data presented in this report concerning the nature and extent of contamination at the site suggest that a 10-foot screen with approximately 8 feet of screen below the groundwater surface will be sufficient to intercept the contaminant plume at this site. Figure 7.2 is a proposed groundwater monitoring well completion diagram for both the LTM wells and the POC wells.

TABLE 7.1
LONG-TERM GROUNDWATER MONITORING ANALYTICAL PROTOCOL
SITE 56
INTRINSIC REMEDIATION TS
MACDILL AIR FORCE BASE, FLORIDA

Analyte	Method/Reference	Comments	Data Use	Recommended Frequency of Analysis	Sample Volume, Sample Container, Sample Preservation	Field or Fixed-Base Laboratory
Ferrous Iron (Fe^{2+})	Colorimetric A3500-Fe D	Field only.	Elevated ferrous iron concentrations may be indicative of the anaerobic biodegradation process of iron reduction.	Every Second Year for 14 Years.	Collect 100 milliliters (mL) of water in a glass container; acidify with hydrochloric acid per method.	Field
Ferrous Iron (Fe^{2+})	Colorimetric HACH 25140-25	Alternate method; field only.	Same as above.	Every Second Year for 14 Years.	Collect 100 mL of water in a glass container.	Field
Temperature	E170.1	Field only.	Metabolism rates for microorganisms depend on temperature.	Every Year for 14 Years.	N/A	Field
Dissolved Oxygen	Dissolved oxygen meter	Refer to Method A4500 for a comparable laboratory procedure.	The oxygen concentration is a data input to the Bioplume II model; concentrations less than 1 mg/L generally indicate an anaerobic pathway.	Every Second Year for 14 Years.	Collect 300 mL of water in biochemical oxygen demand bottles; analyze immediately; alternately, measure dissolved oxygen in situ.	Field
pH	E150.1/SW9040, direct reading meter	Protocols/Handbook methods[a/].	Aerobic and anaerobic processes are pH-sensitive.	Every Year for 14 Years.	Collect 100–250 mL of water in a glass or plastic container; analyze immediately.	Field
Conductivity	E120.1/SW9050, direct reading meter	Protocols/Handbook methods.	General water quality parameter used as a marker to verify that site samples are obtained from the same groundwater system.	Every Year for 14 Years.	Collect 100–250 mL of water in a glass or plastic container.	Field
Nitrate (NO_3^{-1})	IC method E300 or method SW9056; colorimetric, method E353.2	Method E300 is a Handbook method; method SW9056 is an equivalent procedure.	Substrate for microbial respiration if oxygen is depleted.	Every Second Year for 14 Years.	Collect up to 40 mL of water in a glass or plastic container; cool to 4°C; analyze within 48 hours.	Fixed-base

TABLE 7.1 (Continued)
LONG-TERM GROUNDWATER MONITORING ANALYTICAL PROTOCOL
SITE 56
INTRINSIC REMEDIATION TS
MACDILL AIR FORCE BASE, FLORIDA

Analyte	Method/Reference	Comments	Data Use	Recommended Frequency of Analysis	Sample Volume, Sample Container, Sample Preservation	Field or Fixed-Base Laboratory
Sulfate (SO_4^{2-})	IC method E300 or method SW9056 or HACH SulfaVer 4 method	Method E300 is a Handbook method; method SW9056 is an equivalent procedure. HACH method is Photometric.	Substrate for anaerobic microbial respiration.	Every Second Year for 14 Years.	Collect up to 40 mL of water in a glass or plastic container; cool to 4°C.	Fixed-base or field (for HACH method)
Redox potential	A2580 B	Measurements are made with electrodes; results are displayed on a meter; samples should be protected from exposure to atmospheric oxygen.	The redox potential of groundwater influences and is influenced by biologically mediated reactions; the redox potential of groundwater may range from more than 200 mV to less than -400 mV.	Every Second Year for 14 Years.	Collect 100–250 mL of water in a glass container, filling container from bottom; analyze immediately.	Field
Methane	RSKSOP-114 modified to analyze water samples for methane by headspace sampling with dual thermal conductivity and flame ionization detection.	Method published and used by the USEPA Robert S. Kerr Laboratory.	The presence of methane suggests BTEX degradation via an anaerobic pathway utilizing carbon dioxide (carbonate) as the electron acceptor (methanogenesis). The presence of ethane and ethene suggest that cometabolism of vinyl chloride is occurring.	Every Second Year for 14 Years.	Collect water samples in 40 mL volatile organic analysis (VOA) vials with butyl gray/Teflon-lined caps (zero headspace); cool to 4°C.	Fixed-base
Aromatic hydrocarbons (BTEX)	Purge and trap GC method SW8020.	Handbook method; analysis may be extended to higher molecular weight alkylbenzenes.	BTEX is the primary target analyte for monitoring natural attenuation; BTEX concentrations must also be measured for regulatory compliance.	Every Year for 14 Years.	Collect water samples in a 40 mL VOA vial with zero headspace; cool to 4°C; add hydrochloric acid to pH $\leq$2.	Fixed-base

TABLE 7.1 (Continued)
LONG-TERM GROUNDWATER MONITORING ANALYTICAL PROTOCOL
SITE 56
INTRINSIC REMEDIATION TS
MACDILL AIR FORCE BASE, FLORIDA

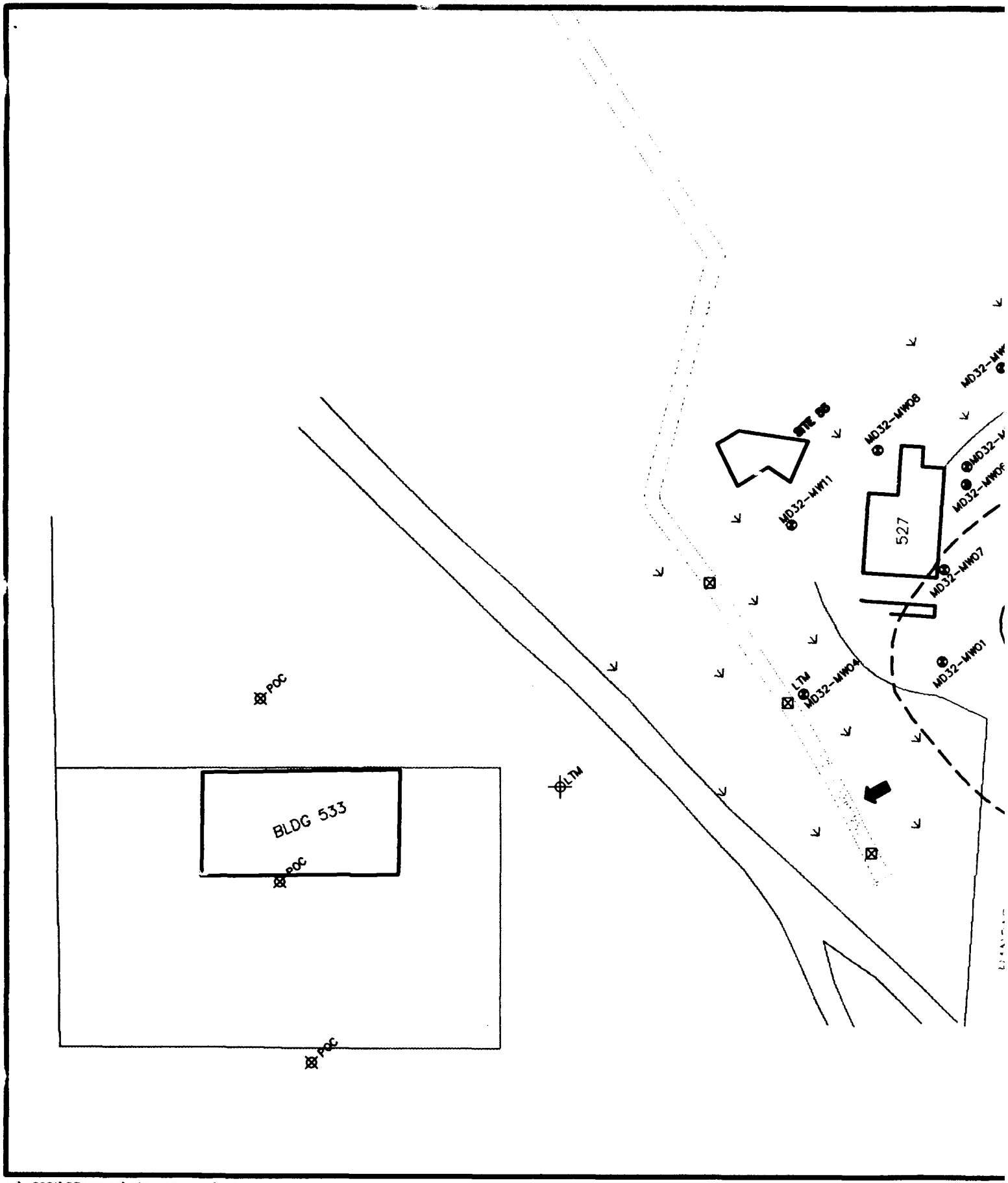
Analyte	Method/Reference	Comments	Data Use	Recommended Frequency of Analysis	Sample Volume, Sample Container, Sample Preservation	Field or Fixed-Base Laboratory
Lead	E239.2, Standard Method 304	Method presented in DEP62-770.	Regulatory Compliance.	Every year for 14 years. Discontinue if levels below 50 µg/L.	Collect water sample in 500-ml polyethylene bottle; cool to 4°C; add nitric acid to pH <2.	Fixed-base
MTBE	E602 or SW5030/8020	Method presented in DEP62-770.	Regulatory Compliance.	Every year for 14 years.	Collect water sample in 40-ml VOA vial with zero headspace; cool to 4°C; add hydrochloric acid to pH	Fixed-base

a/ Protocol methods are presented by Wiedemeier *et al.* (1995).

TABLE 7.2
POINT-OF-COMPLIANCE GROUNDWATER MONITORING ANALYTICAL PROTOCOL
SITE 56
INTRINSIC REMEDIATION TS
MACDILL AIR FORCE BASE, FLORIDA

Analyte	Method/Reference	Comments	Data Use	Recommended Frequency of Analysis	Sample Volume, Sample Container, Sample Preservation	Field or Fixed-Base Laboratory
Temperature	E170.1	Field only.	Well development and purging.	Every Year for 14 Years.	N/A	Field
Dissolved Oxygen	Dissolved oxygen meter	Refer to method A4500 for a comparable laboratory procedure.	The oxygen concentration is a data input to the Bioplume model; concentrations less than 1 mg/L generally indicate an anaerobic pathway.	Every Second Year for 14 Years.	Collect 300 mL of water in biochemical oxygen demand bottles; analyze immediately; alternately, measure dissolved oxygen *in situ*.	Field
pH	E150.1/SW9040, direct reading meter	Protocols/Handbook methods[a].	Aerobic and anaerobic processes are pH-sensitive.	Every Year for 14 Years.	Collect 100–250 mL of water in a glass or plastic container; analyze immediately.	Field
Conductivity	E120.1/SW9050, direct reading meter	Protocols/Handbook methods.	General water quality parameter used as a marker to verify that site samples are obtained from *the same groundwater system.*	Every Year for 14 Years.	Collect 100–250 mL of water in a glass or plastic container.	Field
Redox potential	A2580 B	Measurements are made with electrodes; results are displayed on a meter; samples should be protected from exposure to atmospheric oxygen.	The redox potential of groundwater influences and is influenced by biologically mediated reactions; the redox potential of groundwater may range from more than 200 mV to less than -400 mV.	Every Second Year for 14 Years.	Collect 100–250 mL of water in a glass container, filling container from bottom; analyze immediately.	Field
Aromatic hydrocarbons (BTEX)	Purge and trap GC method SW8020	Handbook method; analysis may be extended to higher molecular weight alkylbenzenes.	BTEX is the primary target analyte for monitoring natural attenuation; BTEX concentrations must also be measured for regulatory compliance.	Every Year for 14 Years.	Collect water samples in a 40 mL VOA vial with zero headspace; cool to 4°C; add hydrochloric acid to pH $\leq$2.	Fixed-base
Lead	E239.2, Standard Method 304	Method presented in DEP62-770.	Regulatory Compliance.	Every year for 14 years.	Collect water sample in 500-ml polyethylene bottle; cool to 4°C; add nitric acid to pH < 2.	Fixed-base

[a] Protocol methods are presented by Wiedemeier *et al.* (1995).



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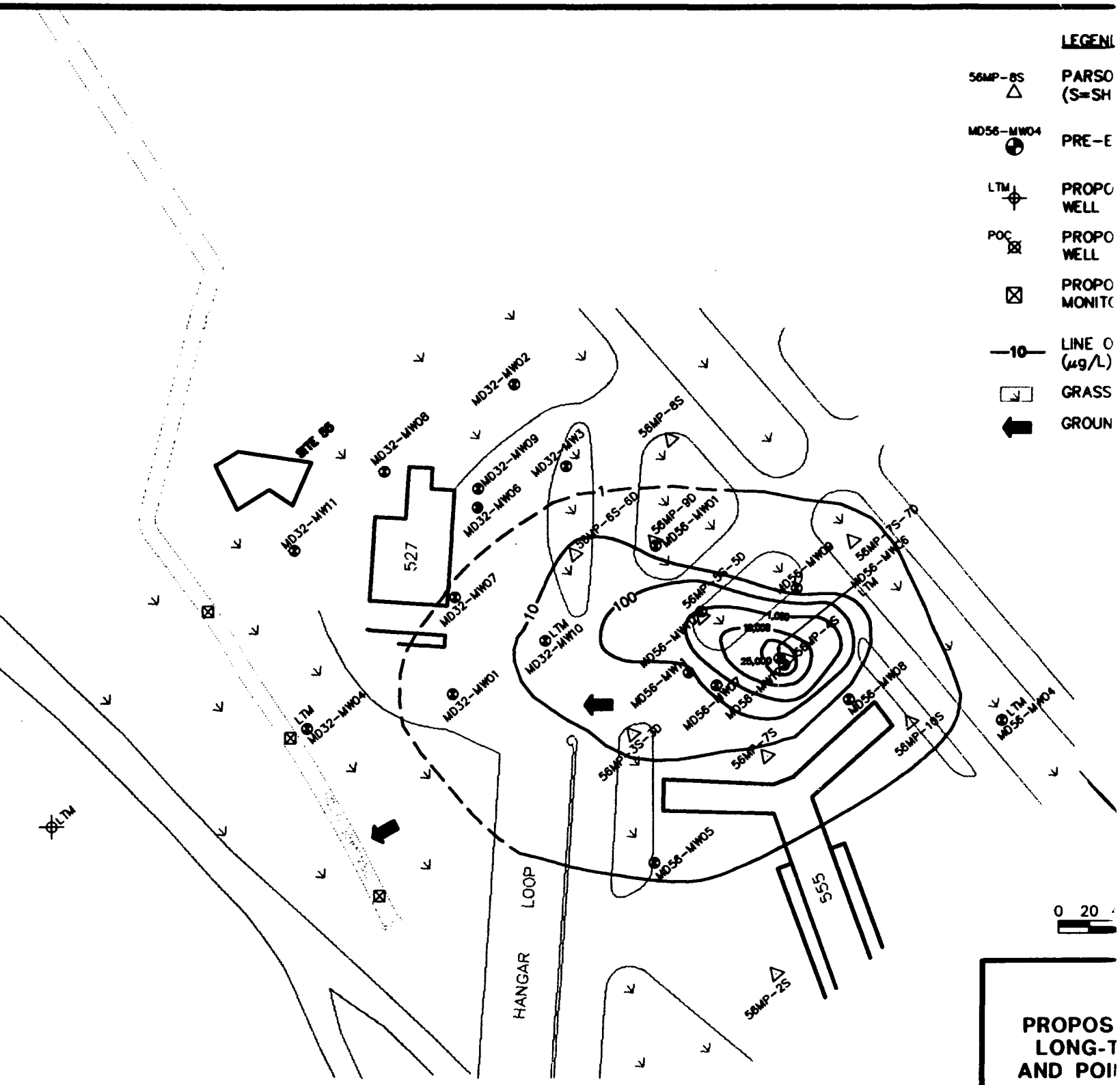
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56MP-8S
PARSO
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PRE-E
LTM
PROPO
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PROPO
MONITO
10
LINE O
(µg/L)
GRASS
GROUN
MD32-MW02
MD32-MW08
MD32-MW09
MD32-MW3
56MP-8S
MD32-MW11
MD32-MW6
56MP-6S-6D
56MP-9D
MD56-MW01
56MP-7S-7D
527
MD32-MW07
56MP-5S-5D
MD56-MW09
MD56-MW06
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56MP-4S
MD56-MW02
MD56-MW07
MD56-MW10
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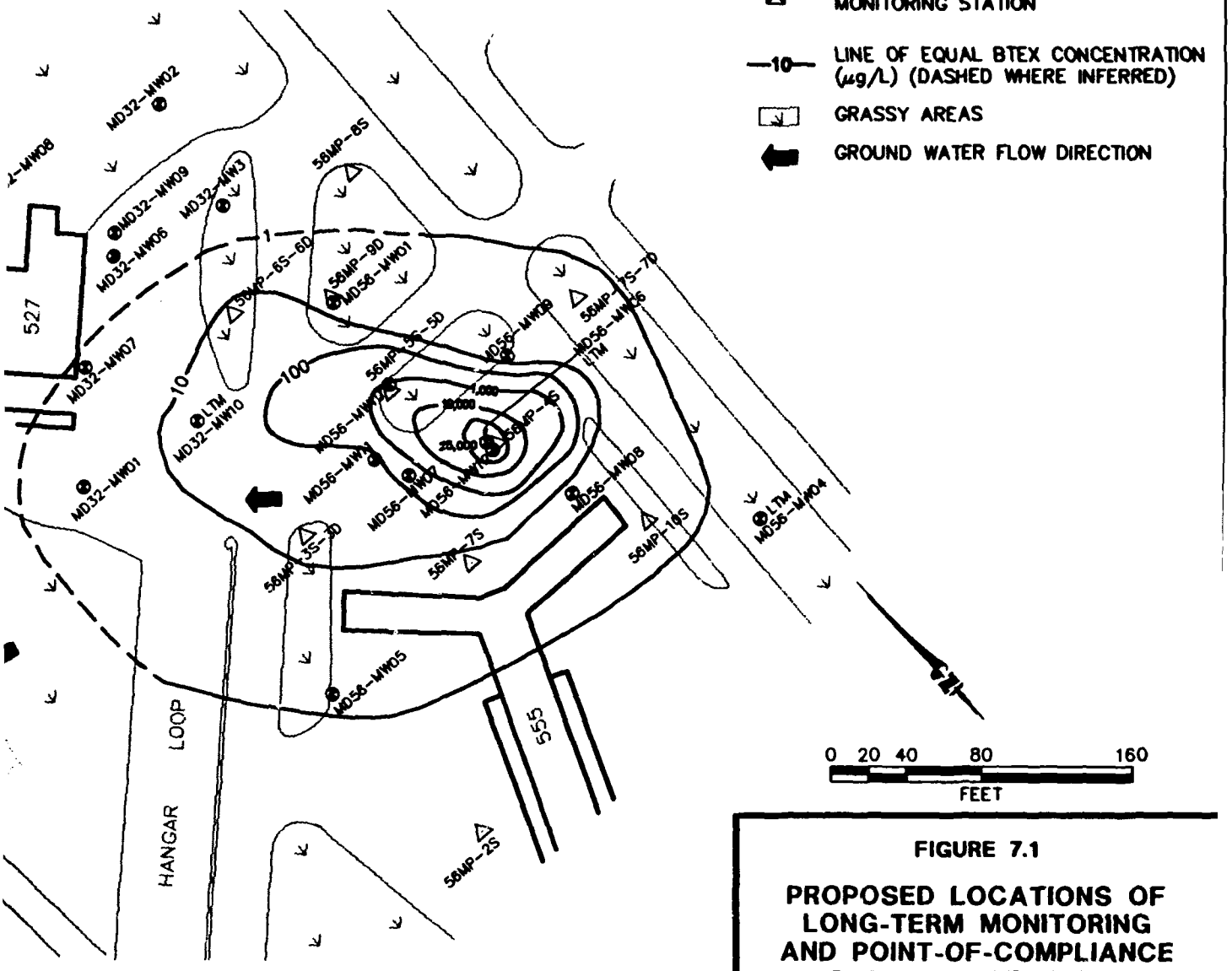

FIGURE 7.1

PROPOSED LOCATIONS OF LONG-TERM MONITORING AND POINT-OF-COMPLIANCE SAMPLING STATIONS

Intrinsic Remediation TS
MacDill Air Force Base, Florida

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

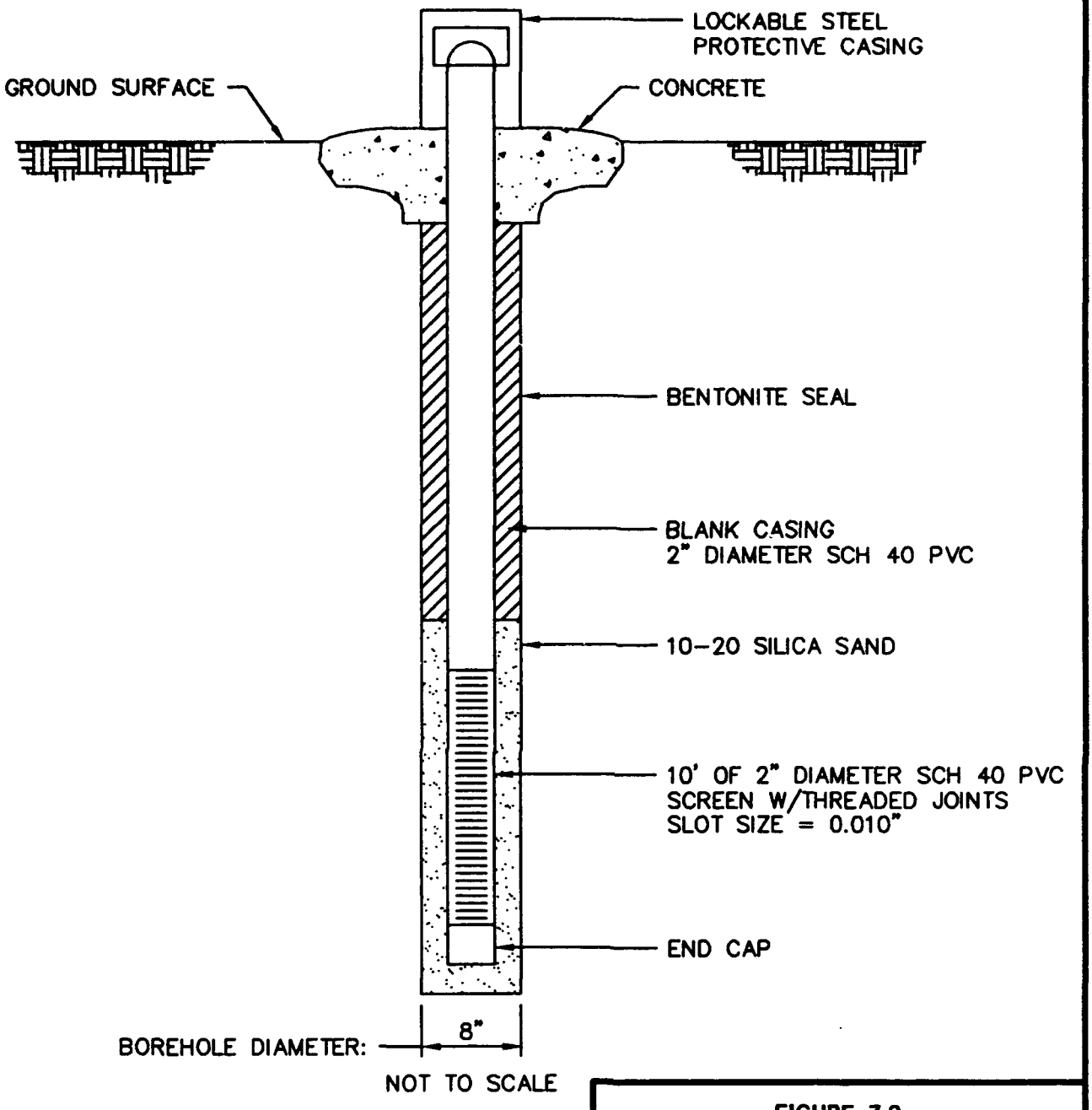

FIGURE 7.2

PROPOSED MONITORING WELL COMPLETION DIAGRAM SITE 56

Intrinsic Remediation TS
MacDill Air Force Base, Florida

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

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7.3 SURFACE WATER MONITORING

Three surface water monitoring stations will be established in the drainage ditch for long-term monitoring purposes. These stations will be located upstream, within, and downstream from the anticipated plume discharge area. This sampling station distribution will allow determination of the degree to which contamination migrating from Site 56 is impacting surface water quality, and the degree to which dilution, biodegradation, and volatilization are diminishing BTEX and MTBE concentrations in the downstream direction. Based on available information, the furthest downstream station should not be significantly impacted by discharge of petroleum-contaminated groundwater sourced at Site 32. The targeted analytes and sampling frequencies for these surface water stations are listed in Table 7.3. If future sampling results indicate that contaminant concentrations in groundwater from monitoring well MD32-MW4 have peaked and are diminishing, and surface water contaminant concentrations are below applicable surface water standards (Table 6.1), then discontinuation of surface water sampling should be evaluated.

7.4 GROUNDWATER AND SURFACE WATER SAMPLING

To ensure that sufficient contaminant removal is occurring at Site 56 to meet site-specific remediation goals, the long-term groundwater and surface water monitoring plan includes a comprehensive SAP. Samples from LTM and POC wells and surface water stations will be collected and analyzed annually to verify that naturally occurring processes are effectively reducing contaminant mass and mobility. Reductions in toxicity will be implied by mass reduction. The SAP also will be aimed at assuring intrinsic remediation can achieve state remediation BTEX concentration goals that are intended to be protective of human health and the environment.

7.4.1 Analytical Protocol

All LTM and POC wells and surface water stations in the LTM program will be sampled and analyzed to determine compliance with chemical-specific remediation goals and to verify the effectiveness of intrinsic remediation at the site. Groundwater level measurements and surface water flow rate measurements will be made during each sampling event. Groundwater samples will be analyzed for the parameters listed in Tables 7.1 and 7.2, and surface water samples will be analyzed as indicated in Table 7.3. A site-specific SAP should be prepared as part of a remedial action plan (in compliance with state requirements) prior to initiating the LTM program.

7.4.2 Sampling Frequency

Each of the LTM and POC sampling points will be sampled once each year for 14 years. If the data collected during this time period supports the anticipated effectiveness of the intrinsic remediation alternative at this site, the sampling frequency could be reduced to once every other year for all wells in the LTM program, or sampling could be eliminated. If the data collected at any time during the monitoring period indicate the need for additional remedial activities at the site, sampling frequency should be adjusted accordingly.

TABLE 7.3
LONG-TERM SURFACE WATER MONITORING ANALYTICAL PROTOCOL
SITE 56
INTRINSIC REMEDIATION TS
MACDILL AIR FORCE BASE, FLORIDA

Analyte	Method/Reference	Comments	Data Use	Recommended Frequency of Analysis	Sample Volume, Sample Container, Sample Preservation	Field or Fixed-Base Laboratory
Temperature	E170.1	Field only.	Metabolism rates for microorganisms depend on temperature.	Every Year for 14 Years.	N/A	Field
pH	E150.1/SW9040, direct reading meter	Protocols/Handbook methods[a/].	Aerobic and anaerobic processes are pH-sensitive.	Every Year for 14 Years.	Collect 100–250 mL of water in a glass or plastic container; analyze immediately.	Field
Conductivity	E120.1/SW9050, direct reading meter	Protocols/Handbook methods.	General water quality parameter used as a marker to verify that site samples are obtained from the same groundwater system.	Every Year for 14 Years.	Collect 100–250 mL of water in a glass or plastic container.	Field
Aromatic hydrocarbons (BTEX)	Purge and trap GC method SW8020.	Handbook method; analysis may be extended to higher molecular weight alkylbenzenes.	BTEX is the primary target analyte for monitoring natural attenuation; BTEX concentrations must also be measured for regulatory compliance.	Every Year for 14 Years.	Collect water samples in a 40 mL VOA vial with zero headspace; cool to 4°C; add hydrochloric acid to pH $\leq$2.	Fixed-base
Lead	E239.2, Standard Method 304	Method presented in DEP62-770.	Regulatory Compliance.	Every year for 14 years. Discontinue if levels below 50 µg/L.	Collect water sample in 500-ml polyethylene bottle; cool to 4°C; add nitric acid to pH < 2.	Fixed-base
MTBE	E602 or SW5030/8020	Method presented in DEP62-770.	Regulatory Compliance.	Every year for 14 years.	Collect water sample in 40-ml VOA vial with zero headspace; cool to 4°C; add hydrochloric acid to pH < 2.	Fixed-base

a/ Protocol methods are presented by Wiedemeier *et al.* (1995).

SECTION 8

CONCLUSIONS AND RECOMMENDATIONS

This report presents the results of a treatability study conducted to evaluate the use of intrinsic remediation for remediation of fuel-hydrocarbon-contaminated groundwater in the vicinity of the AAFES Service Station (Site 56) at MacDill AFB, Florida. Specifically, the finite-difference groundwater model Bioplume II was used in conjunction with site-specific geologic, hydrologic, and laboratory analytical data to simulate the migration and biodegradation of fuel hydrocarbon compounds dissolved in groundwater. To collect the data necessary for the intrinsic remediation demonstration, Parsons ES researchers collected soil and groundwater samples from the site. Physical and chemical data collected under this program were supplemented (where necessary) with data collected during previous site characterization events.

Comparison of BTEX, electron acceptor, and biodegradation byproduct isopleth maps for Site 56 provides strong qualitative evidence of biodegradation of BTEX compounds. Geochemical data strongly suggest that biodegradation of fuel hydrocarbons is occurring at the site primarily via the anaerobic processes of sulfate reduction and methanogenesis. In addition, patterns observed in the distribution of hydrocarbons, electron acceptors, and biodegradation byproducts further indicate that biodegradation is reducing dissolved BTEX concentrations in site groundwater.

Site-specific geologic, hydrologic, and laboratory analytical data were used in the Bioplume II numerical groundwater model to simulate the effects of advection, dispersion, sorption, and biodegradation on the fate and transport of the dissolved BTEX plume. Extensive site-specific data were used for model calibration and implementation. Model parameters that could not be obtained from existing site data were estimated using widely accepted literature values for aquifer materials similar to those found at the site. Conservative input parameters were used to construct the Bioplume II model for this study, and th :fore, the model results presented herein are conservative (i.e., the plume should not migrate further than predicted by the models).

For one simulation (model 56_A), it was assumed that groundwater discharges to the downgradient drainage ditch, and that BTEX dissolution from source area soils into groundwater would naturally decrease at a rate of 10 percent per year (each concentration was decreased by a factor equal to 10 percent of the previous year's concentration). The results of this model suggest that the plume would migrate to the drainage ditch, and that total BTEX concentrations at the ditch would peak at 266 µg/L after 9 years. After 9 years, the plume would shrink back toward the source area as a result of natural attenuation, and total BTEX concentrations at the ditch would steadily decrease to 4 µg/L

after 50 years. Model 56_C also assumes groundwater discharge to the ditch; however, this model also assumes that bioventing or soil excavation in the source area would significantly reduce BTEX dissolution from residual NAPL after 3 years. This assumption is consistent with bioventing results at similar sites (Patrick AFB, FL.). Results of this model also suggest that the plume will migrate to the drainage ditch; however, the maximum total BTEX concentration in groundwater at the ditch is decreased by approximately one-half from that simulated by model 56_A, and occurs after 6 years. Using this scenario, discharge of BTEX to the ditch ceases after 15 years. Applicable BTEX surface water quality standards should not be exceeded in the drainage ditch due to the effects of dilution and volatilization.

Models 56_B and 56_D assume that groundwater and dissolved contamination migrate beneath the drainage ditch, and that discharge to the ditch does not occur. In model 56_B, the rate of BTEX dissolution into the groundwater from source area soils is decreased by 10 percent per year as described above for 56_A. A 50-year simulation using this model suggests that the leading edge of the dissolved BTEX plume would reach the downgradient model boundary, but the low magnitude of the BTEX concentrations crossing this boundary (a maximum of 14 µg/L after 12 years) indicate that BTEX at concentrations exceeding regulatory standards will not migrate a significant distance beyond the boundary. After 12 years, the effects of natural attenuation cause the BTEX plume to shrink back toward the source area. However, low levels of total BTEX continue to reach the downgradient model boundary until year 47. In model 56_D, BTEX dissolution into the groundwater from source areas soils ceases after 3 years, simulating the effects of source removal via bioventing or another engineered remedial action. Under this scenario, the maximum dissolved BTEX concentration reaching the downgradient model boundary is approximately 8 µg/L after 10 years, and the plume no longer intercepts the downgradient model boundary by year 17.

The results of this study suggest that natural attenuation of BTEX compounds is occurring at Site 56 to the extent that the dissolved concentrations of these compounds in groundwater should be reduced to levels below current regulatory guidelines before potential downgradient receptors could be adversely affected (i.e., the potential contaminant migration pathway will not be complete for any of the potential receptors described in Section 6.2). However, model results suggest that LTM and institutional controls may be required for as long as 56 years if an engineered remedial action is not implemented to supplement the effects of intrinsic remediation. Therefore, the Air Force recommends a combination of intrinsic remediation, institutional controls, LTM, and source removal via bioventing or biosparging as the remedial option for BTEX-impacted groundwater at the site. Addition of an engineered source removal action should substantially decrease the length of time required for LTM. Excavation activities in the plume area and groundwater use in and downgradient from the plume area should be restricted for a period of at least 14 years.

To verify the results of the Bioplume II modeling effort, and to ensure that natural attenuation is occurring at rates sufficient to protect potential downgradient receptors, groundwater from existing monitoring wells MD56-MW4, MD56-MW6, MD32-MW10, MD32-MW4, and one additional proposed LTM well should be sampled annually and

analyzed for the parameters listed in Table 7.1. In addition, three POC groundwater monitoring wells should be installed downgradient from the predicted maximum travel distance of the BTEX plume and sampled annually for the parameters listed in Table 7.2. Figure 7.1 shows suggested locations for the three new POC monitoring wells and the new LTM well. These wells should be sampled annually for 14 years. If dissolved BTEX concentrations in groundwater in the POC wells exceed state guidelines for no further action of 50 µg/L for benzene, total BTEX, and lead, then additional evaluation or corrective action may be necessary at this site. Once it is decided that the groundwater monitoring points installed for this study will not be used for future resampling, they should be abandoned according to state requirements.

Annual surface water sampling should be performed at the three stations shown on Figure 7.1, and samples should be analyzed for the parameters listed in Table 7.3. If future sampling results indicate that contaminant concentrations in groundwater from monitoring well MD32-MW4 have peaked and are diminishing, and surface water contaminant concentrations are below applicable standards, then discontinuation of surface water sampling should be evaluated. A site-specific remedial action plan, including a detailed SAP, should be submitted to the Florida DEP for approval prior to implementation of the recommended remedial alternative for Site 56.

SECTION 9

REFERENCES

Abdul, S.A., Gibson, T.L., and Rai, D.N., 1987, Statistical Correlations for Predicting the Partition Coefficient for Nonpolar Organic Contaminants Between Aquifer Organic Carbon and Water: Hazardous Waste and Hazardous Materials, v. 4, no. 3, p. 211-222.

Anderson, M.P., and Woessner, W.W., 1992, Applied Groundwater Modeling - Simulation of Flow and Advective Transport: Academic Press, New York, 381 p.

Barker, J.F., Patrick, G.C., and Major, D., 1987, Natural Attenuation of Aromatic hydrocarbons in a Shallow Sand Aquifer: Groundwater Monitoring Review, Winter, pp. 64 - 71.

Bear, J., 1979, Hydraulics of Groundwater: McGraw-Hill, Inc., New York, 569 p.

Beller, H.R. Reinhard, M., and Grbic-Galic, D., 1992, Metabolic byproducts of anaerobic toluene degradation by sulfate-reducing enrichment cultures: Appl. Environ. Microbiol., v. 58, p. 3192-3195.

Black & Veatch Waste Science, Inc. 1995. *Final Contamination Assessment Report (Site 32 Former Gas Station, Site 56 AAFES Service Station), MacDill Air Force Base, Florida. March 8. Atlanta, Georgia.*

Bohon, R.L., and Claussen, W.F., 1951, The Solubility of Aromatic Hydrocarbons in Water: Journal of American Chemical Society, v. 73, no. 4, p. 1571-1578.

Borden, R.C., and Bedient, P.B., 1986, Transport of Dissolved Hydrocarbons Influenced by Oxygen Limited Biodegradation - Theoretical Development: Water Resources Research, v. 22, no. 13, p. 1973-1982.

Bouwer, E.J., 1992, Bioremediation of Subsurface Contaminants, *in* Mitchell, R., ed.: Environmental Microbiology: Wiley-Liss, New York, New York.

Bouwer, H., 1989, The Bouwer and Rice Slug Test - an Update: Groundwater, v. 27, no. 3, p. 304-309.

Bouwer, H., and Rice, R.C., 1976, A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers with Completely or Partially Penetrating Wells: Water Resources Research, v. 12, no. 3, p. 423-428.

Buscheck, T.E., O'Reilly, K.T., and Nelson, S.N. 1993. Evaluation of Intrinsic Bioremediation at Field Sites: Proceedings, Petroleum Hydrocarbons, and Organic

Chemicals in Ground Water: Prevention, Detection, and Restoration, pp. 367-381. National Ground Water Association/API. Houston, TX..

Busheck, T.E., and Alcantar, C.M. 1995. Regression Techniques and Analytical Solutions to Demonstrate Intrinsic Bioremediation. In: Proceedings of the 1995 Battelle International Symposium on In Situ and On-Site Bioreclamation. April.

California Leaking Underground Fuel Tank Task Force, 1989, Leaking Underground Fuel Tank Field Manual: Guidelines for Site Assessment, Cleanup, and Underground Storage Tank Closure. November 1989.

CH2M Hill. 1990. U.S. Air Force Installation Restoration Program Contamination Assessment for Site 24, MacDill Air Force Base. April.

CH2M Hill. 1991a. U.S. Air Force Installation Restoration Program Contamination Assessment Report addendum for OT-24 (Site 24), MacDill Air Force Base. April.

CH2M Hill. 1991b. U.S. Air Force Installation Restoration Program Remedial Action Plan for Site OT-24, MacDill Air Force Base. May.

Chapelle, F.H., 1993, Ground-water Microbiology and Geochemistry: John Wiley and Sons, Inc., New York.

Chapelle, F.H., 1994, Assessing the Efficiency of Intrinsic Bioremediation, *in* Proceedings of the Symposium on Intrinsic Bioremediation of Groundwater, August 30 - September 1, 1994: US Environmental Protection Agency, p. 171.

Chiang, C.Y., Salanitro, H.P., Chai, E.Y., Colthart, H.D., and Klein, C.L., 1989, Aerobic biodegradation of benzene, toluene, and xylene in a sandy aquifer - data analysis and computer modeling: Groundwater, vol. 27, no. 6, p. 823-834.

Cozzarelli, I.M., Eganhouse, R.P., and Baedecker, M.J., 1990, Transformation of Monoaromatic Hydrocarbons to Organic Acids in Anoxic Groundwater Environment: Environmental and Geological Water Science, 16.

Cozzarelli, I.M., Baedecker, M.J., Eganhouse, R.P., and Goerlitz, D.F., 1994, The geochemical evolution of low-molecular-weight organic acids derived from the degradation of petroleum contaminants in groundwater: Geochimica et Cosmochimica Acta, v. 58, no. 2, p. 863-877.

Davies, J.S., and Westlake, D.W.S., 1979, Crude Oil Utilization by Fungi: Canadian Journal of Microbiology, v. 25, p. 146-156.

Domenico, P.A., and Schwartz, F.W., 1990, Physical and Chemical Hydrogeology: John Wiley & Sons, New York.

Edwards, E., Wills, L.E., Grbic-Galic, D., and Reinhard, M., 1991, Anaerobic degradation of toluene and xylene--evidence for sulfate as the terminal electron acceptor, *in* In Situ Bioreclamation, Applications and Investigations for Hydrocarbon and Contaminated Site Remediation. Eds. R.E. Hinchee and R.F. Olfenbuttel. Butterworth-Heinemann. Boston, MA. p. 463-471.

Edwards, E.A., Wells, L.E., Reinhard, M., and Grbic-Galic, D., 1992, Anaerobic degradation of toluene and xylene by aquifer microorganisms under sulfate-reducing conditions: Appl. Environ. Microbiol., v. 58, p. 794-800.

Florida Department of Environmental Regulation. 1990. No Further Action and Monitoring Only Guidelines for Petroleum Contaminated Sites. Division of Onsite Management, Bureau of Water Cleanup, Technical Review Section. October.

Freeze, R.A., and Cherry, J.A., 1979, Groundwater: Prentice-Hall, Inc., Englewood Cliffs, New Jersey.

Geraghty & Miller, Inc. 1991. Quickflow Analytical 2D Ground-Water Flow Model. Version 1.0. Millersville, Maryland. September.

Geraghty & Miller, Inc. 1994. AQTESOLV® Aquifer Test Solver, Version 2.0. Millersville, Maryland. October.

Goldstein, R.M., Mallory, L.M., and Alexander, M., 1985, Reasons for Possible Failure of Inoculation to Enhance Biodegradation: Applied Environmental Microbiology, v. 50, no. 4, p. 977-983.

Grbic'-Galic', D., 1990, Anaerobic microbial transformation of nonoxygenated aromatic and alicyclic compounds in soil, subsurface, and freshwater sediments, *in* Bollag, J.M., and Stotzky, G., eds., Soil Biochemistry: Marcel Dekker, Inc., New York, p. 117-189.

Grbic'-Galic', D., and Vogel, T.M., 1987, Transformation of toluene and benzene by mixed methanogenic cultures: Applied and Environmental Microbiology, v. 53, p. 254-260.

Hine, J., and Mookerjee, P.K., 1975, The Intrinsic Hydrophilic Character of Organic Compounds. Correlations in Terms of Structural Contributions: Journal or Organic Chemistry, v. 40, no. 3, p. 292-298.

Hopper, D.J., 1978, Microbial Degradation of Aromatic Hydrocarbons *in* R.J. Watkinson (editor), Developments in Biodegradation of Hydrocarbons, I: Applied Science Publishers, Ltd., London.

Howard, P. *et al.*, 1991. Handbook of Environmental Degradation Rates: Lewis Publishers, Inc. Chelsea, Michigan.

Hutchins, S.R., and Wilson, J.T., 1991, Laboratory and field studies on BTEX biodegradation in a fuel-contaminated aquifer under denitrifying conditions, In: *In Situ Bioreclamation, Applications and Investigations for Hydrocarbon and Contaminated Site Remediation.* Eds. R.E. Hinchee and R.F. Olfenbuttel. Butterworth-Heinemann. Boston, MA. p. 157-172.

Hutchins, S.R., 1991, Biodegradation of monoaromatic hydrocarbons by aquifer microorganisms using oxygen, nitrate, or nitrous oxide as the terminal electron acceptor: Appl. Environ. Microbiol., v. 57, p. 2403-2407.

Isnard, S., and Lambert, S., 1988, Estimating Bioconcentration Factors from Octanol-Water Partition Coefficient and Aqueous Solubility: Chemosphere, v. 17, no. 1, p. 21-34.

Jamison, V.W., Raymond, R.L., and Hudson, J.O. Jr., 1975, Biodegredation of High-Octane Gasoline in Groundwater: Developments in Industrial Microbiology, v. 16.

Johnson, A.I. 1967. Specific Yield-Compilation of Specific Yields for Various Materials. U.S. Geological Survey Water-Supply Paper 1662-0. U.S. Government Printing Office. Washington, D.C.

Jones, J.G., and Eddington, M.A., 1968, An Ecological Survey of Hydrocarbon-Oxidizing Microorganisms: Journal of General Microbiology, v. 52, p. 381-390.

Jury, W.A., Spencer, W.F., and Farmer, W.J., 1984, Behavior Assessment Model for Trace Organics in Soil: III, Application of Screening Model: Journal of Environmental Quality, v. 13, no. 4, p. 573-579.

Kemblowski, M.W., Salanitro, J.P., Deeley, G.M., and Stanley, C.C. 1987. Fate and Transport of Residual Hydrocarbons in Ground Water: A Case Study: In: Proceedings of the Petroleum Hydrocarbons and Organic Chemicals in Ground Water Conference, National Water Well Association and American Petroleum Institute. Houston, Texas. Pp. 207-231.

Konikow, L.F., 1978, Calibration of Ground-Water Models, *in* Verification of Mathematical and Physical Models in Hydraulic Engineering: American Society of Civil Engineers, New York, pp. 87 - 93.

Konikow, L.F., and Bredehoeft, J.D., 1978, Computer Model of Two-Dimensional Solute Transport And Dispersion In Groundwater: United States Geological Survey, Techniques of Water Resources Investigations of the United States Geological Survey, Book 7, Chapter C2, 90 p.

Lovley, D.R., and Phillips, E.J.P., 1988, Novel Mode Of Microbial Energy Metabolism: Organic Carbon Oxidation Coupled to Dissimilatory Reduction of Iron or Manganese: Applied and Environmental Microbiology, v. 54, no. 6, p. 1472 - 1480.

Lovley, D.R., M.J. Baedecker, D.J. Lonergan, I.M. Cozzarelli, E.J.P. Phillips, and D.I. Siegel. 1989. Oxidation of aromatic contaminants coupled to microbial iron reduction: Nature, v. 339, p. 297-299.

Lovley, D.R., Phillips, E.J.P., and Lonergan, D.J., 1991, Enzymatic versus nonenzymatic mechanisms for Fe(III) reduction in aquatic sediments: Environmental Science and Technology, v. 26, no. 6, p. 1062 - 1067.

Lyman, W.J., Reidy, P.J., and Levy, B., 1992, Mobility and Degradation of Organic Contaminants in Subsurface Environments: C.K. Smoley, Inc., Chelsea, Michigan.

MacIntyre, W.G., Boggs, M., Antworth, C.P., and Stauffer, T.B., 1993, Degradation Kinetics of Aromatic Organic Solutes Introduced into a Heterogeneous aquifer: Water Resources Research, v.29, no. 12, p. 4045-4051.

Mackay, D., and Wolkoff, A.W., 1973, Rate of Evaporation of Low-Solubility Contaminants from Water Bodies to Atmosphere: Environmental Science and Technology, v. 7, no. 7, p. 611-614.

Mackay, D., and Shiu, W.Y., 1981, A Critical Review of Henry's Law Constants for Chemicals of Environmental Interest: Journal of Physical Chemistry Reference Data, v. 10, no. 4, p. 1175-1199.

Miller, M.M., Wasik, S.P., Huang, G.L., Shiu, W.Y., and Mackay, D., 1985, Relationships Between Octanol-Water Partition Coefficient and Aqueous Solubility: Environmental Science and Technology, v. 19, no. 6, p. 522-529.

Montgomery, J.M. Groundwater Chemicals Desk Reference. 2nd Edition. CRC Press, Inc., 1345 p.

Parsons Engineering Science, Inc. 1995a. Draft Work Plan for a Treatability Study in Support of the Intrinsic Remediation (Natural Attenuation) Option at Site OT-24, Pumphouse 75 (Site 57), and Site 56, MacDill Air Force Base, Tampa, Florida. Denver, Colorado. January.

Parsons Engineering Science, Inc. 1995b. Treatability Study in Support of Intrinsic Remediation of POL Site SS-36, Eglin Air Force Base, Fort Walton Beach, Florida. Denver, Colorado. July.

Parsons Engineering Science, Inc. 1995c. Bioventing Test Results Letter Report to AFCEE. April. Denver, Colorado

Perry, J.J., 1984, Microbial Metabolism of Cyclic Alkanes, *in* Atlas, R.M. ed.: Petroleum Microbiology: Macmillan Publishing Co., New York, New York.

Ribbons, D.W., and Eaton, R.W., 1992, Chemical Transformations of Aromatic Hydrocarbons that Support the Growth of Microorganisms: *in* Mitchell, R., ed.: Environmental Microbiology: Wiley-Liss, New York, New York.

Rifai, H.S., Bedient, P.B., Wilson, J.T., Miller, K.M., and Armstrong, J.M., 1988, Biodegradation modeling at aviation fuel spill site: Journal of Environmental Engineering, v. 114, no. 5, p. 1007-1029.

Stauffer, T.B., Antworth, T.B., Boggs, J.M., and MacIntyre, W.G., 1994, A Natural Gradient Tracer Experiment in a Heterogeneous Aquifer with Measured In Situ Biodegradation Rates: A Case for Natural Attenuation, *in* Proceedings of the Symposium on Intrinsic Bioremediation of Groundwater, August 30 - September 1, 1994: US Environmental Protection Agency, p. 73 - 84.

Strack, D.L., 1989, Groundwater Mechanics: Prentice-Hall, Englewood Cliff, New Jersey, 7320.

US Environmental Protection Agency, 1988a, Guidance for Conducting Remedial Investigations and Feasibility Studies (RI/FS) Under CERCLA. OSWER Directive 9355.3-01.

US Environmental Protection Agency. 1988b. Guidelines for Conduction Remedial Investigations and Feasibility Studies Under CERCLA. Office of Emergency and Remedial Response. Washington, D.C. Interim Final. October.

US Environmental Protection Agency. 1991a. Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions. OSWER Directive 9355.0-30. April.

US Environmental Protection Agency, 1991b, Risk Assessment Guidance for Superfund: Volume I - Human Health Evaluation Manual (Part B, Development of Risk-Based Preliminary Remediation Goals), Interim. Publication 9285.7-01B.

US Geological Survey (USGS), 1986. 7.5 Minute Quadrangle Map of the Port Tampa Quadrangle, Florida.

US Geological Survey (USGS), 1987. 7.5 Minute Quadrangle Map of the Gibsonton Quadrangle, Florida.

Valsaraj, K.T., 1988, On the Physio-Chemical Aspects of Partitioning of Non-Polar Hydrophobic Organics at the Air-Water Interface: Chemosphere, 17(5):875-887.

Verschueren, K., 1983, Handbook of Environmental Data on Organic Chemicals: Van Nostrand Reinhold Co., New York, New York.

Vroblesky, D.A., and Chapelle, F.H., 1994, Temporal and spatial changes of terminal electron-accepting processes in a petroleum hydrocarbon-contaminated aquifer and the significance for contaminant biodegradation: Water Resources Research, v. 30, no. 5, p. 1561-1570.

Walton, W.C., 1988, Practical Aspects of Groundwater Modeling: National Water Well Association, Dublin, Ohio, 587 p.

Wiedemeier, T.H., Swanson, M.A., Herrington, R.T., Wilson, J.T., Kampbell, D.H., Miller, R.N., and hansen, J.E. 1995a. Comparison of two methods for determining Biodegradation rate constants at the field scale: Submitted to Groundwater.

Wiedemeier, T.H., Downey, D.C., Wilson, J.T., Kampbell, D.H., Miller, R.N., and Hansen, J.E., 1995, Draft Technical Protocol for Implementing the Intrinsic Remediation with Long-Term Monitoring Option for Natural Attenuation of Dissolved-Phase Fuel Contamination in Ground Water: Air Force Center for Environmental Excellence, Brooks Air Force Base, Texas.

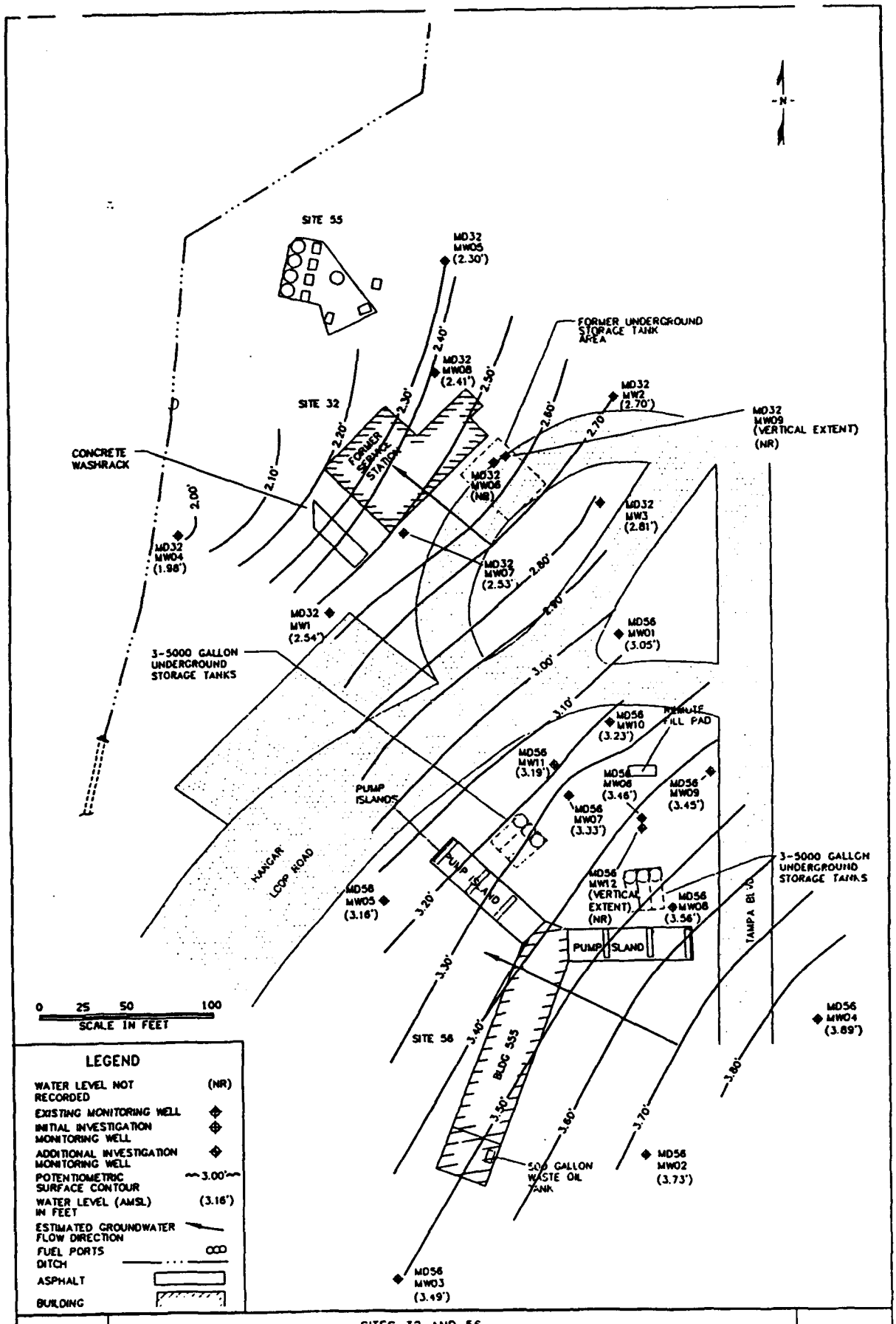
Wilson, B.H., Smith, G.B., and Rees, J.F., 1986, Biotransformations of Selected Alkylbenzenes and Halogenated Aliphatic Hydrocarbons in Methanogenic Aquifer Material: A Microcosm Study: Environmental Science and Technology, 20(10):997-1002.

Wilson, B.H., Wilson, J.T., Kampbell, D.H., Bledsoe, B.E., and Armstrong, J.M., 1990, Biotransformation of Monoaromatic and Chlorinated Hydrocarbons at an Aviation Gasoline Spill Site: Geomicrobiology Journal, 8:225-240.

Wilson, B.H., Wilson, J.T., Kampbell, D.H., and Bledsoe, B.E., 1994, Traverse City: Geochemistry and Intrinsic Bioremediation of BTX Compounds, *in* Proceedings of the Symposium on Intrinsic Bioremediation of Groundwater, August 30 - September 1, 1994: US Environmental Protection Agency, p. 94 - 102.

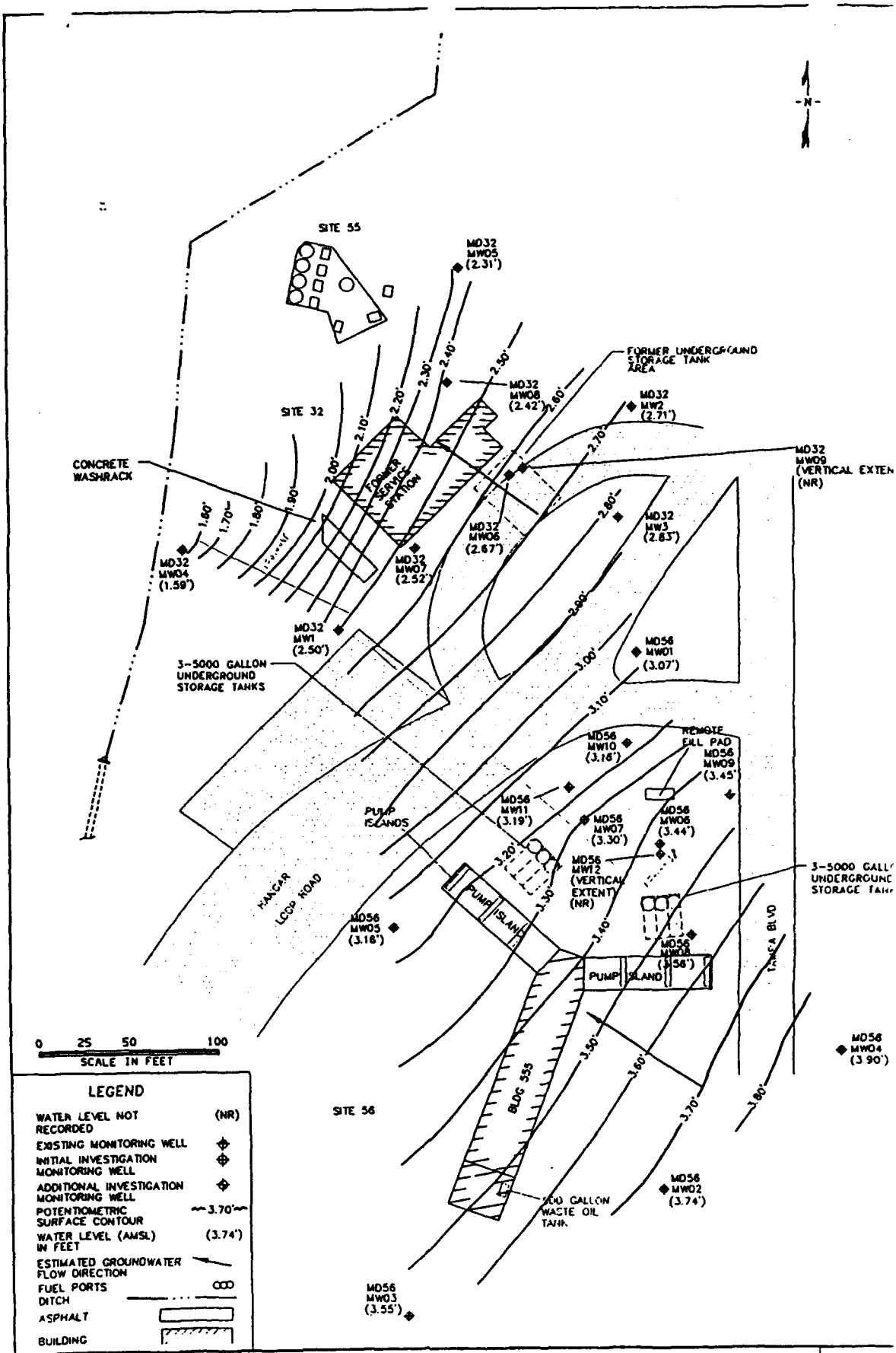
APPENDIX A

INFORMATION FROM THE *FINAL CONTAMINATION ASSESSMENT REPORT* (BVWS, 1995)



SITES 32 AND 56
ESTIMATED GROUNDWATER FLOW DIRECTION AT HIGH TIDE ON 8-21-94
MacDILL AIR FORCE BASE
TAMPA, FLORIDA

FIGURE 2-9



SITES 32 AND 56
ESTIMATED GROUNDWATER FLOW DIRECTION AT LOW TIDE ON 8-21-94
MacDILL AIR FORCE BASE
TAMPA, FLORIDA

FIGURE 2-10

Table 2-12
Groundwater Results - Initial Activities
Site 56 - AAFES Service Station, MacDill Air Force Base

Parameters	Chapter 62-770 FAC	MD56-MW01 3-12*	MD56-MW02 2-11*	MD56-MW03 3-11*	MD56-MW04 2-11*	MD56-MW05 3-11*	MD56-MW06 3-11*	MD56-MW60 **	MD56-MW07 3-11*
Halogenated Volatiles (SW846 Method 8010) (µg/L)									
Trichlorofluoromethane	NA	--	--	1.1	--	--	--	--	--
Vinyl Chloride	NA	--	--	0.6 J	--	--	--	--	--
Aromatic Volatiles (SW846 Method 8020) (µg/L)									
Benzene	1	--	--	--	--	--	1800	1700	207 J
Toluene	NA	--	--	--	--	--	2200	2190	271 J
Ethylbenzene	NA	--	--	--	--	--	249	258	71.8 J
Total Xylene	NA	--	--	--	--	--	1470	1570	389 J
Total VOA***	50	--	--	--	--	--	5719	5718	938.8 J
Methyl tert butyl ether	50	--	--	--	--	--	519	479 J	1300 J
1,2-Dichlorobenzene	NA	--	--	--	--	--	99.1 M	100 M	6.21 JM
Semi-Volatiles (SW846 Method 8270) (µg/L)									
Naphthalene	NA	--	--	--	--	--	82	69 JL	26 JL
2-Methylnaphthalene	NA	--	--	--	--	--	22	20 JL	3.2 JL
Total Naphthalenes	100	--	--	--	--	--	104	89 JL	29.2 JL
Bis(2-ethylhexyl)phthalate	NA	4.4 JB	21 B	2.9 JB	230 BE	2.3 JB	1.9 JB	7.9 JLB	4.4 JLB
Pentachlorophenol	NA	--	--	--	--	--	--	--	10 JL
Phenol	NA	--	--	--	--	--	31	30 JL	5.9 JL
2-Methylphenol	NA	--	--	--	--	--	16	13 JL	2.6 JL
4-Methylphenol	NA	--	--	--	--	--	41	35 JL	2.9 JL
TRPH (EPA Method 418.1) (mg/L)									
Petroleum Hydrocarbons	5	--	--	--	--	--	2.4	2.9	--
RCRA Metals (SW846 Method 6010 and 7000 series) (µg/L)									
Barium	NA	13.0	9.0	--	5.2	10.0	--	--	--
Chromium	NA	--	7.39	--	--	5.3	--	7.3	--
Lead (7421)	50	--	7.4	--	--	4.0	8.3	9.2	--
Mercury (7470/7471)	NA	--	1.9	1.4	1.0	1.1	1.3	1.3	--

NOTES:

Chapter 62-770 FAC	Chapter 62-770, Florida Administrative Code Petroleum Contamination Site Cleanup Criteria
MW	Monitoring Well.
*	Monitoring well screened interval to nearest foot below land surface.
NA	Not applicable.
--	Below detection limits.
M	Method results conflict; not quantifiable due to coelution of peaks.
J	Estimated quantitation based on QC data.
B	Possible false positive based on blank contamination.
E	Estimated quantitation above calibration range of the instrument.
JL	Possibly biased low based on surrogate recovery.
**	MD56-MW60 is a duplicate sample of MD56-MW06.
***	Total VOA includes BTEX constituents only.
	Samples collected on December 19-20, 1993.

Table 2-22
Groundwater Results - Additional Activities
Site 56 -- AAFES Service Station, MacDill Air Force Base

Parameters	Chapter 62-770 FAC	MD56-MW01 3-12[1]	MD56-MW02 2-11[1]	MD56-MW06 3-11[1]	MD56-MW07 3-11[1]	MD56-MW08 3-12[1]	MD56-MW09 2-11[1]	MD56-MW90[2] 2-11[1]	MD56-MW10 3-12[1]	MD56-MW11 3-12[1]	MD56-MW12 28-32[1]
Halogenated Volatiles (Method 8010) (µg/L)											
2-Chloroethylvinylether	NA	--	--	--	--	--	1.00	--	--	--	--
Chloroform	NA	--	--	0.6 JB	--	--	--	--	--	--	--
Methylene chloride	NA	6.80	--	0.6 JB	--	--	--	--	--	--	0.9 J
Aromatic Volatiles (Method 8020) (µg/L)											
Benzene	1	--	--	3390	91.6	43.5	--	--	51.6	6.80	0.9 J
Toluene	NA	--	--	5380	222	0.7 JB	--	--	206	0.8 JB	--
Ethylbenzene	NA	--	--	1340	96.2	31.4	--	--	156	15.3	4.40
Xylenes (total)	NA	--	--	7050	619	17.7	--	--	3100	4.60	0.5 J
Total VOA[3]	50	--	--	17,160	1028.8	93.3 JB	--	--	3513.6	27.5 JB	5.8 J
Methyl tert butyl ether	50	--	--	1500	424	399 E	--	--	--	402 E	--
Chlorobenzene	NA	--	--	--	--	--	--	--	39.8 J	1.6	--
1,2-Dichlorobenzene	NA	--	--	--	--	--	--	--	351	--	--
1,3-Dichlorobenzene	NA	--	--	--	--	0.6 J	--	--	214	0.6 J	--
1,4-Dichlorobenzene	NA	--	--	283 M	39.7	9.40 M	--	--	--	1.50	0.5 JM
***Semivolatiles* (Method 8270) (µg/L)**											
2-Methylnaphthalene	NA	--	--	64.0 JL	4.0 JL	71.0 JL	--	--	42.0	--	--
Naphthalene	NA	--	--	120 JL	19.0 JL	140 JL	--	--	130	11.0	--
Total Naphthalenes	100	--	--	184 JL	23.0 JL	211 JL	--	--	172	11.0	--
2-Methylphenol	NA	--	--	18.0 JL	--	20.0 JL	--	--	--	--	--
4-Methylphenol	NA	--	--	39.0 JL	--	42.0 JL	--	--	40.0	--	--
Benzoic acid	NA	2.00 J	1.00 J	--	--	--	--	2.00 J	37.0 J	6.00 J	1.00 J
Bis(2-ethylhexyl)phthalate	NA	--	1.00 J	20.0 JL	48 JLB	18.0 JL	4.0 JB	--	18.0	28.0 B	2.0 JB

Table 2-22 (Continued)
Groundwater Results - Additional Activities
Site 56 -- AAFES Service Station, MacDill Air Force Base

Parameters	Chapter 62-770 FAC	MD56-MW01 3-12[1]	MD56-MW02 2-11[1]	MD56-MW06 3-11[1]	MD56-MW07 3-11[1]	MD56-MW08 3-12[1]	MD56-MW09 2-11[1]	MD56-MW90[2] 2-11[1]	MD56-MW10 3-12[1]	MD56-MW11 3-12[1]	MD56-MW12 28-32[1]
Semivolatiles (Method 8270) (µg/L)											
Butylbenzylphthalate	NA	--	--	--	1.00 JL	--	--	--	--	--	--
2,4-Dimethylphenol	NA	--	--	23.0 JL	--	25.0 JL	--	--	86.0	--	--
Phenol	NA	--	--	36.0 JL	--	32.0 JL	--	--	33.0	--	--
TRPH (EPA Method 418.1) (mg/L)											
TRPH	5	--	--	--	0.7	6.2	--	--	1.9	--	--
RCRA METALS (µg/L)											
Barium (method 6010)	NA	5.20	5.20	9.40	6.30	48.6	25.3	9.40	17.1	5.90	47.6
Chromium (method 6010)	NA	--	--	--	--	7.60	--	--	--	--	--
Arsenic (method 7060)	NA	3.10	14.8	13.9	--	34.3	--	--	3.40	--	--
Lead (method 7421)	50	--	--	--	--	18.1	--	--	58.0	--	--

NOTES:

Chapter 62-770 FAC	Chapter 62-770, Florida Administrative Code Petroleum Contamination Site Cleanup Criteria.
MW	Monitoring Well.
NA	Not applicable.
--	Below detection limits.
J	Estimated quantitation based on QC data.
B	Possible false positive based on blank contamination.
E	Estimated quantitation above calibration range of the instrument.
M	Method results conflict; not quantifiable due to coelution of peaks.
JL	Possible bias low based on surrogate recovery.
1	Monitoring well screened interval to nearest foot below land surface.
2	MD56-MW90 is a duplicate sample of MD56-MW09.
3	Total VOA includes BTEX constituents only.
	Samples were collected in September and October 1994.

Table 2-11
Groundwater Results-Initial Activities
Site 32 - Former Gas Station, MacDill Air Force Base

Parameters	Chapter 62-770 F.A.C.	MD32-MW01 2-12*	MD32-MW02 2-12*	MD32-MW03 2-12*	MD32-MW04 2-11*	MD32-MW05 2-11*	MD32-MW06 2-11*
Aromatic Volatiles (SW846 Method 8020) (µg/L)							
Benzene	1	0.5J	--	--	0.9J	--	20.8J
Ethylbenzene	NA	--	--	--	--	--	84.9J
Xylenes (total)	NA	0.5J	--	--	--	--	149J
MTBE	50	288	--	--	390E	--	--
Total VOA**	50	1J	--	--	0.9J	--	254.7J
Chlorobenzene	NA	--	--	--	0.6JM	--	--
1,2-Dichlorobenzene	NA	7.4M	--	--	0.7JM	--	56.4JM
1,3-Dichlorobenzene	NA	--	--	--	--	3.0M	--
PAHs (SW846 Method 8100) (µg/L)							
Naphthalene	NA	--	--	--	--	--	48.9J
1-Methylnaphthalene	NA	--	--	--	--	--	3.7J
2-Methylnaphthalene	NA	--	--	--	--	--	8.3J
Total Naphthalenes	100	--	--	--	--	--	60.9J
Acenaphthylene	NA	0.8J	--	--	--	--	--
Pyrene	NA	--	--	--	--	3.8J	--
Benzo(B)Fluoranthene(1)/ Benzo(K)Fluoranthene(1)	NA	--	16.2J	--	--	--	--
Total PAHs	10	0.8J	16.2J	--	--	3.8J	--
Total Lead (EPA Method 7421) (µg/L)							
Lead	50	--	--	--	--	3.5	--

NOTES:

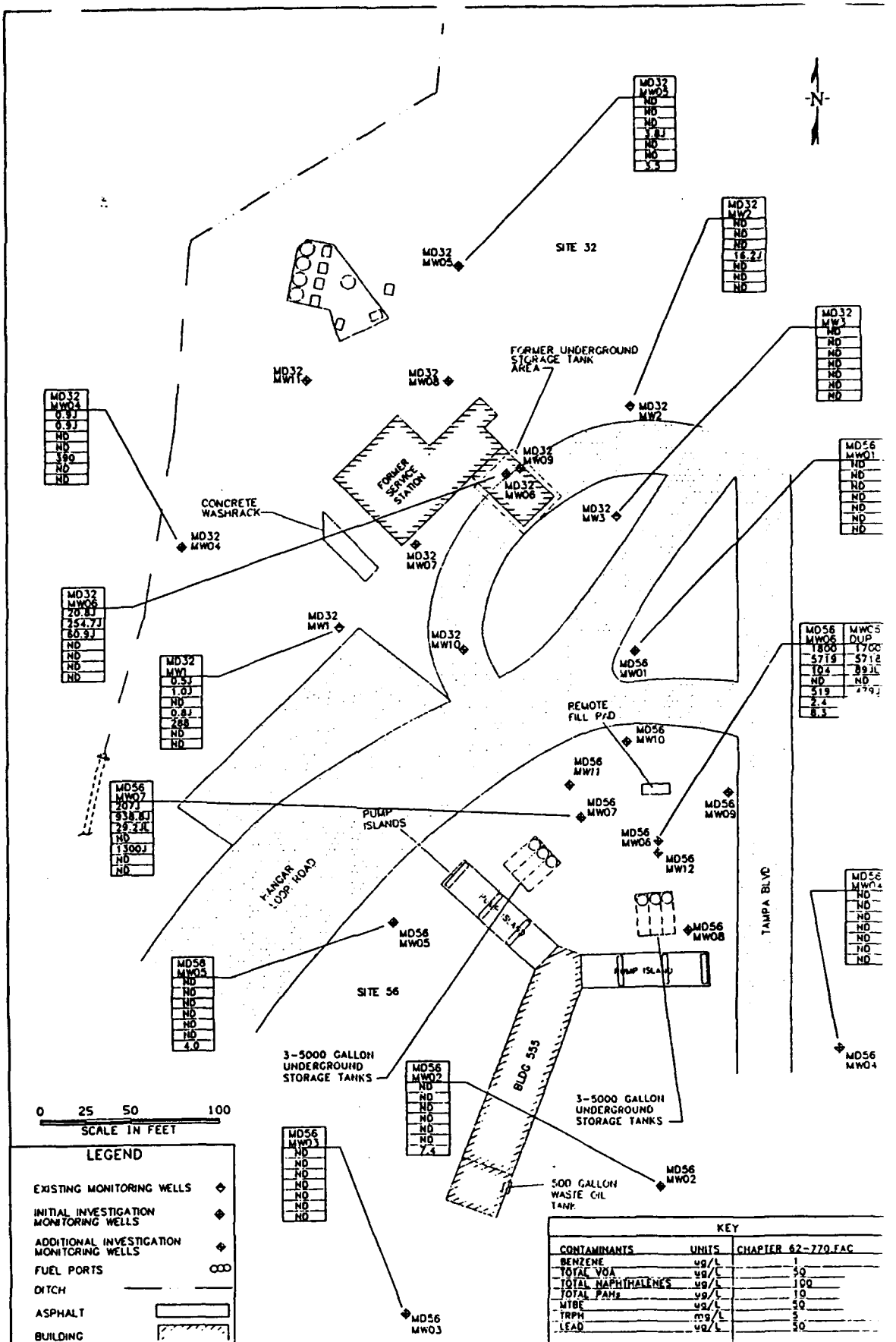
Chapter 62-770 F.A.C.	Chapter 62-770 Florida Administrative Code Petroleum Contamination Site Cleanup Criteria.
MW	Monitoring Well.
J	Estimated quantitation based on QC data.
E	Estimated quantitation above calibration range of the instrument.
M	Method results conflict; not quantifiable due to coelution of peaks.
NA	Not applicable.
--	Below detection limits.
*	Monitoring well screened interval to nearest foot below land surface.
(1)	These compounds coelute during chemical analysis.
**	Total VOAs includes BTEX constituents only.
	Samples collected on December 18-19, 1993.

Table 2-21
Groundwater Analytical Results - Additional Investigation Activities
Site 32 - Former Gas Station, MacDill Air Force Base

Parameters	Chapter 62-770 FAC	MD32-MW01 2-12[1]	MD32-MW02 2-12[1]	MD32-MW03 2-12[1]	MD32-MW04 2-11[1]	MD32-MW05 2-11[1]	MD32-MW06 2-11[1]	MD32-MW07 2-11[1]	MD32-MW08 2-11[1]	MD32-MW09 19-23[1]	MD32-MW10 3-12[1]	MD32-MW11 3-12[1]	MD32-MW50[2] 2-11[1]
Halogenated Volatiles (SW846 Method 8010) (µg/L)													
Methylene Chloride	NA	0.8JB	2.3JB	0.5B	1.3B	2.6B	1.6B	1.4B	1.6B	1.8B	1B	1.3B	1.4B
Chlorobenzene	NA	--	--	--	--	--	--	--	--	1.9	--	--	--
Tetrachloroethane	NA	--	--	--	--	--	0.6J	--	--	--	--	--	--
Aromatic Volatiles (SW846 Method 8020) (µg/L)													
Benzene	1	0.8J	--	--	2.6M	--	53.8	--	--	--	--	0.6J	--
Ethylbenzene	NA	--	--	--	--	--	206	--	--	--	--	--	--
Xylenes (total)	NA	0.5J	--	--	0.7J	--	263	--	--	--	--	--	--
Total VOA[3]	50	1.3J	--	--	3.3JM	--	522.8	--	--	--	--	0.6J	--
Chlorobenzene	NA	--	--	--	0.9M	--	--	--	--	1.4	--	--	--
1,4-Dichlorobenzene	NA	--	--	--	--	--	38.8M	--	--	--	--	--	--
MTBE	50	254	--	--	277	--	--	23.4	--	16.2	12.1	--	--
PAHs (S846 Method 8100) (µg/L)													
Naphthalene	NA	--	--	--	--	--	164	--	--	--	4.1	--	--
1-Methylnaphthalene	NA	12.8	--	--	9.5	1.5	63.3	--	--	--	10.5	--	--
2-Methylnaphthalene	NA	3.5	--	--	3.7	--	36.4	--	--	--	--	--	--
Total Naphthalenes	100	16.3	--	--	13.2	1.5	263.7	--	--	--	14.6	--	--
Acenaphthene	NA	--	--	--	--	1.3	--	--	--	--	--	--	--
Fluorene	NA	--	--	--	--	--	2.7	--	--	--	--	--	--
Benzo(b)fluoranthene	NA	--	--	--	--	--	--	--	--	--	--	3.7	--
Total PAHs	10	--	--	--	--	1.3	2.7	--	--	--	--	3.7	--
TRPH (EPA Method 418.1) (mg/L)													
Pet Hydrocarbons	5	--	--	--	--	--	--	--	--	--	--	0.7	--
Total Lead (EPA Method 7421) (µg/L)													
Lead	50	--	--	--	--	--	5.2	--	--	--	3.6	13.7	2.2

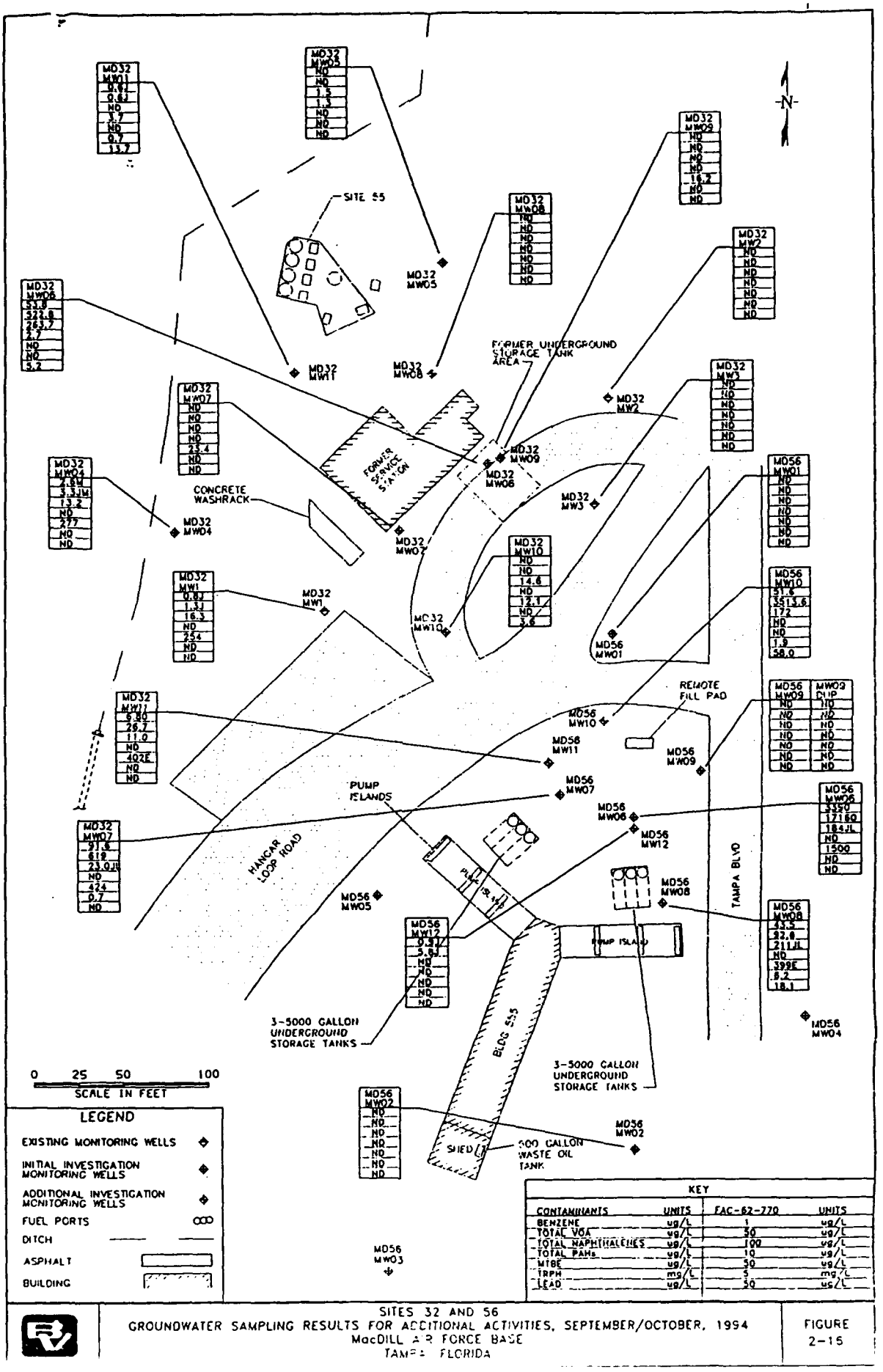
NOTES:

Chapter 62-770 FAC	Chapter 62-770, Florida Administrative Code Petroleum Contamination Site Cleanup Criteria
MW	Monitoring Well.
J	Estimated quantitation based on QC data.
M	Method results conflict; not quantifiable due to coelution of peaks.
NA	Not applicable.
--	Below detection limits.
B	Possible false positive based on blank contamination.
1	Monitoring well screened interval to nearest foot below land surface.
2	MD32-MW50 is a duplicate of MD32-MW05.
3	BTEX only.
	Samples were collected in October 1994.



SITES 32 AND 56
GROUNDWATER SAMPLING RESULTS FOR INITIAL ACTIVITIES, DECEMBER 18-20, 1993
MacDILL AIR FORCE BASE
TAMPA, FLORIDA

FIGUR
2-1



SITES 32 AND 56
GROUNDWATER SAMPLING RESULTS FOR ADDITIONAL ACTIVITIES, SEPTEMBER/OCTOBER, 1994
MacDILL AIR FORCE BASE
TAMPA, FLORIDA

FIGURE 2-15

Table 2-18
Sediment Results - Initial Activities
Site 32 -- Former Gas Station, MacDill Air Force Base

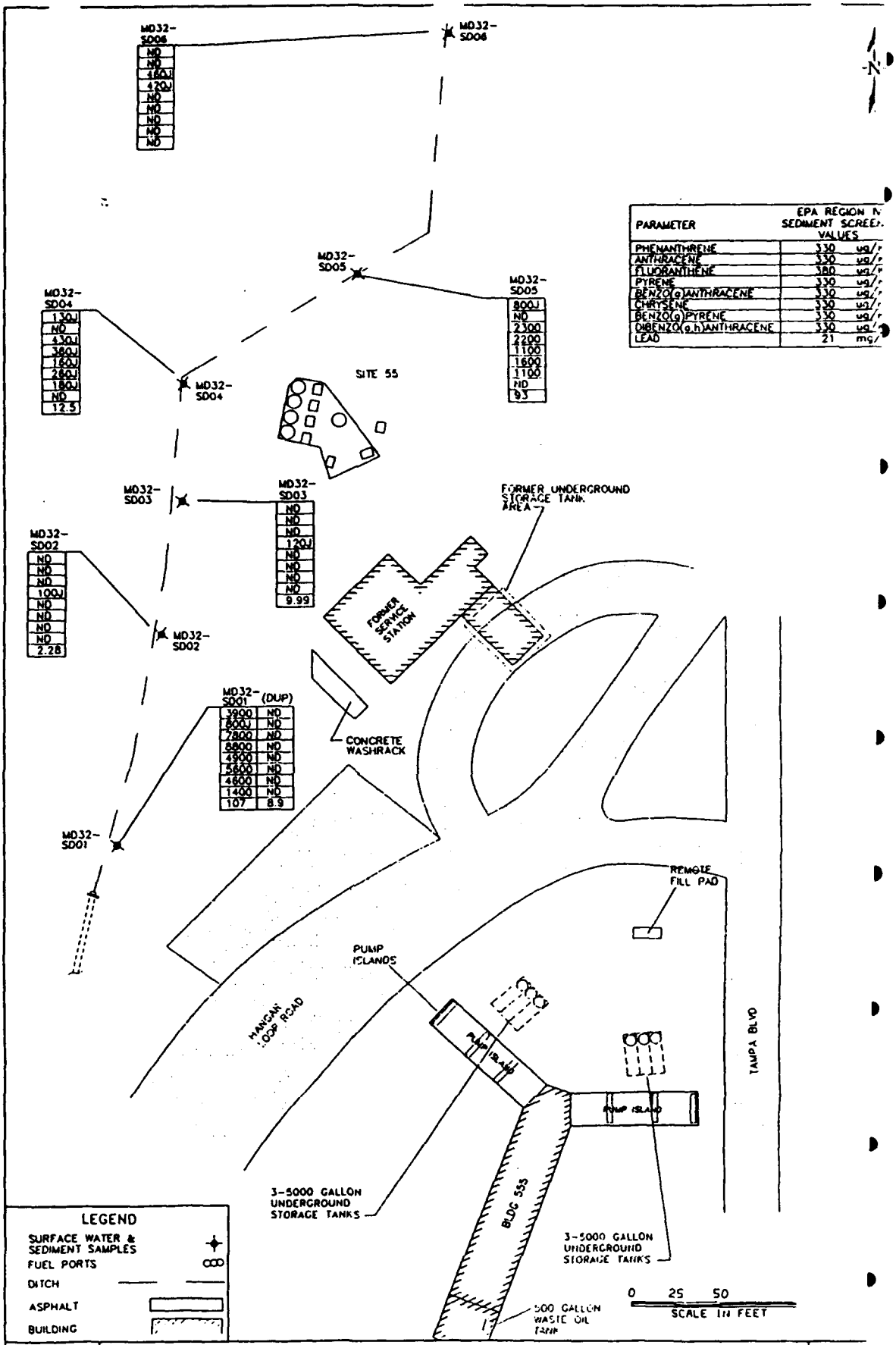
Parameters	EPA S.S.V.	MD32-SD01	MD32-SD01 (DUP)	MD32-SD02	MD32-SD03	MD32-SD04	MD32-SD05	MD32-SD06
Halogenated Volatiles (SW 846 Method 8010) (µg/kg)								
Methylene Chloride	NA	6.6 JLB	6.6 B	6.2 B	6.6 B	5.5 B	6.3 B	5.2 B
Trichlorofluoromethane	NA	--	--	--	--	LJ	--	--
1,2-Dichlorobenzene	NA	--	--	--	--	--	--	1.1
1,3-Dichlorobenzene	NA	--	--	--	--	0.6 J	--	--
1,4-Dichlorobenzene	NA	--	--	--	--	--	--	0.5 J
Aromatic Volatiles (SW 846 Method 8020) (µg/kg)								
Benzene	NA	0.8 JL	--	--	--	--	--	--
Ethylbenzene	NA	--	--	--	--	--	--	51.4 M
1,2-Dichlorobenzene	NA	2.5 JLM	--	--	--	4M	5.4 M	79E
1,3-Dichlorobenzene	NA	2.2 JLM	0.6 JM	--	--	--	--	--
1,4-Dichlorobenzene	NA	1.2 JLM	0.7 JM	--	--	--	2M	--
Toluene	NA	2JL	--	--	0.9 JL	--	0.7 J	45.3
Xylenes (Total)	NA	2.4 JL	--	--	--	0.5 J	0.6 J	8.9
MTBE	NA	--	--	--	--	--	--	11.2
Semi-Volatiles (SW 846 Method 8270) (µg/kg)								
phthene	330	120J	--	--	--	140J	--	--
.ene	330	210J	--	--	--	--	--	
Phenanthrene	330	3900	--	--	--	130J	800J	130
Anthracene	330	800J	--	--	--	--	160J	--
Fluoranthene	380	7800	--	--	--	430J	2300	460J
Pyrene	330	8800	--	100J	120J	380J	2200	420J
Benzo(a)anthracene	330	4900	--	--	--	160J	1100	160J
Bis(2-ethylhexyl)phthalate	NA	3900	330J	260J	370J	610J	1400	100J
Chrysene	330	5600	--	--	--	260J	1600	300J
Di-n-octyl phthalate	NA	140J	--	--	--	--	--	--
Benzo(b)fluoranthene	NA	5400	--	--	--	200J	1300	220J
Benzo(k)fluoranthene	NA	2900	--	--	--	240J	1200	260J
Benzo(a)pyrene	330	4600	--	--	--	180J	1100	190J
Indeno(1,2,3-cd)pyrene	NA	3700	--	--	--	120J	810J	140J
Dibenz(a,h)anthracene	330	1400	--	--	--	--	310J	--
Benzo(g,h,i)perylene	NA	2500	--	--	--	92J	600J	120J
Carbazole	NA	1400	--	--	--	--	200J	--
Total PAHs	2[illegible]0	52770J	--	100J	120J	2332J	13480J	2400J
TRPH (EPA Method 418.1) (mg/kg)								
TRPH	NA	910	14	13	13	210	380	130

Table 2-18 (Continued)
Sediment Results - Initial Activities
Site 32 -- Former Gas Station, MacDill Air Force Base

Parameters	EPA S.S.V.	MD32-SD01	MD32-SD01 (DUP)	MD32-SD02	MD32-SD03	MD32-SD04	MD32-SD05	MD32-SD06
RCRA Metals (SW 846 Method 6010 and 7000 series) (mg/kg)								
Barium	NA	10.3	4.0	4.7	2.5	4	134	1.8
Cadmium	1	1.1	--	--	--	--	--	--
Chromium	33	12.7	1.8	2.3	--	4.3	21.4	2.7
Silver	2	1.1	--	--	--	--	--	3.2
Arsenic	8	--	--	--	1	--	--	--
Lead (7421)	21	107	8.9	2.28	9.99	12.5	93	11.3

NOTES:

EPA S.S.V.	Environmental Protection Agency, Region IV, sediment screening values.
B	Possible false positive based on blank contamination.
J	Estimated quantitation based on QC data.
JL	Possible bias low based on surrogate recovery.
M	Method results conflict; not quantifiable due to coelution of peaks.
E	Estimated quantitation above calibration range of the instrument.
--	Below detection limits.
	Samples were collected in February 1994.



PARAMETER	EPA REGION IV SEDIMENT SCREEN VALUES	
PHENANTHRENE	330	ug/
ANTHRACENE	330	ug/
FLUORANTHENE	380	ug/
PYRENE	330	ug/
BENZO(a)ANTHRACENE	330	ug/
CHRYSENE	330	ug/
BENZO(g)PYRENE	330	ug/
DIBENZO(a,h)ANTHRACENE	330	ug/
LEAD	21	mg/

SITES 32 AND 56
SEDIMENT SAMPLING RESULTS FOR INITIAL ACTIVITES, FEBRUARY, 1994
MacDILL AIR FORCE BASE
TAMPA, FLORIDA

FIGUI
2-1

CAD DWG NO. 5433058
DATE 03-03-95
PLOT SCALE 1=50
ORIGINAL DWG SIZE 17 x 11

Table 2-17
Surface Water Analytical Results - Initial Activities
Site 32 - Former Gas Station, MacDill Air Force Base

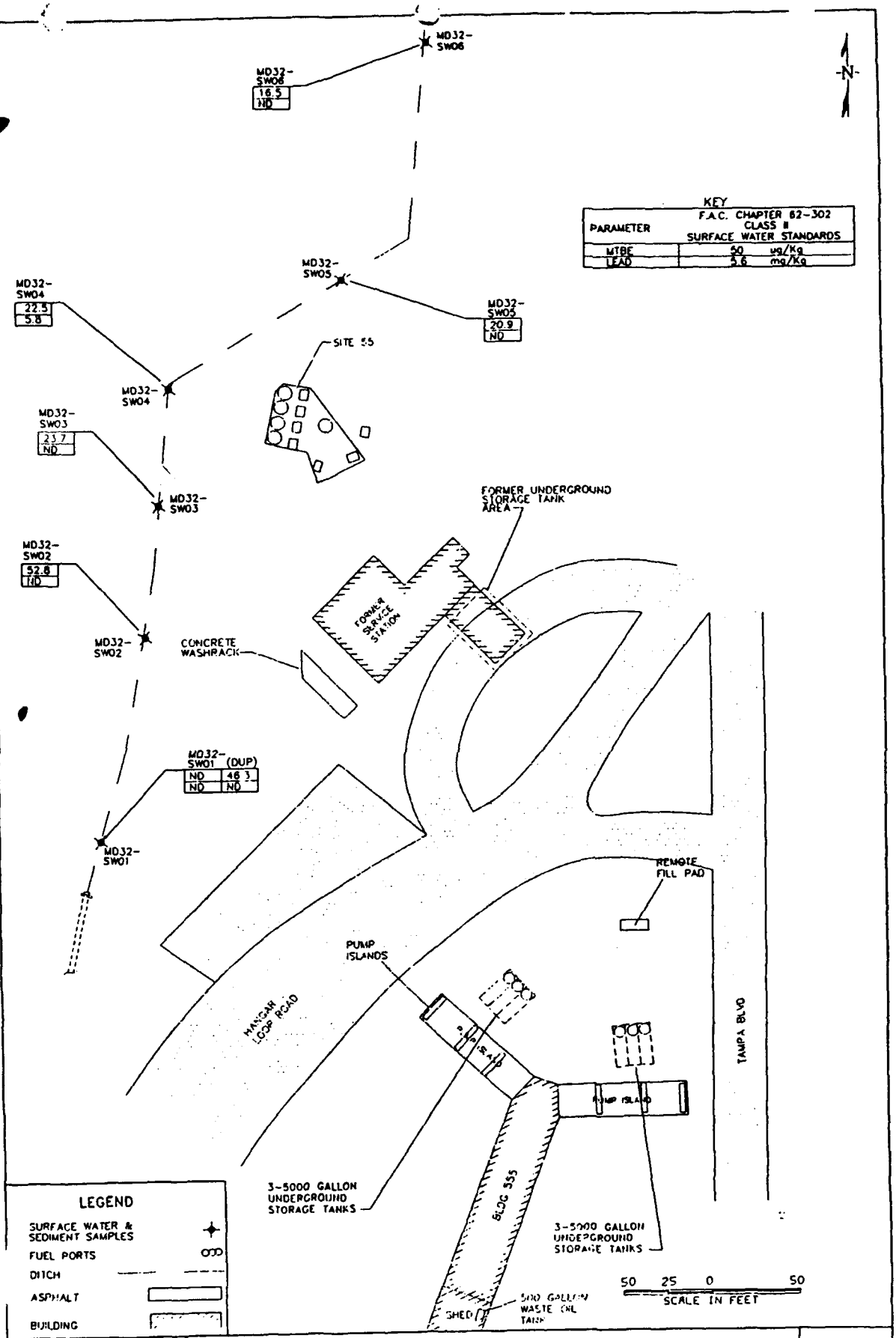
Parameters	Chapter 62-302 FAC	MD32-SW01	MD32-SW12 (DUP)	MD32-SW02	MD32-SW03	MD32-SW04	MD32-SW05	MD32-SW06
Halogenated Volatiles (SW846 Method 8010) (µg/L)								
Chloromethane	NA	--	--	--	0.9J	--	--	--
Methylene Chloride	1.58	--	--	--	--	5.3B	30.3B	12.6B
1,2-Dichloroethane	NA	0.5J	--	--	--			
Chlorobenzene	NA	--	2.4	2.8	1.6	1.4	1.1	0.9J
1,4-Dichlorobenzene	NA	--	0.7J	0.9J	0.5J	--	--	--
Chloroform	NA	--	--	--	--	1.2B	0.8JB	0.6JB
1,2-Dichlorobenzene	NA	--	3.2	3.5	2.4	2.0	1.9	1.4
Aromatic Volatiles (SW846 Method 8020) (µg/L)								
Benzene	71.28	--	--	--	--	--	--	0.6J
Chlorobenzene	NA	--	2.2	2.0	1.5	1.2	0.9J	0.9J
1,2-Dichlorobenzene	NA	--	2.3	2.2	1.9	1.7	1.3	1.4
1,4-Dichlorobenzene	NA	--	0.5J	--	--	--	--	0.5JM
Toluene	NA	--	--	--	--	--	--	0.6J
MTBE	50	--	46.3	52.8	23.7	22.5	20.9	16.5
Semi-Volatiles (SW846 Method 8270) (µg/L)								
1,2-Dichlorobenzene	NA	--	1.8J	1.5J	1.4J	--	--	--
Benzoic Acid	NA	--	1.1J	--	1.8J	--	--	--
Butylbenzylphthalate	NA	--	1.1J	--	--	--	--	--
Bis(2-ethylhexyl)phthalate	NA	1.0J	66	--	1.8J	3.2JLB	1.1JLB	2.8JLB
RCRA Metals (SW846 Methods 6010 and 7421) (mg/L)								
Barium	NA	15	15	14	17	29	27.7	25.2
Cadmium	9.3	--	--	--	--	5.2	--	--
Chromium	NA	--	--	--	--	7.9B	6.5B	5.6B
Lead (7421)	5.6	--	--	--	--	5.8	--	--

NOTES:

Chapter 62-302 FAC	Chapter 62-302, Florida Administrative Code, Shellfish Propagation or Harvesting, Class II Surface Water Quality Classification
MW	Monitoring Well.
J	Estimated quantitation based on QC data.
JL	Possible bias low based on surrogate recovery.
M	Method results conflict; not quantifiable due to coelution of peaks.
NA	Not applicable.
--	Below detection limits.
B	Possible false positive based on blank contamination.
	Samples were collected in February 1994.

Table 2-16
Soil Results - Initial Activities
Site 56 - AAFES Service Station, MacDill Air Force Base

Parameters	FDEP S.C.G.	MD56-MW01			MD56-MW02		MD56-MW03		MD56-MW04		MD56-MW05		MD56-MW06		MD56-MW07	
		0-1 feet bls	2-3 feet bls	2-3 dup feet bls	0-1 feet bls	2-3 feet bls	0-1 feet bls	2-3 feet bls	0-1 feet bls	2-3 feet bls	0-1 feet bls	2-3 feet bls	0-1 feet bls	2-3 feet bls	0-1 feet bls	2-3 feet bls
Halogenated Volatiles (SW846 Method 8010) (µg/kg)																
Trichlorofluoromethane	NA	--	1.3 JL	6.3 JL	NA	NA	--	--	--	--	--	--	--	--	--	--
Methylene chloride	1.13	11.3 B	22.8 JLB	15.1 JLB	NA	NA	6.9 JLB	13.1 B	6.2 B	6.7 JLB	6.3 B	6.9 B	--	--	--	--
Tetrachloroethene	NA	--	0.7 JL	--	NA	NA	--	--	--	--	--	--	--	--	--	--
Total VOHs	50*	--	2JL	6.3JL	NA	NA	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethene	NA	0.9 J	0.8 JL	0.6 JL	NA	NA	--	--	--	--	--	--	--	--	--	--
Aromatic Volatiles (SW846 Method 8020) (µg/kg)																
Benzene	0.386	--	--	--	NA	NA	--	--	--	--	--	--	21,000	35,300 JH	--	22,300 JH
Chlorobenzene	NA	--	--	--	NA	NA	--	--	--	--	--	--	13,800 M	11,500 JHM	2,970 M	20,600 JHM
Ethylbenzene	72.7	--	--	--	NA	NA	--	--	--	--	--	--	118,000	318,000 JH	17,600	332,000 JH
1,2-Dichlorobenzene	NA	--	--	--	NA	NA	--	--	--	--	--	--	78,700 M	90,900 JHM	35,700 M	122,000 JHM
1,3-Dichlorobenzene	NA	--	--	--	NA	NA	--	--	--	--	--	--	--	37,400 JHM	--	47,900 JHM
1,4-Dichlorobenzene	NA	--	--	--	NA	NA	--	--	--	--	--	--	29,500 M	102,000 JHM	12,800 M	132,000 JHM
Toluene	NA	5.7	5.7	1.2 JL	NA	NA	2.5 JL	7.7	1.4 JL	1.4 JL	0.9 J	4.4 JL	194,000	250,000 JH	14,600	182,000 JH
Xylenes (Total)	14.1	--	--	--	NA	NA	1.2 JL	1.2	1.7 JL	--	--	--	583,000	648,000 JH	140,000	724,000 JH
Total VOAs	100*	5.7	5.7	1.2JL	NA	NA	3.7 JL	8.9	3.1 JL	1.4 JL	0.9 J	4.4 JL	916,000	1,251,300 JH	172,200	1,260,300 JH
MTBE	NA	--	--	--	NA	NA	--	--	--	--	--	--	--	10,900 JH	--	8,531 JB



SITES 32 AND 56
SURFACE WATER SAMPLING RESULTS FOR INITIAL ACTIVITIES, FEBRUARY, 1994
MacDILL AIR FORCE BASE
TAMPA, FLORIDA

FIGURE 2-14

Table 2-16 (Continued)
Soil Results - Initial Activities
Site 56 - AAFES Service Station, MacDill Air Force Base

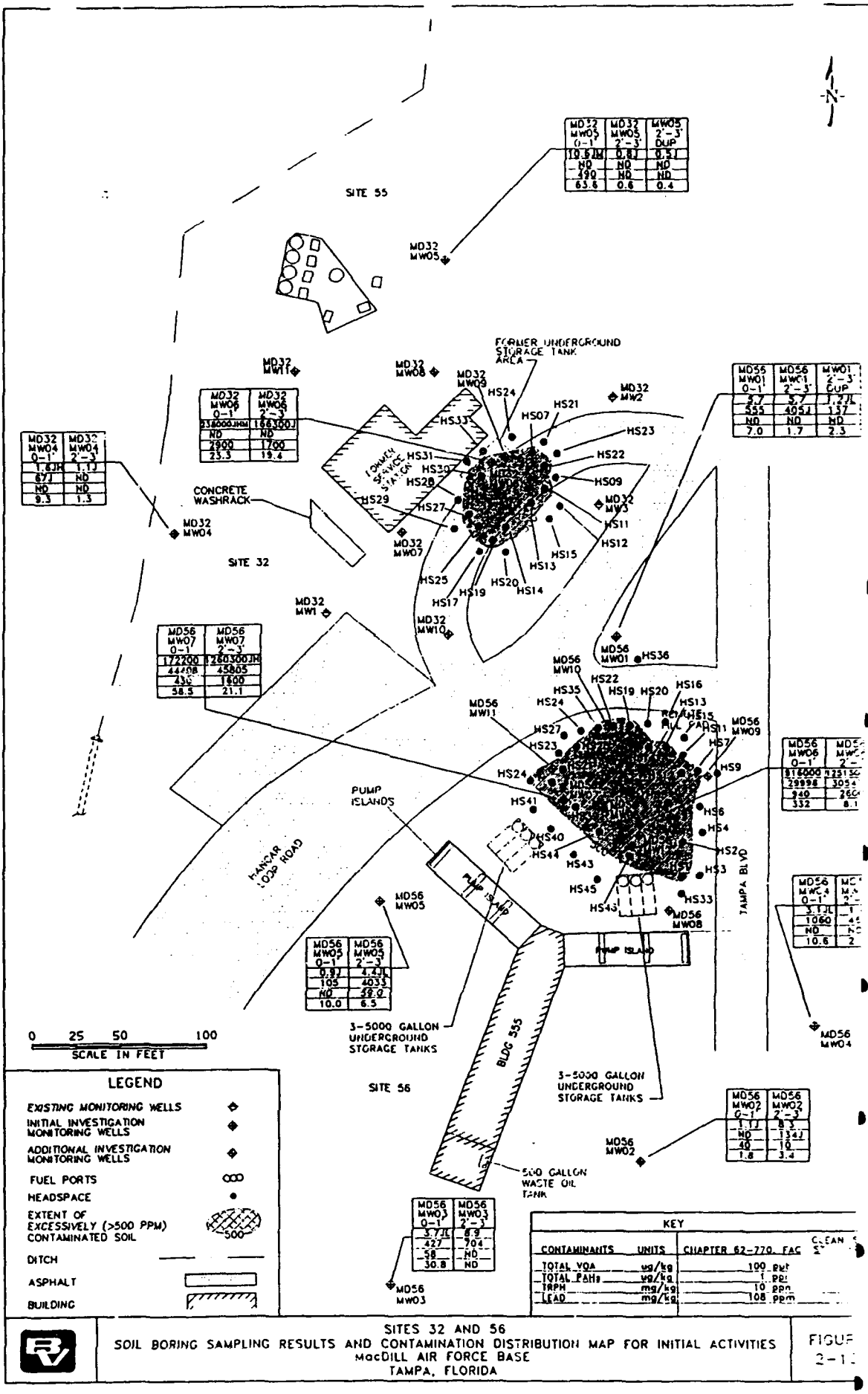
Parameters	FDEP S.S.C.G.	MD56-MW01			MD56-MW02		MD56-MW03		MD56-MW04		MD56-MW05		MD56-MW06		MD56-MW07	
		0-1 feet bls	2-3 feet bls	2-3 dup feet bls	0-1 feet bls	2-3 feet bls	0-1 feet bls	2-3 feet bls	0-1 feet bls	2-3 feet bls	0-1 feet bls	2-3 feet bls	0-1 feet bls	2-3 feet bls	0-1 feet bls	2-3 feet bls
PAH (SW846 Method 8100) (µg/kg)																
Naphthalene	14.1	--	--	--	NA	NA	--	--	--	--	--	--	28,473	305,474	21,182	45,805
Acenaphthylene	52.1	--	--	--	NA	NA	--	--	--	--	--	98.0	--	--	--	--
Acenaphthene	188	--	--	--	NA	NA	--	--	--	--	--	53.0	--	--	--	--
Fluorene	4,140	--	30 J	--	NA	NA	--	--	--	--	--	116.0	--	--	--	--
Phenanthrene	282	41	--	--	NA	NA	--	--	--	--	--	966.0	--	--	2,439	--
Fluoranthene	21,300	90	243	91	NA	NA	289	--	--	--	105.0	930.0	--	--	4,466	--
Pyrene	16,000	78	132	--	NA	NA	138	--	--	--	--	1,870.0	1,525	--	5,190	--
Benzo(a)anthracene	5,040	--	--	--	NA	NA	--	--	--	--	--	--	--	--	1,657	--
Chrysene	2,000	107	--	--	NA	NA	--	--	--	--	--	--	--	--	3,750	--
Benzo(b)fluoranthene(1)/ Benzo(k)fluoranthene(1)	NA	--	--	--	NA	NA	--	--	--	--	--	--	--	--	4,967	--
Benzo(a)pyrene	505	80.0	--	46	NA	NA	--	--	--	--	--	--	--	--	757	--
Dibenz(a,h)anthracene(1) /Indeno(1,2,3-cd)pyrene	NA	159.0	--	--	NA	NA	--	704	1060	486	--	--	--	--	--	--
Total PAHs	1000*	555	405J	137	NA	NA	427	704	1,060	486	105	4,033	29,998	305,474	44,408	45,805
Volatiles (SW846 Method 8240) (µg/kg)																
Methylene chloride	1.13	NA	NA	NA	8.8	11	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acetone	143	NA	NA	NA	36 B	51 B	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Butanone	878	NA	NA	NA	--	2.3 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	NA	NA	NA	NA	--	7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Toluene	NA	NA	NA	NA	1.1 J	8.3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 2-16 (Continued)
Soil Results - Initial Activities
Site 56 - AAFES Service Station, MacDill Air Force Base

Parameters	FDEP S.S.C.G.*	MD56-MW01			MD56-MW02		MD56-MW03		MD56-MW04		MD56-MW05		MD56-MW06		MD56-MW07	
		0-1 feet bls	2-3 feet bls	2-3 dup feet bls	0-1 feet bls	2-3 feet bls	0-1 feet bls	2-3 feet bls	0-1 feet bls	2-3 feet bls	0-1 feet bls	2-3 feet bls	0-1 feet bls	2-3 feet bls	0-1 feet bls	2-3 feet bls
Semivolatiles (SW846 Method 8270) (µg/kg)																
Fluoranthene	21,300	NA	NA	NA	--	56 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	15,000	NA	NA	NA	--	78 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bis(2-ethylhexyl) phthalate	NA	NA	NA	NA	40 J	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TRPH (EPA Method 418.1) (mg/kg)																
TRPH	10*	--	--	--	40	10	58	--	--	--	--	59.0	940	2,600	430	1,600
RCRA metals (SW846 Method 6010 and 7000 series) (mg/kg)																
Barium (method 6010)	NA	NA	NA	NA	7.7	1.7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium (method 6010)	382	NA	NA	NA	3.5	2.6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead (method 7421)	108*	7.0	1.7	2.3	1.8	3.4	30.8	--	10.6	2.0	10.0	6.5	332	8.1	58.5	21.1

NOTES:

FDEP S.S.C.G.	Florida Department of Environmental Protection Selected Soil Clean-up Goals for Military Sites.
*	Chapter 62-775, F.A.C. Soil Thermal Treatment Criteria.
bls	below land surface.
µg/kg	micrograms per kilogram.
mg/kg	milligrams per kilogram.
NA	Not applicable: Either no regulatory standard established (FDEP S.S.C.G. values), or sample not analyzed for particular method (sample results values).
JL	Possible bias based on low surrogate recovery.
J	Estimated quantitation based on quality control results.
--	Below detection limits.
B	Possible false positive based on blank data.
JH	Possible bias based on high surrogate recovery.
D	Estimated quantitation based on sample dilution.
M	Method results conflict; not quantifiable due to coelution of peaks.
	Samples were collected on October 24 - November 21, 1993.



SITES 32 AND 56
SOIL BORING SAMPLING RESULTS AND CONTAMINATION DISTRIBUTION MAP FOR INITIAL ACTIVITIES
MacDILL AIR FORCE BASE
TAMPA, FLORIDA

FIGURE 2-12

APPENDIX B

BOREHOLE LOGS, MONITORING POINT INSTALLATION RECORDS, MONITORING POINT/WELL DEVELOPMENT AND SAMPLING RECORDS, SLUG TESTING RESULTS, AND SURVEY DATA

GEOLOGIC BORING LOG

Sheet 1 of 1

BORING NO.:	56MP-1	CONTRACTOR:	PARSONS ES	DATE SPUD:	3/17/95
CLIENT:	AFCEE	RIG TYPE:	GEOPROBE	DATE CMPL.:	3/17/95
JOB NO.:	722450.21	DRLG METHOD:	GEOPROBE	ELEVATION:	
LOCATION:	MACDILL AFB	BORING DIA.:	2 INCHES	TEMP:	
GEOLOGIST:	KC	DRLG FLUID:	NONE	WEATHER:	OVERCAST
COMMENTS:	BACKGROUND PID = 0.0 ppmv				

Elev (ft)	Depth (ft)	Pro-file	US CS	Geologic Description	Sample No.	Sample Depth (ft)	Sample Type	Penet Res	PID(ppm)	WKSPC PID(ppm)	TOTAL BTEX(ppm)	TPH (ppm)
	1			1 foot ASPHALT and limestone FILL. Effervesced with HCl.			CONTINUOUS CORE					
			SP	Dark grey, fine- to medium-grained SAND with silt. Odor present. Limestone gravel present. SAA turning moist at 4 feet bgs.					16.2	0.0		
▼	5		SW	Tan, fine-grained SAND with silt. Saturated at 4.8 feet bgs. Strong sulfur odor present.	1	4-6			0.9			
									1.6			
	10				2	8-10			>115.6	0.0		
									18.8			
									20.2			
	15		CH	Greenish grey, highly plastic, limestone CLAY.								
				Bottom of hole at 16 feet bgs.								
	20											
	25											
	30											
	35											

NOTES

bgs – Below Ground Surface
GS – Ground Surface
TOC – Top of Casing
NS – Not Sampled
SAA – Same As Above

SAMPLE TYPE

D – DRIVE
C – CORE
G – GRAB

▼ Water level dr'ed

GEOLOGIC BORING LOG

Intrinsic Remediction TS
MacDill Air Force Base, Florida

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

M:\45021\DRAWINGS\BORINGS\56MP1 4/17/95 at 1600

GEOLOGIC BORING LOG

Sheet 1 of 1

BORING NO.:	56MP-2	CONTRACTOR:	PARSONS ES	DATE SPUD:	3/17/95
CLIENT:	AFCEE	RIG TYPE:	GEOPROBE	DATE CMPL.:	3/17/95
JOB NO:	722450.21	DRLG METHOD:	GEOPROBE	ELEVATION:	
LOCATION:	MACDILL AFB	BORING DIA.:	2 INCHES	TEMP:	
GEOLOGIST:	KC	DRLG FLUID:	NONE	WEATHER:	SUNNY

COMMENTS: BACKGROUND PID = 0.0 ppmv

Elev (ft)	Depth (ft)	Profile	USCS	Geologic Description	Sample No.	Sample Depth (ft)	Sample Type	Penet Res	PID(ppm)	WKSPC PID(ppm)	TOTAL BTEX(ppm)	TPH (ppm)
	1			No Sample. FILL with 4 inches of ASPHALT.			CONTINUOUS CORE					
			SP	Limestone sandy, silty FILL with limestone gravel. Reddish yellow, sandy FILL at 3.5 feet bgs. Limestone cobbles present. Strong sulfur odor.					0.9	0.0		
	5		SW	Grey, fine- to medium-grained SAND with silt. Subangular grains. Becoming wet at 4 feet bgs.					49.0			
▼				SAA turning brown. Saturated at 6.0 feet bgs.	1	6-8			0.0			
	10			SAA with strong sulfur odor. Roots present.					2.3			
				SAA with low sample recovery.					12.5			
	15		CH		2	13-15			0.3			
				Greenish grey, highly plastic, limestone CLAY with sand to sandy CLAY.								
				Bottom of hole at 17 feet bgs.								
	20											
	25											
	30											
	35											

NOTES

bgs - Below Ground Surface
GS - Ground Surface
TOC - Top of Casing
NS - Not Sampled
SAA - Same As Above

SAMPLE TYPE

D - DRIVE
C - CORE
G - GRAB

▼ Water level drilled

GEOLOGIC BORING LOG

Intrinsic Remediation TS
MacDill Air Force Base, Florida

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

M:\45021\DRAWINGS\BORINGS\56MP2 4/17/95 at 1620

GEOLOGIC BORING LOG

Sheet 1 of 1

BORING NO.:	56MP-3	CONTRACTOR:	PARSONS ES	DATE SPUD:	3/17/95
CLIENT:	AFCEE	RIG TYPE:	GEOPROBE	DATE CMPL.:	3/17/95
JOB NO.:	722450.21	DRLG METHOD:	GEOPROBE	ELEVATION:	
LOCATION:	MACDILL AFB	BORING DIA.:	2 INCHES	TEMP:	
GEOLOGIST:	KC	DRLG FLUID:	NONE	WEATHER:	WINDY, OVERCAST

COMMENTS: BACKGROUND PID = 0.0 ppmv

Elev (ft)	Depth (ft)	Pro-file	US CS	Geologic Description	Sample No.	Sample Depth (ft)	Sample Type	Penet Res	PID(ppm)	WKSPC PID(ppm)	TOTAL BTEX(ppm)	TPH (ppm)
	1			No Sample. FILL. HCl.			CONTINUOUS CORE					
			SP	Dark brown, silty SAND to SAND with silt. Subangular to subrounded grains. Strong sulfur odor.					0.0			
▼	5			Saturated at 4.5 feet bgs.	1	4-6			0.0			
			SW	Tan, fine- to medium-grained SAND with silt. Subangular grains.					1.6			
	10				2	10-12			0.0			
									4.2			
	15		SP	Brown, clayey SAND to SAND with clay. Semi-plastic.								
				Bottom of hole at 17 feet bgs.								
	20											
	25											
	30											
	35											

NOTES

bgs - Below Ground Surface
GS - Ground Surface
TOC - Top of Casing
NS - Not Sampled
SAA - Same As Above

SAMPLE TYPE

D - DRIVE
C - CORE
G - GRAB

▼ Water level drilled

GEOLOGIC BORING LOG

Intrinsic Remediation TS
MacDill Air Force Base, Florida

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

M \45021\DRAWINGS\BORINGS\56MP3 4/17/95 at 1630

GEOLOGIC BORING LOG

Sheet 1 of 1

BOR. NO.:	56MP-4	CONTRACTOR:	PARSONS ES	DATE SPUD:	3/20/95
CLIENT:	AFCEE	RIG TYPE:	GEOPROBE	DATE CMPL.:	3/20/95
JOB NO.:	722450.21	DRLG METHOD:	GEOPROBE	ELEVATION:	
LOCATION:	MACDILL AFB	BORING DIA.:	2 INCHES	TEMP:	
GEOLOGIST:	KC	DRLG FLUID:	NONE	WEATHER:	SUN, CLEAR

COMMENTS: BACKGROUND PID = 0.3 ppmv

Elev (ft)	Depth (ft)	Pro-file	US CS	Geologic Description	Sample No.	Sample Depth (ft)	Sample Type	Penet Res	PID(ppm)	WKSPC PID(ppm)	TOTAL BTEX(ppm)	TPH (ppm)
	1			No Sample.			CONTINUOUS CORE					
▼	5		SW	Brown, fine- to medium-grained SAND.								
			GP	White, limestone GRAVEL with clay.								
				Bottom of hole at 8 feet bgs.								
	10											
	15											
	20											
	25											
	30											
	35											

NOTES

bgs – Below Ground Surface
GS – Ground Surface
TOC – Top of Casing
NS – Not Sampled
SAA – Same As Above

SAMPLE TYPE

D – DRIVE
C – CORE
G – GRAB

▼ Water level drilled

GEOLOGIC BORING LOG

Intrinsic Remediation TS
MacDill Air Force Base, Florida

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

M:\45021\DRAWINGS\BORINGS\56MP4 4/17/95 at 1645

GEOLOGIC BORING LOG

Sheet 1 of 1

BORING NO.:	56MP-5	CONTRACTOR:	PARSONS ES	DATE SPUD:	3/20/95
CLIENT:	AFCEE	RIG TYPE:	GEOPROBE	DATE CMPL.:	3/20/95
JOB NO.:	722450.21	DRLG METHOD:	GEOPROBE	ELEVATION:	
LOCATION:	MACDILL AFB	BORING DIA.:	2 INCHES	TEMP:	HOT
GEOLOGIST:	KC	DRLG FLUID:	NONE	WEATHER:	CLEAR
COMMENTS:	BACKGROUND PID = 0.3 ppmv				

Elev (ft)	Depth (ft)	Pro-file	US CS	Geologic Description	Sample No.	Sample Depth (ft)	Sample Type	Penet Res	PID(ppm)	WKSPC PID(ppm)	TOTAL BTEX(ppm)	TPH (ppm)
	1			No Sample.			CONTINUOUS CORE					
			SP	Loose, brown to grey, fine- to medium-grained SAND with silt. Chemical odor present.								
▼				Saturated at 4.5 feet bgs. Strong sulfur odor present.					853	0.0		
	5		SW	Tan, fine-grained, well sorted SAND. Turning brown. Slight chemical or hydrocarbon odor present.	1	4-6			46.5			
				No sample from 6 to 8 feet bgs.								
				SAA with low sample recovery. Highly saturated.								
	10		CL	Brown, clayey SAND at 10.5 feet bgs.	2	9-11			2.9			
				Grey, plastic, sandy CLAY.								
				Bottom of hole at 12 feet bgs.								
	15											
	20											
	25											
	30											
	35											

NOTES

bgs – Below Ground Surface
GS – Ground Surface
TOC – Top of Casing
NS – Not Sampled
SAA – Same As Above

SAMPLE TYPE

D – DRIVE
C – CORE
G – GRAB

▼ Water level drilled

GEOLOGIC BORING LOG

Intrinsic Remediation TS
MacDill Air Force Base, Florida

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

M:\45021\DRAWINGS\BORINGS\56mp5 4/17/95 at 1700

GEOLOGIC BORING LOG

BORING NO.:	56MP-6	CONTRACTOR:	PARSONS ES	DATE SPUD:	3/20/95
CLIENT:	AFCEE	RIG TYPE:	GEOPROBE	DATE CMPL.:	3/20/95
JOB NO.:	722450.21	DRLG METHOD:	GEOPROBE	ELEVATION:	
LOCATION:	MACDILL AFB	BORING DIA.:	2 INCHES	TEMP:	WARM
GEOLOGIST:	KC	DRLG FLUID:	NONE	WEATHER:	CLEAR
COMMENTS:	BACKGROUND PID = 0.3 ppmv				

Elev (ft)	Depth (ft)	Pro-file	USCS	Geologic Description	Sample No.	Sample Depth (ft)	Sample Type	Penet Res	PID(ppm)	WKSPC PID(ppm)	TOTAL BTEX(ppm)	TPH (ppm)
	1			No Sample			CONTINUOUS CORE					
			SW	Loose, brown, fine- to medium-grained SAND. Subangular grains.								
▼				Saturated at 4.0 feet bgs. Slight sulfur odor present.					0.0			
	5			SAA with some roots present.	1	4-6			0.3			
									0.9			
				SAA with low sample recovery. Highly saturated.								
	10		CL									
				Blue-grey, plastic, CLAY	2	10-11						
				Bottom of hole at 12 feet bgs.								
	15											
	20											
	25											
	30											
	35											

NOTES

bgs - Below Ground Surface
GS - Ground Surface
TOC - Top of Casing
NS - Not Sampled
SAA - Same As Above

SAMPLE TYPE

D - DRIVE
C - CORE
G - GRAB

▼ Water level d[illegible]ed

GEOLOGIC BORING LOG

Intrinsic Remediation TS
MacDill Air Force Base, Florida

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

M:\45021\DRAWINGS\BORINGS\56MP6 4/18/95 at 0940

MONITORING POINT INSTALLATION RECORD

JOB NAME MACDILL AIR FORCE BASE MONITORING POINT NUMBER 56MP-1S

JOB NUMBER 722450.21 INSTALLATION DATE 3/17/95 LOCATION SITE 56

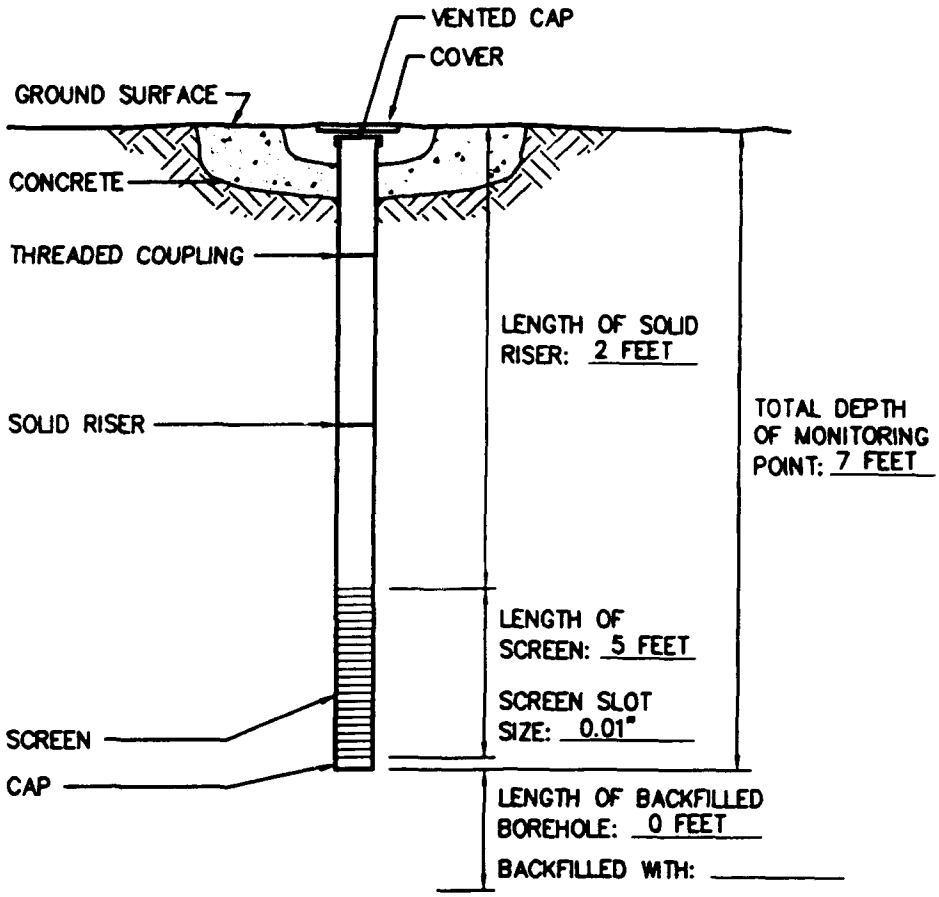
DATUM ELEVATION 8.072 FEET ABOVE MSL WELL CASING ELEVATION 7.922 FT AMSL

DATUM FOR WATER LEVEL MEASUREMENT GROUND SURFACE

SCREEN DIAMETER & MATERIAL 0.5 INCH PVC SLOT SIZE 0.01 INCH

RISER DIAMETER & MATERIAL 0.5 INCH PVC BOREHOLE DIAMETER 2 INCHES

GEOPROBE CONTRACTOR PARSONS ENGINEERING SCIENCE ES REPRESENTATIVE KC



(NOT TO SCALE)

MONITORING POINT INSTALLATION RECORD

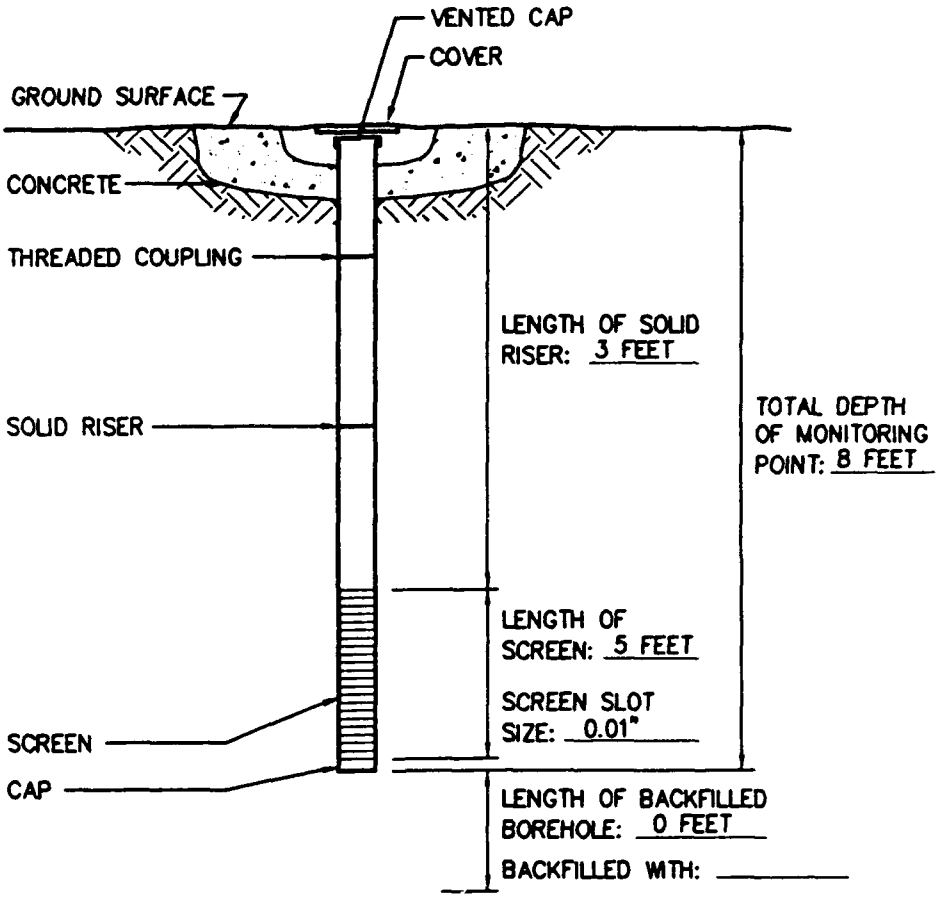
Site 56
Intrinsic Remediation TS
MacDill Air Force Base, Florida

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

M:\45021\DRAWINGS\WELLINST\SITE56\56MP1S ON 4/30/95 AT 1200

MONITORING POINT INSTALLATION RECORD

JOB NAME MACDILL AIR FORCE BASE MONITORING POINT NUMBER 56MP-2S
JOB NUMBER 722450.21 INSTALLATION DATE 3/17/95 LOCATION SITE 56
DATUM ELEVATION 8.096 FEET ABOVE MSL WELL CASING ELEVATION 8.002 FT /
DATUM FOR WATER LEVEL MEASUREMENT GROUND SURFACE
SCREEN DIAMETER & MATERIAL 0.5 INCH PVC SLOT SIZE 0.01 INCH
RISER DIAMETER & MATERIAL 0.5 INCH PVC BOREHOLE DIAMETER 2 INCHES
GEOPROBE CONTRACTOR PARSONS ENGINEERING SCIENCE ES REPRESENTATIVE KC



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MONITORING POINT INSTALLATION RECORD

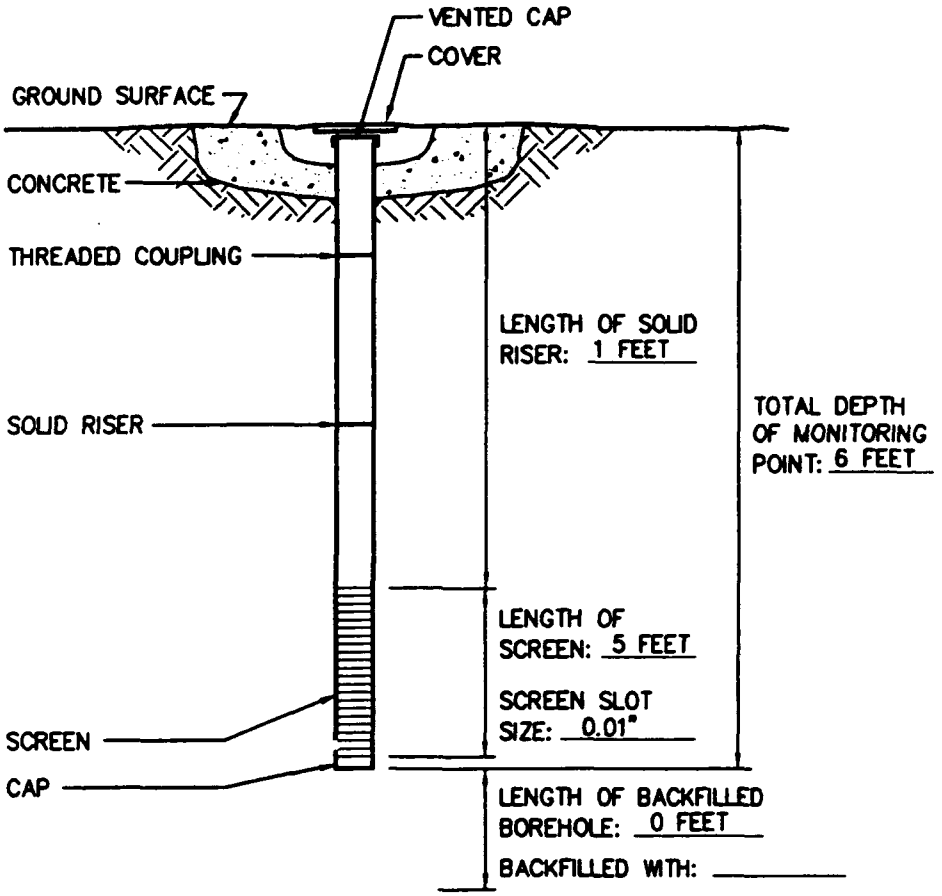
Site 56
Intrinsic Remediation TS
MacDill Air Force Base, Florida

PARSONS ENGINEERING SCIENCE, IN
Denver, Colorado

M:\45021\DRAWINGS\WELLINST\SITE56\56MP2S ON 4/30/95 AT 1200

MONITORING POINT INSTALLATION RECORD

JOB NAME MACDILL AIR FORCE BASE MONITORING POINT NUMBER 56MP-3S
JOB NUMBER 722450.21 INSTALLATION DATE 3/17/95 LOCATION SITE 56
DATUM ELEVATION 6.752 FEET ABOVE MSL WELL CASING ELEVATION 6.719 FT AMSL
DATUM FOR WATER LEVEL MEASUREMENT GROUND SURFACE
SCREEN DIAMETER & MATERIAL 1.0 INCH PVC SLOT SIZE 0.01 INCH
RISER DIAMETER & MATERIAL 1.0 INCH PVC BOREHOLE DIAMETER 2 INCHES
GEOPROBE CONTRACTOR PARSONS ENGINEERING SCIENCE ES REPRESENTATIVE KC



(NOT TO SCALE)

MONITORING POINT INSTALLATION RECORD

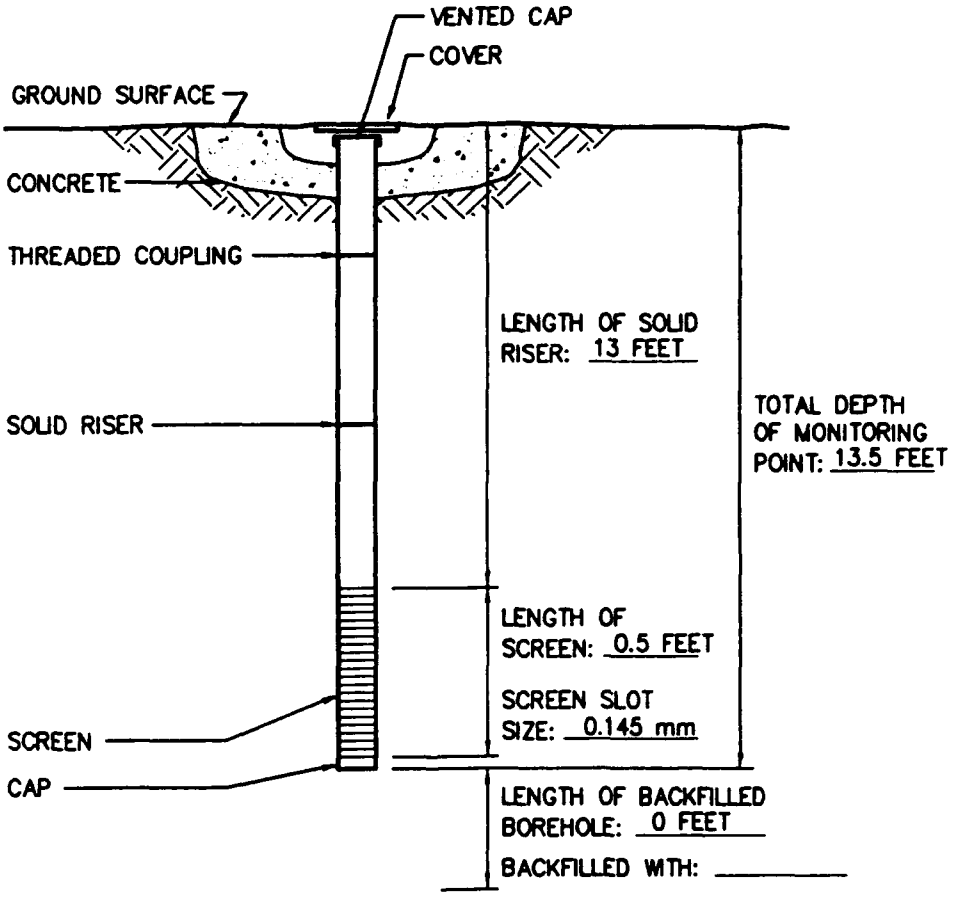
Site 56
Intrinsic Remediation TS
MacDill Air Force Base, Florida

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

M:\45021\DRAWINGS\WELLINST\SITE56\56MP3S ON 4/30/95 AT 1:200

MONITORING POINT INSTALLATION RECORD

JOB NAME MACDILL AIR FORCE BASE MONITORING POINT NUMBER 56MP-3D
JOB NUMBER 722450.21 INSTALLATION DATE 3/17/95 LOCATION SITE 56
DATUM ELEVATION 6.752 FEET ABOVE MSL WELL CASING ELEVATION TUBE WELL POIN
DATUM FOR WATER LEVEL MEASUREMENT GROUND SURFACE
SCREEN DIAMETER & MATERIAL 0.25"STAINLESS STEEL SLOT SIZE 0.145 mm
RISER DIAMETER & MATERIAL 0.375 INCH TEFLON TUBING BOREHOLE DIAMETER 1 INCH
GEOPROBE CONTRACTOR PARSONS ENGINEERING SCIENCE ES REPRESENTATIVE KC



(NOT TO SCALE)

NO WATER LEVEL MEASUREMENTS TAKEN.

MONITORING POINT INSTALLATION RECORD

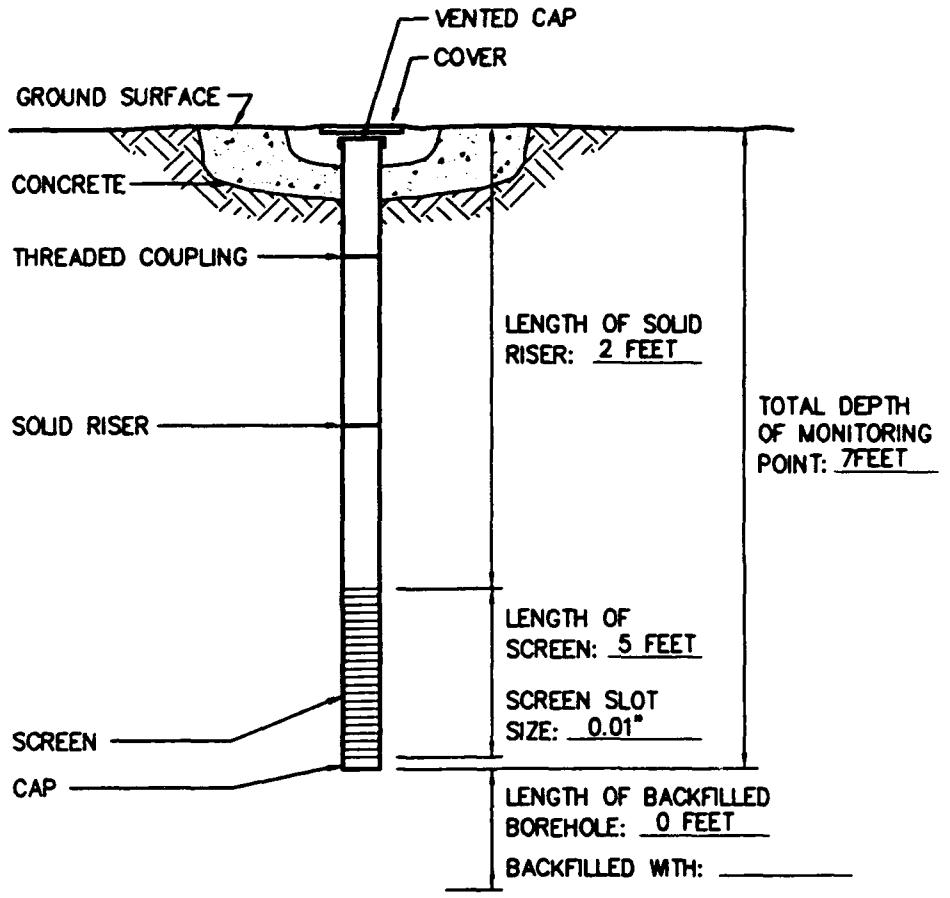
Site 56
Intrinsic Remediation TS
MacDill Air Force Base, Florida

PARSONS ENGINEERING SCIENCE, IN
Denver, Colorado

M:\45021\DRAWINGS\WELLINST\SITE56\56MP3D ON 4/30/95 AT 1200

MONITORING POINT INSTALLATION RECORD

JOB NAME MACDILL AIR FORCE BASE MONITORING POINT NUMBER 56MP-4S
JOB NUMBER 722450.21 INSTALLATION DATE 3/20/95 LOCATION SITE 56
DATUM ELEVATION 7.752 FEET ABOVE MSL WELL CASING ELEVATION 7.556 FT AMSL
DATUM FOR WATER LEVEL MEASUREMENT GROUND SURFACE
SCREEN DIAMETER & MATERIAL 1.0 INCH PVC SLOT SIZE 0.01 INCH
RISER DIAMETER & MATERIAL 1.0 INCH PVC BOREHOLE DIAMETER 2 INCHES
GEOPROBE CONTRACTOR PARSONS ENGINEERING SCIENCE ES REPRESENTATIVE KC



(NOT TO SCALE)

MONITORING POINT INSTALLATION RECORD

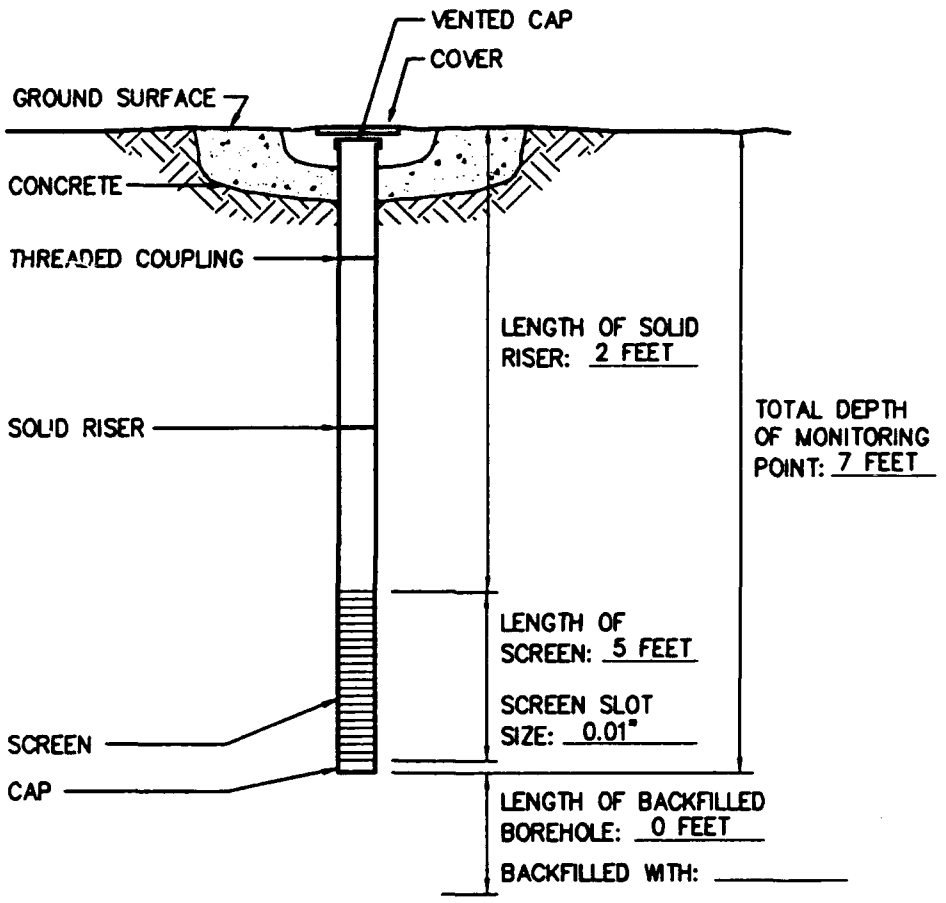
Site 56
Intrinsic Remediation TS
MacDill Air Force Base, Florida

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

M:\45021\DRAWINGS\WELLINST\SITE56\56MP4S ON 4/30/95 AT 200

MONITORING POINT INSTALLATION RECORD

JOB NAME MACDILL AIR FORCE BASE MONITORING POINT NUMBER 56MP-5S
JOB NUMBER 722450.21 INSTALLATION DATE 3/20/95 LOCATION SITE 56
DATUM ELEVATION 6.916 FEET ABOVE MSL WELL CASING ELEVATION 6.546 FT AM
DATUM FOR WATER LEVEL MEASUREMENT GROUND SURFACE
SCREEN DIAMETER & MATERIAL 1.0 INCH PVC SLOT SIZE 0.01 INCH
RISER DIAMETER & MATERIAL 1.0 INCH PVC BOREHOLE DIAMETER 2 INCHES
GEOPROBE CONTRACTOR PARSONS ENGINEERING SCIENCE ES REPRESENTATIVE KC



(NOT TO SCALE)

MONITORING POINT INSTALLATION RECORD

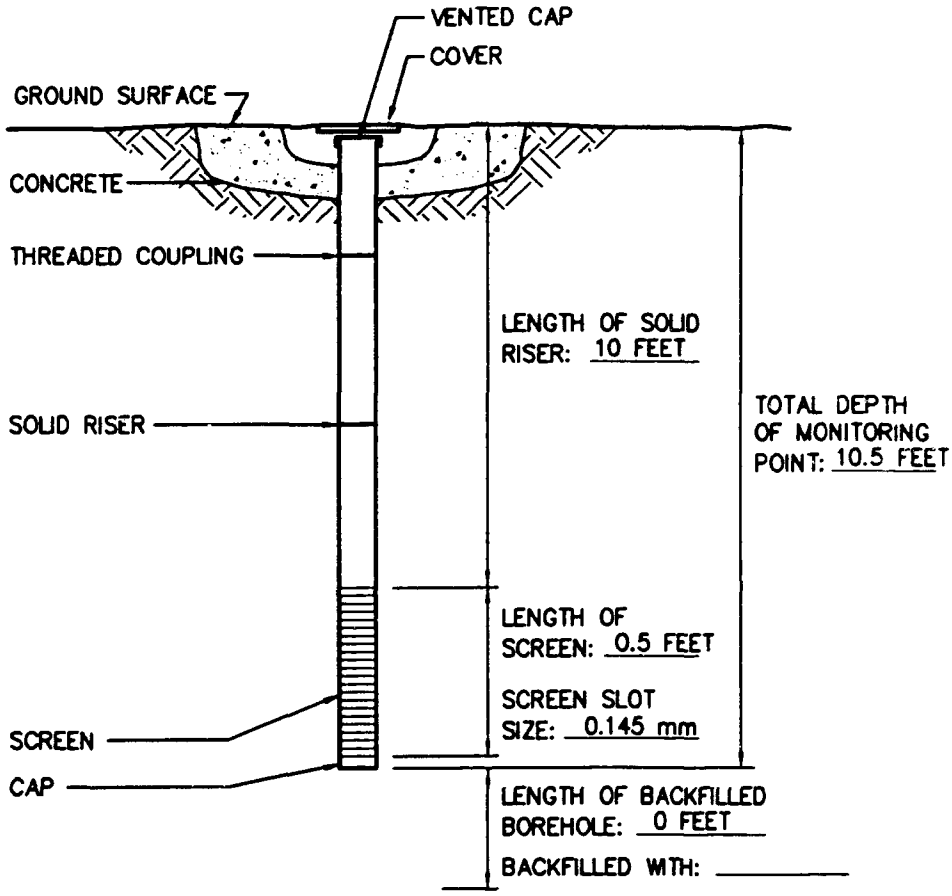
Site 56
Intrinsic Remediation TS
MacDill Air Force Base, Florida

PARSONS ENGINEERING SCIENCE, INC
Denver, Colorado

N:\45021\DRAWINGS\WELLINST\SITE56\56MP5S ON 4/30/95 AT 1200

MONITORING POINT INSTALLATION RECORD

JOB NAME MACDILL AIR FORCE BASE MONITORING POINT NUMBER 56MP-5D
JOB NUMBER 722450.21 INSTALLATION DATE 3/20/95 LOCATION SITE 56
DATUM ELEVATION 6.916 FEET ABOVE MSL WELL CASING ELEVATION TUBE WELL POINT
DATUM FOR WATER LEVEL MEASUREMENT GROUND SURFACE
SCREEN DIAMETER & MATERIAL 0.25" STAINLESS STEEL SLOT SIZE 0.145 mm
RISER DIAMETER & MATERIAL 0.375 INCH TEFLON TUBING BOREHOLE DIAMETER 1 INCH
GEOPROBE CONTRACTOR PARSONS ENGINEERING SCIENCE ES REPRESENTATIVE KC



(NOT TO SCALE)

NO WATER LEVEL MEASUREMENTS TAKEN.

MONITORING POINT INSTALLATION RECORD

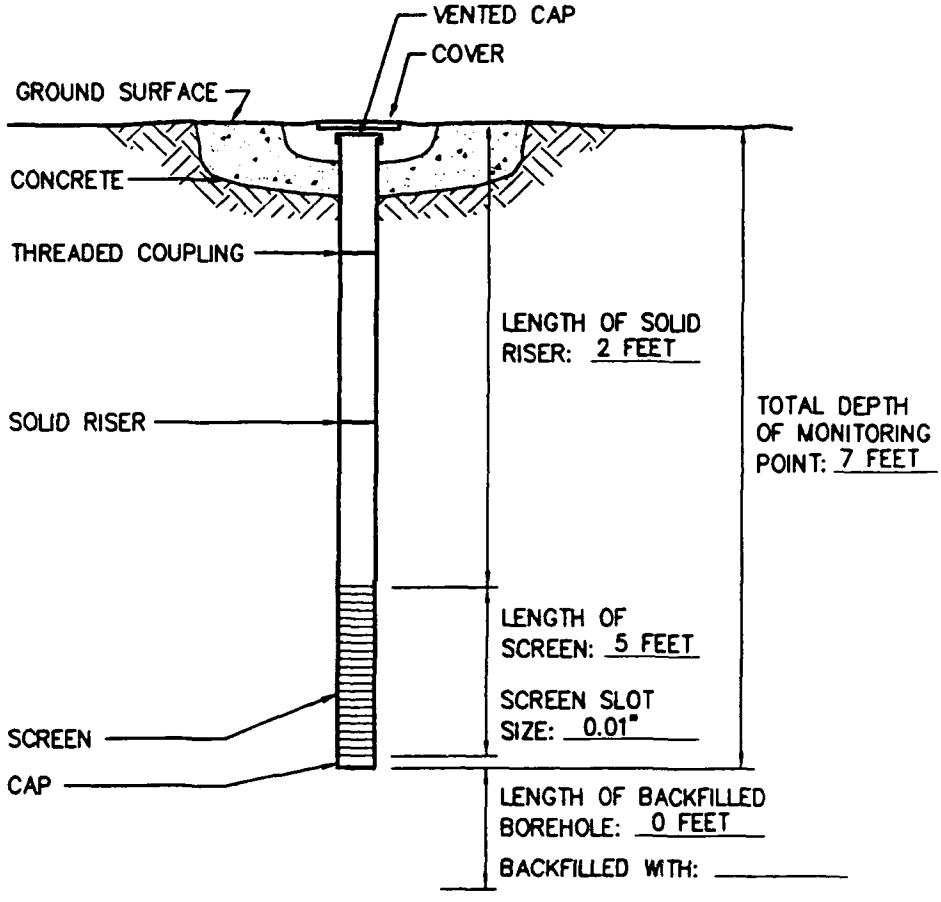
Site 56
Intrinsic Remediation TS
MacDill Air Force Base, Florida

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

M:\45021\DRAWINGS\WELLINST\SITE56\56MP5D ON 4/30/95 AT 1200

MONITORING POINT INSTALLATION RECORD

JOB NAME MACDILL AIR FORCE BASE MONITORING POINT NUMBER 56MP-6S
JOB NUMBER 722450.21 INSTALLATION DATE 3/20/95 LOCATION SITE 56
DATUM ELEVATION 6.582 FEET ABOVE MSL WELL CASING ELEVATION 6.582 FT AM
DATUM FOR WATER LEVEL MEASUREMENT GROUND SURFACE
SCREEN DIAMETER & MATERIAL 1.0 INCH PVC SLOT SIZE 0.01 INCH
RISER DIAMETER & MATERIAL 1.0 INCH PVC BOREHOLE DIAMETER 2 INCHES
GEOPROBE CONTRACTOR PARSONS ENGINEERING SCIENCE ES REPRESENTATIVE KC



(NOT TO SCALE)

MONITORING POINT INSTALLATION RECORD

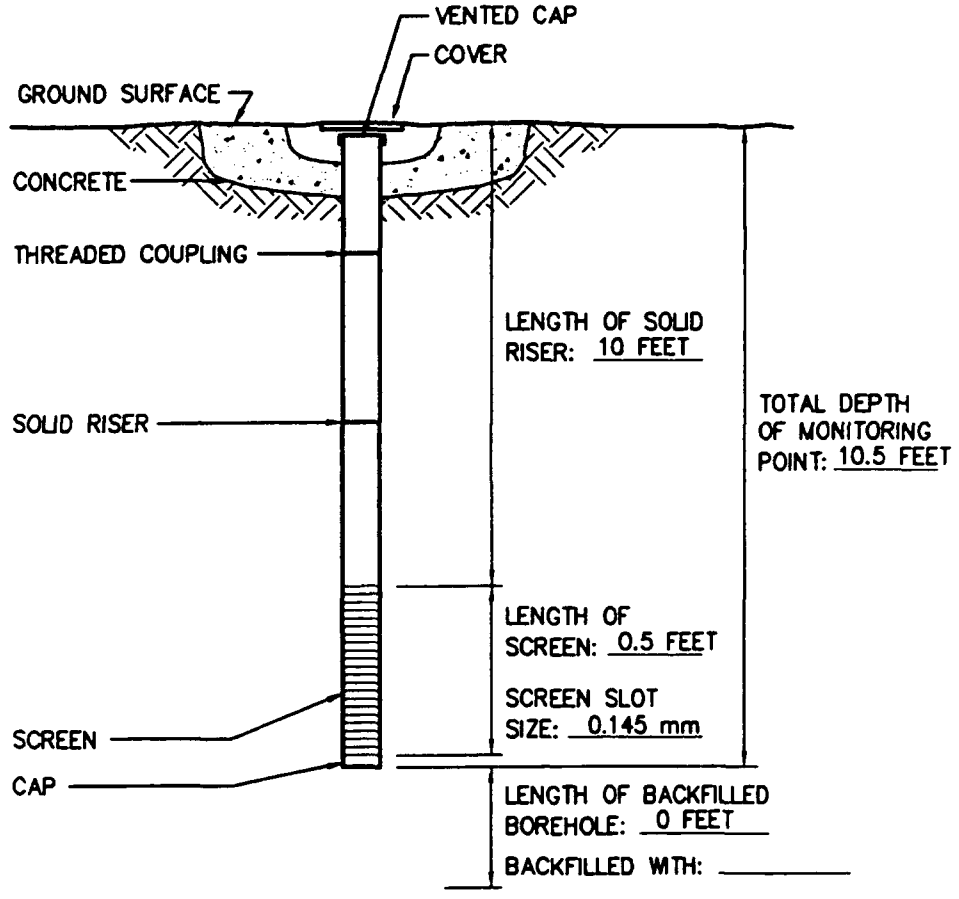
Site 56
Intrinsic Remediation TS
MacDill Air Force Base, Florida

PARSONS ENGINEERING SCIENCE, INC
Denver, Colorado

M:\722450\DRAWINGS\WELLINST\SITE56\56MP6S ON 4/30/95 AT 1700

MONITORING POINT INSTALLATION RECORD

JOB NAME MACDILL AIR FORCE BASE MONITORING POINT NUMBER 56MP-6D
JOB NUMBER 722450.21 INSTALLATION DATE 3/20/95 LOCATION SITE 56
DATUM ELEVATION 6.582 FEET ABOVE MSL WELL CASING ELEVATION TUBE WELL POINT
DATUM FOR WATER LEVEL MEASUREMENT GROUND SURFACE
SCREEN DIAMETER & MATERIAL 0.25"STAINLESS STEEL SLOT SIZE 0.145 mm
RISER DIAMETER & MATERIAL 0.375 INCH TEFLON TUBING BOREHOLE DIAMETER 1 INCH
GEOPROBE CONTRACTOR PARSONS ENGINEERING SCIENCE ES REPRESENTATIVE KC



(NOT TO SCALE)

NO WATER LEVEL MEASUREMENTS TAKEN.

MONITORING POINT INSTALLATION RECORD

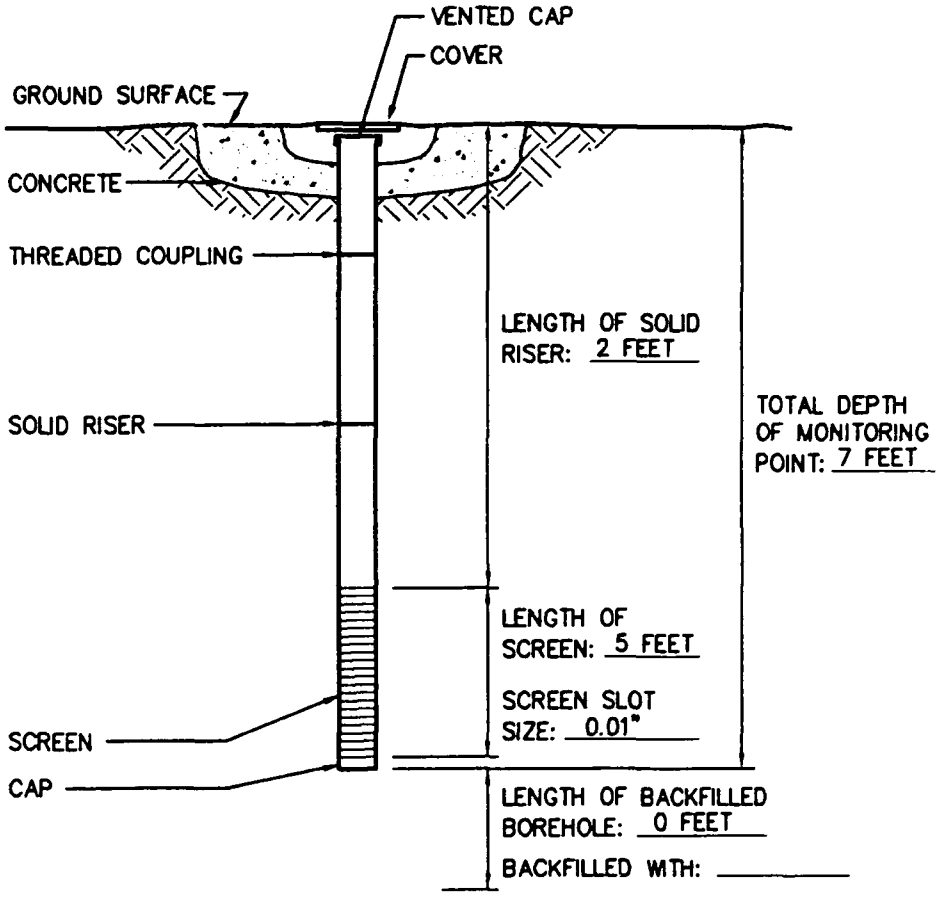
Site 56
Intrinsic Remediation TS
MacDill Air Force Base, Florida

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

M:\45021\DRAWNGS\WELLINST\SITE56\56MP6D ON 4/20/95 AT 1700

MONITORING POINT INSTALLATION RECORD

JOB NAME MACDILL AIR FORCE BASE MONITORING POINT NUMBER 56MP-7S
JOB NUMBER 722450.21 INSTALLATION DATE 3/20/95 LOCATION SITE 56
DATUM ELEVATION 7.236 FEET ABOVE MSL WELL CASING ELEVATION 7.162 FT A
DATUM FOR WATER LEVEL MEASUREMENT GROUND SURFACE
SCREEN DIAMETER & MATERIAL 1.0 INCH PVC SLOT SIZE 0.01 INCH
RISER DIAMETER & MATERIAL 1.0 INCH PVC BOREHOLE DIAMETER 2 INCHES
GEOPROBE CONTRACTOR PARSONS ENGINEERING SCIENCE ES REPRESENTATIVE KC



(NOT TO SCALE)

MONITORING POINT INSTALLATION RECORD

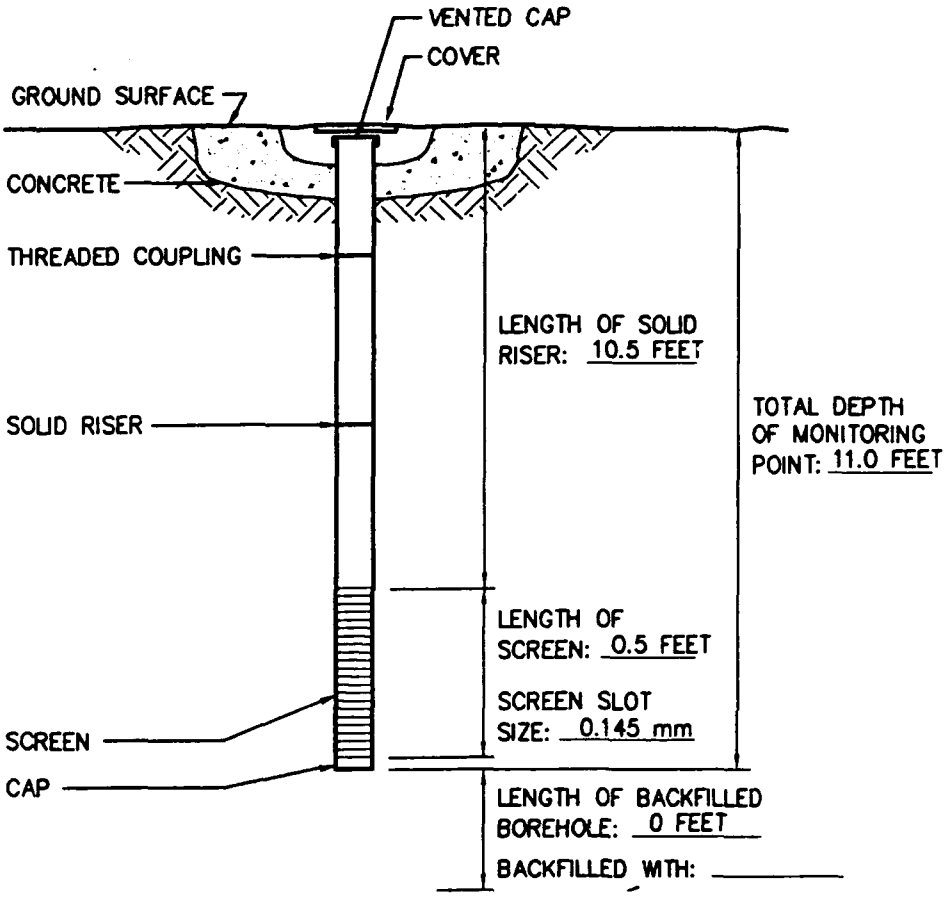
Site 56
Intrinsic Remediation TS
MacDill Air Force Base, Florida

PARSONS ENGINEERING SCIENCE, IN
Denver, Colorado

M:\45021\DRAWINGS\MELINST\SITE56\56MP7S ON 4/20/95 AT 1700

MONITORING POINT INSTALLATION RECORD

JOB NAME MACDILL AIR FORCE BASE MONITORING POINT NUMBER 56MP-7D
JOB NUMBER 722450.21 INSTALLATION DATE 3/20/95 LOCATION SITE 56
DATUM ELEVATION 7.236 FEET ABOVE MSL WELL CASING ELEVATION TUBE WELL POINT
DATUM FOR WATER LEVEL MEASUREMENT GROUND SURFACE
SCREEN DIAMETER & MATERIAL 0.25"STAINLESS STEEL SLOT SIZE 0.145 mm
RISER DIAMETER & MATERIAL 0.375 INCH TEFLON TUBING BOREHOLE DIAMETER 1 INCH
GEOPROBE CONTRACTOR PARSONS ENGINEERING SCIENCE ES REPRESENTATIVE KC



(NOT TO SCALE)

NO WATER LEVEL MEASUREMENTS TAKEN.

MONITORING POINT INSTALLATION RECORD

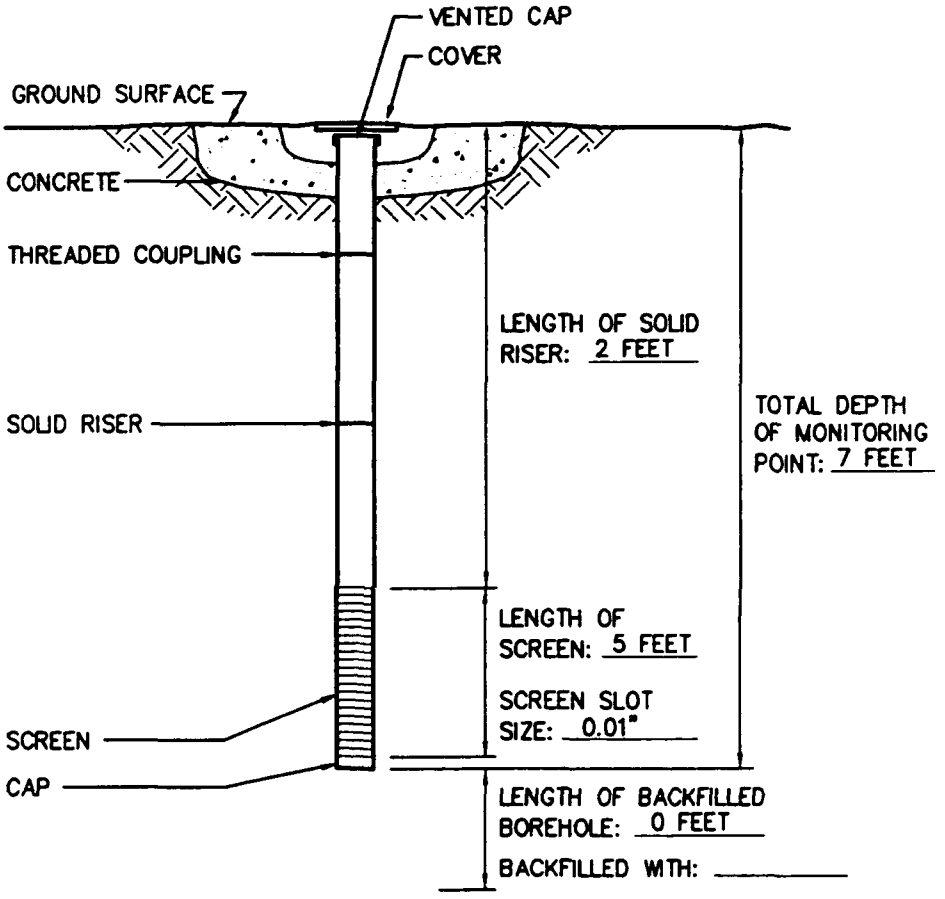
Site 56
Intrinsic Remediation TS
MacDill Air Force Base, Florida

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

M:\45021\DRAWINGS\WELLINST\SITE56\56MP7D ON 4/20/95 AT 1700

MONITORING POINT INSTALLATION RECORD

JOB NAME MACDILL AIR FORCE BASE MONITORING POINT NUMBER 56MP-8S
JOB NUMBER 722450.21 INSTALLATION DATE 3/20/95 LOCATION SITE 56
DATUM ELEVATION 6.522 FEET ABOVE MSL WELL CASING ELEVATION 6.549 FT AM
DATUM FOR WATER LEVEL MEASUREMENT GROUND SURFACE
SCREEN DIAMETER & MATERIAL 1.0 INCH PVC SLOT SIZE 0.01 INCH
RISER DIAMETER & MATERIAL 1.0 INCH PVC BOREHOLE DIAMETER 2 INCHES
GEOPROBE CONTRACTOR PARSONS ENGINEERING SCIENCE ES REPRESENTATIVE KC



(NOT TO SCALE)

MONITORING POINT INSTALLATION RECORD

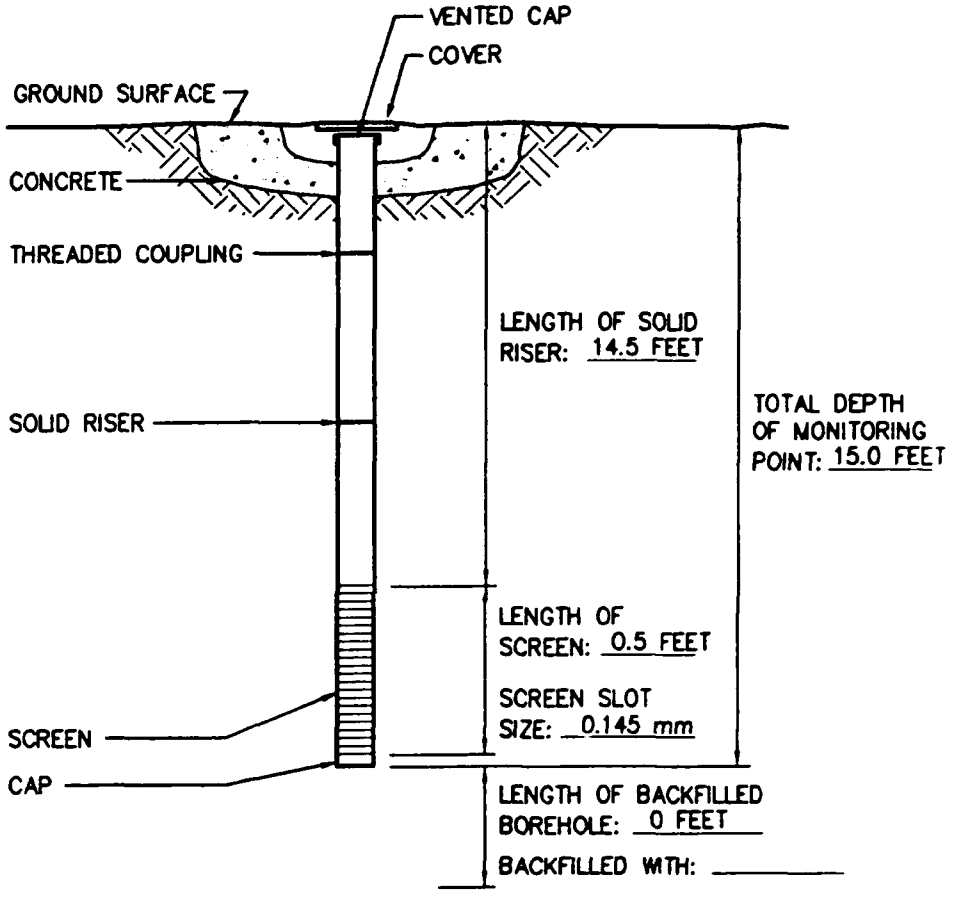
Site 56
Intrinsic Remediation TS
MacDill Air Force Base, Florida

PARSONS ENGINEERING SCIENCE, IN
Denver, Colorado

M:\4502\DRAWINGS\WELLINST\SITE56\56MP8S ON 4/20/95 AT 1700

MONITORING POINT INSTALLATION RECORD

JOB NAME MACDILL AIR FORCE BASE MONITORING POINT NUMBER 56MP-9D
JOB NUMBER 722450.21 INSTALLATION DATE 3/20/95 LOCATION SITE 56
DATUM ELEVATION 6.439 FEET ABOVE MSL WELL CASING ELEVATION TUBE WELL POINT
DATUM FOR WATER LEVEL MEASUREMENT GROUND SURFACE
SCREEN DIAMETER & MATERIAL 0.25"STAINLESS STEEL SLOT SIZE 0.145 mm
RISER DIAMETER & MATERIAL 0.375 INCH TEFLON TUBING BOREHOLE DIAMETER 1 INCH
GEOPROBE CONTRACTOR PARSONS ENGINEERING SCIENCE ES REPRESENTATIVE KC



(NOT TO SCALE)

NO WATER LEVEL MEASUREMENTS TAKEN.

MONITORING POINT INSTALLATION RECORD

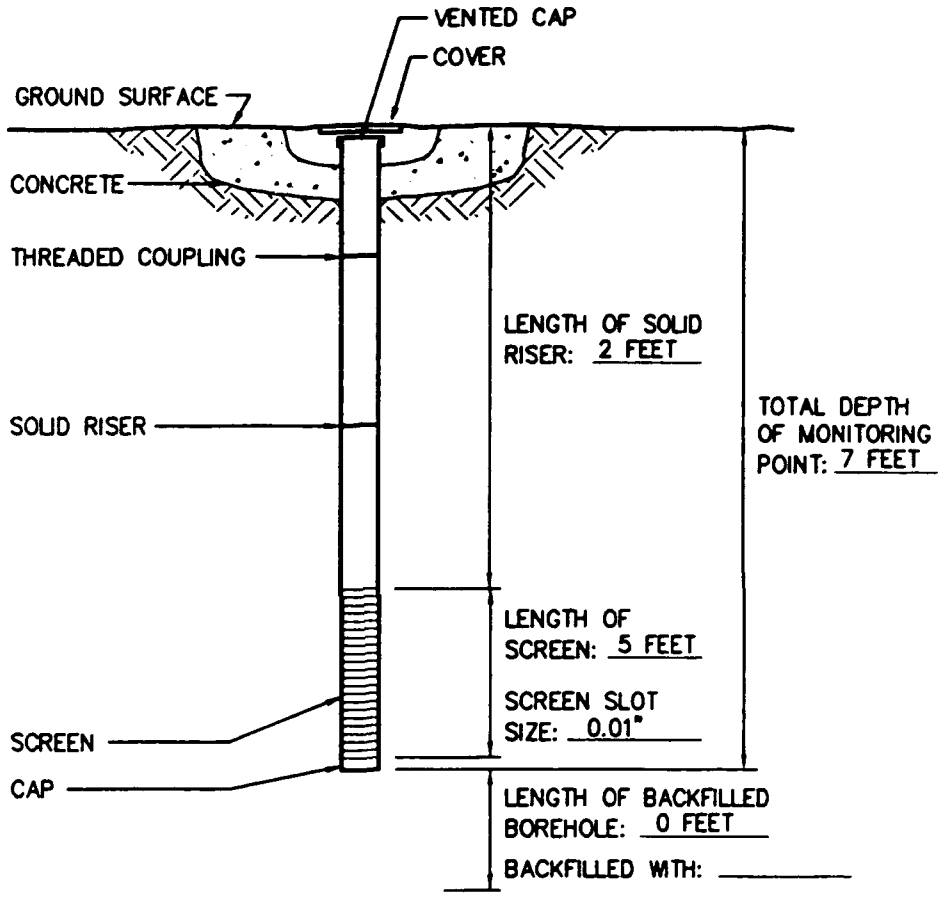
Site 56
Intrinsic Remediation TS
MacDill Air Force Base, Florida

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

N:\45021\DRAWINGS\WELLINST\SITE56\56MP9D ON 4/20/95 AT 1700

MONITORING POINT INSTALLATION RECORD

JOB NAME MACDILL AIR FORCE BASE MONITORING POINT NUMBER 56MP-10S
JOB NUMBER 722450.21 INSTALLATION DATE 3/20/95 LOCATION SITE 56
DATUM ELEVATION 7.602 FEET ABOVE MSL WELL CASING ELEVATION 7.462 FT
DATUM FOR WATER LEVEL MEASUREMENT GROUND SURFACE
SCREEN DIAMETER & MATERIAL 1.0 INCH PVC SLOT SIZE 0.01 INCH
RISER DIAMETER & MATERIAL 1.0 INCH PVC BOREHOLE DIAMETER 2 INCHES
GEOPROBE CONTRACTOR PARSONS ENGINEERING SCIENCE ES REPRESENTATIVE KC



(NOT TO SCALE)

MONITORING POINT INSTALLATION RECORD

Site 56
Intrinsic Remediation TS
MacDill Air Force Base, Florida

PARSONS ENGINEERING SCIENCE, IN
Denver, Colorado

M:\45021\DRAWINGS\WELLINST\SITE56\56MP10S ON 4/20/95 AT 1700

MONITORING POINT DEVELOPMENT RECORD

Page 1 of 1

Job Number: 722450.21 Job Name: MacDill AFB
Location Site 56 By KC / MV Date 3/24/95
Well Number 56MP-15 Measurement Datum TOC

Pre-Development Information Time (Start): ~~16:35~~ 16:35

Water Level: NM Total Depth of Well:

Water Characteristics

Color DARK Brown Clear (Cloudy) muddy
Odor: None Weak Moderate Strong
Any Films or Immiscible Material no
pH _____ Temperature(°F °C) _____
Specific Conductance(µS/cm) _____

Interim Water Characteristics

Gallons Removed

pH

Temperature (°F °C)

Specific Conductance(µS/cm)

Post-Development Information Time (Finish): 17:00

Water Level: Total Depth of Well:

Approximate Volume Removed: 16 GALLONS

Water Characteristics

Color Clear (Clear) Cloudy
Odor: None ~~Weak~~ Moderate Strong
Any Films or Immiscible Material no
pH _____ Temperature(°F °C) _____
Specific Conductance(µS/cm) _____

Comments: Slow pump rate - Pumped dry Three times

Monitoring Point Type Shallow / Deep

MONITORING POINT DEVELOPMENT RECORD

Job Number: 722450.21 Job Name: MacDill AFB Date 3/21/95
Location Site 56 By KC / MV
Well Number SC MP -2S Measurement Datum TOC

Pre-Development Information

Time (Start): 17:05

Water Level:

Total Depth of Well:

Water Characteristics

Color dark Brown Clear Cloudy muddy
Odor: None Weak Moderate Strong
Any Films or Immiscible Material no
pH Temperature(°F °C)
Specific Conductance(µS/cm)

Interim Water Characteristics

Gallons Removed

pH

Temperature (°F °C)

Specific Conductance(µS/cm)

Post-Development Information

Time (Finish): 17:30

Water Level: 5.64' Total Depth of Well: 7.80' btc

Approximate Volume Removed: 3 gallons

Water Characteristics

Color Clear Clear Cloudy
Odor: None Weak Moderate Strong
Any Films or Immiscible Material no
pH Temperature(°F °C)
Specific Conductance(µS/cm)

Comments: Fast Pump rate

Monitoring Point Type Shallow / Deep

MONITORING POINT DEVELOPMENT RECORD

Page 1 of 1

Job Number: 722450.21 Job Name: MacDill AFB
Location Site 56 By KC / MV Date 3/24/95
Well Number 56 MP- 35 Measurement Datum TOC

Pre-Development Information Time (Start): 16:00

Water Level: Total Depth of Well:

Water Characteristics

Color Dark Brown Clear (Cloudy) muddy
Odor: None (Weak) Moderate Strong
Any Films or Immiscible Material no
pH — Temperature(°F °C) —
Specific Conductance(µS/cm) —

Interim Water Characteristics

Gallons Removed

pH —

Temperature (°F °C)

Specific Conductance(µS/cm)

Post-Development Information Time (Finish): 16:30

Water Level: 5.35 Total Depth of Well:

Approximate Volume Removed: 3 gallon

Water Characteristics

Color Clear (Clear) Cloudy
Odor: (None) Weak Moderate Strong
Any Films or Immiscible Material no
pH 6.81 Temperature(°F (°C) 25.2
Specific Conductance(µS/cm) 5.5 x 10

Comments: Slow pump rate

Monitoring Point Type Shallow / (Deep)

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MONITORING POINT DEVELOPMENT RECORD

Job Number: 722450.21 Job Name: MacDill AFB
Location Site 56 By KC / MV Date 3/24/95
Well Number 56mp-30 Measurement Datum TOC

Pre-Development Information

Time (Start): 1125

Water Level: nm

Total Depth of Well:

Water Characteristics

Color Light Brown Clear (Cloudy)
Odor: None Weak (Moderate) Strong
Any Films or Immiscible Material ns
pH _____ Temperature(°F °C) _____
Specific Conductance(µS/cm) _____

Interim Water Characteristics

Gallons Removed 3 gallons

pH

Temperature (°F °C)

Specific Conductance(µS/cm)

Post-Development Information

Time (Finish): 1115

Water Level:

Total Depth of Well:

Approximate Volume Removed:

Water Characteristics

Color _____ (Clear) Cloudy
Odor: None Weak (Moderate) Strong
Any Films or Immiscible Material _____
pH _____ Temperature(°F °C) _____
Specific Conductance(µS/cm) _____

Comments:

Monitoring Point Type Shallow / (Deep)

MONITORING POINT DEVELOPMENT RECORD

Page 1 of 1

Job Number: 722450.21 Job Name: MacDill AFB
Location Site 56 By KC / MV Date 3/22/95
Well Number 56MP-45 Measurement Datum TOC

Pre-Development Information

Time (Start): 16:35

Water Level: 5.02

Total Depth of Well:

Water Characteristics

Color dark brown Clear (Cloudy)
Odor: None Weak Moderate (Strong) HC
Any Films or Immiscible Material yes - film
pH _____ Temperature(°F °C) _____
Specific Conductance(µS/cm) _____

Interim Water Characteristics

Gallons Removed 3 gallons

pH

Temperature (°F °C)

Specific Conductance(µS/cm)

Post-Development Information

Time (Finish): 17:10

Water Level: 5.02

Total Depth of Well:

Approximate Volume Removed:

Water Characteristics

Color clear (Clear) Cloudy
Odor: None Weak Moderate Strong
Any Films or Immiscible Material no
pH 6.73 Temperature(°F °C) 27.1
Specific Conductance(µS/cm) 48810

Comments: fast pump rate

Monitoring Point Type Shallow / Deep

MONITORING POINT DEVELOPMENT RECORD

Job Number: 722450.21 Job Name: MacDill AFB
Location Site 56 By KC / MV Date 3/23/95
Well Number 56 MP-56 Measurement Datum TOC

Pre-Development Information Time (Start): 16:10

Water Level: 11.11 Total Depth of Well:

Water Characteristics

Color DARK BROWN Clear Cloudy
Odor: None Weak Moderate Strong HC
Any Films or Immiscible Material yes
pH 7.36 Temperature(°F °C) 28 4
Specific Conductance(µS/cm) 9 x 1 c

Interim Water Characteristics

Gallons Removed

pH

Temperature (°F °C)

Specific Conductance(µS/cm)

Post-Development Information Time (Finish): 16:25

Water Level: 11.41 Total Depth of Well:

Approximate Volume Removed: 2 gallons

Water Characteristics

Color Clear Cloudy
Odor: None Weak Moderate Strong
Any Films or Immiscible Material
pH Temperature(°F °C)
Specific Conductance(µS/cm)
D.C. (mmho/c)

Comments: fast pump rate

Monitoring Point Type Shallow / Deep

MONITORING POINT DEVELOPMENT RECORD

Job Number: 722450.21 Job Name: MacDill AFB
Location Site 56 By KC CMV Date 3/23/95
Well Number 56-MW-5D Measurement Datum TOC

Pre-Development Information Time (Start): 15:52

Water Level: NM Total Depth of Well:

Water Characteristics

Color Clear / yellow Clear Cloudy
Odor: None Weak Moderate Strong
Any Films or Immiscible Material no
pH 6.41 Temperature(°F °C)
Specific Conductance(µS/cm) 411 x 10

Interim Water Characteristics

Gallons Removed 2 gallons

pH

Temperature (°F °C)

Specific Conductance(µS/cm)

Post-Development Information Time (Finish): 16:05

Water Level: NM Total Depth of Well:

Approximate Volume Removed: 2

Water Characteristics

Color Clear / yellow Clear Cloudy
Odor: None Weak Moderate Strong
Any Films or Immiscible Material no
pH 5.97 Temperature(°F °C) 20.0
Specific Conductance(µS/cm) 411 x 10
D.O. (mg/l) 0.08

Comments: fast pump rate
Monitoring Point Type Shallow / Deep

MONITORING POINT DEVELOPMENT RECORD

Job Number: 722450.21 Job Name: MacDill AFB
Location Site 56 By KC / MV Date 3/24/95
Well Number 56 MP-6S Measurement Datum TOC

Pre-Development Information Time (Start): 10:25

Water Level: Total Depth of Well:

Water Characteristics

Color Dark Brown Clear Cloudy muddy
Odor: None Weak Moderate Strong
Any Films or Immiscible Material yes - 5.1 m
pH Temperature(°F °C)
Specific Conductance(µS/cm)

Interim Water Characteristics

Gallons Removed 3

pH

Temperature (°F °C)

Specific Conductance(µS/cm)

Post-Development Information Time (Finish): 10:40

Water Level: Total Depth of Well:

Approximate Volume Removed: 3 gallons

Water Characteristics

Color Clear / yellow Clear Cloudy
Odor: None Weak Moderate Strong
Any Films or Immiscible Material no
pH 6.57 Temperature(°F °C) 24.1
Specific Conductance(µS/cm) ~~33x10~~ 53x10

Comments: fast Pump Rate

Monitoring Point Type Shallow / Deep

MONITORING POINT DEVELOPMENT RECORD

Job Number: 722450.21 Job Name: MacDill AFB
Location Site 56 By KC / MV Date 5/24/98
Well Number 56MP-6D Measurement Datum TOC

Pre-Development Information Time (Start): 10:00

Water Level: NM Total Depth of Well:

Water Characteristics

Color Brown Clear (Cloudy)
Odor: None Weak Moderate Strong
Any Films or Immiscible Material slight film
pH _____ Temperature(°F °C) _____
Specific Conductance(µS/cm) _____

Interim Water Characteristics

Gallons Removed

pH

Temperature (°F °C)

Specific Conductance(µS/cm)

Post-Development Information Time (Finish): 10:20

Water Level: Total Depth of Well:

Approximate Volume Removed: 3 gallons

Water Characteristics

Color clear yellow (Clear) Cloudy
Odor: None Weak Moderate Strong
Any Films or Immiscible Material no
pH 7.32 Temperature(°F °C) 24.1
Specific Conductance(µS/cm) 85F10

Comments: fast pump rate

Monitoring Point Type Shallow / (Deep)

MONITORING POINT DEVELOPMENT RECORD

Page 1 of 1

Job Number: 722450.21 Job Name: MacDill AFB
Location Site 56 By KC / MV Date 3/23/95
Well Number 56 MP - 7B S Measurement Datum TOC

Pre-Development Information Time (Start): 16:15

Water Level: 4.59 Total Depth of Well:

Water Characteristics

Color Dark Brown Clear (Cloudy) – muddy
Odor: None Weak Moderate (Strong)
Any Films or Immiscible Material no
pH _____ Temperature(°F °C) _____
Specific Conductance(µS/cm) _____

Interim Water Characteristics

Gallons Removed 5

pH

Temperature (°F °C)

Specific Conductance(µS/cm)

Post-Development Information Time (Finish): 17:00

Water Level: 5.14 Total Depth of Well:

Approximate Volume Removed:

Water Characteristics

Color Clear (Clear) Cloudy
Odor: None Weak (Moderate) Strong
Any Films or Immiscible Material no
pH _____ Temperature(°F °C) _____
Specific Conductance(µS/cm) _____

Comments: Moderate pump rate

Monitoring Point Type (Shallow) / Deep

MONITORING POINT DEVELOPMENT RECORD

Page 1 of 1

Job Number: 722450.21 Job Name: MacDill AFB
Location Site 56 By KC / MV Date 3/26/95
Well Number SG MP-#7D Measurement Datum TOC

Pre-Development Information Time (Start): 15:20

Water Level: NM Total Depth of Well:

Water Characteristics

Color Yellow Clear Cloudy
Odor: None Weak Moderate Strong
Any Films or Immiscible Material no
pH _____ Temperature(°F °C) _____
Specific Conductance(µS/cm) _____

Interim Water Characteristics

Gallons Removed 7

pH

Temperature (°F °C)

Specific Conductance(µS/cm)

Post-Development Information Time (Finish): 16:45

Water Level: NM Total Depth of Well:

Approximate Volume Removed:

Water Characteristics

Color Clear Clear Cloudy
Odor: None Weak Moderate Strong
Any Films or Immiscible Material none
pH _____ Temperature(°F °C) _____
Specific Conductance(µS/cm) _____

Comments: fast pump rate

Monitoring Point Type Shallow / Deep

MONITORING POINT DEVELOPMENT RECORD

Page 1 of 1

Job Number: 722450.21 Job Name: MacDill AFB
Location Site 56 By KC / MV Date 3/24/95
Well Number 56MP-8S Measurement Datum TOC

Pre-Development Information

Time (Start):

Water Level:

Total Depth of Well: 10.45

Water Characteristics

Color DARK Brown Clear Cloudy muddy
Odor: None Weak Moderate → Strong
Any Films or Immiscible Material no
pH _____ Temperature(°F °C) _____
Specific Conductance(µS/cm) _____

Interim Water Characteristics

Gallons Removed 3

pH

Temperature (°F °C)

Specific Conductance(µS/cm)

Post-Development Information

Time (Finish): 11:15

Water Level: NM

Total Depth of Well:

Approximate Volume Removed: 3 gall

Water Characteristics

Color Clear / yellow Clear Cloudy
Odor: None Weak Moderate Strong
Any Films or Immiscible Material no
pH 7.17 Temperature(°F °C) 24.7
Specific Conductance(µS/cm) 55 x 10

Comments: moderate pump rate

Monitoring Point Type Shallow / Deep

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MONITORING POINT DEVELOPMENT RECORD

Page 1 of 1

Job Number: 722450.21 Job Name: MacDill AFB
Location Site 56 By KC / MV Date 3/22/95 3/24/95
Well Number 56 MP-9D Measurement Datum TOC

Pre-Development Information Time (Start): 16:25 & 9845

Water Level: NM Total Depth of Well:

Water Characteristics No. Recovery

Color _____ Clear Cloudy
Odor: None Weak Moderate Strong
Any Films or Immiscible Material _____
pH _____ Temperature(^{o}F ^{o}C) _____
Specific Conductance(µS/cm) _____

Interim Water Characteristics

Gallons Removed

pH

Temperature (^{o}F ^{o}C)

Specific Conductance(µS/cm)

Post-Development Information Time (Finish):

Water Level: Total Depth of Well:

Approximate Volume Removed:

Water Characteristics

Color _____ Clear Cloudy
Odor: None Weak Moderate Strong
Any Films or Immiscible Material _____
pH _____ Temperature(^{o}F ^{o}C) _____
Specific Conductance(µS/cm) _____

Comments:

Monitoring Point Type Shallow / Deep

MONITORING POINT DEVELOPMENT RECORD

Job Number: 722450.21 Job Name: MacDill AFB
Location Site 56 By KC / MV Date 3/12/95
Well Number 56MW-11S Measurement Datum TOC

Pre-Development Information Time (Start): 1617.00

Water Level: Total Depth of Well:

Water Characteristics

Color Dark Brown Clear (Cloudy)
Odor: None (Weak) Moderate Strong
Any Films or Immiscible Material no
pH _____ Temperature(°F °C) _____
Specific Conductance(µS/cm) _____

Interim Water Characteristics

Gallons Removed

pH

Temperature (°F °C)

Specific Conductance(µS/cm)

Post-Development Information Time (Finish):

Water Level: Total Depth of Well:

Approximate Volume Removed:

Water Characteristics

Color Clear
Odor: None Weak Moderate Strong
Any Films or Immiscible Material _____
pH _____ Temperature(°F °C) _____
Specific Conductance(µS/cm) _____

Comments:

Monitoring Point Type Shallow / Deep

SAMPLING LOCATION MacDill AFB Site 56
SAMPLING DATE(S) March 1995

GROUND WATER SAMPLING RECORD - MONITORING WELL 56 MP-1S
(number)

REASON FOR SAMPLING: [X] Regular Sampling; [ ] Special Sampling;
DATE AND TIME OF SAMPLING: 3/28/95, 19__ 11:30 a.m./p.m.
SAMPLE COLLECTED BY: MV/KC of ES Denver
WEATHER: 70° Cloudy
DATUM FOR WATER DEPTH MEASUREMENT (Describe): Top of Well Casing

MONITORING WELL CONDITION:
[ ] LOCKED: [X] UNLOCKED
WELL NUMBER ((S) IS NOT) APPARENT
STEEL CASING CONDITION IS: New
INNER PVC CASING CONDITION IS: New
WATER DEPTH MEASUREMENT DATUM ((S) IS NOT) APPARENT
[ ] DEFICIENCIES CORRECTED BY SAMPLE COLLECTOR
[ ] MONITORING WELL REQUIRED REPAIR (describe):

Check-off

1 [x] EQUIPMENT CLEANED BEFORE USE WITH Alconox, Distilled H2O, and Acetone
Items Cleaned (List): All Equipment used in sampling

2 [x] PRODUCT DEPTH NP FT. BELOW DATUM
Measured with: Oil/ Water Interface Probe

WATER DEPTH 5.36 FT. BELOW DATUM
Measured with: Water Level Probe

3 [x] WATER-CONDITION BEFORE WELL EVACUATION (Describe):
Appearance: Brown
Odor: Strong HCl
Other Comments:

4 [x] WELL EVACUATION:
Method: Peristaltic
Volume Removed: 2500 ml
Observations: Water (slightly - (very) cloudy
Water level (rose - (fell) - no change)
Water odors: Moderate
Other comments:

Ground Water Sampling Record - Monitoring Well No. 15 (Cont'd)

5 [x] SAMPLE EXTRACTION METHOD:

[ ] Bailer made of:_____
[x] Pump, type: Peristaltic Pump
[ ] Other, describe:_____

Sample obtained is [x] GRAB; [ ] COMPOSITE SAMPLE

6 [x] ON-SITE MEASUREMENTS:

Temp: _____° C		Measured with: Orion Instrument
pH: _____		Measured with:_____
Conductivity: _____	µS/cm	Measured with:_____
Dissolved Oxygen: _____	mg/l	Measured with: Orion Instrument
Redox Potential: _____	mV	Measured with:_____
Salinity: _____		Measured with:_____
Nitrate: _____		Measured with:_____
Sulfate: _____		Measured with:_____
Ferrous Iron: _____		Measured with:_____
Other: _____		

7 [ ] SAMPLE CONTAINERS (material, number, size): 1-Meth, Hach, Anion
2-BTex, VOC, TVH

8 [ ] ON-SITE SAMPLE TREATMENT:

[ ] Filtration: Method_____ Containers:_____
Method_____ Containers:_____
Method_____ Containers:_____

[ ] Preservatives added:

Method_____ Containers:_____
Method_____ Containers:_____
Method_____ Containers:_____
Method_____ Containers:_____

9 [ ] CONTAINER HANDLING:

[ ] Container Sides Labeled
[ ] Container Lids Taped
[ ] Containers Placed in Ice Chest

10 [ ] OTHER COMMENTS:_____

SAMPLING LOCATION MacDill AFB Site 56
SAMPLING DATE(S) March 1995

GROUND WATER SAMPLING RECORD - MONITORING WELL 56 MP-2S
(number)

REASON FOR SAMPLING: [X] Regular Sampling; [ ] Special Sampling;
DATE AND TIME OF SAMPLING: 3/29, 1995 8:00 a.m./p.m.
SAMPLE COLLECTED BY: MV/KC of ES Denver
WEATHER:
DATUM FOR WATER DEPTH MEASUREMENT (Describe): Top of Well Casing

MONITORING WELL CONDITION:
[ ] LOCKED: [X] UNLOCKED
WELL NUMBER (IS - IS NOT) APPARENT
STEEL CASING CONDITION IS: New
INNER PVC CASING CONDITION IS: New
WATER DEPTH MEASUREMENT DATUM (IS - IS NOT) APPARENT
[ ] DEFICIENCIES CORRECTED BY SAMPLE COLLECTOR
[ ] MONITORING WELL REQUIRED REPAIR (describe):

Check-off

1 [x] EQUIPMENT CLEANED BEFORE USE WITH Alconox, Distilled H2O, and Acetone
Items Cleaned (List): All Equipment used in sampling

2 [x] PRODUCT DEPTH NP FT. BELOW DATUM
Measured with: Oil/ Water Interface Probe

WATER DEPTH a.m. FT. BELOW DATUM
Measured with: Water Level Probe

3 [x] WATER-CONDITION BEFORE WELL EVACUATION (Describe):
Appearance: Brown
Odor: moderate
Other Comments:

4 [x] WELL EVACUATION:
Method: peristaltic
Volume Removed: 2500 ml
Observations: Water (slightly - very - cloudy
Water level (rose - fell - no change)
Water odors: moderate
Other comments:

Ground Water Sampling Record - Monitoring Well No. -AS (Cont'd)

5 [x] SAMPLE EXTRACTION METHOD:

[ ] Bailer made of: _____
[x] Pump, type: Peristaltic Pump
[ ] Other, describe: _____

Sample obtained is [x] GRAB; [ ] COMPOSITE SAMPLE

6 [x] ON-SITE MEASUREMENTS:

Temp:	24.4 ° C	Measured with:	Orion Instrument
pH:	6.34	Measured with:	
Conductivity:	1291.10 µS/cm	Measured with:	
Dissolved Oxygen:	0.10 mg/l	Measured with:	Orion Instrument
Redox Potential:	-39.0 mV	Measured with:	
Salinity:		Measured with:	
Nitrate:		Measured with:	
Sulfate:		Measured with:	
Ferrous Iron:		Measured with:	

Other: _____

7 [ ] SAMPLE CONTAINERS (material, number, size): 1-Hach, Methane, Anions
2-BTEX, VOC, TVH

8 [ ] ON-SITE SAMPLE TREATMENT:

[ ] Filtration: Method _____ Containers: _____
Method _____ Containers: _____
Method _____ Containers: _____

[ ] Preservatives added:

Method _____ Containers: _____
Method _____ Containers: _____
Method _____ Containers: _____
Method _____ Containers: _____

9 [ ] CONTAINER HANDLING:

[✓] Container Sides Labeled
[ ] Container Lids Taped
[✓] Containers Placed in Ice Chest

10 [ ] OTHER COMMENTS: _____

SAMPLING LOCATION MacDill AFB Site 56
SAMPLING DATE(S) March 1995

GROUND WATER SAMPLING RECORD - MONITORING WELL 56 MP-35
(number)

REASON FOR SAMPLING: [✓] Regular Sampling; [ ] Special Sampling;
DATE AND TIME OF SAMPLING: 3/26/, 19 95 9:40 a.m./p.m.
SAMPLE COLLECTED BY: MY / KC of ES Denver
WEATHER:
DATUM FOR WATER DEPTH MEASUREMENT (Describe): Top of Well Casing

MONITORING WELL CONDITION:
[ ] LOCKED: [✓] UNLOCKED
WELL NUMBER (IS - IS NOT) APPARENT
STEEL CASING CONDITION IS: new
INNER PVC CASING CONDITION IS: new
WATER DEPTH MEASUREMENT DATUM (IS - IS NOT) APPARENT
[ ] DEFICIENCIES CORRECTED BY SAMPLE COLLECTOR
[ ] MONITORING WELL REQUIRED REPAIR (describe):

Check-off

1 [x] EQUIPMENT CLEANED BEFORE USE WITH Alconox, Distilled H2O, and Acetone
Items Cleaned (List): All Equipment used in sampling

2 [x] PRODUCT DEPTH NP FT. BELOW DATUM
Measured with: Oil/ Water Interface Probe

WATER DEPTH 4.41 FT. BELOW DATUM
Measured with: Water Level Probe

3 [x] WATER-CONDITION BEFORE WELL EVACUATION (Describe):
Appearance: clear / yellow
Odor: ~~none~~ weak sulfuric
Other Comments:

4 [x] WELL EVACUATION:
Method: peristaltic
Volume Removed: 2500 ml
Observations: Water (slightly - very) cloudy
Water level (rose - fell - no change)
Water odors: ~~none~~ weak
Other comments:

Ground Water Sampling Record - Monitoring Well No. 35 (Cont'd)

5 [x] SAMPLE EXTRACTION METHOD:

[ ] Bailer made of:_____
[x] Pump, type: Peristaltic Pump
[ ] Other, describe:_____

Sample obtained is [x] GRAB; [ ] COMPOSITE SAMPLE

6 [x] ON-SITE MEASUREMENTS:

Temp:	25.1 ° C	Measured with:	Orion Instrument
pH:	7.14	Measured with:	
Conductivity:	5740 µs/cm	Measured with:	
Dissolved Oxygen:	0.61 mg/l	Measured with:	Orion Instrument
Redox Potential:	-147.1 mV	Measured with:	
Salinity:		Measured with:	
Nitrate:		Measured with:	
Sulfate:		Measured with:	
Ferrous Iron:		Measured with:	

Other:_____

7 [ ] SAMPLE CONTAINERS (material, number, size): 1-Multi, Anion, Alk, TOC, Hach
2-BTex, VOC, TVH

8 [ ] ON-SITE SAMPLE TREATMENT:

[ ] Filtration:
Method_____ Containers:_____
Method_____ Containers:_____
Method_____ Containers:_____

[ ] Preservatives added:

Method_____ Containers:_____
Method_____ Containers:_____
Method_____ Containers:_____
Method_____ Containers:_____

9 [ ] CONTAINER HANDLING:

[X] Container Sides Labeled
[ ] Container Lids Taped
[X] Containers Placed in Ice Chest

10 [ ] OTHER COMMENTS:_____

SAMPLING LOCATION MacDill AFB Site 56
SAMPLING DATE(S) March 1995

GROUND WATER SAMPLING RECORD - MONITORING WELL 56MP-3D
(number)

REASON FOR SAMPLING: [X] Regular Sampling; [ ] Special Sampling;
DATE AND TIME OF SAMPLING: 3/28/95, 19 10:30 a.m./p.m.
SAMPLE COLLECTED BY: MV / KC of ES Denver
WEATHER: cloudy - 70°
DATUM FOR WATER DEPTH MEASUREMENT (Describe): Top of Well Casing

MONITORING WELL CONDITION:
[ ] LOCKED: [X] UNLOCKED
WELL NUMBER (IS - IS NOT) APPARENT
STEEL CASING CONDITION IS: new
INNER PVC CASING CONDITION IS: new
WATER DEPTH MEASUREMENT DATUM (IS - IS NOT) APPARENT
[ ] DEFICIENCIES CORRECTED BY SAMPLE COLLECTOR
[ ] MONITORING WELL REQUIRED REPAIR (describe):

Check-off

1 [x] EQUIPMENT CLEANED BEFORE USE WITH Alconox, Distilled H2O, and Acetone
Items Cleaned (List): All Equipment used in sampling

2 [x] PRODUCT DEPTH NP FT. BELOW DATUM
Measured with: Oil/ Water Interface Probe

WATER DEPTH NM FT. BELOW DATUM
Measured with: Water Level Probe

3 [x] WATER-CONDITION BEFORE WELL EVACUATION (Describe):
Appearance: Clear / yellow
Odor: moderate to Strong Sulfuric
Other Comments:

4 [x] WELL EVACUATION:
Method: peristaltic
Volume Removed: 2000 ml
Observations: Water (slightly - very) cloudy
Water level (rose - fell - no change)
Water odors: moderate
Other comments:

Ground Water Sampling Record - Monitoring Well No. 3D (Cont'd)

5 [x] SAMPLE EXTRACTION METHOD:

[ ] Bailer made of:_____
[x] Pump, type: Peristaltic Pump
[ ] Other, describe:_____

Sample obtained is [x] GRAB; [ ] COMPOSITE SAMPLE

6 [x] ON-SITE MEASUREMENTS:

Temp: _____ ° C	Measured with: Orion Instrument
pH: _____	Measured with:_____
Conductivity: _____	Measured with:_____
Dissolved Oxygen: _____	Measured with: Orion Instrument
Redox Potential: _____	Measured with:_____
Salinity: _____	Measured with:_____
Nitrate: _____	Measured with:_____
Sulfate: _____	Measured with:_____
Ferrous Iron: _____	Measured with:_____

Other: _____

7 [ ] SAMPLE CONTAINERS (material, number, size): 1- Anions, meth, & Hach
2- BTEX, VOC, TVH

8 [ ] ON-SITE SAMPLE TREATMENT:

[ ] Filtration: Method_____ Containers:_____
Method_____ Containers:_____
Method_____ Containers:_____

[ ] Preservatives added:

Method_____ Containers:_____
Method_____ Containers:_____
Method_____ Containers:_____
Method_____ Containers:_____

9 [ ] CONTAINER HANDLING:

[ ] Container Sides Labeled
[ ] Container Lids Taped
[ ] Containers Placed in Ice Chest

10 [ ] OTHER COMMENTS:_____

SAMPLING LOCATION MacDill AFB Site 56
SAMPLING DATE(S) March 1995

GROUND WATER SAMPLING RECORD - MONITORING WELL 56MP-45
(number)

REASON FOR SAMPLING: [✓] Regular Sampling; [ ] Special Sampling;
DATE AND TIME OF SAMPLING: 3/27, 1995 900 a.m./p.m.
SAMPLE COLLECTED BY: ~~MVRC~~ of ES Denver
WEATHER: Sunny - 80° F
DATUM FOR WATER DEPTH MEASUREMENT (Describe): Top of Well Casing

MONITORING WELL CONDITION:
[ ] LOCKED: [✓] UNLOCKED
WELL NUMBER (IS - IS NOT) APPARENT
STEEL CASING CONDITION IS: New
INNER PVC CASING CONDITION IS: New
WATER DEPTH MEASUREMENT DATUM (IS - IS NOT) APPARENT
[ ] DEFICIENCIES CORRECTED BY SAMPLE COLLECTOR
[ ] MONITORING WELL REQUIRED REPAIR (describe):

Check-off

1 [x] EQUIPMENT CLEANED BEFORE USE WITH Alconox, Distilled H2O, and Acetone
Items Cleaned (List): All Equipment used in sampling

2 [x] PRODUCT DEPTH _____ FT. BELOW DATUM
Measured with: Oil/ Water Interface Probe

WATER DEPTH i 5.09 f= 5.21 FT. BELOW DATUM
Measured with: Water Level Probe

3 [x] WATER-CONDITION BEFORE WELL EVACUATION (Describe):
Appearance: Clear/orange
Odor: Strong H.C.
Other Comments:

4 [x] WELL EVACUATION:
Method: peristaltic
Volume Removed: 2500 mL
Observations: Water (slightly - very) cloudy
Water level (rose - fell - no change)
Water odors: Strong HC
Other comments:

Ground Water Sampling Record - Monitoring Well No. SMP-45 (Cont'd)

5 [x] SAMPLE EXTRACTION METHOD:

[ ] Bailer made of: _____
[x] Pump, type: Peristaltic Pump
[ ] Other, describe: _____

Sample obtained is [x] GRAB; [ ] COMPOSITE SAMPLE

6 [x] ON-SITE MEASUREMENTS:

Temp: 27.1 ° C	Measured with: Orion Instrument	
pH: 6.88	Measured with: _____	
Conductivity: 97x10 µS/cm	Measured with: _____	
Dissolved Oxygen: 0.03 mg/l	Measured with: Orion Instrument	
Redox Potential: 468.7 mV	Measured with: _____	
Salinity: _____	Measured with: _____	
Nitrate: _____	Measured with: _____	
Sulfate: _____	Measured with: _____	
Ferrous Iron: _____	Measured with: _____	

Other: _____

7 [ ] SAMPLE CONTAINERS (material, number, size): 1-HACH, Anion, Methane
2-BTEX, 2-VOC, TVH

8 [ ] ON-SITE SAMPLE TREATMENT:

[ ] Filtration: Method_____ Containers:_____
Method_____ Containers:_____
Method_____ Containers:_____

[ ] Preservatives added:

Method_____ Containers:_____
Method_____ Containers:_____
Method_____ Containers:_____
Method_____ Containers:_____

9 [ ] CONTAINER HANDLING:

[✓] Container Sides Labeled
[ ] Container Lids Taped
[✓] Containers Placed in Ice Chest

10 [ ] OTHER COMMENTS: _____

Ground Water Sampling Record - Monitoring Well No. 5S (Cont'd)

5 [x] SAMPLE EXTRACTION METHOD:

[ ] Bailer made of: _____
[x] Pump, type: Peristaltic Pump
[ ] Other, describe: _____

Sample obtained is [x] GRAB; [ ] COMPOSITE SAMPLE

6 [x] ON-SITE MEASUREMENTS:

Temp: 26.9 ° C	Measured with:	Orion Instrument
pH: 6.48	Measured with:	
Conductivity: 88 x10 µS/cm	Measured with:	
Dissolved Oxygen: 0.66 mg/l	Measured with:	Orion Instrument
Redox Potential: -209.6 mV	Measured with:	
Salinity:	Measured with:	
Nitrate:	Measured with:	
Sulfate:	Measured with:	
Ferrous Iron:	Measured with:	

Other: _____

7 [ ] SAMPLE CONTAINERS (material, number, size): 1-Anions, Hach, nitrate
2- VOC, TVH, BTEX VOC

8 [ ] ON-SITE SAMPLE TREATMENT:

[ ] Filtration: Method _____ Containers: _____
Method _____ Containers: _____
Method _____ Containers: _____

[ ] Preservatives added:

Method _____ Containers: _____
Method _____ Containers: _____
Method _____ Containers: _____
Method _____ Containers: _____

9 [ ] CONTAINER HANDLING:

[x] Container Sides Labeled
[ ] Container Lids Taped
[x] Containers Placed in Ice Chest

10 [ ] OTHER COMMENTS: _____

SAMPLING LOCATION MacDill AFB Site 56
SAMPLING DATE(S) March 1995

GROUND WATER SAMPLING RECORD - MONITORING WELL 56MP-5S
(number)

REASON FOR SAMPLING: [/] Regular Sampling; [ ] Special Sampling;
DATE AND TIME OF SAMPLING: 3/27, 1995 _____ a.m./p.m.
SAMPLE COLLECTED BY: MV/RC of ES Denver
WEATHER: Sunny 80°F
DATUM FOR WATER DEPTH MEASUREMENT (Describe): Top of Well Casing

MONITORING WELL CONDITION:
[ ] LOCKED: [/] UNLOCKED
WELL NUMBER (IS - IS NOT) APPARENT
STEEL CASING CONDITION IS: NEW
INNER PVC CASING CONDITION IS: NEW
WATER DEPTH MEASUREMENT DATUM (IS - IS NOT) APPARENT
[ ] DEFICIENCIES CORRECTED BY SAMPLE COLLECTOR
[ ] MONITORING WELL REQUIRED REPAIR (describe):

Check-off

1 [x] EQUIPMENT CLEANED BEFORE USE WITH Alconox, Distilled H2O, and Acetone
Items Cleaned (List): All Equipment used in sampling

2 [x] PRODUCT DEPTH NP FT. BELOW DATUM
Measured with: Oil/ Water Interface Probe

WATER DEPTH 4.16 for 5.10 FT. BELOW DATUM
Measured with: Water Level Probe

3 [x] WATER-CONDITION BEFORE WELL EVACUATION (Describe):
Appearance: Clear, yellow/orange
Odor: V. Strong Sulfuric
Other Comments:

4 [x] WELL EVACUATION:
Method: Peristaltic
Volume Removed: 2500 ml
Observations: Water (slightly - very) cloudy
Water level (rose - fell - no change)
Water odors: V. Strong Sulfuric
Other comments:

SAMPLING LOCATION MacDill AFB Site 56
SAMPLING DATE(S) March 1995

GROUND WATER SAMPLING RECORD - MONITORING WELL 56MW-05D (LnBAO 15
(number)

REASON FOR SAMPLING: [✓] Regular Sampling; [ ] Special Sampling;
DATE AND TIME OF SAMPLING: 3/27/95, 19__ 12:20 a.m./p.m.
SAMPLE COLLECTED BY: MYAKE of ES Denver
WEATHER: Sunny ~ 85°
DATUM FOR WATER DEPTH MEASUREMENT (Describe): Top of Well Casing

MONITORING WELL CONDITION:
[ ] LOCKED: [✓] UNLOCKED
WELL NUMBER (IS - IS NOT) APPARENT
STEEL CASING CONDITION IS: New
INNER PVC CASING CONDITION IS: New
WATER DEPTH MEASUREMENT DATUM (IS - IS NOT) APPARENT
[ ] DEFICIENCIES CORRECTED BY SAMPLE COLLECTOR
[ ] MONITORING WELL REQUIRED REPAIR (describe):

Check-off

1 [x] EQUIPMENT CLEANED BEFORE USE WITH Alconox, Distilled H2O, and Acetone
Items Cleaned (List): All Equipment used in sampling

2 [x] PRODUCT DEPTH NP FT. BELOW DATUM
Measured with: Oil/ Water Interface Probe

WATER DEPTH NM FT. BELOW DATUM
Measured with: Water Level Probe

3 [x] WATER-CONDITION BEFORE WELL EVACUATION (Describe):
Appearance: Clear / yellow
Odor: moderate Sulfuric
Other Comments:

4 [x] WELL EVACUATION:
Method: 2500 ml a peristaltic
Volume Removed: 2500 ml
Observations: Water (slightly - very) cloudy
Water level (rose - fell - no change)
Water odors: moderate Sulfuric
Other comments:

Ground Water Sampling Record - Monitoring Well No. 5D (Cont'd)

5 [x] SAMPLE EXTRACTION METHOD:

[ ] Bailer made of: _____
[x] Pump, type: Peristaltic Pump
[ ] Other, describe: _____

Sample obtained is [x] GRAB; [ ] COMPOSITE SAMPLE

6 [x] ON-SITE MEASUREMENTS:

Temp:	17.0 ° C	Measured with:	Orion Instrument
pH:	6.45	Measured with:	
Conductivity:	46.40 µS/cm	Measured with:	
Dissolved Oxygen:	0.03 mg/l	Measured with:	Orion Instrument
Redox Potential:	-235.2	Measured with:	
Salinity:		Measured with:	
Nitrate:		Measured with:	
Sulfate:		Measured with:	
Ferrous Iron:		Measured with:	
Other:			

7 [ ] SAMPLE CONTAINERS (material, number, size): 1-HACH, Alkalinity ← no DUP
2-Anions, METHANE
4-BTEX, VOC, TVH

8 [ ] ON-SITE SAMPLE TREATMENT:

[ ] Filtration:
Method _____ Containers: _____
Method _____ Containers: _____
Method _____ Containers: _____

[ ] Preservatives added:

Method _____ Containers: _____
Method _____ Containers: _____
Method _____ Containers: _____
Method _____ Containers: _____

9 [ ] CONTAINER HANDLING:

[ ] Container Sides Labeled
[ ] Container Lids Taped
[ ] Containers Placed in Ice Chest

10 [ ] OTHER COMMENTS: LAB DUP & EPA DUP

SAMPLING LOCATION MacDill AFB Site 56
SAMPLING DATE(S) March 1995

GROUND WATER SAMPLING RECORD - MONITORING WELL 56MP-65
(number)

REASON FOR SAMPLING: [✓] Regular Sampling; [ ] Special Sampling;
DATE AND TIME OF SAMPLING: 3/26, 19 95 11:00 a.m./p.m.
SAMPLE COLLECTED BY: ~~MV~~ ~~KC~~ of ES Denver
WEATHER: Sunny, windy 80°F
DATUM FOR WATER DEPTH MEASUREMENT (Describe): Top of Well Casing

MONITORING WELL CONDITION:
[ ] LOCKED: [✓] UNLOCKED
WELL NUMBER (IS - IS NOT) APPARENT
STEEL CASING CONDITION IS: new
INNER PVC CASING CONDITION IS: new
WATER DEPTH MEASUREMENT DATUM (IS - IS NOT) APPARENT
[ ] DEFICIENCIES CORRECTED BY SAMPLE COLLECTOR
[ ] MONITORING WELL REQUIRED REPAIR (describe):

Check-off

1 [x] EQUIPMENT CLEANED BEFORE USE WITH Alconox, Distilled H2O, and Acetone
Items Cleaned (List): All Equipment used in sampling

2 [x] PRODUCT DEPTH NP FT. BELOW DATUM
Measured with: Oil/ Water Interface Probe

WATER DEPTH 1-4.70 FT. BELOW DATUM
Measured with: Water Level Probe

3 [x] WATER-CONDITION BEFORE WELL EVACUATION (Describe):
Appearance: Brown
Odor: Strong Sulfuric
Other Comments:

4 [x] WELL EVACUATION:
Method: Peristalic
Volume Removed: 2500 ml
Observations: Water (slightly - very) cloudy
Water level (rose - fell - no change)
Water odors: Strong
Other comments:

Ground Water Sampling Record - Monitoring Well No. 65 (Cont'd)

5 [x] SAMPLE EXTRACTION METHOD:

[ ] Bailer made of:_____
[x] Pump, type: Peristaltic Pump
[ ] Other, describe:_____

Sample obtained is [x] GRAB; [ ] COMPOSITE SAMPLE

6 [x] *ON-SITE MEASUREMENTS:*

Temp: _____ ° C	Measured with: Orion Instrument
pH: _____	Measured with: _____
Conductivity: _____	Measured with: _____
Dissolved Oxygen: _____	Measured with: Orion Instrument
Redox Potential: _____	Measured with: _____
Salinity: _____	Measured with: _____
Nitrate: _____	Measured with: _____
Sulfate: _____	Measured with: _____
Ferrous Iron: _____	Measured with: _____

Other: _____

7 [ ] SAMPLE CONTAINERS (material, number, size): 1-Alk Anion, Methane, Hach
2-BTEX, VOC, TPH

8 [ ] ON-SITE SAMPLE TREATMENT:

[ ] Filtration:
Method_____ Containers:_____
Method_____ Containers:_____
Method_____ Containers:_____

[ ] Preservatives added:

Method_____ Containers:_____
Method_____ Containers:_____
Method_____ Containers:_____
Method_____ Containers:_____

9 [ ] CONTAINER HANDLING:

[✓] Container Sides Labeled
[ ] Container Lids Taped
[✓] Containers Placed in Ice Chest

10 [ ] OTHER COMMENTS:_____

SAMPLING LOCATION MacDill AFB Site 56
SAMPLING DATE(S) March 1995

GROUND WATER SAMPLING RECORD - MONITORING WELL 56MP-6D
(number)

REASON FOR SAMPLING: [✓] Regular Sampling; [ ] Special Sampling;
DATE AND TIME OF SAMPLING: 3/26/95, 1995 10:30 a.m./p.m.
SAMPLE COLLECTED BY: MV/KE of ES Denver
WEATHER: Sunny - 80 - windy
DATUM FOR WATER DEPTH MEASUREMENT (Describe): Top of Well Casing

MONITORING WELL CONDITION:
[ ] LOCKED: [✓] UNLOCKED
WELL NUMBER (IS - IS NOT) APPARENT
STEEL CASING CONDITION IS: new
INNER PVC CASING CONDITION IS: new
WATER DEPTH MEASUREMENT DATUM (IS - IS NOT) APPARENT
[ ] DEFICIENCIES CORRECTED BY SAMPLE COLLECTOR
[ ] MONITORING WELL REQUIRED REPAIR (describe):

Check-off

1 [x] EQUIPMENT CLEANED BEFORE USE WITH Alconox, Distilled H2O, and Acetone
Items Cleaned (List): All Equipment used in sampling

2 [x] PRODUCT DEPTH NP FT. BELOW DATUM
Measured with: Oil/ Water Interface Probe

WATER DEPTH NM FT. BELOW DATUM
Measured with: Water Level Probe

3 [x] WATER-CONDITION BEFORE WELL EVACUATION (Describe):
Appearance: Clear / yellow
Odor: moderate gasoline
Other Comments:

4 [x] WELL EVACUATION:
Method: peristaltic
Volume Removed: 2500 ml
Observations: Water (slightly - very) cloudy
Water level (rose - fell - no change)
Water odors: moderate
Other comments:

Ground Water Sampling Record - Monitoring Well No. LD (Cont'd)

5 [x] SAMPLE EXTRACTION METHOD:

[ ] Bailer made of: _____
[x] Pump, type: Peristaltic Pump
[ ] Other, describe: _____

Sample obtained is [x] GRAB; [ ] COMPOSITE SAMPLE

6 [x] ON-SITE MEASUREMENTS:

Temp:	25.0 ° C	Measured with:	Orion Instrument
pH:	6.87	Measured with:	
Conductivity:	8340 µS/cm	Measured with:	
Dissolved Oxygen:	0.06	Measured with:	Orion Instrument
Redox Potential:	-163.9	Measured with:	
Salinity:		Measured with:	
Nitrate:		Measured with:	
Sulfate:		Measured with:	
Ferrous Iron:		Measured with:	
Other:			

7 [ ] SAMPLE CONTAINERS (material, number, size): 1 - AIK, Anions, Methane Hach
2 - BTEX, VOC, TVH

8 [ ] ON-SITE SAMPLE TREATMENT:

[ ] Filtration:
Method _____ Containers: _____
Method _____ Containers: _____
Method _____ Containers: _____

[ ] Preservatives added:

Method _____ Containers: _____
Method _____ Containers: _____
Method _____ Containers: _____
Method _____ Containers: _____

9 [ ] CONTAINER HANDLING:

[ ] Container Sides Labeled
[ ] Container Lids Taped
[X] Containers Placed in Ice Chest

10 [ ] OTHER COMMENTS: _____

SAMPLING LOCATION MacDill AFB Site 56
SAMPLING DATE(S) March 1995

GROUND WATER SAMPLING RECORD - MONITORING WELL 56 IP-7S
(number)

REASON FOR SAMPLING: [/] Regular Sampling; [ ] Special Sampling;
DATE AND TIME OF SAMPLING: 3/29/, 1995 8:45 a.m./p.m.
SAMPLE COLLECTED BY: ~~MYRE~~ of ES Dennis
WEATHER: Sunny 85°
DATUM FOR WATER DEPTH MEASUREMENT (Describe): Top of Well Casing

MONITORING WELL CONDITION:
[ ] LOCKED: [/] UNLOCKED
WELL NUMBER (IS - IS NOT) APPARENT
STEEL CASING CONDITION IS: New
INNER PVC CASING CONDITION IS: New
WATER DEPTH MEASUREMENT DATUM (IS - IS NOT) APPARENT
[ ] DEFICIENCIES CORRECTED BY SAMPLE COLLECTOR
[ ] MONITORING WELL REQUIRED REPAIR (describe):

Check-off

1 [x] EQUIPMENT CLEANED BEFORE USE WITH Alconox, Distilled H2O, and Acetone
Items Cleaned (List): All Equipment used in sampling

2 [x] PRODUCT DEPTH NP FT. BELOW DATUM
Measured with: Oil/ Water Interface Probe

WATER DEPTH " 4.64 f-6.09 FT. BELOW DATUM
Measured with: Water Level Probe

3 [x] WATER-CONDITION BEFORE WELL EVACUATION (Describe):
Appearance: Light Brown
Odor: moderate sulfuric
Other Comments:

4 [x] WELL EVACUATION:
Method: peristaltic
Volume Removed: 2500 ml
Observations: Water (slightly - very) cloudy
Water level (rose - fell) - no change)
Water odors: moderate
Other comments:

Ground Water Sampling Record - Monitoring Well No. 75 (Cont'd)

5 [x] SAMPLE EXTRACTION METHOD:

[ ] Bailer made of:_____
[x] Pump, type: Peristaltic Pump
[ ] Other, describe:_____

Sample obtained is [x] GRAB; [ ] COMPOSITE SAMPLE

6 [x] ON-SITE MEASUREMENTS:

Temp:	22.5 ° C	Measured with:	Orion Instrument
pH:	6.28	Measured with:	
Conductivity:	60 X 10 µS/cm	Measured with:	
Dissolved Oxygen:	~~DRY~~ 0.6 mg/l	Measured with:	Orion Instrument
Redox Potential:	-111.6 mV	Measured with:	
Salinity:		Measured with:	
Nitrate:		Measured with:	
Sulfate:		Measured with:	
Ferrous Iron:		Measured with:	
Other:			

7 [ ] SAMPLE CONTAINERS (material, number, size): 1-HACH, TOC, ALK, methane, Anion
2-BTEX, VOC, TVH

8 [ ] ON-SITE SAMPLE TREATMENT:

[ ] Filtration:
Method_____ Containers:_____
Method_____ Containers:_____
Method_____ Containers:_____

[ ] Preservatives added:

Method_____ Containers:_____
Method_____ Containers:_____
Method_____ Containers:_____
Method_____ Containers:_____

9 [ ] CONTAINER HANDLING:

[✓] Container Sides Labeled
[ ] Container Lids Taped
[✓] Containers Placed in Ice Chest

10 [ ] OTHER COMMENTS:_____

SAMPLING LOCATION MacDill AFB Site 56
SAMPLING DATE(S) March 1995

GROUND WATER SAMPLING RECORD - MONITORING WELL 56MP-7D (HACH DUP)
(number)

REASON FOR SAMPLING: [✓] Regular Sampling; [ ] Special Sampling;
DATE AND TIME OF SAMPLING: 3/27/95, 19__ _____ a.m./p.m.
SAMPLE COLLECTED BY: MV/KC of ES Denver
WEATHER: Sunny 80°
DATUM FOR WATER DEPTH MEASUREMENT (Describe): Top of Well Casing

MONITORING WELL CONDITION:
[ ] LOCKED: [✓] UNLOCKED
WELL NUMBER (IS - IS NOT) APPARENT
STEEL CASING CONDITION IS: New
INNER PVC CASING CONDITION IS: New
WATER DEPTH MEASUREMENT DATUM (IS - IS NOT) APPARENT
[ ] DEFICIENCIES CORRECTED BY SAMPLE COLLECTOR
[ ] MONITORING WELL REQUIRED REPAIR (describe):

Check-off

1 [x] EQUIPMENT CLEANED BEFORE USE WITH Alconox, Distilled H2O, and Acetone
Items Cleaned (List): All Equipment used in sampling

2 [x] PRODUCT DEPTH NP FT. BELOW DATUM
Measured with: Oil/ Water Interface Probe

WATER DEPTH NM FT. BELOW DATUM
Measured with: Water Level Probe

3 [x] WATER-CONDITION BEFORE WELL EVACUATION (Describe):
Appearance:
Odor:
Other Comments:

4 [x] WELL EVACUATION:
Method: peristaltic
Volume Removed: 2500 ml
Observations: Water (slightly - very) cloudy
Water level (rose - fell - no change)
Water odors:
Other comments:

1

Ground Water Sampling Record - Monitoring Well No. TD (Cont'd)

5 [x] SAMPLE EXTRACTION METHOD:

[ ] Bailer made of:_____
[x] Pump, type: Peristaltic Pump
[ ] Other, describe:_____

Sample obtained is [x] GRAB; [ ] COMPOSITE SAMPLE

6 [x] ON-SITE MEASUREMENTS:

Temp:	21.0 ° C	Measured with:	Orion Instrument
pH:	6.76	Measured with:	
Conductivity:	46x10 µs/cm	Measured with:	
Dissolved Oxygen:	0.06 mg/l	Measured with:	Orion Instrument
Redox Potential:	-176.8 mV	Measured with:	
Salinity:		Measured with:	
Nitrate:		Measured with:	
Sulfate:		Measured with:	
Ferrous Iron:		Measured with:	
Other:			

7 [ ] SAMPLE CONTAINERS (material, number, size): 1-TOC, meth, HACH, Anion; ~~BTEX~~
2-BTEX, TVH, ~~TOC~~

8 [ ] ON-SITE SAMPLE TREATMENT:

[ ] Filtration:
Method_____ Containers:_____
Method_____ Containers:_____
Method_____ Containers:_____

[ ] Preservatives added:

Method_____ Containers:_____
Method_____ Containers:_____
Method_____ Containers:_____
Method_____ Containers:_____

9 [ ] CONTAINER HANDLING:

[ ] Container Sides Labeled
[ ] Container Lids Taped
[ ] Containers Placed in Ice Chest

10 [ ] OTHER COMMENTS:_____

SAMPLING LOCATION MacDill AFB Site 56
SAMPLING DATE(S) March 1995

GROUND WATER SAMPLING RECORD - MONITORING WELL 56 MP-8S
(number)

REASON FOR SAMPLING: [✓] Regular Sampling; [ ] Special Sampling;
DATE AND TIME OF SAMPLING: 3/26, 1995 12:10 a.m./p.m.
SAMPLE COLLECTED BY: ~~MV/KG~~ of ES Den
WEATHER: Sunny 80° wind
DATUM FOR WATER DEPTH MEASUREMENT (Describe): Top of Well Casing

MONITORING WELL CONDITION:
[✓] LOCKED: [ ] UNLOCKED
WELL NUMBER (IS - IS NOT) APPARENT
STEEL CASING CONDITION IS: Good
INNER PVC CASING CONDITION IS: Good
WATER DEPTH MEASUREMENT DATUM (IS - IS NOT) APPARENT
[ ] DEFICIENCIES CORRECTED BY SAMPLE COLLECTOR
[ ] MONITORING WELL REQUIRED REPAIR (describe):

Check-off

1 [x] EQUIPMENT CLEANED BEFORE USE WITH Alconox, Distilled H2O, and Acetone
Items Cleaned (List): All Equipment used in sampling

2 [x] PRODUCT DEPTH NP FT. BELOW DATUM
Measured with: Oil/ Water Interface Probe

WATER DEPTH i- 4.19 f- 5.33 FT. BELOW DATUM
Measured with: Water Level Probe

3 [x] WATER-CONDITION BEFORE WELL EVACUATION (Describe):
Appearance: Clear / yellow
Odor: slight sulfuric
Other Comments:

4 [x] WELL EVACUATION:
Method: peristaltic
Volume Removed: 2500 ml
Observations: Water (slightly - very) cloudy
Water level (rose - fell - no change)
Water odors: Slight
Other comments:

Ground Water Sampling Record - Monitoring Well No. BS (Cont'd)

5 [x] SAMPLE EXTRACTION METHOD:

[ ] Bailer made of: _____
[x] Pump, type: Peristaltic Pump
[ ] Other, describe: _____

Sample obtained is [x] GRAB; [ ] COMPOSITE SAMPLE

6 [x] ON-SITE MEASUREMENTS:

Temp:	23.8 ° C	Measured with:	Orion Instrument
pH:	6.48	Measured with:	
Conductivity:	107 x 10	Measured with:	
Dissolved Oxygen:	0.44	Measured with:	Orion Instrument
Redox Potential:	-83.8	Measured with:	
Salinity:		Measured with:	
Nitrate:		Measured with:	
Sulfate:		Measured with:	
Ferrous Iron:		Measured with:	

Other: _____

7 [ ] SAMPLE CONTAINERS (material, number, size): 1-Anions, Hach, Methane
2- BTEX, VOC, TUH

8 [ ] ON-SITE SAMPLE TREATMENT:

[ ] Filtration: Method _____ Containers: _____
Method _____ Containers: _____
Method _____ Containers: _____

[ ] Preservatives added:

Method _____ Containers: _____
Method _____ Containers: _____
Method _____ Containers: _____
Method _____ Containers: _____

9 [ ] CONTAINER HANDLING:

[x] Container Sides Labeled
[ ] Container Lids Taped
[x] Containers Placed in Ice Chest

10 [ ] OTHER COMMENTS: _____

SAMPLING LOCATION MacDill AFB Site 56
SAMPLING DATE(S) March 1995

GROUND WATER SAMPLING RECO[illegible] MONITORING WELL 56MP-10S
(number)

REASON FOR SAMPLING: [✓] Regu[illegible]mpling; [ ] Special Sampling;
DATE AND TIME OF SAMPLING: 3/26, 1995 _____ a.m./p.m.
SAMPLE COLLECTED BY: MK/KG of ES Dan
WEATHER: Sunny ~ 80°
DATUM FOR WATER DEPTH MEASUREMENT (Describe): Top of Well Casing

MONITORING WELL CONDITION:
[ ] LOCKED: [✓] UNLOCKED
WELL NUMBER (IS - IS NOT) APPARENT
STEEL CASING CONDITION IS: New
INNER PVC CASING CONDITION IS: new
WATER DEPTH MEASUREMENT DATUM (IS - IS NOT) APPARENT
[ ] DEFICIENCIES CORRECTED BY SAMPLE COLLECTOR
[ ] MONITORING WELL REQUIRED REPAIR (describe):

Check-off

1 [x] EQUIPMENT CLEANED BEFORE USE WITH Alcs. Distilled H2O, and Acetone
Items Cleaned (List): All Equipment used in sampling

2 [x] PRODUCT DEPTH NP FT. BELOW DATUM
Measured with: Oil/ Water Interface Probe

WATER DEPTH ~ 5.84 BTOC FT. BELOW DATUM
Measured with: Water Level Probe

3 [x] WATER-CONDITION BEFORE WELL EVACUATION (Describe):
Appearance: Brown
Odor: Strong Sulfuric
Other Comments:

4 [x] WELL EVACUATION:
Method: peristaltic
Volume Removed: 3000 ml
Observations: Water (slightly - (very) cloudy
Water level (rose - (fell) - no change)
Water odors: Strong
Other comments:

Ground Water Sampling Record - Monitoring Well No. 10S (Cont'd)

5 [x] SAMPLE EXTRACTION METHOD:

[ ] Bailer made of:_____
[x] Pump, type: Peristaltic Pump
[ ] Other, describe:_____

Sample obtained is [x] GRAB; [ ] COMPOSITE SAMPLE

6 [x] ON-SITE MEASUREMENTS:

Temp:	28.6 ° C	Measured with:	Orion Instrument
pH:	6.93	Measured with:	
Conductivity:	54 x10	Measured with:	
Dissolved Oxygen:	0.81 *	Measured with:	Orion Instrument
Redox Potential:	=109.6	Measured with:	
Salinity:		Measured with:	
Nitrate:		Measured with:	
Sulfate:		Measured with:	
Ferrous Iron:		Measured with:	
Other:			

7 [ ] SAMPLE CONTAINERS (material, number, size): 1-Anion, Hach, METHANE
2-BTEX, VOC, TVH

8 [ ] ON-SITE SAMPLE TREATMENT:

[ ] Filtration: Method_____ Containers:_____
Method_____ Containers:_____
Method_____ Containers:_____

[ ] Preservatives added:

Method_____ Containers:_____
Method_____ Containers:_____
Method_____ Containers:_____
Method_____ Containers:_____

9 [ ] CONTAINER HANDLING:

[ ] Container Sides Labeled
[ ] Container Lids Taped
[ ] Containers Placed in Ice Chest

10 [ ] OTHER COMMENTS: * Slow pump rate unable to get D.O. to stabilize

SAMPLING LOCATION MacDill AFB Site 56
SAMPLING DATE(S) March 1995

GROUND WATER SAMPLING RECORD - MONITORING WELL MW 56-1 (AFD56-MW1)
(number)

REASON FOR SAMPLING: [ ] Regular Sampling; [ ] Special Sampling;
DATE AND TIME OF SAMPLING: 3/26, 1995 a.m./p.m.
SAMPLE COLLECTED BY: ~~MYERS~~ of ES Nemier
WEATHER: Sunny, 80°F
DATUM FOR WATER DEPTH MEASUREMENT (Describe): Top of Well Casing

MONITORING WELL CONDITION:
[X] LOCKED: [ ] UNLOCKED no
WELL NUMBER (IS - IS NOT) APPARENT
STEEL CASING CONDITION IS: Good
INNER PVC CASING CONDITION IS: Good
WATER DEPTH MEASUREMENT DATUM (IS - IS NOT) APPARENT
[ ] DEFICIENCIES CORRECTED BY SAMPLE COLLECTOR
[ ] MONITORING WELL REQUIRED REPAIR (describe):

Check-off

1 [x] EQUIPMENT CLEANED BEFORE USE WITH Alconox, Distilled H2O, and Acetone
Items Cleaned (List): All Equipment used in sampling

2 [x] PRODUCT DEPTH NP FT. BELOW DATUM
Measured with: Oil/ Water Interface Probe

WATER DEPTH ± 4.09 - ± 4.13 FT. BELOW DATUM
Measured with: Water Level Probe

3 [x] WATER-CONDITION BEFORE WELL EVACUATION (Describe):
Appearance: Clear / Yellow
Odor: Strong Sulfuric
Other Comments:

4 [x] WELL EVACUATION:
Method: peristaltic
Volume Removed: 2500 ml
Observations: Water (slightly very) cloudy
Water level (rose - fell - no change)
Water odors: Strong
Other comments:

Ground Water Sampling Record - Monitoring Well No. MW-1 (Cont'd)

5 [x] SAMPLE EXTRACTION METHOD:

[ ] Bailer made of: _____
[x] Pump, type: Peristaltic Pump
[ ] Other, describe: _____

Sample obtained is [x] GRAB; [ ] COMPOSITE SAMPLE

6 [x] ON-SITE MEASUREMENTS:

Temp:	25.2 ° C	Measured with:	Orion Instrument
pH:	6.87	Measured with:	
Conductivity:	59 x 10 µS/cm	Measured with:	
Dissolved Oxygen:	9.20 mg/l	Measured with:	Orion Instrument
Redox Potential:	-121.5 mv	Measured with:	
Salinity:		Measured with:	
Nitrate:		Measured with:	
Sulfate:		Measured with:	
Ferrous Iron:		Measured with:	

Other: _____

7 [ ] SAMPLE CONTAINERS (material, number, size): 2 1-HALN, Anion, METH (DUP, DUP)
LAB (MW-21) 2-BTEX, VOC, TVH (DUP, DUP)
& HACH DUP

8 [ ] ON-SITE SAMPLE TREATMENT:

[ ] Filtration:
Method _____ Containers: _____
Method _____ Containers: _____
Method _____ Containers: _____

[ ] Preservatives added:

Method _____ Containers: _____
Method _____ Containers: _____
Method _____ Containers: _____
Method _____ Containers: _____

9 [ ] CONTAINER HANDLING:

[x] Container Sides Labeled
[ ] Container Lids Taped
[x] Containers Placed in Ice Chest

10 [ ] OTHER COMMENTS: LAB DUP - MW56-21

SAMPLING LOCATION MacDill AFB Site 56
SAMPLING DATE(S) March 1995

GROUND WATER SAMPLING RECORD - MONITORING WELL MW 56-2 (MO56-MW2)
(number)

REASON FOR SAMPLING: [ ] Regular Sampling; [ ] Special Sampling;
DATE AND TIME OF SAMPLING: 3/26/95, 19__ 15:10 a.m./p.m.
SAMPLE COLLECTED BY: ~~MV/KE~~ _____ of ES Denver
WEATHER: Sunny - 85°F
DATUM FOR WATER DEPTH MEASUREMENT (Describe): Top of Well Casing

MONITORING WELL CONDITION:
[ ] LOCKED: [ ] UNLOCKED
WELL NUMBER (IS - IS NOT) APPARENT
STEEL CASING CONDITION IS: Good
INNER PVC CASING CONDITION IS: Good
WATER DEPTH MEASUREMENT DATUM (IS - IS NOT) APPARENT
[ ] DEFICIENCIES CORRECTED BY SAMPLE COLLECTOR
[ ] MONITORING WELL REQUIRED REPAIR (describe):

Check-off

1 [x] EQUIPMENT CLEANED BEFORE USE WITH Alconox, Distilled H2O, and Acetone
Items Cleaned (List): All Equipment used in sampling

2 [x] PRODUCT DEPTH NP FT. BELOW DATUM
Measured with: Oil/ Water Interface Probe

WATER DEPTH _____ FT. BELOW DATUM
Measured with: Water Level Probe

3 [x] WATER-CONDITION BEFORE WELL EVACUATION (Describe):
Appearance: Clear / yellow
Odor: weak
Other Comments:

4 [x] WELL EVACUATION:
Method: Peristaltic
Volume Removed: 2500 ml
Observations: Water (slightly - very) cloudy
Water level (rose - fell - no change)
Water odors: no
Other comments:

Ground Water Sampling Record - Monitoring Well No. MW-2 (Cont'd)

5 [x] SAMPLE EXTRACTION METHOD:

[ ] Bailer made of: _____
[x] Pump, type: Peristaltic Pump
[ ] Other, describe: _____

Sample obtained is [x] GRAB; [ ] COMPOSITE SAMPLE

6 [x] ON-SITE MEASUREMENTS:

Temp:	18.6 ° C	Measured with:	Orion Instrument
pH:	6.93	Measured with:	
Conductivity:	5410	Measured with:	
Dissolved Oxygen:	0.07	Measured with:	Orion Instrument
Redox Potential:	-109.6	Measured with:	
Salinity:		Measured with:	
Nitrate:		Measured with:	
Sulfate:		Measured with:	
Ferrous Iron:		Measured with:	
Other:			

7 [ ] SAMPLE CONTAINERS (material, number, size): 1-Anion, Hach, methane
2-BTEX, VOC, TVH

8 [ ] ON-SITE SAMPLE TREATMENT:

[ ] Filtration:
Method _____ Containers: _____
Method _____ Containers: _____
Method _____ Containers: _____

[ ] Preservatives added:

Method _____ Containers: _____
Method _____ Containers: _____
Method _____ Containers: _____
Method _____ Containers: _____

9 [ ] CONTAINER HANDLING:

[X] Container Sides Labeled
[ ] Container Lids Taped
[X] Containers Placed in Ice Chest

10 [ ] OTHER COMMENTS: _____

SAMPLING LOCATION MacDill AFB Site 56
SAMPLING DATE(S) March 1995

GROUND WATER SAMPLING RECORD - MONITORING WELL ~~MW56-04~~ / MW56-MW4
(number) (MW56-MW4)

REASON FOR SAMPLING: [X] Regular Sampling; [ ] Special Sampling;
DATE AND TIME OF SAMPLING: 3/29, 1995 9:45 a.m./p.m.
SAMPLE COLLECTED BY: MP/KC of ES Denver
WEATHER:
DATUM FOR WATER DEPTH MEASUREMENT (Describe): Top of Well Casing

MONITORING WELL CONDITION:
[X] LOCKED: [ ] UNLOCKED
WELL NUMBER (IS - IS NOT) APPARENT
STEEL CASING CONDITION IS: Good
INNER PVC CASING CONDITION IS: Good
WATER DEPTH MEASUREMENT DATUM (IS - IS NOT) APPARENT
[ ] DEFICIENCIES CORRECTED BY SAMPLE COLLECTOR
[ ] MONITORING WELL REQUIRED REPAIR (describe):

Check-off

1 [x] EQUIPMENT CLEANED BEFORE USE WITH Alconox, Distilled H2O, and Acetone
Items Cleaned (List): All Equipment used in sampling

2 [x] PRODUCT DEPTH ND FT. BELOW DATUM
Measured with: Oil/ Water Interface Probe

WATER DEPTH i- 4.73 f- 4.76 FT. BELOW DATUM
Measured with: Water Level Probe

3 [x] WATER-CONDITION BEFORE WELL EVACUATION (Describe):
Appearance: clear / yellow
Odor: moderate Sulfur
Other Comments:

4 [x] WELL EVACUATION:
Method: Peristaltic
Volume Removed: 2500 ml
Observations: Water (slightly - very) cloudy
Water level (rose - fell - no change)
Water odors: moderate Sulfuric
Other comments:

Ground Water Sampling Record - Monitoring Well No. MW56-4 (Cont'd)

5 [x] SAMPLE EXTRACTION METHOD:

[ ] Bailer made of: _____
[x] Pump, type: Peristaltic Pump
[ ] Other, describe: _____

Sample obtained is [x] GRAB; [ ] COMPOSITE SAMPLE

6 [x] ON-SITE MEASUREMENTS:

Temp:	23.3 ° C	Measured with:	Orion Instrument
pH:	6.78	Measured with:	
Conductivity:	61x10 µS/cm	Measured with:	
Dissolved Oxygen:	0.81 mg/l	Measured with:	Orion Instrument
Redox Potential:	-4.4 mV	Measured with:	
Salinity:		Measured with:	
Nitrate:		Measured with:	
Sulfate:		Measured with:	
Ferrous Iron:		Measured with:	
Other:			

7 [ ] SAMPLE CONTAINERS (material, number, size): 1-HACH, Anions, Alk, METHANE, TOC
2-BTEX, VOC, TVH
10-mi/mSO's

8 [ ] ON-SITE SAMPLE TREATMENT:

[ ] Filtration: Method _____ Containers: _____
Method _____ Containers: _____
Method _____ Containers: _____

[ ] Preservatives added:

Method _____ Containers: _____
Method _____ Containers: _____
Method _____ Containers: _____
Method _____ Containers: _____

9 [ ] CONTAINER HANDLING:

[✓] Container Sides Labeled
[ ] Container Lids Taped
[✓] Containers Placed in Ice Chest

10 [ ] OTHER COMMENTS: _____

SAMPLING LOCATION MacDill AFB Site 56
SAMPLING DATE(S) March 1995

GROUND WATER SAMPLING RECORD - MONITORING WELL MW56-5 (MO56-MW5)
(number)

REASON FOR SAMPLING: [/] Regular Sampling; [ ] Special Sampling;
DATE AND TIME OF SAMPLING: 3/28, 1995 ____ a.m./p.m.
SAMPLE COLLECTED BY: MY / KC of ES Denver
WEATHER: Cloudy, 70°
DATUM FOR WATER DEPTH MEASUREMENT (Describe): Top of Well Casing

MONITORING WELL CONDITION:
[/] LOCKED: [ ] UNLOCKED
WELL NUMBER (IS - IS NOT) APPARENT
STEEL CASING CONDITION IS: Good
INNER PVC CASING CONDITION IS: Good
WATER DEPTH MEASUREMENT DATUM (IS - IS NOT) APPARENT
[ ] DEFICIENCIES CORRECTED BY SAMPLE COLLECTOR
[ ] MONITORING WELL REQUIRED REPAIR (describe):

Check-off

1 [x] EQUIPMENT CLEANED BEFORE USE WITH Alconox, Distilled H2O, and Acetone
Items Cleaned (List): All Equipment used in sampling

2 [x] PRODUCT DEPTH NP FT. BELOW DATUM
Measured with: Oil/ Water Interface Probe

WATER DEPTH i 4.54 f- 4.61 FT. BELOW DATUM
Measured with: Water Level Probe

3 [x] WATER-CONDITION BEFORE WELL EVACUATION (Describe):
Appearance: Clear / Yellow
Odor: moderate Sulfuric
Other Comments:

4 [x] WELL EVACUATION:
Method: peristaltic
Volume Removed: 2500
Observations: Water (slightly - very) cloudy
Water level (rose - fell - no change)
Water odors: Moderate
Other comments:

Ground Water Sampling Record - Monitoring Well No. 5 (Cont'd)

5 [x] SAMPLE EXTRACTION METHOD:

[ ] Bailer made of:_____
[x] Pump, type: Peristaltic Pump
[ ] Other, describe:_____

Sample obtained is [x] GRAB; [ ] COMPOSITE SAMPLE

6 [x] ON-SITE MEASUREMENTS:

Temp:	26.9 ° C	Measured with:	Orion Instrument
pH:	7.03	Measured with:	
Conductivity:	141 X10 µs/cm	Measured with:	
Dissolved Oxygen:	0.02 mg/l	Measured with:	Orion Instrument
Redox Potential:	-237.9 mV	Measured with:	
Salinity:		Measured with:	
Nitrate:		Measured with:	
Sulfate:		Measured with:	
Ferrous Iron:		Measured with:	

Other:_____

7 [ ] SAMPLE CONTAINERS (material, number, size): 1-Anion, HACH, METHANE
2-BTEX, ~~EB~~ VOC, TVH

8 [ ] ON-SITE SAMPLE TREATMENT:

[ ] Filtration:
Method_____ Containers:_____
Method_____ Containers:_____
Method_____ Containers:_____

[ ] Preservatives added:

Method_____ Containers:_____
Method_____ Containers:_____
Method_____ Containers:_____
Method_____ Containers:_____

9 [ ] CONTAINER HANDLING:

[X] Container Sides Labeled
[ ] Container Lids Taped
[X] Containers Placed in Ice Chest

10 [ ] OTHER COMMENTS:_____

SAMPLING LOCATION MacDill AFB Site 56
SAMPLING DATE(S) March 1995

GROUND WATER SAMPLING RECORD - MONITORING WELL MW56-6 & HACH DUP (MO56-MW6) (number)

REASON FOR SAMPLING: [✓] Regular Sampling; [ ] Special Sampling;
DATE AND TIME OF SAMPLING: 3/27, 1995 a.m./p.m.
SAMPLE COLLECTED BY: MV/KC of ES Denver
WEATHER: Sunny 80°F
DATUM FOR WATER DEPTH MEASUREMENT (Describe): Top of Well Casing

MONITORING WELL CONDITION:
[✓] LOCKED: [ ] UNLOCKED
WELL NUMBER (IS - IS NOT) APPARENT
STEEL CASING CONDITION IS: Good
INNER PVC CASING CONDITION IS: Good
WATER DEPTH MEASUREMENT DATUM (IS - IS NOT) APPARENT
[ ] DEFICIENCIES CORRECTED BY SAMPLE COLLECTOR
[ ] MONITORING WELL REQUIRED REPAIR (describe):

Check-off

1 [x] EQUIPMENT CLEANED BEFORE USE WITH Alconox, Distilled H2O, and Acetone
Items Cleaned (List): All Equipment used in sampling

2 [x] PRODUCT DEPTH NP FT. BELOW DATUM
Measured with: Oil/ Water Interface Probe

WATER DEPTH i 5.11 f- 5.26 FT. BELOW DATUM
Measured with: Water Level Probe

3 [x] WATER-CONDITION BEFORE WELL EVACUATION (Describe):
Appearance: Orange
Odor: V. Strong H-C
Other Comments:

4 [x] WELL EVACUATION:
Method: peristaltic
Volume Removed: 2500 ml
Observations: Water (slightly - very) cloudy
Water level (rose - fell - no change)
Water odors: V2 Strong HC
Other comments:

Ground Water Sampling Record - Monitoring Well No. 6 (Cont'd)

5 [x] SAMPLE EXTRACTION METHOD:

[ ] Bailer made of: _____
[x] Pump, type: Peristaltic Pump
[ ] Other, describe: _____

Sample obtained is [x] GRAB; [ ] COMPOSITE SAMPLE

6 [x] ON-SITE MEASUREMENTS:

Temp: 17.8 ° C	Measured with:	Orion Instrument
pH: 6.83	Measured with:	
Conductivity: 164x10 µS/cm	Measured with:	
Dissolved Oxygen: 0.02 mg/l	Measured with:	Orion Instrument
Redox Potential: -217.5 mV	Measured with:	
Salinity:	Measured with:	
Nitrate:	Measured with:	
Sulfate:	Measured with:	
Ferrous Iron:	Measured with:	
Other:		

7 [ ] SAMPLE CONTAINERS (material, number, size): 1- Methane, Anions
2- BTEX, TVH, VOC, HACH (DW)

8 [ ] ON-SITE SAMPLE TREATMENT:

[ ] Filtration: Method _____ Containers: _____
Method _____ Containers: _____
Method _____ Containers: _____

[ ] Preservatives added:

Method _____ Containers: _____
Method _____ Containers: _____
Method _____ Containers: _____
Method _____ Containers: _____

9 [ ] CONTAINER HANDLING:

[x] Container Sides Labeled
[ ] Container Lids Taped
[x] Containers Placed in Ice Chest

10 [ ] OTHER COMMENTS: _____

SAMPLING LOCATION MacDill AFB Site 56
SAMPLING DATE(S) March 1995

GROUND WATER SAMPLING RECORD - MONITORING WELL MW56-7 (mo:6-mw7)
(number)

REASON FOR SAMPLING: [✓] Regular Sampling; [ ] Special Sampling;
DATE AND TIME OF SAMPLING: 7/28, 1995 8:45 a.m./p.m.
SAMPLE COLLECTED BY: MD/KC of ES Denver
WEATHER: Cloudy - 70°
DATUM FOR WATER DEPTH MEASUREMENT (Describe): Top of Well Casing

MONITORING WELL CONDITION:
[✓] LOCKED: [ ] UNLOCKED
(WELL NUMBER (IS) - IS NOT) APPARENT
STEEL CASING CONDITION IS: Good
INNER PVC CASING CONDITION IS: Good
WATER DEPTH MEASUREMENT DATUM (IS) IS NOT) APPARENT
[ ] DEFICIENCIES CORRECTED BY SAMPLE COLLECTOR
[ ] MONITORING WELL REQUIRED REPAIR (describe):

Check-off

1 [x] EQUIPMENT CLEANED BEFORE USE WITH Alconox, Distilled H2O, and Acetone
Items Cleaned (List): All Equipment used in sampling

2 [x] PRODUCT DEPTH NP FT. BELOW DATUM
Measured with: Oil/ Water Interface Probe

WATER DEPTH i 4.94 - f = 5.00 FT. BELOW DATUM
Measured with: Water Level Probe

3 [x] WATER-CONDITION BEFORE WELL EVACUATION (Describe):
Appearance: Clear / yellow
Odor: Strong H2S
Other Comments:

4 [x] WELL EVACUATION:
Method: peristaltic
Volume Removed: 2500 ml
Observations: Water (slightly - very) cloudy
Water level (rose - fell - no change)
Water odors: Strong
Other comments:

Ground Water Sampling Record - Monitoring Well No. MW-7 (Cont'd)

5 [x] SAMPLE EXTRACTION METHOD:

[ ] Bailer made of:_____
[x] Pump, type: Peristaltic Pump
[ ] Other, describe:_____

Sample obtained is [x] GRAB; [ ] COMPOSITE SAMPLE

6 [x] ON-SITE MEASUREMENTS:

Temp: 26.7 ° C	Measured with: Orion Instrument	
pH: 7.01	Measured with:	
Conductivity: 66400 µS/cm	Measured with:	
Dissolved Oxygen: 0.05 mg/l	Measured with: Orion Instrument	
Redox Potential: -188.5 mv	Measured with:	
Salinity:	Measured with:	
Nitrate:	Measured with:	
Sulfate:	Measured with:	
Ferrous Iron:	Measured with:	
Other:		

7 [ ] SAMPLE CONTAINERS (material, number, size): 1L Multi, Amber, Hach
2-BTEX, VOA, TVH

8 [ ] ON-SITE SAMPLE TREATMENT:

[ ] Filtration:
Method_____ Containers:_____
Method_____ Containers:_____
Method_____ Containers:_____

[ ] Preservatives added:

Method_____ Containers:_____
Method_____ Containers:_____
Method_____ Containers:_____
Method_____ Containers:_____

9 [ ] CONTAINER HANDLING:

[ ] Container Sides Labeled
[ ] Container Lids Taped
[x] Containers Placed in Ice Chest

10 [ ] OTHER COMMENTS:_____

SAMPLING LOCATION MacDill AFB Site 56
SAMPLING DATE(S) March 1995

GROUND WATER SAMPLING RECORD - MONITORING WELL MW56-8 (mo56-mw8)
(number)

REASON FOR SAMPLING: [✓] Regular Sampling; [ ] Special Sampling;
DATE AND TIME OF SAMPLING: 3/26, 1995 15:45 a.m./p.m.
SAMPLE COLLECTED BY: MVTKC of ES Denver
WEATHER: Sunny ~80°
DATUM FOR WATER DEPTH MEASUREMENT (Describe): Top of Well Casing

MONITORING WELL CONDITION:
[✓] LOCKED: [ ] UNLOCKED
WELL NUMBER (IS - IS NOT) APPARENT
STEEL CASING CONDITION IS: Good
INNER PVC CASING CONDITION IS: Good
WATER DEPTH MEASUREMENT DATUM (IS) IS NOT) APPARENT
[ ] DEFICIENCIES CORRECTED BY SAMPLE COLLECTOR
[ ] MONITORING WELL REQUIRED REPAIR (describe):

Check-off

1 [x] EQUIPMENT CLEANED BEFORE USE WITH Alconox, Distilled H2O, and Acetone
Items Cleaned (List): All Equipment used in sampling

2 [x] PRODUCT DEPTH NP FT. BELOW DATUM
Measured with: Oil/ Water Interface Probe

WATER DEPTH i 4.87 f = 4.92 FT. BELOW DATUM
Measured with: Water Level Probe

3 [x] WATER-CONDITION BEFORE WELL EVACUATION (Describe):
Appearance: Clear / yellow
Odor: Strong HC
Other Comments:

4 [x] WELL EVACUATION:
Method: Peristaltic
Volume Removed: 2500ml
Observations: Water (slightly - very) cloudy
Water level (rose - (no) change)
Water odors: Strong H.C.
Other comments:

Ground Water Sampling Record - Monitoring Well No. MW8 (Cont'd)

5 [x] SAMPLE EXTRACTION METHOD:

[ ] Bailer made of:_____
[x] Pump, type: Peristaltic Pump
[ ] Other, describe:_____

Sample obtained is [x] GRAB; [ ] COMPOSITE SAMPLE

6 [x] ON-SITE MEASUREMENTS:

Temp:	25.5 ° C	Measured with:	Orion Instrument
pH:	6.55	Measured with:	
Conductivity:	45*10 µS/cm	Measured with:	
Dissolved Oxygen:	0.07 mg/l	Measured with:	Orion Instrument
Redox Potential:	-126.7	Measured with:	
Salinity:		Measured with:	
Nitrate:		Measured with:	
Sulfate:		Measured with:	
Ferrous Iron:		Measured with:	

Other:_____

7 [ ] SAMPLE CONTAINERS (material, number, size): 1- Amber, METHANE,
2- BTEX, VOC, TVH, HACH

8 [ ] ON-SITE SAMPLE TREATMENT:

[ ] Filtration: Method_____ Containers:_____
Method_____ Containers:_____
Method_____ Containers:_____

[ ] Preservatives added:

Method_____ Containers:_____
Method_____ Containers:_____
Method_____ Containers:_____
Method_____ Containers:_____

9 [ ] CONTAINER HANDLING:

[✓] Container Sides Labeled
[ ] Container Lids Taped
[✓] Containers Placed in Ice Chest

10 [ ] OTHER COMMENTS:_____

SAMPLING LOCATION MacDill AFB Site 56
SAMPLING DATE(S) March 1995

GROUND WATER SAMPLING RECORD - MONITORING WELL MW56-9 (MO56-MW9)
(number)

REASON FOR SAMPLING: [✓] Regular Sampling; [ ] Special Sampling;
DATE AND TIME OF SAMPLING: 3/27, 1995 8:00 a.m./p.m.
SAMPLE COLLECTED BY: ~~MV/KC~~ of ES Denver
WEATHER: Sunny - 80°
DATUM FOR WATER DEPTH MEASUREMENT (Describe): Top of Well Casing

MONITORING WELL CONDITION:
[✓] LOCKED: [ ] UNLOCKED
WELL NUMBER (IS - IS NOT) APPARENT
STEEL CASING CONDITION IS: Good
INNER PVC CASING CONDITION IS: Good
WATER DEPTH MEASUREMENT DATUM (IS - IS NOT) APPARENT
[ ] DEFICIENCIES CORRECTED BY SAMPLE COLLECTOR
[ ] MONITORING WELL REQUIRED REPAIR (describe):

Check-off

1 [x] EQUIPMENT CLEANED BEFORE USE WITH Alconox, Distilled H2O, and Acetone
Items Cleaned (List): All Equipment used in sampling

2 [x] PRODUCT DEPTH NP FT. BELOW DATUM
Measured with: Oil/ Water Interface Probe

WATER DEPTH 4.46 FT. BELOW DATUM
Measured with: Water Level Probe

3 [x] WATER-CONDITION BEFORE WELL EVACUATION (Describe):
Appearance: Clear / yellow
Odor: moderate sulfuric
Other Comments:

4 [x] WELL EVACUATION:
Method: peristaltic
Volume Removed: 2500 ml
Observations: Water (slightly - very) cloudy
Water level (rose - fell - no change)
Water odors: Moderate
Other comments:

Ground Water Sampling Record - Monitoring Well No. MW-9 (Cont'd)

5 [x] SAMPLE EXTRACTION METHOD:

[ ] Bailer made of:_____
[x] Pump, type: Peristaltic Pump
[ ] Other, describe:_____

Sample obtained is [x] GRAB; [ ] COMPOSITE SAMPLE

6 [x] ON-SITE MEASUREMENTS:

Temp:	25.4 ° C	Measured with:	Orion Instrument
pH:	6.31	Measured with:	
Conductivity:	5010 µS/cm	Measured with:	
Dissolved Oxygen:	0.15 mg/l	Measured with:	Orion instrument
Redox Potential:	-48.8 mV	Measured with:	
Salinity:		Measured with:	
Nitrate:		Measured with:	
Sulfate:		Measured with:	
Ferrous Iron:		Measured with:	

Other:_____

7 [ ] SAMPLE CONTAINERS (material, number, size): 1- METHANE, HCl, 4 AMBERS
2- BTEX, VOC, TVH

8 [ ] ON-SITE SAMPLE TREATMENT:

[ ] Filtration: Method_____ Containers:_____
Method_____ Containers:_____
Method_____ Containers:_____

[ ] Preservatives added:

Method_____ Containers:_____
Method_____ Containers:_____
Method_____ Containers:_____
Method_____ Containers:_____

9 [ ] CONTAINER HANDLING:

[✓] Container Sides Labeled
[ ] Container Lids Taped
[✓] Containers Placed in Ice Chest

10 [ ] OTHER COMMENTS:_____

SAMPLING LOCATION MacDill AFB Site 56
SAMPLING DATE(S) March 1995

GROUND WATER SAMPLING RECORD - MONITORING WELL ~~MD56-10~~ MD32-MW10 (number)

REASON FOR SAMPLING: [x] Regular Sampling; [ ] Special Sampling;
DATE AND TIME OF SAMPLING: 3/26, 1995 4:30 a.m./p.m.
SAMPLE COLLECTED BY: ~~MW~~RC of ES Demi
WEATHER: Sunny ~80° Humid
DATUM FOR WATER DEPTH MEASUREMENT (Describe): Top of Well Casing

MONITORING WELL CONDITION:
[x] LOCKED: [ ] UNLOCKED
WELL NUMBER (IS - IS NOT) APPARENT
STEEL CASING CONDITION IS: Good
INNER PVC CASING CONDITION IS: Good
WATER DEPTH MEASUREMENT DATUM (IS - IS NOT) APPARENT
[ ] DEFICIENCIES CORRECTED BY SAMPLE COLLECTOR
[ ] MONITORING WELL REQUIRED REPAIR (describe):

Check-off

1 [x] EQUIPMENT CLEANED BEFORE USE WITH Alconox, Distilled H2O, and Acetone
Items Cleaned (List): All Equipment used in sampling

2 [x] PRODUCT DEPTH NP FT. BELOW DATUM
Measured with: Oil/ Water Interface Probe

WATER DEPTH 4.17 Toc -4.21 FT. BELOW DATUM
Measured with: Water Level Probe

3 [x] WATER-CONDITION BEFORE WELL EVACUATION (Describe):
Appearance: Clear
Odor: Strong Sulfuric
Other Comments:

4 [x] WELL EVACUATION:
Method: peristaltic
Volume Removed: 2500 ml
Observations: Water (slightly - very) cloudy
Water level (rose - fell - no change)
Water odors: Strong Sulfuric
Other comments:

(Site 32)

Ground Water Sampling Record - Monitoring Well No. MW-10 (Cont'd)

5 [x] SAMPLE EXTRACTION METHOD:

[ ] Bailer made of: _____
[x] Pump, type: Peristaltic Pump
[ ] Other, describe: _____

Sample obtained is [x] GRAB; [ ] COMPOSITE SAMPLE

6 [x] ON-SITE MEASUREMENTS:

Temp:	25.5 ° C	Measured with:	Orion Instrument
pH:	6.36	Measured with:	
Conductivity:	44 x 10	Measured with:	
Dissolved Oxygen:	0.8 mg/l	Measured with:	Orion Instrument
Redox Potential:	-118.1 mV	Measured with:	
Salinity:		Measured with:	
Nitrate:		Measured with:	
Sulfate:		Measured with:	
Ferrous Iron:		Measured with:	
Other:			

7 [ ] SAMPLE CONTAINERS (material, number, size): 1- Anion, 1/2CH, Methane
2- BTEX, TVH, VOC

8 [ ] ON-SITE SAMPLE TREATMENT:

[ ] Filtration:
Method _____ Containers: _____
Method _____ Containers: _____
Method _____ Containers: _____

[ ] Preservatives added:

Method _____ Containers: _____
Method _____ Containers: _____
Method _____ Containers: _____
Method _____ Containers: _____

9 [ ] CONTAINER HANDLING:

[✓] Container Sides Labeled
[ ] Container Lids Taped
[✓] Containers Placed in Ice Chest

10 [ ] OTHER COMMENTS: _____

SAMPLING LOCATION MacDill AFB Site 56
SAMPLING DATE(S) March 1995

GROUND WATER SAMPLING RECORD - MONITORING WELL MW 56-10 (MO56-MW10)
(number)

REASON FOR SAMPLING: [/] Regular Sampling; [ ] Special Sampling;
DATE AND TIME OF SAMPLING: 3/26, 19 95 a.m./p.m.
SAMPLE COLLECTED BY: MV/KG of ES Denver
WEATHER: Sunny - 85°
DATUM FOR WATER DEPTH MEASUREMENT (Describe): Top of Well Casing

MONITORING WELL CONDITION:
[/] LOCKED: [ ] UNLOCKED
WELL NUMBER (IS) IS NOT) APPARENT
STEEL CASING CONDITION IS: Good
INNER PVC CASING CONDITION IS: Good
WATER DEPTH MEASUREMENT DATUM (IS) IS NOT) APPARENT
[ ] DEFICIENCIES CORRECTED BY SAMPLE COLLECTOR
[ ] MONITORING WELL REQUIRED REPAIR (describe):

Check-off

1 [x] EQUIPMENT CLEANED BEFORE USE WITH Alconox, Distilled H2O, and Acetone
Items Cleaned (List): All Equipment used in sampling

2 [x] PRODUCT DEPTH NP FT. BELOW DATUM
Measured with: Oil/ Water Interface Probe
WATER DEPTH 4.38 BTOC Final 4.41 FT. BELOW DATUM
Measured with: Water Level Probe

3 [x] WATER-CONDITION BEFORE WELL EVACUATION (Describe):
Appearance: Clear/yellow
Odor: sweet Sulfuric
Other Comments:

4 [x] WELL EVACUATION:
Method: peristaltic
Volume Removed: 2500 ml
Observations: Water (slightly - very) cloudy
Water level (rose - fell - no change)
Water odors: sweet
Other comments:

Ground Water Sampling Record - Monitoring Well No. 10 (Cont'd)

5 [x] SAMPLE EXTRACTION METHOD:

[ ] Bailer made of:_____
[x] Pump, type: Peristaltic Pump
[ ] Other, describe:_____

Sample obtained is [x] GRAB; [ ] COMPOSITE SAMPLE

6 [x] ON-SITE MEASUREMENTS:

Temp: 27.1 ° C	Measured with: Orion Instrument
pH: 6.37	Measured with:
Conductivity: 59 X10 uS/cm	Measured with:
Dissolved Oxygen: 0.03 mg/L	Measured with: Orion Instrument
Redox Potential: -235.6 mV	Measured with:
Salinity:	Measured with:
Nitrate:	Measured with:
Sulfate:	Measured with:
Ferrous Iron:	Measured with:
Other:	

7 [ ] SAMPLE CONTAINERS (material, number, size): 1-HACH, ALK, ANION, METHANE
2-BTEX, VOC TVH

8 [ ] ON-SITE SAMPLE TREATMENT:

[ ] Filtration: Method_____ Containers:_____
Method_____ Containers:_____
Method_____ Containers:_____

[ ] Preservatives added:

Method_____ Containers:_____
Method_____ Containers:_____
Method_____ Containers:_____
Method_____ Containers:_____

9 [ ] CONTAINER HANDLING:

[X] Container Sides Labeled
[ ] Container Lids Taped
[X] Containers Placed in Ice Chest

10 [ ] OTHER COMMENTS:_____

SAMPLING LOCATION MacDill AFB Site 56
SAMPLING DATE(S) March 1995

GROUND WATER SAMPLING RECORD - MONITORING WELL ~~56DR~~ MW56-11
(number)

REASON FOR SAMPLING: (X) Regular Sampling; [ ] Special Sampling;
DATE AND TIME OF SAMPLING: 9/28, 1995 8:45 a.m./p.m.
SAMPLE COLLECTED BY: MVLKC of ES Denver
WEATHER: ~~Hot~~ Cloudy - 70°
DATUM FOR WATER DEPTH MEASUREMENT (Describe): Top of Well Casing

MONITORING WELL CONDITION:
[X] LOCKED: [ ] UNLOCKED
WELL NUMBER (IS IS NOT) APPARENT
STEEL CASING CONDITION IS: Good
INNER PVC CASING CONDITION IS: Good
WATER DEPTH MEASUREMENT DATUM (IS IS NOT) APPARENT
[ ] DEFICIENCIES CORRECTED BY SAMPLE COLLECTOR
[ ] MONITORING WELL REQUIRED REPAIR (describe):

Check-off

1 [x] EQUIPMENT CLEANED BEFORE USE WITH Alconox, Distilled H2O, and Acetone
Items Cleaned (List): All Equipment used in sampling

2 [x] PRODUCT DEPTH NP FT. BELOW DATUM
Measured with: Oil/ Water Interface Probe

WATER DEPTH 4.56 & 4.61 FT. BELOW DATUM
Measured with: Water Level Probe

3 [x] WATER-CONDITION BEFORE WELL EVACUATION (Describe):
Appearance: clear / yellow
Odor: moderate H.C
Other Comments:

4 [x] WELL EVACUATION:
Method: peristaltic
Volume Removed: 2500 ml
Observations: Water (slightly - very) cloudy
Water level (rose - fell - no change)
Water odors: moderate H.C
Other comments:

Ground Water Sampling Record - Monitoring Well No. MW 5G-11 (Cont'd)

5 [x] SAMPLE EXTRACTION METHOD:

[ ] Bailer made of: _____
[x] Pump, type: Peristaltic Pump
[ ] Other, describe: _____

Sample obtained is [x] GRAB; [ ] COMPOSITE SAMPLE

6 [x] ON-SITE MEASUREMENTS:

Temp: ~~27.6~~ 26.2 ° C	Measured with: Orion Instrument	
pH: 6.82	Measured with: _____	
Conductivity: 49 x10 us/cm	Measured with: _____	
Dissolved Oxygen: 0.08 mg/l	Measured with: Orion Instrument	
Redox Potential: -126.8 mV	Measured with: _____	
Salinity: _____	Measured with: _____	
Nitrate: _____	Measured with: _____	
Sulfate: _____	Measured with: _____	
Ferrous Iron: _____	Measured with: _____	

Other: _____

7 [ ] SAMPLE CONTAINERS (material, number, size): 1 - Metal, Amber, Hach
7 - BTEX, VOC, TVH

8 [ ] ON-SITE SAMPLE TREATMENT:

[ ] Filtration: Method _____ Containers: _____
Method _____ Containers: _____
Method _____ Containers: _____

[ ] Preservatives added:

Method _____ Containers: _____
Method _____ Containers: _____
Method _____ Containers: _____
Method _____ Containers: _____

9 [ ] CONTAINER HANDLING:

[ ] Container Sides Labeled
[ ] Container Lids Taped
[ ] Containers Placed in Ice Chest

10 [ ] OTHER COMMENTS: _____

HACH
Dup

SAMPLING LOCATION MacDill AFB Site 56
SAMPLING DATE(S) March 1995

GROUND WATER SAMPLING RECORD - MONITORING WELL MW 32-1 MW32-7000 & Hach Dup
(number)

REASON FOR SAMPLING: [ ] Regular Sampling; [ ] Special Sampling;
DATE AND TIME OF SAMPLING: 3/28, 1995 a.m./p.m.
SAMPLE COLLECTED BY: MW KC of ES Denver
WEATHER: Rainy 70°
DATUM FOR WATER DEPTH MEASUREMENT (Describe): Top of Well Casing

MONITORING WELL CONDITION:
[ ] LOCKED: [ ] UNLOCKED
WELL NUMBER (IS) IS NOT APPARENT
STEEL CASING CONDITION IS: Good
INNER PVC CASING CONDITION IS: Good
WATER DEPTH MEASUREMENT DATUM (IS) IS NOT) APPARENT
[ ] DEFICIENCIES CORRECTED BY SAMPLE COLLECTOR
[ ] MONITORING WELL REQUIRED REPAIR (describe):

Check-off

1 [x] EQUIPMENT CLEANED BEFORE USE WITH Alconox, Distilled H2O, and Acetone
Items Cleaned (List): All Equipment used in sampling

2 [x] PRODUCT DEPTH NP FT. BELOW DATUM
Measured with: Oil/ Water Interface Probe

WATER DEPTH 7.78 FT. BELOW DATUM
Measured with: Water Level Probe

3 [x] WATER-CONDITION BEFORE WELL EVACUATION (Describe):
Appearance: clear / yellow
Odor: moderate sulfuric
Other Comments:

4 [x] WELL EVACUATION:
Method: peristaltic
Volume Removed: 7500 ml
Observations: Water (slightly - very) cloudy
Water level (rose - fell - no change)
Water odors: moderate
Other comments:

Ground Water Sampling Record - Monitoring Well No. ~~32-1~~ MW 32-1 (Cont'd)

5 [x] SAMPLE EXTRACTION METHOD:

[ ] Bailer made of: _____
[x] Pump, type: Peristaltic Pump
[ ] Other, describe: _____

Sample obtained is [x] GRAB; [ ] COMPOSITE SAMPLE

6 [x] ON-SITE MEASUREMENTS:

Temp:	° C	Measured with:	Orion Instrument
pH:		Measured with:	
Conductivity:	µs/cm	Measured with:	
Dissolved Oxygen:	mg/l	Measured with:	Orion Instrument
Redox Potential:	mV	Measured with:	
Salinity:		Measured with:	
Nitrate:		Measured with:	
Sulfate:		Measured with:	
Ferrous Iron:		Measured with:	

Other: _____

7 [ ] SAMPLE CONTAINERS (material, number, size): 1-Hach, Anions, METHANE
2-BTEX, TVH, VOC

8 [ ] ON-SITE SAMPLE TREATMENT:

[ ] Filtration: Method _____ Containers: _____
Method _____ Containers: _____
Method _____ Containers: _____

[ ] Preservatives added:

Method _____ Containers: _____
Method _____ Containers: _____
Method _____ Containers: _____
Method _____ Containers: _____

9 [ ] CONTAINER HANDLING:

[✓] Container Sides Labeled
[✓] Container Lids Taped
[✓] Containers Placed in Ice Chest

10 [ ] OTHER COMMENTS: HACH Dup

SAMPLING LOCATION MacDill AFB Site 56
SAMPLING DATE(S) March 1995

GROUND WATER SAMPLING RECORD - MONITORING WELL MW56-12
(number)

REASON FOR SAMPLING: [✓] Regular Sampling; [ ] Special Sampling;
DATE AND TIME OF SAMPLING: 3/28/95, 19__ 940 a.m. p.m.
SAMPLE COLLECTED BY: MVK of ES Denver
WEATHER: Sunny - 80F
DATUM FOR WATER DEPTH MEASUREMENT (Describe): Top of Well Casing

MONITORING WELL CONDITION:
[✓] LOCKED: [ ] UNLOCKED
WELL NUMBER (IS - IS NOT) APPARENT
STEEL CASING CONDITION IS: Good
INNER PVC CASING CONDITION IS: Good
WATER DEPTH MEASUREMENT DATUM (IS - IS NOT) APPARENT
[ ] DEFICIENCIES CORRECTED BY SAMPLE COLLECTOR
[ ] MONITORING WELL REQUIRED REPAIR (describe):

Check-off

1 [x] EQUIPMENT CLEANED BEFORE USE WITH Alconox, Distilled H2O, and Acetone
Items Cleaned (List): All Equipment used in sampling

2 [x] PRODUCT DEPTH NP FT. BELOW DATUM
Measured with: Oil/ Water Interface Probe

WATER DEPTH 5.76 FT. BELOW DATUM
Measured with: Water Level Probe

3 [x] WATER-CONDITION BEFORE WELL EVACUATION (Describe):
Appearance: Clear yellow
Odor: ? weak ~~Strong~~ H-C.
Other Comments:

4 [x] WELL EVACUATION:
Method: Peristaltic
Volume Removed: 2500 ml
Observations: Water (slightly - very) cloudy
Water level (rose - fell - no change) ?
Water odors: ~~Strong~~ H-C weak - Hoped to fall
Other comments:

Ground Water Sampling Record - Monitoring Well No. MW56-12 (Cont'd)

5 [x] SAMPLE EXTRACTION METHOD:

[ ] Bailer made of: _____
[x] Pump, type: Peristaltic Pump
[ ] Other, describe: _____

Sample obtained is [x] GRAB; [ ] COMPOSITE SAMPLE

6 [x] ON-SITE MEASUREMENTS:

Temp:	28.3 ° C	Measured with:	Orion Instrument
pH:	7.32	Measured with:	
Conductivity:	98x10 us/cm	Measured with:	
Dissolved Oxygen:	2.40 mg/L	Measured with:	Orion Instrument
Redox Potential:	-12.8 mV	Measured with:	
Salinity:		Measured with:	
Nitrate:		Measured with:	
Sulfate:		Measured with:	
Ferrous Iron:		Measured with:	

Other: _____

7 [ ] SAMPLE CONTAINERS (material, number, size): 1-METHANE, HACH, ANIONS
1-BTEX, TVH, ANIONS

8 [ ] ON-SITE SAMPLE TREATMENT:

[ ] Filtration: Method _____ Containers: _____
Method _____ Containers: _____
Method _____ Containers: _____

[ ] Preservatives added:

Method _____ Containers: _____
Method _____ Containers: _____
Method _____ Containers: _____
Method _____ Containers: _____

9 [ ] CONTAINER HANDLING:

[✓] Container Sides Labeled
[ ] Container Lids Taped
[✓] Containers Placed in Ice Chest

10 [ ] OTHER COMMENTS: _____

HACH
Dup

SAMPLING LOCATION MacDill AFB Site 56
SAMPLING DATE(S) March 1995

GROUND WATER SAMPLING RECORD - MONITORING WELL MW 32-1 ~~MW32-1100~~ & Hach Dup
(number)

REASON FOR SAMPLING: [✓] Regular Sampling; [ ] Special Sampling;
DATE AND TIME OF SAMPLING: 3/28, 1995 a.m./p.m.
SAMPLE COLLECTED BY: ~~MW~~ KC of ES Denver
WEATHER: Rainy 70°
DATUM FOR WATER DEPTH MEASUREMENT (Describe): Top of Well Casing

MONITORING WELL CONDITION:
[✓] LOCKED: [✓] UNLOCKED
WELL NUMBER (IS - IS NOT) APPARENT
STEEL CASING CONDITION IS: Good
INNER PVC CASING CONDITION IS: Good
WATER DEPTH MEASUREMENT DATUM (IS - IS NOT) APPARENT
[ ] DEFICIENCIES CORRECTED BY SAMPLE COLLECTOR
[ ] MONITORING WELL REQUIRED REPAIR (describe):

Check-off

1 [x] EQUIPMENT CLEANED BEFORE USE WITH Alconox, Distilled H2O, and Acetone
Items Cleaned (List): All Equipment used in sampling

2 [x] PRODUCT DEPTH NP FT. BELOW DATUM
Measured with: Oil/ Water Interface Probe

WATER DEPTH 7.78 FT. BELOW DATUM
Measured with: Water Level Probe

3 [x] WATER-CONDITION BEFORE WELL EVACUATION (Describe):
Appearance: clear / yellow
Odor: moderate sulfuric
Other Comments:

4 [x] WELL EVACUATION:
Method: peristaltic
Volume Removed: 7500 ml
Observations: Water (slightly - very) cloudy
Water level (rose - fell - no change)
Water odors: moderate
Other comments:

Ground Water Sampling Record - Monitoring Well No. MW 32-1 (Cont'd)

5 [x] SAMPLE EXTRACTION METHOD:

[ ] Bailer made of: _____
[x] Pump, type: Peristaltic Pump
[ ] Other, describe: _____

Sample obtained is [x] GRAB; [ ] COMPOSITE SAMPLE

6 [x] ON-SITE MEASUREMENTS:

Temp:	° C	Measured with:	Orion Instrument
pH:		Measured with:	
Conductivity:	µs/cm	Measured with:	
Dissolved Oxygen:	mg/l	Measured with:	Orion Instrument
Redox Potential:	mV	Measured with:	
Salinity:		Measured with:	
Nitrate:		Measured with:	
Sulfate:		Measured with:	
Ferrous Iron:		Measured with:	
Other:			

7 [ ] SAMPLE CONTAINERS (material, number, size): 1-HACH, Anions, METHANE
2-BTEX, TVH, VOC

8 [ ] ON-SITE SAMPLE TREATMENT:

[ ] Filtration: Method _____ Containers: _____
Method _____ Containers: _____
Method _____ Containers: _____

[ ] Preservatives added:

Method _____ Containers: _____
Method _____ Containers: _____
Method _____ Containers: _____
Method _____ Containers: _____

9 [ ] CONTAINER HANDLING:

[ ] Container Sides Labeled
[ ] Container Lids Taped
[ ] Containers Placed in Ice Chest

10 [ ] OTHER COMMENTS: HACH Dup

SAMPLING LOCATION MacDill AFB Site 56
SAMPLING DATE(S) March 1995

GROUND WATER SAMPLING RECORD - MONITORING WELL MD32-3
(number)

REASON FOR SAMPLING: [√] Regular Sampling; [ ] Special Sampling;
DATE AND TIME OF SAMPLING: 3/24, 1995 15:15 a.m. p.m.
SAMPLE COLLECTED BY: MK HRC of ES Denver
WEATHER: Sunny 80°
DATUM FOR WATER DEPTH MEASUREMENT (Describe): Top of Well Casing

MONITORING WELL CONDITION:
[√] LOCKED: [ ] UNLOCKED
WELL NUMBER (IS - IS NOT) APPARENT
STEEL CASING CONDITION IS: Good
INNER PVC CASING CONDITION IS: Good
WATER DEPTH MEASUREMENT DATUM (IS - IS NOT) APPARENT
[ ] DEFICIENCIES CORRECTED BY SAMPLE COLLECTOR
[ ] MONITORING WELL REQUIRED REPAIR (describe):

Check-off

1 [x] EQUIPMENT CLEANED BEFORE USE WITH Alconox, Distilled H2O, and Acetone
Items Cleaned (List): All Equipment used in sampling

2 [x] PRODUCT DEPTH NP FT. BELOW DATUM
Measured with: Oil/ Water Interface Probe

WATER DEPTH 7.31 FT. BELOW DATUM
Measured with: Water Level Probe

3 [x] WATER-CONDITION BEFORE WELL EVACUATION (Describe):
Appearance: Clear
Odor: Moderate Sulfuric
Other Comments:

4 [x] WELL EVACUATION:
Method: Peristaltic
Volume Removed: 2500 ml
Observations: Water (slightly very) cloudy
Water level (rose - fell - no change)
Water odors: moderate sulfuric
Other comments:

Ground Water Sampling Record - Monitoring Well No. MW 32-3 (Cont'd)

5 [x] SAMPLE EXTRACTION METHOD:

[ ] Bailer made of:_____
[x] Pump, type: Peristaltic Pump
[ ] Other, describe:_____

Sample obtained is [x] GRAB; [ ] COMPOSITE SAMPLE

6 [x] ON-SITE MEASUREMENTS:

Temp: 26.0 ° C	Measured with:	Orion Instrument
pH: 6.81	Measured with:	
Conductivity: 68X10 µS/cm	Measured with:	
Dissolved Oxygen: 0.08 mg/l	Measured with:	Orion Instrument
Redox Potential: -146.9	Measured with:	
Salinity:	Measured with:	
Nitrate:	Measured with:	
Sulfate:	Measured with:	
Ferrous Iron:	Measured with:	
Other:		

7 [ ] SAMPLE CONTAINERS (material, number, size): 1- VOC, METHANE, Anions, Alkalinity
2- HACH, BTEX, VOC, TVH

8 [ ] ON-SITE SAMPLE TREATMENT:

[ ] Filtration:
Method_____ Containers:_____
Method_____ Containers:_____
Method_____ Containers:_____

[ ] Preservatives added:

Method_____ Containers:_____
Method_____ Containers:_____
Method_____ Containers:_____
Method_____ Containers:_____

9 [ ] CONTAINER HANDLING:

[N] Container Sides Labeled
[ ] Container Lids Taped
[ ] Containers Placed in Ice Chest

10 [ ] OTHER COMMENTS:_____

SAMPLING LOCATION MacDill AFB Site 56
SAMPLING DATE(S) March 1995

GROUND WATER SAMPLING RECORD - MONITORING WELL MD32-MW7
(number)

REASON FOR SAMPLING: [X] Regular Sampling; [ ] Special Sampling;
DATE AND TIME OF SAMPLING: 3/28, 1995 17: a.m./p.m.
SAMPLE COLLECTED BY: MP/KC of ES Denver
WEATHER: RAINY - 70°
DATUM FOR WATER DEPTH MEASUREMENT (Describe): Top of Well Casing

MONITORING WELL CONDITION:
[X] LOCKED: [ ] UNLOCKED
WELL NUMBER (IS - IS NOT) APPARENT
STEEL CASING CONDITION IS: Good
INNER PVC CASING CONDITION IS: Good
WATER DEPTH MEASUREMENT DATUM (IS - IS NOT) APPARENT
[ ] DEFICIENCIES CORRECTED BY SAMPLE COLLECTOR
[ ] MONITORING WELL REQUIRED REPAIR (describe):

Check-off

1 [x] EQUIPMENT CLEANED BEFORE USE WITH Alconox, Distilled H2O, and Acetone
Items Cleaned (List): All Equipment used in sampling

2 [x] PRODUCT DEPTH NP FT. BELOW DATUM
Measured with: Oil/ Water Interface Probe

WATER DEPTH i = 4.86 FT. BELOW DATUM
Measured with: Water Level Probe

3 [x] WATER-CONDITION BEFORE WELL EVACUATION (Describe):
Appearance: Clear / yellow
Odor: moderate Sulfuric
Other Comments:

4 [x] WELL EVACUATION:
Method: peristaltic
Volume Removed: 2500 ml
Observations: Water (slightly - very) cloudy
Water level (rose - fell - no change)
Water odors: moderate
Other comments:

Ground Water Sampling Record - Monitoring Well No. 32M70-7 (Cont'd)

5 [x] SAMPLE EXTRACTION METHOD:

[ ] Bailer made of: _____
[x] Pump, type: Peristaltic Pump
[ ] Other, describe: _____

Sample obtained is [x] GRAB; [ ] COMPOSITE SAMPLE

6 [x] ON-SITE MEASUREMENTS:

Temp: 25.8 ° C	Measured with:	Orion Instrument
pH: 6.62	Measured with:	
Conductivity: 57 x 10 µS/cm	Measured with:	
Dissolved Oxygen: 0.03 mg/l	Measured with:	Orion Instrument
Redox Potential: -246.4 mV	Measured with:	
Salinity:	Measured with:	
Nitrate:	Measured with:	
Sulfate:	Measured with:	
Ferrous Iron:	Measured with:	

Other: _____

7 [ ] SAMPLE CONTAINERS (material, number, size): 1- METH, Anions, Hach
2- BTEX, TVH, VOC

8 [ ] ON-SITE SAMPLE TREATMENT:

[ ] Filtration:
Method _____ Containers: _____
Method _____ Containers: _____
Method _____ Containers: _____

[ ] Preservatives added:

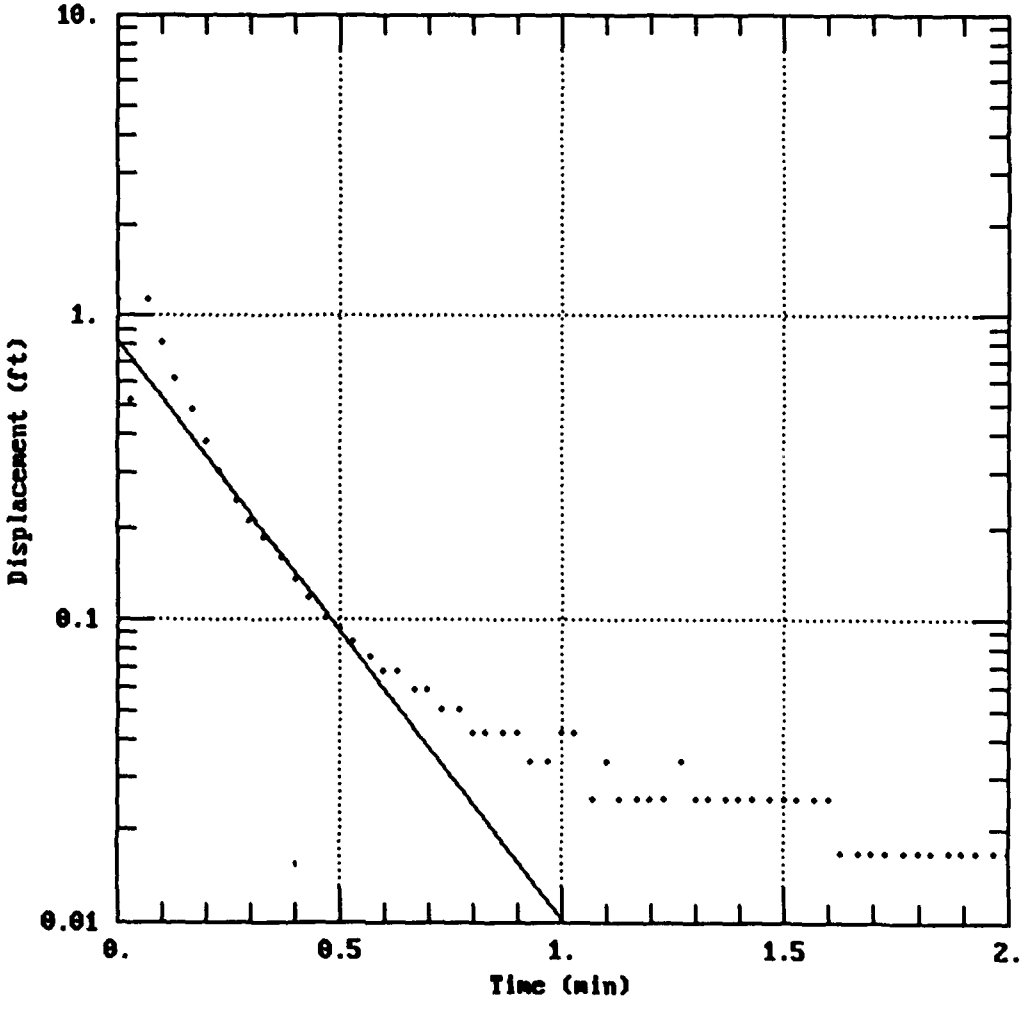
Method _____ Containers: _____
Method _____ Containers: _____
Method _____ Containers: _____
Method _____ Containers: _____

9 [ ] CONTAINER HANDLING:

[x] Container Sides Labeled
[ ] Container Lids Taped
[x] Containers Placed in Ice Chest

10 [ ] OTHER COMMENTS: _____

WELL MD32-MW01
SITE 32
MACDILL AFB, FLORIDA



DATA SET:
S3201R2A.AQT
06/30/95

AQUIFER MODEL:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

TEST DATA:
H0= 1.132 ft
r_c= 0.0833 ft
r_w= 0.333 ft
L = 10. ft
b = 10. ft
H = 7.31 ft

PARAMETER ESTIMATES:
K = 0.018 ft/min
y0 = 0.8303 ft

MacDill Air Force Base
Site 56 Coordinate Data

April 4, 1995

Point	Identification	North	East	Elevation
1	N APRON 1	1281721.5340	496814.7610	6.28
2	N APRON 2	1281001.9190	497577.3020	7.48
3	SET PK NAIL	1281424.1030	498035.9007	6.42
4	SET H/T	1281465.7790	498583.7034	7.24
5	CK.IN	1281721.4205	496814.7082	6.51
6	CK.IN	1281001.8724	497577.3265	7.78
7	SET H/T	1281328.5346	498748.4896	7.61
8	SET H/T	1281173.5404	498555.1639	6.07
9	CK.IN	1281465.8024	498583.6600	7.38
10	CK.IN	1281328.5874	498748.4433	7.73
100	0 SET	1281721.5537	496814.7401	6.36
101	0 SET	1281001.9115	497577.2938	7.64
102	0 SET	1281424.1036	498035.9087	6.63
103	0 SET	1281465.7771	498583.7165	7.39
104	0 SET	1281424.1024	498035.8925	6.49
105	0 SET	1281424.1026	498035.8946	6.49
106	O SET	1281465.7760	498583.7071	7.33
107	0 SET	1281328.5386	498748.4946	7.69
200	MD32-MW01	1281586.8892	498525.2600	9.67
201	Ground Shot	1281588.4298	498526.9752	6.75
202	Building Corner	1281633.8473	498560.4052	6.80
203	Building Corner	1281689.6857	498616.5873	7.08
204	MD32-MW07	1281634.2219	498567.7338	6.72
205	Ground Shot	1281634.5123	498568.3664	6.87
206	MD32-MW06	1281673.7873	498620.7583	6.85
207	Ground Shot	1281675.8838	498623.9593	7.02
208	MD32-MW06	1281677.0708	498626.0067	6.83
209	MD32-MW3	1281650.1777	498679.7099	9.47
210	Ground Shot	1281648.2666	498681.2825	6.75
211	56MP-6S-6D	1281603.3064	498646.4934	6.58
212	Ground Shot	1281602.6150	498645.7493	6.58
213	MD32-MW10	1281573.2270	498594.1430	6.28
214	Ground Shot	1281573.6504	498595.5717	6.49
215	Building Corner555	1281260.1079	498583.5411	8.44
216	Building Corner555	1281391.3178	498633.6650	8.87
217	Building Corner555	1281404.8405	498646.5427	8.87
218	Building Corner555	1281399.8150	498659.5174	8.85
219	Pump Island Corner	1281440.0293	498581.1525	7.46
220	Pump Island Corner	1281454.2661	498594.6232	7.38
221	Pump Island Corner	1281381.8567	498730.5175	7.59
222	Pump Island Corner	1281401.3619	498731.3280	7.64

Prepared by: Landmark Engineering & Surveying Corporation

For: PARSONS ENGINEERING SCIENCE, INC.

MacDill Air Force Base
Site 56 Coordinate Data

April 4, 1995

Point	Identification	North	East	Elevation
223	MD56-MW01	1281573.1017	498690.3496	6.36
224	Ground Shot	1281574.3994	498691.9903	6.44
225	56MP-9D	1281575.4807	498691.2020	6.23
226	56MP-8S	1281618.6294	498743.1065	6.55
227	Ground Shot	1281622.4056	498738.4774	6.52
228	MD56-MW10	1281520.7754	498684.4088	6.69
229	Ground Shot	1281519.4719	498683.9252	6.92
230	56MP-5S-5D	1281519.7160	498682.8915	6.55
231	56MP-7S-7D	1281490.0480	498789.9321	7.16
232	Ground Shot	1281491.0991	498790.1080	7.24
233	MD56-MW04	1281336.2395	498788.4765	7.32
234	Ground Shot	1281334.0409	498787.8972	7.56
235	56MP-10S	1281375.7995	498740.8645	7.46
236	Ground Shot	1281375.0084	498740.6102	7.60
237	MD56-MW08	1281413.6871	498720.0139	7.44
238	Ground Shot	1281412.2621	498719.7423	7.63
239	MD56-MW09	1281490.9242	498741.7342	6.87
240	Ground Shot	1281489.5079	498741.4976	7.06
241	MD56-MW06	1281464.3414	498702.8908	7.57
242	56MP-4S	1281460.4431	498703.6098	7.56
243	MD56-MW12	1281458.5912	498702.9517	7.61
244	Ground Shot	1281462.3673	498702.3851	7.75
245	MD56-MW07	1281477.7911	498660.5641	7.30
246	Ground Shot	1281476.6952	498660.8681	7.55
247	MD56-MW11	1281495.9273	498652.5172	6.88
248	Ground Shot	1281497.0880	498652.1652	7.01
249	56MP-7S	1281421.0440	498655.2691	7.92
250	Ground Shot	1281422.0529	498655.9451	8.07
251	56MP-3S-3D	1281491.1595	498598.7388	6.72
252	Ground Shot	1281490.0632	498599.5395	6.75
253	MD56-MW05	1281417.7812	498553.9555	6.85
254	Ground Shot	1281418.6312	498553.2434	7.06
255	56MP-2S	1281310.0715	498567.0342	8.00
256	Ground Shot	1281310.1419	498565.7355	8.10
257	Building Corner 555	1281381.3564	498659.9758	8.92
258	Building Corner 555	1281249.9317	498609.7983	8.43
259	MD56-MW02	1281267.4891	498701.7897	7.65
260	Ground Shot	1281268.1617	498700.4464	7.88
261	MD56-MW03	1281189.5448	498572.7915	5.84
262	Ground Shot	1281188.1788	498574.6511	6.01

Prepared by: **Landmark Engineering & Surveying Corporation**

For: **PARSONS ENGINEERING SCIENCE, INC.**

APPENDIX C

LABORATORY ANALYTICAL DATA

MANTECH

Ref: 95/JAD21

April 20, 1995

Dr. Don Kampbell
R.S. Kerr Environmental Research Lab
U.S. Environmental Protection Agency
P.O. Box 1198
Ada, OK 74820

THRU: S.A. Vandegrift SV

To MacDill
Was included

Dear Don:

As requested in Service Request # SF-1-123, headspace GC/MS analysis of 90 Patrick AFB water samples for chlorinated VOAs (TCE, PCE, DCE's, and vinyl chloride) was completed. The samples were received on March 28 & April 6, 1995 and analyzed on April 6-11, 1995. RSKSOP-148 (Determination of Volatile Organic Compounds in Water by Automated Headspace Gas Chromatography/Mass Spectrometry (Saturn II Ion Trap Detector) was used for this analysis.

An internal standard calibration method was established for 6 chlorinated compounds. The standard curves were prepared from 1.0 to 5000 ppb. The lower calibration limits were 1.0 ppb.

A dilution corrected quantitation report for the samples, lab duplicates, field duplicates, QC standards and lab blanks is presented in tables 1-4.

If you should have any questions, please feel free to contact me.

Sincerely,

John Allen Daniel

John Allen Daniel

xc: R.L. Cosby
G.B. Smith
D.D. Fine
J.L. Seeley JS

ManTech Environmental Research Services Corporation

R.S. Kerr Environmental Research Laboratory, P.O. Box 1198, 919 Kerr Research Drive
Ada, Oklahoma 74821-1198 405-436-8660 FAX 405-436-8501

Table 1. Quantitation Report for S.R. # SF-1-123 from Patrick AFB.

Concentration = ppb

Compound	24MP-1D	24MP-1S	24MP-1S Lab Dup	24MP-1S Field Rep	24MP-2D	24MP-2S	24MP-3D	24MP-3S	24MP-4S	24MP-5D
VINYL CHLORIDE	ND	20.7	20.2	20.8	ND	ND	ND	ND	ND	ND
1,1-DICHLOROETHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
T-1,2-DICHLOROETHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C-1,2-DICHLOROETHENE	1.1	6.8	6.5	6.2	---	ND	---	ND	ND	ND
TRICHLOROETHENE	ND	---	ND	ND	ND	ND	ND	ND	ND	ND
TETRACHLOROETHENE	ND	1.1	1.0	1.0	ND	ND	ND	ND	ND	ND

	24MP-5S	24MP-6S	24MP-7D	24MP-7D Lab Dup	24MP-7S	24MP-8D	24MP-8S	24MP-9D	24MP-9S	24MP-10D
VINYL CHLORIDE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-DICHLOROETHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
T-1,2-DICHLOROETHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C-1,2-DICHLOROETHENE	ND	ND	ND	ND	ND	ND	ND	1.8	ND	ND
TRICHLOROETHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TETRACHLOROETHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

	24MP-10D Lab Dup	24MP-10S	24PZ-1D	24PZ-1S	24PZ-1S Field Rep	MD24-1	MD24-2	MD24-3	MD24-4	MD24-5
VINYL CHLORIDE	ND	ND	1.0	2.8	2.6	---	3.4	ND	ND	ND
1,1-DICHLOROETHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
T-1,2-DICHLOROETHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C-1,2-DICHLOROETHENE	ND	ND	---	1.0	---	---	1.4	ND	ND	ND
TRICHLOROETHENE	ND	ND	ND	ND	ND	ND	2.6	ND	ND	ND
TETRACHLOROETHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

	MD24-6A	MD24-6	MD24-7	MD24-7 Field Rep	MD24-7 Field Dup	MD24-8	MD24-9	MD24-9 Lab Dup	MD24-10	MD24-10A
VINYL CHLORIDE	16.4	---	1.2	1.5	1.6	ND	ND	ND	ND	ND
1,1-DICHLOROETHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
T-1,2-DICHLOROETHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C-1,2-DICHLOROETHENE	ND	---	ND	ND	ND	ND	ND	ND	---	ND
TRICHLOROETHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TETRACHLOROETHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

ND = None Detected --- = Below Calibration Limit(1.0 ppb) Dup = Duplicate Rep = Replicate

APR-23-1993 15:42 USEPA RSKERL-ADA SSB/SPB 405 436 6725 P.03

Table 2. Quantitation Report for S.R. # SF-1-123 from Patrick AFB.

Concentration = ppb

Compound	MD24-41	MW32-1	MW32-3	MD32-MW7	56MP-1S	56MP-2S	56MP-3D	56MP-3S	56MP-4S 1/5 Dil	56MP-4S Field Rep
VINYL CHLORIDE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-DICHLOROETHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
T-1,2-DICHLOROETHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C-1,2-DICHLOROETHENE	---	ND	ND	ND	ND	ND	ND	ND	ND	ND
TRICHLOROETHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TETRACHLOROETHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Compound	56MP-5D	56MP-5S	56MP-6D	56MP-6D Lab Dup	56MP-6S	56MP-7D	56MP-7S	56MP-8S	56MP-10S	56MP-15D
VINYL CHLORIDE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-DICHLOROETHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
T-1,2-DICHLOROETHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C-1,2-DICHLOROETHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TRICHLOROETHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TETRACHLOROETHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

MD32-MW10 JAK 1/13/15

Compound	MD56-MW1	MD56-MW4	~~56MD-MW10~~	~~56MD-MW10~~ Lab Dup	56-MW1	MW56-2	MW56-5	MW56-5 Lab Dup	MW56-6	MW56-6 Field Rep
VINYL CHLORIDE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-DICHLOROETHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
T-1,2-DICHLOROETHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C-1,2-DICHLOROETHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TRICHLOROETHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TETRACHLOROETHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Compound	MW56-7	MW56-8	MW56-9	MW56-10	MW56-11	MW56-12	75MP-2S	75MP-3D	75MP-4S	75MP-5D
VINYL CHLORIDE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-DICHLOROETHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
T-1,2-DICHLOROETHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C-1,2-DICHLOROETHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TRICHLOROETHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TETRACHLOROETHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

ND = None Detected --- = Below Calibration Limit(1.0 ppb) Rep = Replicate Dup = Duplicate Dil = Dilution

APR-28-1995 15:43 USEPA RSKERL-ADA SSB/SPB 405 436 8763 P.04

Table 3. Quantitation Report for S.R. # SF-1-123 from Patrick AFB.

Concentration = ppb

Compound	75MP-5D Field Rep	75MP-6D	75MP-7D	75MP-7D Lab Dup	75MP-7S	75MP-8[illegible]	[illegible]MP-8S	75MP-8S Field Dup	75MP-9D	75MP-9S
VINYL CHLORIDE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-DICHLOROETHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
T-1,2-DICHLOROETHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C-1,2-DICHLOROETHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TRICHLOROETHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TETRACHLOROETHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

	MD75-MW2	MD75-MW3	MD75-MW4	MD75-MW4 Lab Dup	MD75-MW4 Field Rep	MD75-MW5	MD75-MW6	MD75-MW7	MD75-MW8	MD75-MW9
VINYL CHLORIDE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-DICHLOROETHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
T-1,2-DICHLOROETHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C-1,2-DICHLOROETHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TRICHLOROETHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TETRACHLOROETHENE		ND	ND	ND	ND	ND	ND	ND	ND	ND

	MD75-MW10	MD75-MW11	MD75-MW12	MD75-MW13	MD75-MW14	MD75-MW14 Lab Dup	MD75-MW14 Field Rep	MD75-MW15	MD75-MW16	Trip Blank
VINYL CHLORIDE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-DICHLOROETHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
T-1,2-DICHLOROETHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C-1,2-DICHLOROETHENE	ND	ND	ND	ND	1.0	1.1	1.0	ND	ND	ND
TRICHLOROETHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TETRACHLOROETHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

	QC0406A 20 ppb	QC0406B 200 ppb	QC0406C 20 ppb	QC0406D 200 ppb	QC0406E 20 ppb	QC0406F 200 ppb	QC0406G 20 ppb	QC0406H 200 ppb	QC0408A 20 ppb	QC0408B 200 ppb
VINYL CHLORIDE	20.8	196	20.7	193	18.9	197	19.6	189	19.9	195
1,1-DICHLOROETHENE	20.3	199	19.9	197	18.4	198	18.7	196	19.1	196
T-1,2-DICHLOROETHENE	19.4	185	19.5	180	18.2	186	19.0	187	18.7	192
C-1,2-DICHLOROETHENE	19.2	198	20.2	196	19.5	187	20.4	198	20.8	201
TRICHLOROETHENE	21.2	210	22.1	210	19.9	214	21.1	208	21.3	213
TETRACHLOROETHENE	19.9	195	19.0	197	18.8	193	18.8	194	19.2	[illegible]90

[illegible] Detected -- Below Calibration Limit(1.0 ppb) QC -- Quality Control Std Dup -- Duplicate Rep -- Replicate

USEPA RSKERL-ADA SSB/SF3 P.65
405 435 6723
APR-23-1555 15:43

Table 4. Quantitation Report for S.R. # SF-1-123 from Patrick AFB.

Concentration = ppb

Compound	QC0408C 20 ppb	QC0408D 200 ppb	QC0408E 20 ppb	QC0408F 200 ppb	QC0410A 20 ppb	QC0410B 200 ppb	QC0410C 20 ppb	QC0410D 200 ppb	QC0410E 20 ppb	BL0406A
VINYL CHLORIDE	20.9	198	21.0	188	21	191	19.2	194	20.9	ND
1,1-DICHLOROETHENE	18.7	200	19.7	196	19.8	189	19.1	200	20.0	ND
T-1,2-DICHLOROETHENE	19.0	189	19.2	181	18.6	181	19.6	192	19.1	ND
C-1,2-DICHLOROETHENE	19.8	203	19.0	193	19.2	194	19.9	199	19.3	ND
TRICHLOROETHENE	20.4	214	20.8	206	21.3	203	20.6	212	21.6	ND
TETRACHLOROETHENE	19.0	196	18.7	186	19.3	187	19.5	198	19.9	ND

Compound	BL0406B	BL0408A	BL0410A
VINYL CHLORIDE	ND	ND	ND
1,1-DICHLOROETHENE	ND	ND	ND
T-1,2-DICHLOROETHENE	ND	ND	ND
C-1,2-DICHLOROETHENE	ND	ND	ND
TRICHLOROETHENE	ND	ND	ND
TETRACHLOROETHENE	ND	ND	ND

QC = Quality Control Std BL = Blank ND = None Detected

MANTECH

Ref: 95-JH29/vg

May 9, 1995

Dr. Don Kampbell
R.S. Kerr Environmental Research Lab
U.S. Environmental Protection Agency
P.O. Box 1198
Ada, OK 74820

THRU: S.A. Vandegrift

Dear Don:

Find attached results for methane and ethylene on Patrick AFB samples as per Service Request #SF-1-123. Samples were received on 3/27, 3/28, and 4/6 and analyzed on 3/27, 3/28, 3/30, 4/3, 4/4, 4/7, 4/10, and 4/11/95. Samples were prepared and calculations were done as per RSKSOP-175. Analysis was performed as per RSKSOP-147.

If you have any questions, please feel free to see me.

Sincerely,

Jeff Hickerson

xc: R.L. Cosby
J.L. Seeley
G.B. Smith

SF-1-123 DATA

ANALYZED 3/27/95

SAMPLE	METHANE	ETHYLENE
LAB BLANK	BLQ	ND
2S	12.846	ND
* FIELD DUP	14.150	ND
3D	2.570	ND
3M	12.437	ND
3S	15.534	ND
86-16DD	0.074	ND
9D	9.839	ND
9S	5.822	ND
12D	0.882	ND
12S	12.339	ND
26D	3.756	ND
26S	9.009	ND
86-18D	6.116	ND

ANALYZED 3/28/95

SAMPLE	METHANE	ETHYLENE
LAB BLANK	BLQ	ND
86-21-MWD	0.749	ND
86MW-10D	1.598	ND
* FIELD DUP	1.560	ND
86MW-18S	3.379	ND
* LAB DUP	3.178	ND
86-18DD	0.068	ND
86-MW4D	5.095	ND
86-MW4S	11.630	ND
* LAB DUP	10.594	ND
86-21-MWS	9.857	ND

ANALYZED 3/30/95

SAMPLE	METHANE	ETHYLENE
LAB BLANK	BLQ	ND
24PZ-1S	4.177	ND
24MP-2S	9.887	ND
24MP-3D	0.182	ND
MD32-3	0.137	ND
MD24-4	0.266	ND
* LAB DUP	0.261	ND
MW56-6	6.324	ND
56-MP-6S	0.245	ND
24MP-7S	0.045	ND
56MP-7D	0.067	ND
MW56-8	2.298	ND
24MP-8D	0.068	ND
MD24-9	0.146	ND
24MP-1S	2.501	BLQ

SF-1-123 DATA

ANALYZED 3/30/95

SAMPLE	METHANE	ETHYLENE
24MP-1D	1.788	ND
24MP-2D	0.145	ND
MP24-4	0.288	ND
*LAB DUP	0.271	ND

ANALYZED 4/3/95

SAMPLE	METHANE	ETHYLENE
LAB BLANK	BLQ	ND
24PZ-1D	0.137	ND
MD56-MW9	0.739	ND
56MP-4S	8.968	ND
56MP-5D	0.568	ND
56MP-5S	13.574	ND
56MP-6D	0.086	ND
56MP-8S	0.032	ND
56MP-10S	2.268	ND
*LAB DUP	2.081	ND
dup→7 56MP-15D	0.548	ND
MD24-1	0.573	ND
MD24-2	1.311	ND
MD24-3	0.242	ND
MD24-5	0.217	ND
MD24-6	0.610	ND
MD24-6A	2.335	0.001
MD24-7	0.429	ND

ANALYZED 4/4/95

SAMPLE	METHANE	ETHYLENE
LAB BLANK	BLQ	ND
MD24-7 FIELD DUP	0.048	ND
MD24-8	0.578	ND
MD24-10	0.249	ND
MD24-10A	0.749	ND
24MP-3S	0.970	ND
24MP-5D	0.075	ND
24MP-5S	0.065	ND
24MP-6S	1.045	ND
24MP-7D	0.033	ND
*LAB DUP	0.032	ND
24MP-8S	0.125	ND
24MP-9D	0.053	ND
24MP-9S	3.270	ND
24MP-10	0.696	ND
24MP-10D	0.060	ND
MW56-1	0.442	ND
MW56-2	0.492	ND

SF-1-123 DATA

ANALYZED 4/4/95

SAMPLE	METHANE	ETHYLENE
MW56-10	3.711	ND
* LAB DUP	3.513	ND
MW56-12	0.014	ND

ANALYZED 4/7/95

SAMPLE	METHANE	ETHYLENE
LAB BLANK	BLQ	ND
56MW-1	0.087	ND
MW56-5	0.136	ND
MW56-7	7.953	ND
MW56-11	5.279	ND
56MP-1S	0.161	ND
56MP-2S	0.030	ND
56MP-3D	1.069	ND
56MP-3S	0.092	ND
56MP-7S	0.035	ND
MD32-MW7	4.749	ND
* LAB DUP	4.545	ND

ANALYZED 4/10/95

SAMPLE	METHANE	ETHYLENE
LAB BLANK	BLQ	ND
MD56-MW4	0.034	ND
MW32-1	2.634	ND
MD75-MW2	0.271	ND
MD75-MW3	0.038	ND
MD75-MW4	1.890	BLQ
MD75-MW5	0.035	ND
MD75-MW9	2.245	ND
MD75-MW6	2.466	ND
*LAB DUP	2.351	ND
MD75-MW7	0.641	ND
MD75-MW8	8.962	ND
MD75-MW10	5.394	ND
MD75-MW11	0.986	ND
MD75-MW12	7.310	ND
MD75-MW13	1.227	ND
MD75-MW14	15.439	ND
MD75-MW15	0.050	ND
MD75-MW16	6.039	ND
75MP-2S	6.550	0.001
* LAB DUP	6.215	ND

SF-1-123 DATA

ANALYZED 4/11/95

SAMPLE	METHANE	ETHYLENE
LAB BLANK	BLQ	ND
75MP-3D	1.777	ND
* FIELD DUP	0.036	ND
75MP-4S	14.469	0.001
75MP-5D	7.361	ND
75MP-6D	8.613	ND
75MP-7D	0.437	ND
75MP-8D	0.038	ND
75MP-8S	0.042	ND
* LAB DUP	0.041	ND
75MP-9D	0.072	ND
75MP-9S	0.132	ND
75MP-28S	0.043	ND

STANDARDS

SAMPLE	METHANE	ETHYLENE
10 PPM CH4	9.71	ND
100 PPM CH4	100.03	ND
1000 PPM CH4	1044.51	ND
1% CH4	1.01	ND
10% CH4	9.63	ND
20% CH4	20.18	ND
10 PPM C2H4	ND	9.95
100 PPM C2H4	ND	100.00
1000 PPM C2H4	ND	999.62

LOWER LIMIT OF QUANTITATION

METHANE	ETHYLENE
0.001	0.003

UNITS FOR THE SAMPLES ARE mg/L.

UNITS FOR THE STANDARDS CORRESPOND TO THE UNITS IN THE SAMPLE COLUMN.

ND DENOTES NONE DETECTED.
BLQ DENOTES BELOW LIMIT OF QUANTITATION.

Note
I would round off the reported values to two significa digits. Don Campbell

Evergreen

CASE NARRATIVE

Evergreen Analytical Laboratory (EAL) Project #: 95-0983

Parsons Engineering Science, Inc. (PES) Project: MacDill AFB (722450.21020)

Sample Receipt

On March 28, 1995, 22 water samples and one trip blank were received in good condition at EAL with the following discrepancies: 1. Holding times for samples 24PZ-1S, 24PZ-1D, 24MP-6S and MD32-3 for Nitrate/Nitrite analyses had expired prior to sample shipment; the chain of custody requested the trip blank be analyzed for BTEX, TVH, alkalinity, anions and TOC. The laboratory was instructed by John Hicks of PES to proceed with the anion analyses and to analyze the trip blank for BTEX.

Refer to the EAL Sample Log Sheet for specific log-in information and cross-reference of EAL and PES sample identifications.

BTEX, Water Matrix, Method 602

Samples 24PZ-1S, 56MP-5S and MW56-10 were analyzed at dilutions due to contaminant beyond the linear range of the instrument. The reporting limits were raised accordingly. Samples 56MP-4S and MW56-6 were originally analyzed within holding times at a dilution factor of 100 due to target analytes. Toluene was still beyond the linear range so the samples were re-run at a dilution factor of 250 outside holding times. The original data is reported with extrapolated values for toluene.

There were no other quality control anomalies to report.

Total Volatile Hydrocarbons (TVH), Water Matrix, Method 8015M

The sequence for samples 56MP-15D (laboratory duplicate), MW56-10 and 56MP-7D was initiated before the holding time expired, however, the analyses were completed shortly after midnight. There were no other quality control anomalies to report.

General Chemistry

The holding times for samples 24PZ-1S, 24PZ-1D, 24MP-6S and MD32-3 for Nitrate/Nitrite expired prior to sample receipt. There were no other quality control anomalies to report.

P McClellan

Patricia A. McClellan, ~~Project~~ Manager

Evergreen Analytical Sample Log Sheet

Project # 95-0983

Date(s) Sampled: 03/24,26,27/95 COC

Date Due: 03/31-BTEX,TVH
04/11 OTHERS

Date Received: 03/28/95 0930

Holding Time(s): 03/26,28,29-NO_2,N
04/7,9,10-BTEX,TVH,ALKALIN..

Client Project I.D. 722450.21020/MAC DILL

Rush STANDARD

Client: Parsons Engineering Science, Inc.

Address: 1700 Broadway Suite 900
Denver, CO 80290

Contact: TODD WIEDEMEIER

Client P.O. _____

Phone #831-8100 **Fax #**831-8208

Shipping Charges N/A

E.A. Cooler # 263

Airbill # FED EX

Custody Seal Intact? Y
Cooler X Bottles ___
COC Present Y
Sample Tags Present? Y
Sample Tags Listed? Y
Sample(s) Sealed? Y

Special Invoicing/Billing
Special Instructions * ALL BTEX ARE TO INCLUDE CHLOROBENZENE, TMB AND TEMB
* AN MS/MSD AND LAB DUPLICATE IS TO BE ANALYZED ON ALL PES PROJECTS.

Lab ID #	Client ID#	Analysis	Mtx	Btl	Loc
X04848A/B	24 PZ-1S	* BTEX 602	W	40V	2
X04849A/B	24 PZ-1D	* BTEX 602	W	40V	2
X04850A/B	24 MP-6S	* BTEX 602	W	40V	2
X04851A/B	MD 32-3	* BTEX 602	W	40V	2
X04852A/B	MW 56-10	* BTEX 602	W	40V	2
X04853A/B	56 MP-6D	* BTEX 602	W	40V	2
X04854A/B	56 MP-6S	* BTEX 602	W	40V	2
X04855A/B	MW 56-1	* BTEX 602	W	40V	2
X04856A/B	MW 56-21	* BTEX 602	W	40V	2
X04857A/B	56 MP-8S	* BTEX 602	W	40V	2
X04858A/B	56 MP-10S	* BTEX 602	W	40V	2
X04859A/B	MW 56-2	* BTEX 602	W	40V	2
X04860A/B	MW 56-8	* BTEX 602	W	40V	2
X04861A/B	MW 56-9	* BTEX 602	W	40V	2
X04862A/B	56 MP-4S	* BTEX 602	W	40V	2
X04863A/B	MW 56-12	* BTEX 602	W	40V	2
X04864A/B	MW 56-6	* BTEX 602	W	40V	2

R=Sample to be returned

Route To: GC/MS ___ GC 3 Metals ___ Wet Chem 2 SxPrep ___ Acctg 1
SxRec C QA/QC C Sales C File Orig

Page 1 of 1 Page(s)

Custodian/Date: 3/29

Lab ID #	Client ID#	Analysis	Mtx	Btl	Loc
)4865A/B	56 MP-5S	* BTEX 602	W	40V	2
.04866A/B	56 MP-5D	* BTEX 602	W	40V	2
X04867A/B	56 MP-15D	* BTEX 602	W	40V	2
X04868A/B	MW 56-10 (MD.32-MW10)	* BTEX 602	W	40V	2
X04869A/B	56 MP-7D	* BTEX 602	W	40V	2
X04870A/B	TRIP BLANK	* BTEX 602	W	40V	2
X04848C/D	24 PZ-1S	TVPH	W	40V	2
X04849C/D	24 PZ-1D	TVPH	W	40V	2
X04850C/D	24 MP-6S	TVPH	W	40V	2
X04851C/D	MD 32-3	TVPH	W	40V	2
X04852C/D	MW 56-10	TVPH	W	40V	2
X04853C/D	56 MP-6D	TVPH	W	40V	2
X04854C/D	56 MP-6S	TVPH	W	40V	2
X04855C/D	MW 56-1	TVPH	W	40V	2
X04856C/D	MW 56-21	TVPH	W	40V	2
X04857C/D	56 MP-8S	TVPH	W	40V	2
X04858C/D	56 MP-10S	TVPH	W	40V	2
)4859C/D	MW 56-2	TVPH	W	40V	2
^04860C/D	MW 56-8	TVPH	W	40V	2
X04861C/D	MW 56-9	TVPH	W	40V	2
X04862C/D	56 MP-4S	TVPH	W	40V	2
X04863C/D	MW 56-12	TVPH	W	40V	2
X04864C/D	MW 56-6	TVPH	W	40V	2
X04865C/D	56 MP-5S	TVPH	W	40V	2
X04866C/D	56 MP-5D	TVPH	W	40V	2
X04867C/D	56 MP-15D	TVPH	W	40V	2
X04868C/D	MW 56-10	TVPH	W	40V	2
X04869C/D	56 MP-7D	TVPH	W	40V	2
X04848E	24 PZ-1S	ANIONS Cl, SO_4, NO_2, NO_3	W	125P	CR3
X04849E	24 PZ-1D	ANIONS Cl, SO_4, NO_2, NO_3	W	125P	CR3
X04850E	24 MP-6S	ANIONS Cl, SO_4, NO_2, NO_3	W	125P	CR3
X04851E	MD 32-3	ANIONS Cl, SO_4, NO_2, NO_3	W	125P	CR3
X04852E	MW 56-10	ANIONS Cl, SO_4, NO_2, NO_3	W	125P	CR3
X04853E	56 MP-6D	ANIONS Cl, SO_4, NO_2, NO_3	W	125P	CR3
)4854E	56 MP-6S	ANIONS Cl, SO_4, NO_2, NO_3	W	125P	CR3

Project # 95-0983

Lab ID #	Client ID#	Analysis	Mtx	Btl	Loc
X04855E	MW 56-1	ANIONS	W	125P	CR3
X04856E	MW 56-21	ANIONS Cl, SO_4, NO_2, NO_3	W	125P	CR3
X04857E	56 MP-8S	ANIONS Cl, SO_4, NO_2, NO_3	W	125P	CR3
X04858E	56 MP-10S	ANIONS Cl, SO_4, NO_2, NO_3	W	125P	CR3
X04859E	MW 56-2	ANIONS Cl, SO_4, NO_2, NO_3	W	125P	CR3
X04860E	MW 56-8	ANIONS Cl, SO_4, NO_2, NO_3	W	125P	CR3
X04861E	MW 56-9	ANIONS Cl, SO_4, NO_2, NO_3	W	125P	CR3
X04862E	56 MP-4S	ANIONS Cl, SO_4, NO_2, NO_3	W	125P	CR3
X04863E	MW 56-12	ANIONS Cl, SO_4, NO_2, NO_3	W	125P	CR3
X04864E	MW 56-6	ANIONS Cl, SO_4, NO_2, NO_3	W	125P	CR3
X04865E	56 MP-5S	ANIONS Cl, SO_4, NO_2, NO_3	W	125P	CR3
X04866E	56 MP-5D	ANIONS Cl, SO_4, NO_2, NO_3	W	125P	CR3
X04867E	56 MP-15D	ANIONS Cl, SO_4, NO_2, NO_3	W	125P	CR3
X04868E	MW 56-10	ANIONS Cl, SO_4, NO_2, NO_3	W	125P	CR3
X04869E	56 MP-7D	ANIONS Cl, SO_4, NO_2, NO_3	W	125P	CR3
X04851F	MD 32-3	ALKALINITY	W	250P	CR3
X04853F	56 MP-6D	ALKALINITY	W	250P	CR3
X04854F	56 MP-6S	ALKALINITY	W	250P	CR3
X04866F	56 MP-5D	ALKALINITY	W	250P	CR3
X04867F	56 MP-15D	ALKALINITY	W	250P	CR3
X04868F	MW 56-10	ALKALINITY	W	250P	CR3
X04851G	MD 32-3	TOC	W	125A	CR3
X04850	24 MP-6S	TOC	W	125A	CR3

Project # 95-0983

CHAIN OF CUSTODY RECORD / ANALYTICAL SERVICES REQUEST

Evergreen Analytical Inc.
4036 Youngfield St.
Wheat Ridge, Colorado 80033
(303) 425-6021
FAX (303) 425-6854
(800) 845-7400

COMPANY Parsons Engineering Science
ADDRESS 1700 Broadway, Suite 900
CITY Denver STATE CO ZIP 80290
PHONE# 303-831-8100 FAX # 303-831-8202 FAX RESULTS Y / N

CLIENT CONTACT (print) Todd Wiedmeier
PROJECT I.D. 722458.21020
EAL QUOTE # _____ P.O.# _____
TURNAROUND REQUIRED* 30 days
*expedited turnaround subject to additional fee

Sampler Name:
(signature) Mark Vessely
(print) Mark Vessely
Evergreen Analytical Cooler No. 263
Cooler Received _____

Please **PRINT** all information:

CLIENT SAMPLE IDENTIFICATION	DATE SAMPLED	TIME	No. of Containers	MATRIX: Water-Drinking/Discharge/Ground (circle)	MATRIX: Soil / Solid	MATRIX: Oil / Sludge	TCLP VOA/BNA/Pest/Herb/Metals (circle)	VOA 8260/624/524.2 (circle)	BNA 8270/625 (circle)	Pesticides 8080/608 (circle)	Pest/PCBs 8080/608/508 (circle)	Herbicides 8150/515 (circle)	PCB Screen	BTEX 8020/602 (circle)/MTBE (circle) Eg Tmb and TetCl A8	TRPH 418.1/Oil & Grease 413.1 (circle)	VPH 8015mod. (Gasoline)	TEPH 8015mod. (Diesel)	Total Metals-DW / NPDES / SW846 (circle & list metals below)	Dissolved Metals - DW / SW846 (circle & list metals below)	Alkalinity	Anions (Cl⁻, SO₄⁻², NO₃⁻)	TDC & Tmb & Tet. MB	EAL Sample No.
24 PZ-1S	3/24/95	1230	5	X									X		X				X				04848
24 PZ-1D	3/24/95	1345	5	X									X		X				X				49
24MP-6S	3/24/95	1410	6	X									X		X				X	X			50
MD32-3	3/24/95	1545	7	X									X		X				X	X			51
MW56-10	3/26/95	0930	5	X									X		X				X				52
56MP-6D	3/26/95	1030	6	X									X		X				X				53
56MP-6S	3/26/95	1100	6	X									X		Y				X				54
MW56-1	3/26/95	1210	5	X									X		X				X				55
MW56-21	3/26/95	1200	5	X									X		X				X				56
56MP-8S	3/26/95	1310	5	X									X		X				X				57
HT:													40V		40V			250P	125T	125A			Location #2, CR3
DD:																							Container Size

EAL use only
Do not write in shaded area

EAL Project # 0983
Custodian _____

Instructions: Samples Packed on ICE

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time	Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time

CHAIN OF CUSTODY RECORD / ANALYTICAL SERVICES REQUEST

Evergreen Analytical Inc.
4036 Youngfield St.
Wheat Ridge, Colorado 80033
(303) 425-6021
FAX (303) 425-6854
(800) 845-7400

COMPANY Parsons Engineering Science
ADDRESS 1700 Broadway, Suite
CITY Denver STATE CO ZIP 80290
PHONE# 303-831-8100 FAX # 303-831-8202 FAX RESULTS Y / N

CLIENT CONTACT (print) Todd Wiedemeier
PROJECT I.D. 722415.0.2102
EAL. QUOTE # _____ P.O.# _____
TURNAROUND REQUIRED* 30 days
*expedited turnaround subject to additional fee

Sampler Name:
(signature) Mark Vessely
(print) MARK VESSELY

Evergreen Analytical Cooler No. 263
Cooler Received _____

Please **PRINT** all information:

CLIENT SAMPLE IDENTIFICATION	DATE SAMPLED	TIME	No. of Containers	MATRIX: Water-Drinking/Discharge/Ground (circle)	MATRIX: Soil / Solid	MATRIX: Oil / Sludge	ANALYSIS REQUESTED: TCLP VOA/BNA/Pest/Herb/Metals (circle)	VOA 8260/624/524.2 (circle)	BNA 8270/625 (circle)	Pesticides 8080/608 (circle)	Pest/PCBs 8080/608/508 (circle)	Herbicides 8150/515 (circle)	PCB Screen	BTEX 8020/602 (circle) + TMB + MTBE	TRPH 418.1/Oil & Grease 413.1 (circle)	VPH 8015mod. (Gasoline)	TEPH 8015mod. (Diesel)	Total Metals-DW / NPDES / SW846 (circle & list metals below)	Dissolved Metals - DW / SW846 (circle & list metals below)	Alkalinity	Anions (Cl, SO4, NO3-N, NO2-N)	TOC (+ TMB & TPH-MB)	EAL Sample No.
56MP-10S	3/26/95	1410	5	X									X		X				X				04858
MW56-2	3/26/95	1510	5	X									X		X				X				59
MW56-8	3/26/95	1545	5	X									X		X				X				60
MW56-9	3/27/95	0800	5	X									X		X				X				61
56MP-4S	3/27/95	0900	5	X									X		X				X				62
MW56-12	3/27/95	0940	5	X									X		X				X				63
MW56-6	3/27/95	1030	5	X									X		X				X				64
56MP-5S	3/27/95	1130	5	X									X		X				X				65
56MP-5D	3/27/95	1220	6	X									X		X				X	X			66
56MP-15D	3/27/95	1220	6	X									X		X				X	X			67
HT:																							Location A2, CB3
DD:																							Container Size

EAL use only
Do not write in shaded area

EAL Project # 0983
Custodian _____

Instructions: See page 1

CHAIN OF CUSTODY RECORD / ANALYTICAL SERVICES REQUEST

Evergreen Analytical Inc.
4036 Youngfield St.
Wheat Ridge, Colorado 80033
(303) 425-6021
FAX (303) 425-6854
(800) 845-7400

COMPANY: Parsons Engineering Science
ADDRESS: 1700 Broadway, Suite 900
CITY: Denver STATE: CO ZIP: 80290
PHONE#: 303-831-8100 FAX #: 303-831-8202 FAX RESULTS Y / N

CLIENT CONTACT (print): Todd Wiedmeier
PROJECT I.D.: 722450.21020
EAL. QUOTE #: P.O.#:
TURNAROUND REQUIRED*: 30 days
*expedited turnaround subject to additional fee

Sampler Name:
(signature)
(print): MARK VESSELY

Evergreen Analytical Cooler No.: 263
Cooler Received:

Please **PRINT** all information:

CLIENT SAMPLE IDENTIFICATION	DATE SAMPLED	TIME	No. of Containers	MATRIX: Water-Drinking/Discharge/Ground (circle)	MATRIX: Soil / Solid	MATRIX: Oil / Sludge	ANALYSIS REQUESTED: TCLP VOA/BNA/Pest/Herb/Metals (circle)	VOA 8260/624/524.2 (circle)	BNA 8270/625 (circle)	Pesticides 8080/608 (circle)	Pest/PCBs 8080/608/508 (circle)	Herbicides 8150/515 (circle)	PCB Screen	BTEX 8020/602 (circle)/MTBE (circle) & TPH 418.1/Oil & Grease 413.1 (circle)	TVPH 8015mod. (Gasoline)	TEPH 8015mod. (Diesel)	Total Metals-DW / NPDES / SW846 (circle & list metals below)	Dissolved Metals - DW / SW846 (circle & list metals below)	Alkalinity	Anions (Cl, SO4, NO3-N)	TDC (TMB's Tetra M6)	EAL Sample No.
MW56-10	3/27/95	1310	6	X									X	X					X	X		04868
56MP-70	3/27/95	1345	5	X									X	X						X		69
Trip Blank			1										X	X					X	X	X	70
HT:																						Location #2, CR3
DD:																						Container Size

EAL use only
Do not write in shaded area

EAL Project #: 0483
Custodian:

Instructions: Analyze trip blank for BTEX only /Leigh Berson 3/22/95 pm 3/28/95

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time	Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time

Evergreen Analytical Sample Receipt/Check-in Record

Date & Time Rec'd: 3-28-95 1100 Shipped Via: ~~UPS~~ Fedex
(Airbill # if applicable)

Client : Eng. Sci.

Client Project ID(s): 722450.21020

EAL Project #(s): 95- 0963 EAL Cooler(s): (Y) N

Cooler#	263								
Ice packs	(Y)	N	Y	N	Y	N	Y	N	Y	N
Temperature °C	4°C								

	Y	N	N/A
1. Custody seal(s) present:	X		
Seals on cooler intact	X		
Seals on bottle intact			X
2. Chain of Custody present:	X		
3. Containers broken or leaking: (Comment on COC if Y)		X	
4. Containers labeled:	X		
5. COC agrees w/ bottles received: (Comment on COC if N)	X		
6. COC agrees w/ labels: (Comment on COC if N)	X		
7. Headspace in VOA vials-waters only (comment on COC if Y)		X	
8. VOA samples preserved:	X		
9. pH measured on metals, cyanide or phenolics*:			X
List discrepancies			
*Non-EAL provided containers only, water samples only.			
10. Metal samples present:			X
Total _____ , Dissolved _____			
D or PD to be filtered:			
T,TR,D,PD to be Preserved:			
11. Short holding times:		X	
Specify parameters			
12. Multi-phase sample(s) present:		X	
13. COC signed w/ date/time:	X		

Comments:

(Additional comments on back)
Custodian Signature/Date: 3-28-95

CHAIN OF CUSTODY RECORD / ANALYTICAL SERVICES REQUEST

Evergreen Analytical Inc.

4036 Youngfield St.
Wheat Ridge, Colorado 80033
(303) 425-6021
FAX (303) 425-6854
(800) 845-7400

Page 1 of 3

COMPANY Parsons Engineering Science
ADDRESS 1700 Broadway, Suite 900
CITY Denver STATE CO ZIP 80290
PHONE# 303-831-8100 FAX # 303-831-8202 FAX RESULTS Y / N

CLIENT CONTACT (print) Todd Wiedmeier
PROJECT I.D. 722450.21020
EAL. QUOTE # _____ P.O.# _____
TURNAROUND REQUIRED* 30 days
*expedited turnaround subject to additional fee

Sampler Name:
(signature) Mark Vessely
(print) Mark Vessely

Evergreen Analytical Cooler No. 263
Cooler Received _____

Please **PRINT** all information:

CLIENT SAMPLE IDENTIFICATION	DATE SAMPLED	TIME	No. of Containers	MATRIX: Water-Drinking/Discharge/Ground (circle)	MATRIX: Soil / Solid	MATRIX: Oil / Sludge	TCLP VOA/BNA/Pest/Herb/Metals (circle)	VOA 8260/624/524.2 (circle)	BNA 8270/625 (circle)	Pesticides 8080/608 (circle)	Pest/PCBs 8080/608/508 (circle)	Herbicides 8150/515 (circle)	PCB Screen	BTEX 8020/602 (circle)/MTBE (circle) Tmb and Tetra MB	TRPH 418.1/Oil & Grease 413.1 (circle)	TVPH 8015mod. (Gasoline)	TEPH 8015mod. (Diesel)	Total Metals-DW / NPDES / SW846 (circle & list metals below)	Dissolved Metals - DW / SW846 (circle & list metals below)	Alkalinity	Anions (Cl^-, SO_4^{-2}, NO_3^-)	TDC & Tmb & Tetra MB	EAL Sample No.
24 PZ-1S	3/24/95	1230	5	X									X		X					X			
24 PZ-1D	3/24/95	1345	5	X									X		X					X			
24 MP-6S	3/24/95	1410	6	X									X		X					X	X		
MD3L-3	3/24/95	1545	7	X									X		X				X	X	X		
MW56-10	3/26/95	0930	5	X									X		X					X			
56MP-6D	3/26/95	1030	6	X									X		X				X	X			
56MP-6S	3/26/95	1100	6	X									X		Y				X	X			
MW56-1	3/26/95	1210	5	X									X		X					X			
MW56-21	3/26/95	1210	5	X									X		X					X			
56MP-8S	3/26/95	1310	5	X									X		X					X			
HT:																						Location	
DD:																						Container Size	

EAL use only
Do not write in shaded area

EAL
Project # _____
Custodian _____

Instructions: Samples Packed on ICE

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time	Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time

CHAIN OF CUSTODY RECORD / ANALYTICAL SERVICES REQUEST

Evergreen Analytical Inc.
4036 Youngfield St.
Wheat Ridge, Colorado 80033
(303) 425-6021
FAX (303) 425-6854
(800) 845-7400

COMPANY Parsons Engineering Science
ADDRESS 1700 Broadway Suite
CITY Denver STATE CO ZIP 80290
PHONE# 303-831-8100 FAX # 303-831-8202 FAX RESULTS Y / N

CLIENT CONTACT (print) Todd Wiedemeier
PROJECT I.D. 722450.2102
EAL. QUOTE # P.O.#
TURNAROUND REQUIRED* 30 days
*expedited turnaround subject to additional fee

Sampler Name:
(signature)
(print) MARK VESSELY

Evergreen Analytical Cooler No. 263
Cooler Received

Please **PRINT** all information:

CLIENT SAMPLE IDENTIFICATION	DATE SAMPLED	TIME	No. of Containers	MATRIX: Water-Drinking/Discharge (circle) Ground	MATRIX: Soil / Solid	MATRIX: Oil / Sludge	TCLP VOA/BNA/Pest/Herb/Metals (circle)	VOA 8260/624/524.2 (circle)	BNA 8270/625 (circle)	Pesticides 8080/608 (circle)	Pest/PCBs 8080/608/508 (circle)	Herbicides 8150/515 (circle)	PCB Screen	BTEX 8020/602 (circle)/MTBE (circle) & TMB	TRPH 418.1/Oil & Grease 413.1 (circle)	TVPH 8015mod. (Gasoline)	TEPH 8015mod. (Diesel)	Total Metals-DW / NPDES / SW846 (circle & list metals below)	Dissolved Metals - DW / SW846 (circle & list metals below)	Alkalinity	Anions (Cl^-, SO_4^{-2}, NO_2^-, NO_3^-)	TOC (& TMB & TEX & MB)				EAL Sample No.
56MP-10S	3/26/95	1410	5	X										X		X				X						
MW56-7	3/26/95	1510	5	X										X		X				X						
MW56-8	3/26/95	1546	5	X										X		X				X						
MW56-9	3/27/95	0800	5	X										X		X				X						
56MP-4S	3/27/95	0900	5	X										X		X				X						
MW56-12	3/27/95	0940	5	X										X		X				X						
MW56-6	3/27/95	1030	5	X										X		X				X						
56MP-5S	3/27/95	1130	5	X										X		X				X						
56MP-5D	3/27/95	1220	6	X										X		X			X	X						
56MP-15D	3/27/95	1220	6	X										X		X			X	X						
HT:																									Location	
DD:																									Container Size	

EAL use only
Do not write in shaded area

EAL
Project #
Custodian

Instructions: See page 1

CHAIN OF CUSTODY RECORD / ANALYTICAL SERVICES REQUEST

Evergreen Analytical Inc.
4036 Youngfield St.
Wheat Ridge, Colorado 80033
(303) 425-6021
FAX (303) 425-6854
(800) 845-7400

COMPANY Parsons Engineering Science
ADDRESS 1700 Broadway, Suite 600
CITY Denver STATE CO ZIP 80290
PHONE # 303-831-8100 FAX # 303-831-8202 FAX RESULTS Y / N

CLIENT CONTACT (print) Todd Wiedmeier
PROJECT I.D. 722450.21020
EAL. QUOTE # P.O.#
TURNAROUND REQUIRED* 30 days
*expedited turnaround subject to additional fee

Sampler Name:
(signature)
(print) MARK VESSELY

Evergreen Analytical Cooler No. 263
Cooler Received

Please **PRINT** all information:

CLIENT SAMPLE IDENTIFICATION	DATE SAMPLED	TIME	No. of Containers	MATRIX: Water-Drinking/Discharge/Ground (circle)	MATRIX: Soil / Solid	MATRIX: Oil / Sludge	TCLP VOA/BNA/Pest/Herb/Metals (circle)	VOA 8260/624/524.2 (circle)	BNA 8270/625 (circle)	Pesticides 8080/608 (circle)	Pest/PCBs 8080/608/508 (circle)	Herbicides 8150/515 (circle)	PCB Screen	BTEX 8020/602 (circle)/MTBE (circle) & TMB's by Tekmar	TRPH 418.1/Oil & Grease 413.1 (circle)	TVPH 8015mod. (Gasoline)	TEPH 8015mod. (Diesel)	Total Metals-DW / NPDES / SW846 (circle & list metals below)	Dissolved Metals - DW / SW846 (circle & list metals below)	Alkalinity	Anions (Cl, SO4, NO3)	TOC & TMB's by Tekmar 8015					EAL Sample No.
MW56-10	3/27/95	1310	6	X										X		X				X	X					
56MP-7D	3/27/95	1345	5	X										X		X					X					
Trip blank			1											X		X				X	X	X				
HT:																										Location
DD:																										Container Size

EAL use only
Do not write in shaded area

EAL
Project #
Custodian

Instructions: Analyse trip blank for BTEX only / Leigh Benson pm 3/25/95 3/27/95

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time	Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time
	3/27/95						

EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303) 425-6021

Method 602 Data Report

Client Sample Number	: MD32-3	Client Project No.	: 722450.21020/MacDill
Lab Sample Number	: X04851	Lab Project No.	: 95-0983
Date Sampled	: 3/24/95	Dilution Factor	: 1.00
Date Received	: 3/28/95	Method	: 602
Date Prepared	: 4/5/95	Matrix	: Water
Date Analyzed	: 4/6/95	Lab File No.	: BX2040525
		Method Blank No.	: MB040595

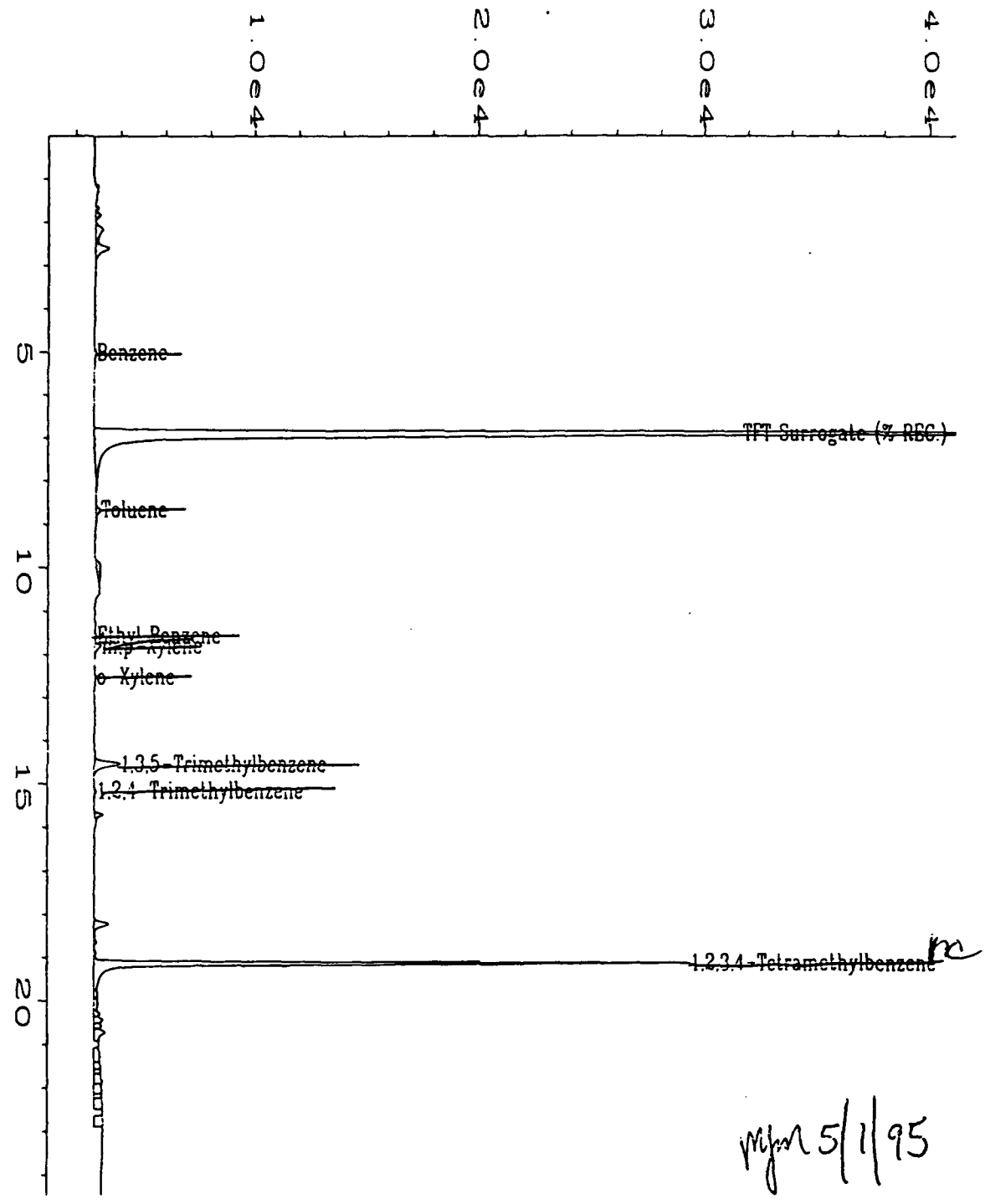
Compound Name	Cas Number	Sample Concentration ug/L		RL ug/L
Benzene	71-43-2		U	0.4
Toluene	108-88-3		U	0.4
Chlorobenzene	108-90-7		U	0.4
Ethyl Benzene	100-41-4		U	0.4
Total Xylenes (m, p & o)	108-38-3, 106-42-3 and 95-47-6		U	0.4
1,3,5-Trimethylbenzene	108-67-8		U	0.4
1,2,4-Trimethylbenzene	95-63-6		U	0.4
1,2,3-Trimethylbenzene	526-73-8		U	0.4
1,2,3,4-Tetramethylbenzene	488-23-3		U	0.4
Surrogate Recovery (α,α,α-Trifluorotoluene):		83%		70%-130% (QC limits)

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene RL is for a single peak.

QUALIFIERS:
E = Extrapolated value.
U = Compound analyzed for, but not detected.
B = Compound also found in the blank.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit (RL).
RL = Reporting Limit.
NA = Not Available/Not Applicable.

Analyst

K. Cone
Approved



mjm 5/1/95

Data File Name	: C:\HPCHEM\2\DATA\BX20405\025R0901.D		
Operator	: SW Tyson	Page Number	: 1
Instrument	: BTEX2	Vial Number	: 25
Sample Name	: X04851;1;5	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 9
Acquired on	: 06 Apr 95 04:32 AM	Instrument Method	: BX20405.MTH
Report Created on	: 06 Apr 95 08:42 AM	Analysis Method	: BX20405.MTH
Last Recalib on	: 06 APR 95 08:23 AM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:
Sample Info	: Project#: 95-0983 Client#: MD32-3 Water		

EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303) 425-6021

Method 602 Data Report

Client Sample Number	: MD32-3	Client Project No.	: 722450.21020/MacDill
Lab Sample Number	: X04851DUP	Lab Project No.	: 95-0983
Date Sampled	: 3/24/95	Dilution Factor	: 1.00
Date Received	: 3/28/95	Method	: 602
Date Prepared	: 4/5/95	Matrix	: Water
Date Analyzed	: 4/6/95	Lab File No.	: BX2040526
		Method Blank No.	: MB040595

Compound Name	Cas Number	Sample Concentration ug/L		RL ug/L
Benzene	71-43-2	U		0.4
Toluene	108-88-3	U		0.4
Chlorobenzene	108-90-7	U		0.4
Ethyl Benzene	100-41-4	U		0.4
Total Xylenes (m, p & o)	108-38-3, 106-42-3 and 95-47-6	U		0.4
1,3,5-Trimethylbenzene	108-67-8	U		0.4
1,2,4-Trimethylbenzene	95-63-6	U		0.4
1,2,3-Trimethylbenzene	526-73-8	U		0.4
1,2,3,4-Tetramethylbenzene	488-23-3	U		0.4

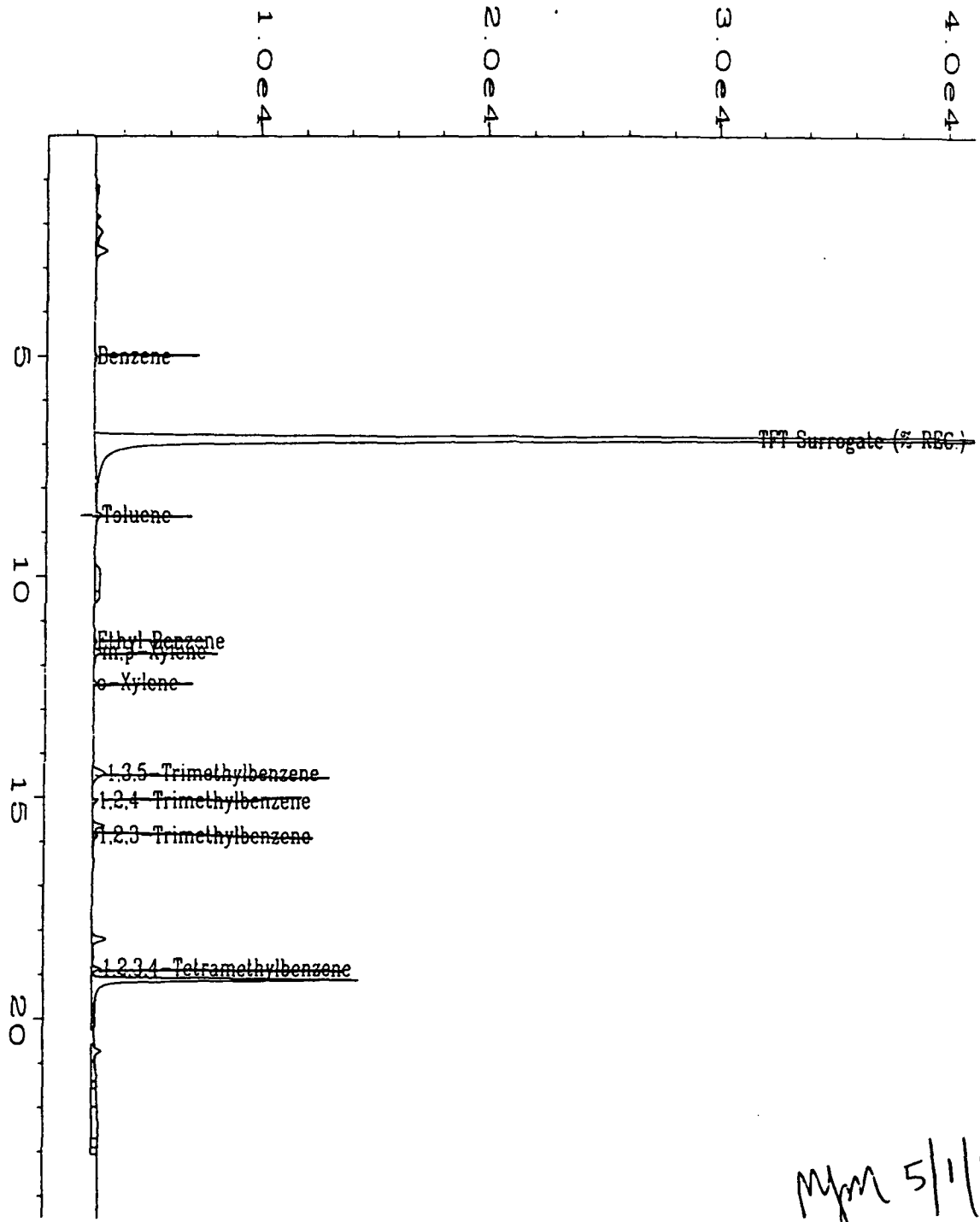
Surrogate Recovery (α,α,α-Trifluorotoluene):	87%	70%-130% (QC limits)

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene RL is for a single peak.

QUALIFIERS:
E = Extrapolated value.
U = Compound analyzed for, but not detected.
B = Compound also found in the blank.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit (RL).
RL = Reporting Limit.
NA = Not Available/Not Applicable.

Analyst

K. Cone
Approved



MJM 5/1/95

Data File Name	: C:\HPCHEM\2\DATA\BX20405\026R0901.D		
Operator	: SW Tyson	Page Number	: 1
Instrument	: BTEX2	Vial Number	: 26
Sample Name	: X04851DUP;1;5	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 9
uired on	: 06 Apr 95 05:19 AM	Instrument Method	: BX20405.MTH
ort Created on	: 06 Apr 95 08:43 AM	Analysis Method	: BX20405.MTH
Last Recalib on	: 06 APR 95 08:23 AM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:
Sample Info	: Project#: 95-0983 Client#: MD32-3 Water		

EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303) 425-6021

Method 602 Data Report

Client Sample Number	: MW56-1	**Client Project No.**	: 722450.21020/MacD
Lab Sample Number	: X04855	**Lab Project No.**	: 95-0983
Date Sampled	: 3/26/95	**Dilution Factor**	: 1.00
Date Received	: 3/28/95	**Method**	: 602
Date Prepared	: 4/6/95	**Matrix**	: Water
Date Analyzed	: 4/7/95	**Lab File No.**	: BX2040620
		Method Blank No.	: MB040695

Compound Name	Cas Number	Sample Concentration ug/L	RL ug/L
Benzene	71-43-2	U	0.4
Toluene	108-88-3	U	0.4
Chlorobenzene	108-90-7	U	0.4
Ethyl Benzene	100-41-4	U	0.4
Total Xylenes (m, p & o)	108-38-3, 106-42-3 and 95-47-6	U	0.4
1,3,5-Trimethylbenzene	108-67-8	U	0.4
1,2,4-Trimethylbenzene	95-63-6	U	0.4
1,2,3-Trimethylbenzene	526-73-8	U	0.4
1,2,3,4-Tetramethylbenzene	488-23-3	U	0.4

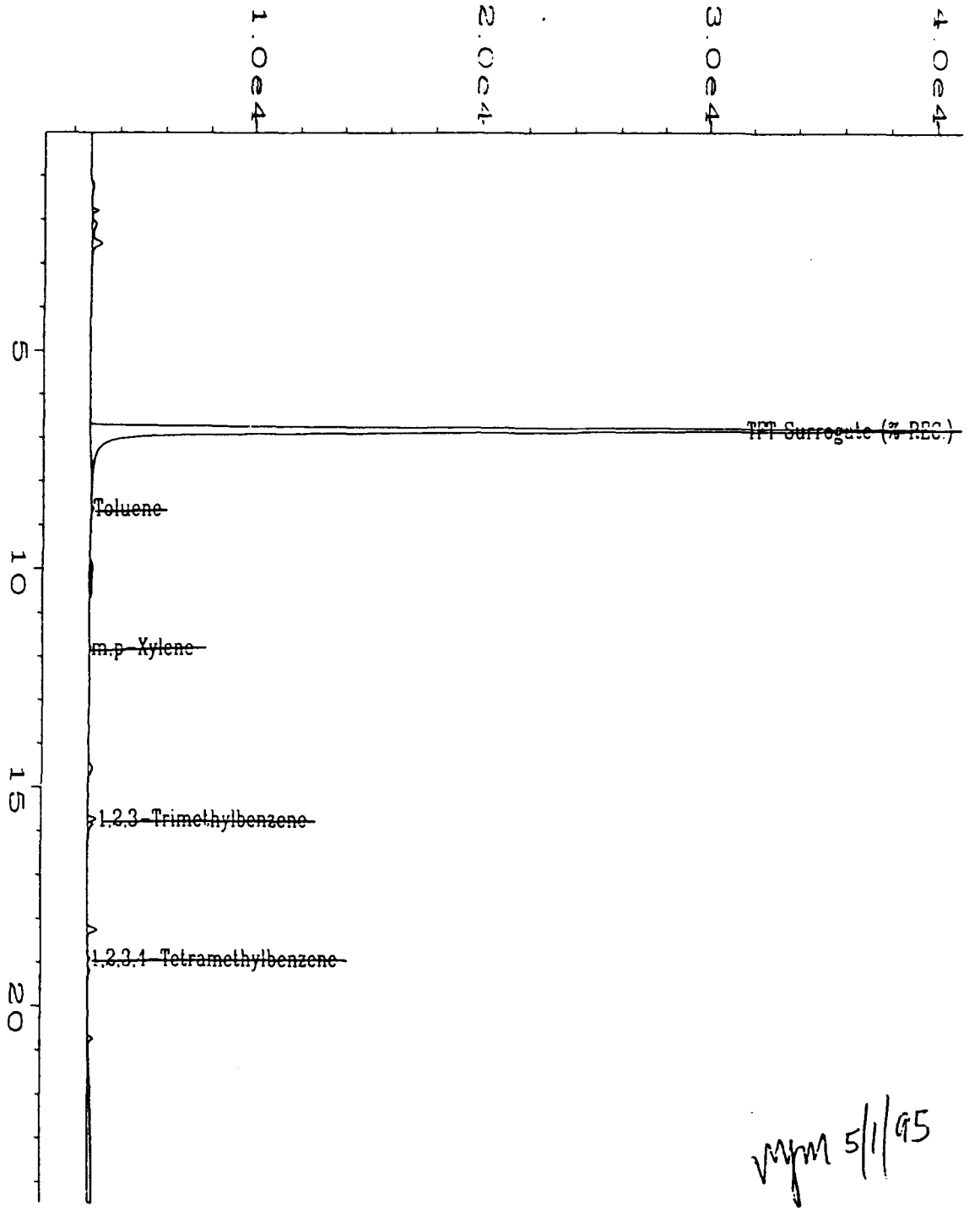
Surrogate Recovery (α,α,α-Trifluorotoluene):	98%	70%-130% (QC limits)

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene RL is for a single peak.

QUALIFIERS:
E = Extrapolated value.
U = Compound analyzed for, but not detected.
B = Compound also found in the blank.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit (RL).
RL = Reporting Limit.
NA = Not Available/Not Applicable.

K. Cone
Analyst

Approved



vvpm 5/1/95

Data File Name	: C:\HPCHEM\2\DATA\BX20406\020R0101.D		
Operator	: C.J. Cook	Page Number	: 1
Instrument	: BTEX2	Vial Number	: 20
Sample Name	: X04855;1;5	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 1
Acquired on	: 07 Apr 95 02:03 AM	Instrument Method	: BX20406.MTH
Report Created on	: 30 Apr 95 08:26 PM	Analysis Method	: BX20406B.MTH
Last Recalib on	: 30 APR 95 08:02 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:
Sample Info	: Project#: 95-0983 Client#: MW 56-1 Water		

EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303) 425-6021

Method 602 Data Report

Client Sample Number	: MW56-1	Client Project No.	: 722450.21020/MacD:
Lab Sample Number	: X04855DUP	Lab Project No.	: 95-0983
Date Sampled	: 3/26/95	Dilution Factor	: 1.00
Date Received	: 3/28/95	Method	: 602
Date Prepared	: 4/6/95	Matrix	: Water
Date Analyzed	: 4/7/95	Lab File No.	: BX2040621
		Method Blank No.	: MB040695

Compound Name	Cas Number	Sample Concentration ug/L	RL ug/L
Benzene	71-43-2	U	0.4
Toluene	108-88-3	U	0.4
Chlorobenzene	108-90-7	U	0.4
Ethyl Benzene	100-41-4	U	0.4
Total Xylenes (m, p & o)	108-38-3, 106-42-3 and 95-47-6	U	0.4
1,3,5-Trimethylbenzene	108-67-8	U	0.4
1,2,4-Trimethylbenzene	95-63-6	U	0.4
1,2,3-Trimethylbenzene	526-73-8	U	0.4
1,2,3,4-Tetramethylbenzene	488-23-3	U	0.4

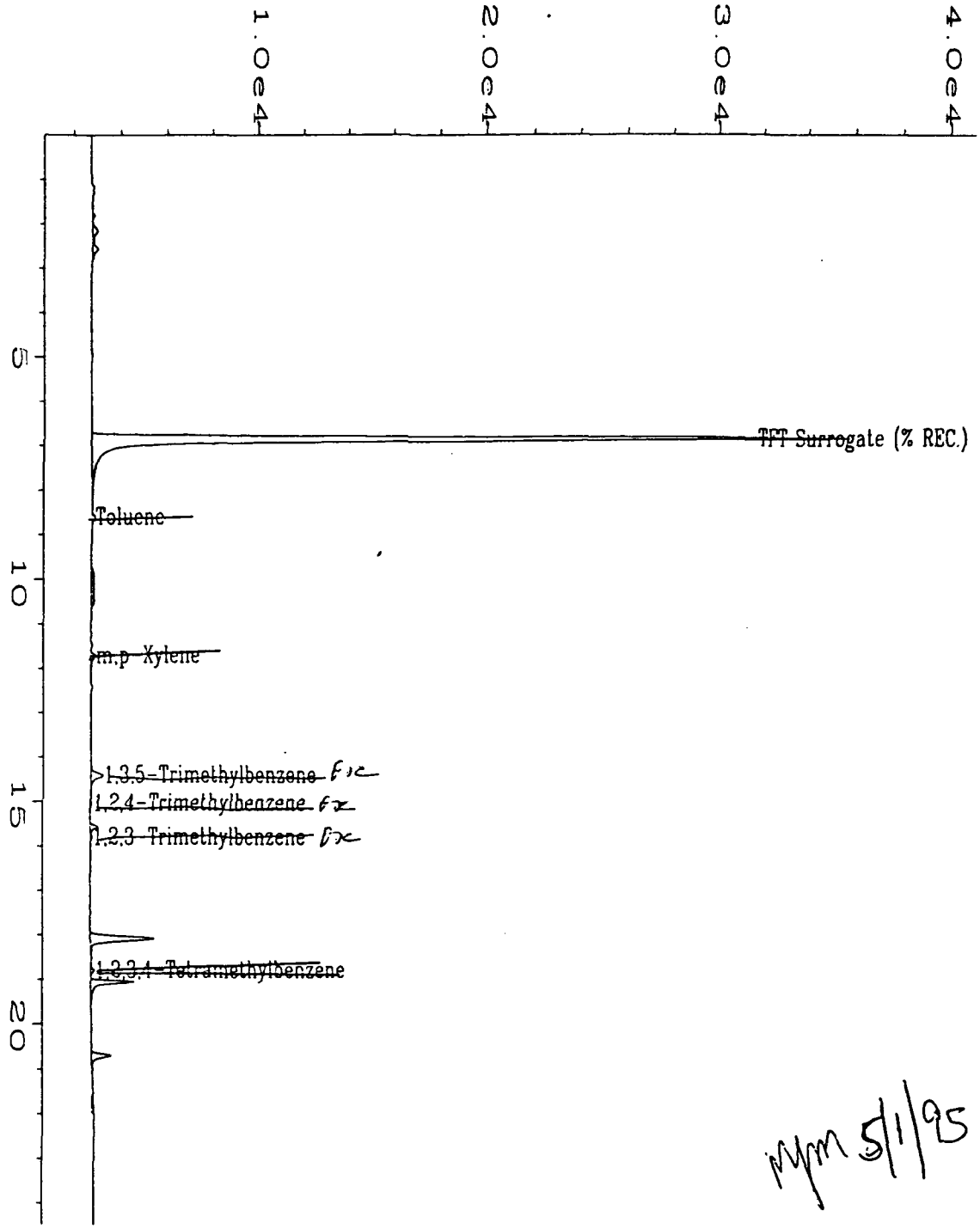
Surrogate Recovery (α,α,α-Trifluorotoluene):	80%	70%-130% (QC limits

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene RL is for a single peak.

QUALIFIERS:
E = Extrapolated value.
U = Compound analyzed for, but not detected.
B = Compound also found in the blank.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit (RL).
RL = Reporting Limit.
NA = Not Available/Not Applicable.

K. Cone
Analyst

Approved



mym 5/1/95

Data File Name : C:\HPCHEM\2\DATA\BX20406\021R0101.D
Operator : C.J. Cook
Instrument : BTEX2
Sample Name : X04855DUP;1;5
Run Time Bar Code:
Acquired on : 07 Apr 95 02:47 AM
Report Created on: 30 Apr 95 08:27 PM
Last Recalib on : 30 APR 95 08:02 PM
Multiplier : 1
Sample Info : Project#: 95-0983 Client#: MW 56-1 Water

Page Number : 1
Vial Number : 21
Injection Number : 1
Sequence Line : 1
Instrument Method: BX20406.MTH
Analysis Method : BX20406B.MTH
Sample Amount : 0
ISTD Amount :

EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303) 425-6021

Method 602 Data Report

Client Sample Number	: MW56-2	Client Project No.	: 722450.21020/MacDil
Lab Sample Number	: X04859	Lab Project No.	: 95-0983
Date Sampled	: 3/26/95	Dilution Factor	: 1.00
Date Received	: 3/28/95	Method	: 602
Date Prepared	: 4/6/95	Matrix	: Water
Date Analyzed	: 4/7/95	Lab File No.	: BX2040625
		Method Blank No.	: MB040695

Compound Name	Cas Number	Sample Concentration ug/L	RL ug/L
Benzene	71-43-2	U	0.4
Toluene	108-88-3	U	0.4
Chlorobenzene	108-90-7	U	0.4
Ethyl Benzene	100-41-4	U	0.4
Total Xylenes (m, p & o)	108-38-3, 106-42-3 and 95-47-6	U	0.4
1,3,5-Trimethylbenzene	108-67-8	U	0.4
1,2,4-Trimethylbenzene	95-63-6	U	0.4
1,2,3-Trimethylbenzene	526-73-8	U	0.4
1,2,3,4-Tetramethylbenzene	488-23-3	U	0.4

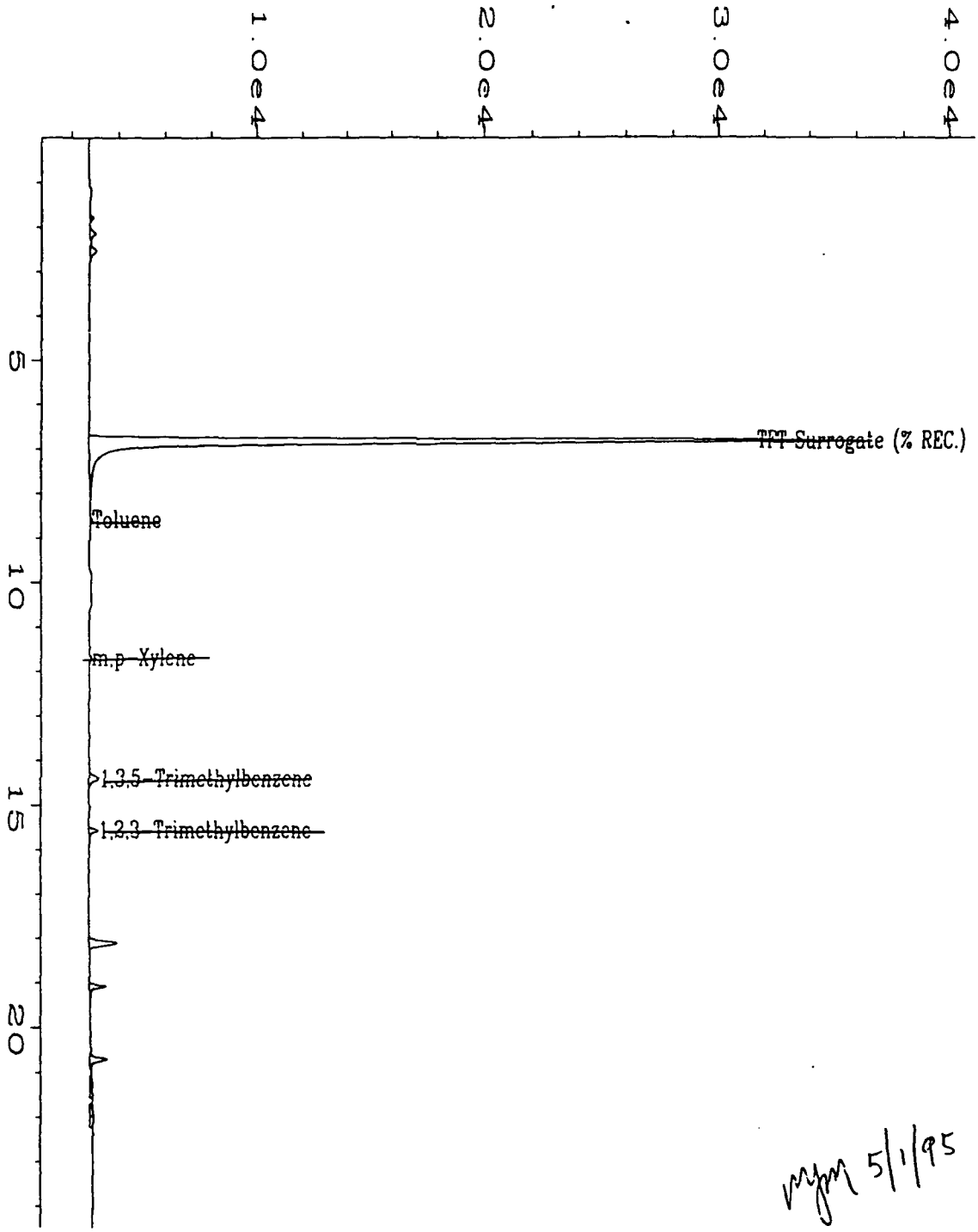
Surrogate Recovery (α,α,α-Trifluorotoluene):	83%	70%-130% (QC limits)

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene RL is for a single peak.

QUALIFIERS:
E = Extrapolated value.
U = Compound analyzed for, but not detected.
B = Compound also found in the blank.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit (RL).
RL = Reporting Limit.
NA = Not Available/Not Applicable.

K. Cone
Analyst

Approved



mgm 5/1/95

Data File Name	: C:\HPCHEM\2\DATA\BX20406\025R0101.D		
Operator	: C.J. Cook	Page Number	: 1
Instrument	: BTEX2	Vial Number	: 25
Sample Name	: X04859;1;5	Injection Number	: 1
n Time Bar Code	:	Sequence Line	: 1
quired on	: 07 Apr 95 05:40 AM	Instrument Method	: BX20406.MTH
Report Created on	: 30 Apr 95 08:29 PM	Analysis Method	: BX20406B.MTH
Last Recalib on	: 30 APR 95 08:02 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:
Sample Info	: Project#: 95-0983 Client#: MW 56-2 Water		

EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303) 425-6021

Method 602 Data Report

Client Sample Number	: MW56-6	Client Project No.	: 722450.21020/Mac
Lab Sample Number	: X04864	Lab Project No.	: 95-0983
Date Sampled	: 3/27/95	Dilution Factor	: 100.00
Date Received	: 3/28/95	Method	: 602
Date Prepared	: 4/8/95	Matrix	: Water
Date Analyzed	: 4/8/95	Lab File No.	: BX2040814
		Method Blank No.	: MB040895

Compound Name	Cas Number	Sample Concentration ug/L		RL ug/L
Benzene	71-43-2	7600		40
Toluene	108-88-3	>80 **		40
Chlorobenzene	108-90-7		U	40
Ethyl Benzene	100-41-4	1600		40
Total Xylenes (m, p & o)	108-38-3, 106-42-3 and 95-47-6	7700		40
1,3,5-Trimethylbenzene	108-67-8	490		40
1,2,4-Trimethylbenzene	95-63-6	1500		40
1,2,3-Trimethylbenzene	526-73-8	310		40
1,2,3,4-Tetramethylbenzene	488-23-3		U	40
Surrogate Recovery (α,α,α-Trifluorotoluene):		101%		70%-130% (QC limits

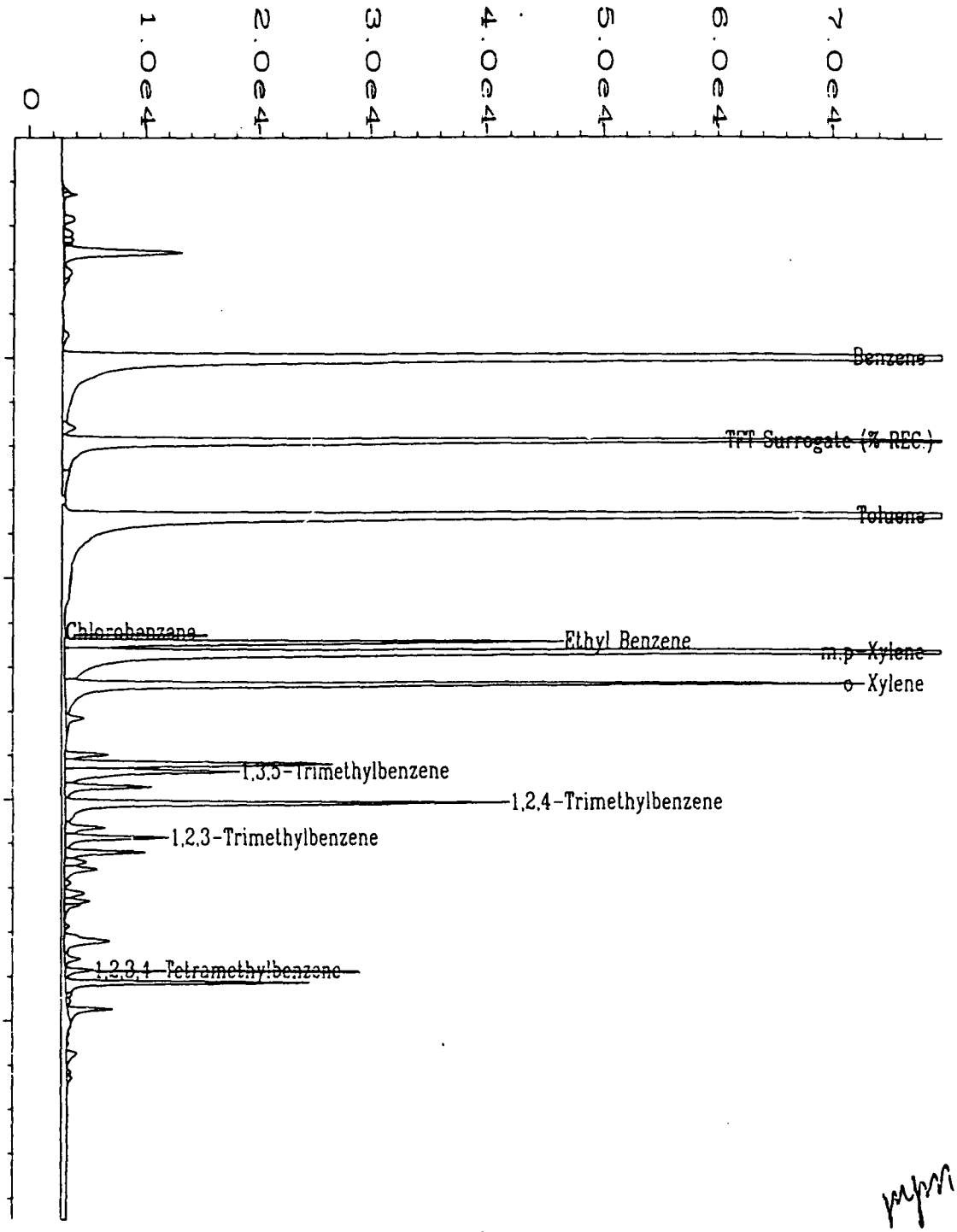
Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene RL is for a single peak.

** = Greater than 10% of calibration range. See BX1041313 (DF=250) run past holding time.

QUALIFIERS:
E = Extrapolated value.
U = Compound analyzed for, but not detected.
B = Compound also found in the blank.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit (RL).
RL = Reporting Limit.
NA = Not Available/Not Applicable.

K. Cone
Anaiyst

Approved



mpm 5/1/95

Data File Name : C:\HPCHEM\2\DATA\BX20408\014R0901.D
Operator : S.W. Tyson
Instrument : BTEX2
Sample Name : X04864;100;0.05
Run Time Bar Code:
Acquired on : 08 Apr 95 07:15 PM
Report Created on: 09 Apr 95 02:27 PM
Last Recalib on : 09 Apr 95 02:21 PM
Multiplier : 1

Page Number : 1
Vial Number : 14
Injection Number : 1
Sequence Line : 9
Instrument Method: BX20408.MTH
Analysis Method : BX20408.MTH
Sample Amount : 0
ISTD Amount :

MW56-6

EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303) 425-6021

Method 602 Data Report

Client Sample Number	: MW56-8	Client Project No.	: 722450.21020/MacDill
Lab Sample Number	: X04860	Lab Project No.	: 95-0983
Date Sampled	: 3/26/95	Dilution Factor	: 1.00
Date Received	: 3/28/95	Method	: 602
Date Prepared	: 4/6/95	Matrix	: Water
Date Analyzed	: 4/7/95	Lab File No.	: BX2040626
		Method Blank No.	: MB040695

Compound Name	Cas Number	Sample Concentration ug/L		RL ug/L
Benzene	71-43-2	1.1		0.4
Toluene	108-88-3		U	0.4
Chlorobenzene	108-90-7		U	0.4
Ethyl Benzene	100-41-4	2.0		0.4
Total Xylenes (m, p & o)	108-38-3, 106-42-3 and 95-47-6		U	0.4
1,3,5-Trimethylbenzene	108-67-8		U	0.4
1,2,4-Trimethylbenzene	95-63-6		U	0.4
1,2,3-Trimethylbenzene	526-73-8		U	0.4
1,2,3,4-Tetramethylbenzene	488-23-3		U	0.4

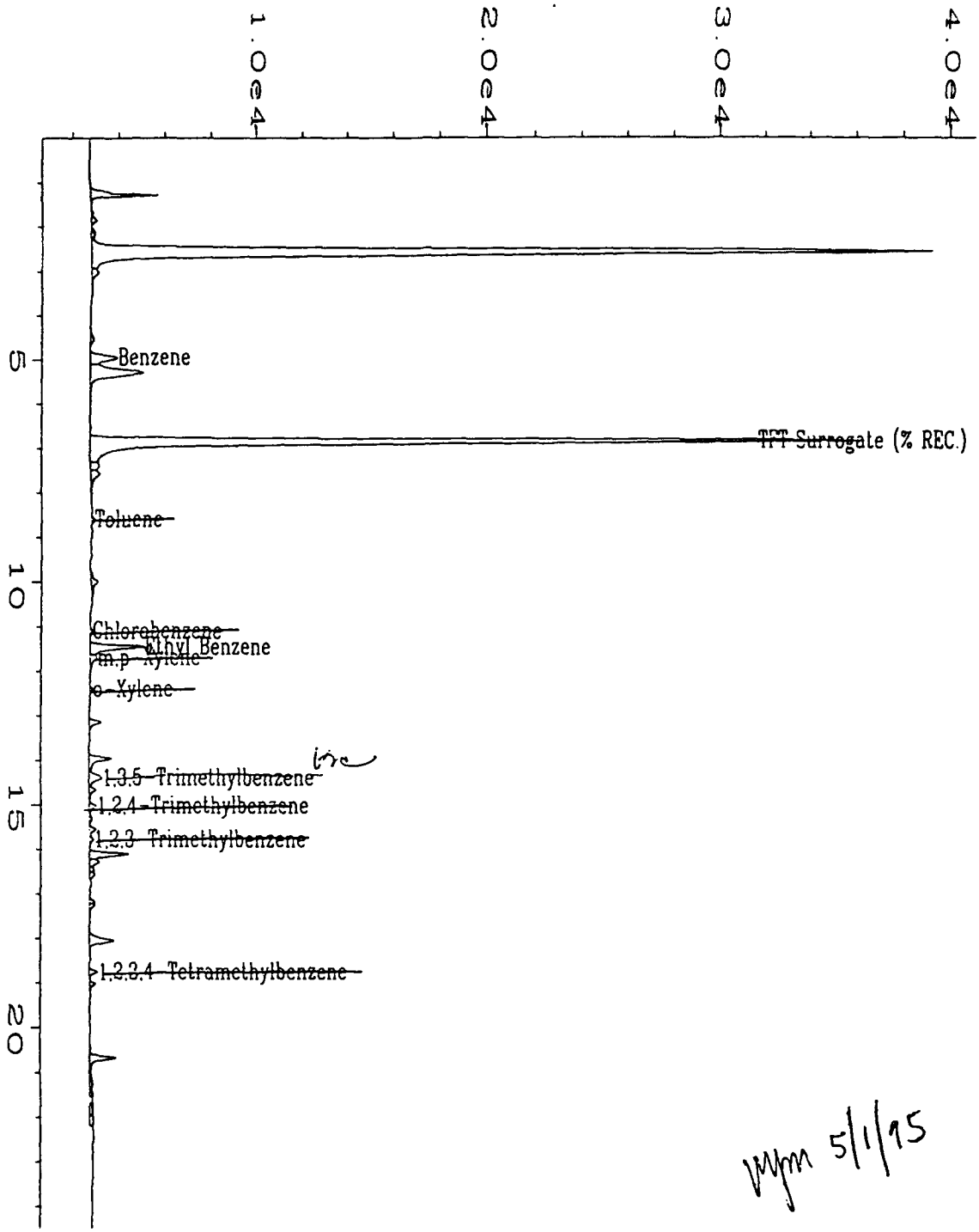
Surrogate Recovery (α,α,α-Trifluorotoluene):	80%	70%-130% (QC limits)

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene RL is for a single peak.

QUALIFIERS:
E = Extrapolated value.
U = Compound analyzed for, but not detected.
B = Compound also found in the blank.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit (RL).
RL = Reporting Limit.
NA = Not Available/Not Applicable.

K. Cone
Analyst

Approved



jmm 5/1/95

Data File Name : C:\HPCHEM\2\DATA\BX20406\026R0101.D
Operator : C.J. Cook
Instrument : BTEX2
Sample Name : X04860;1;5
n Time Bar Code:
quired on : 07 Apr 95 06:23 AM
Report Created on: 30 Apr 95 08:29 PM
Last Recalib on : 30 APR 95 08:02 PM
Multiplier : 1
Sample Info : Project#: 95-0983 Client#: MW 56-8 Water

Page Number : 1
Vial Number : 26
Injection Number : 1
Sequence Line : 1
Instrument Method: BX20406.MTH
Analysis Method : BX20406B.MTH
Sample Amount : 0
ISTD Amount :

EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303) 425-6021

Method 602 Data Report

Client Sample Number	: MW56-9	Client Project No.	: 722450.21020/MacD
Lab Sample Number	: X04861	Lab Project No.	: 95-0983
Date Sampled	: 3/27/95	Dilution Factor	: 1.00
Date Received	: 3/28/95	Method	: 602
Date Prepared	: 4/6/95	Matrix	: Water
Date Analyzed	: 4/7/95	Lab File No.	: BX2040627
		Method Blank No.	: MB040695

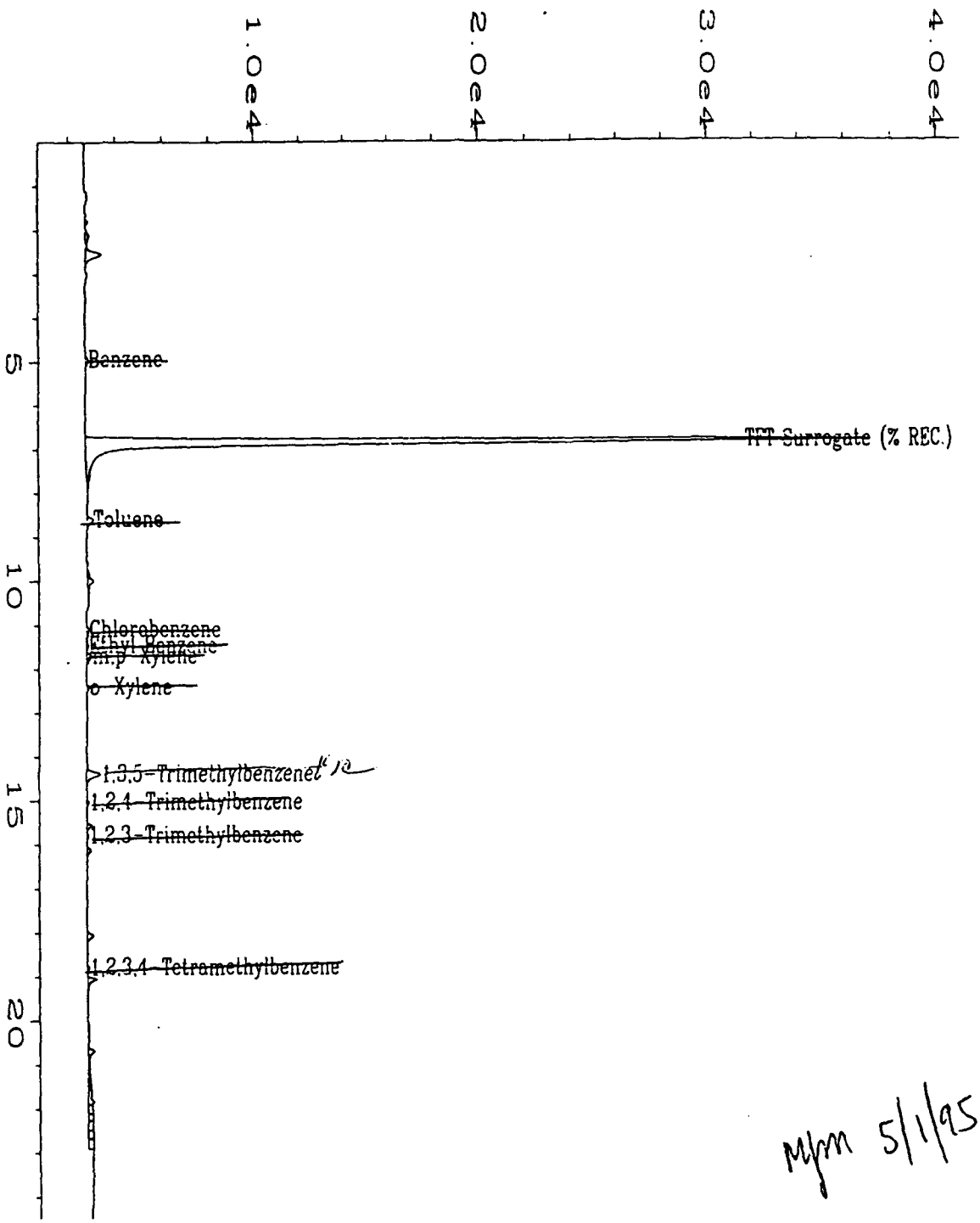
Compound Name	Cas Number	Sample Concentration ug/L	RL ug/L
Benzene	71-43-2	U	0.4
Toluene	108-88-3	U	0.4
Chlorobenzene	108-90-7	U	0.4
Ethyl Benzene	100-41-4	U	0.4
Total Xylenes (m, p & o)	108-38-3, 106-42-3 and 95-47-6	U	0.4
1,3,5-Trimethylbenzene	108-67-8	U	0.4
1,2,4-Trimethylbenzene	95-63-6	U	0.4
1,2,3-Trimethylbenzene	526-73-8	U	0.4
1,2,3,4-Tetramethylbenzene	488-23-3	U	0.4
Surrogate Recovery (α,α,α-Trifluorotoluene):		83%	70%-130% (QC limits

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene RL is for a single peak.

QUALIFIERS:
E = Extrapolated value.
U = Compound analyzed for, but not detected.
B = Compound also found in the blank.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit (RL).
RL = Reporting Limit.
NA = Not Available/Not Applicable.

K. Cone
Analyst

Approved



mjm 5/1/95

Data File Name	: C:\HPCHEM\2\DATA\BX20406\027R0101.D		
Operator	: C.J. Cook	Page Number	: 1
Instrument	: BTEX2	Vial Number	: 27
Sample Name	: X04861;1;5	Injection Number	: 1
n Time Bar Code:		Sequence Line	: 1
quired on	: 07 Apr 95 07:06 AM	Instrument Method	: BX20406.MTH
Report Created on	: 30 Apr 95 08:30 PM	Analysis Method	: BX20406B.MTH
Last Recalib on	: 30 APR 95 08:02 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:
Sample Info	: Project#: 95-0983 Client#: MW 56-9 Water		

EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303) 425-6021

Method 602 Data Report

Client Sample Number	: MW56-10	Client Project No.	: 722450.21020/MacD.
Lab Sample Number	: X04868	Lab Project No.	: 95-0983
Date Sampled	: 3/27/95	Dilution Factor	: 1.00
Date Received	: 3/28/95	Method	: 602
Date Prepared	: 4/7/95	Matrix	: Water
Date Analyzed	: 4/8/95	Lab File No.	: BX2040723
		Method Blank No.	: MB040795

Compound Name	Cas Number	Sample Concentration ug/L	RL ug/L
Benzene	71-43-2	18	0.4
Toluene	108-88-3	43	0.4
Chlorobenzene	108-90-7	2.7	0.4
Ethyl Benzene	100-41-4	77	0.4
Total Xylenes (m, p & o)	108-38-3, 106-42-3 and 95-47-6	**	**
1,3,5-Trimethylbenzene	108-67-8	**	**
1,2,4-Trimethylbenzene	95-63-6	**	**
1,2,3-Trimethylbenzene	526-73-8	**	**
1,2,3,4-Tetramethylbenzene	488-23-3	**	**
Surrogate Recovery (α,α,α-Trifluorotoluene):		94%	70%-130% (QC limits)

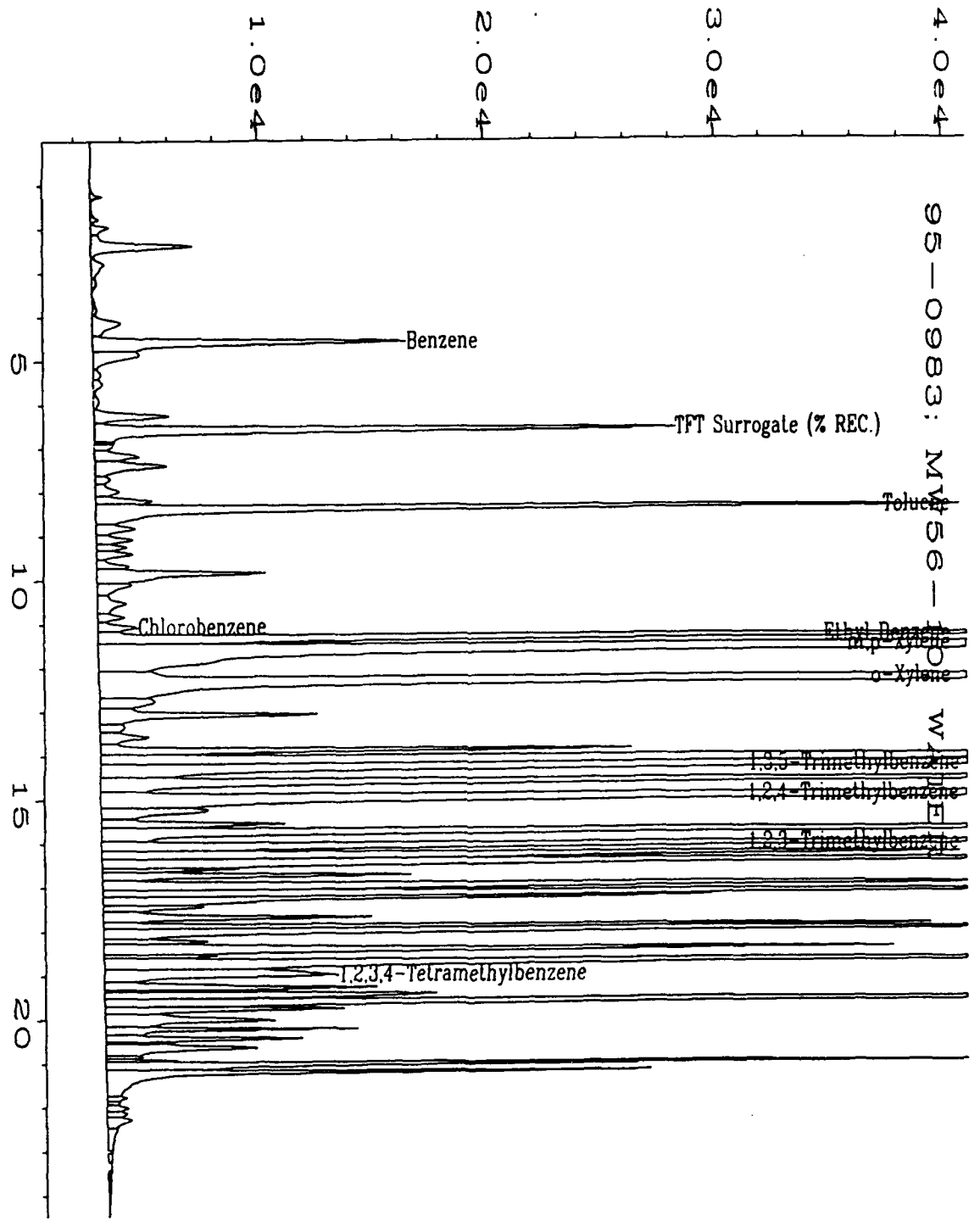
Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene RL is for a single peak.

** = See BX2040821 for noted values, df=10, 04/09/95.

QUALIFIERS:
E = Extrapolated value.
U = Compound analyzed for, but not detected.
B = Compound also found in the blank.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit (RL).
RL = Reporting Limit.
NA = Not Available/Not Applicable.

K. Cone
Analyst

Approved



Data File Name	: D:\2\DATA\BX20407\023R0901.D		
Operator	: C.J. Cook	Page Number	: 1
Instrument	: BTEX2	Vial Number	: 23
Sample Name	: X04868;1;5	Injection Number	: 1
n Time Bar Code:		Sequence Line	: 9
quired on	: 08 Apr 95 00:58 AM	Instrument Method	: BX20407.MTH
Report Created on	: 01 May 95 09:45 AM	Analysis Method	: BX20407B.MTH
Last Recalib on	: 10 APR 95 07:26 AM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:

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(303) 425-6021

Method 602 Data Report

Client Sample Number	: MW56-10	**Client Project No.**	: 722450.21020/MacD
Lab Sample Number	: X04868	**Lab Project No.**	: 95-0983
Date Sampled	: 3/27/95	**Dilution Factor**	: 10.00
Date Received	: 3/28/95	**Method**	: 602
Date Prepared	: 4/8/95	**Matrix**	: Water
Date Analyzed	: 4/9/95	**Lab File No.**	: BX2040821
		Method Blank No.	: MB040895

Compound Name	Cas Number	Sample Concentration ug/L	RL ug/L
Benzene	71-43-2	**	**
Toluene	108-88-3	**	**
Chlorobenzene	108-90-7	**	**
Ethyl Benzene	100-41-4	**	**
Total Xylenes (m, p & o)	108-38-3, 106-42-3 and 95-47-6	880	4.0
1,3,5-Trimethylbenzene	108-67-8	130	4.0
1,2,4-Trimethylbenzene	95-63-6	390	4.0
1,2,3-Trimethylbenzene	526-73-8	120	4.0
1,2,3,4-Tetramethylbenzene	488-23-3	74	4.0
Surrogate Recovery (α,α,α-Trifluorotoluene):		87%	70%-130% (QC limit

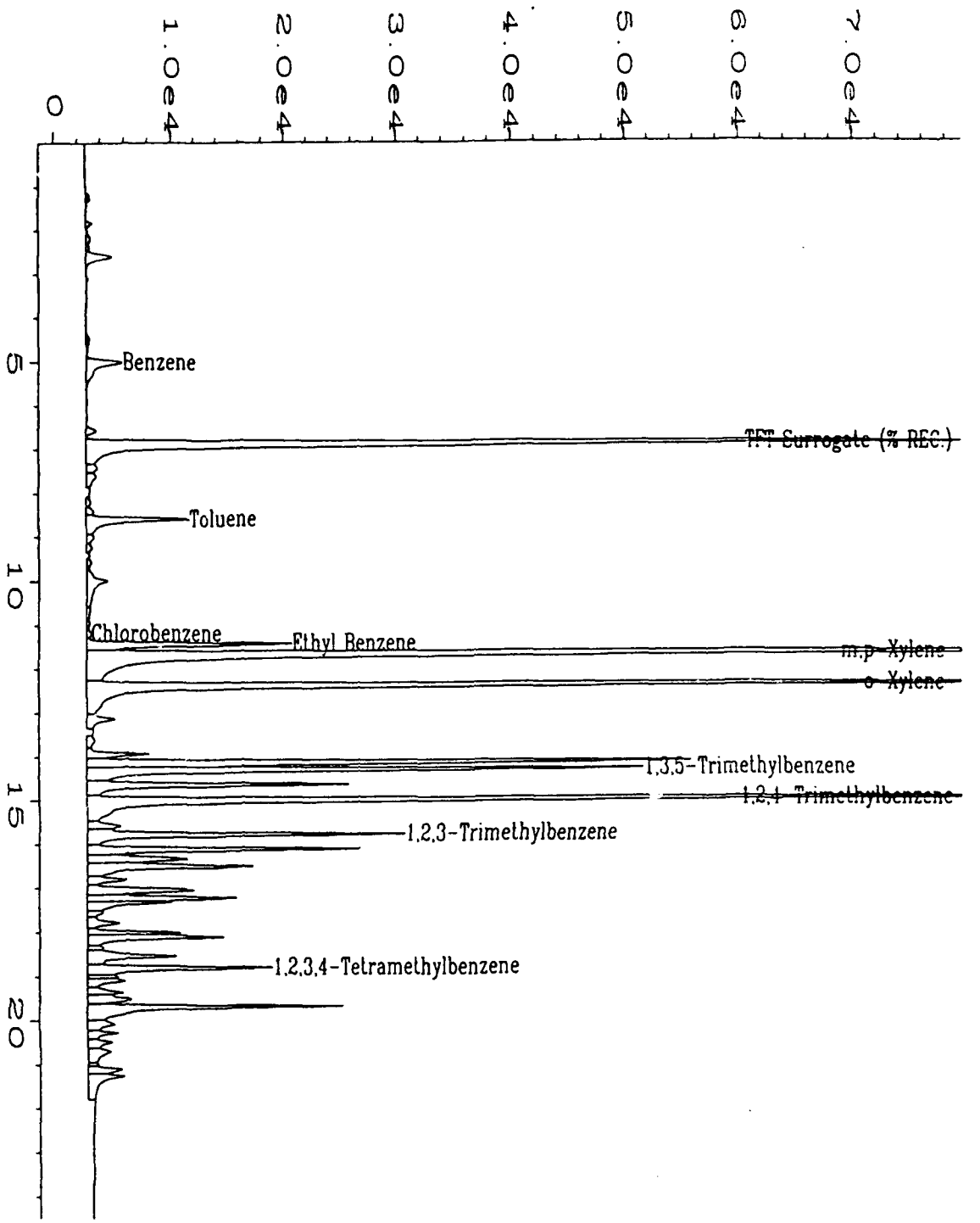
Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene RL is for a single peak.

** = See BX2040723 for noted values, df=1, 04/08/95.

QUALIFIERS:
E = Extrapolated value.
U = Compound analyzed for, but not detected.
B = Compound also found in the blank.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit (RL).
RL = Reporting Limit.
NA = Not Available/Not Applicable.

K. Cone
Analyst

Approved



Data File Name : D:\2\DATA\BX20408\021R0901.D
Operator : S.W. Tyson
Instrument : BTEX2
Sample Name : X04868;10;0.5
[illegible]n Time Bar Code:
[illegible]quired on : 09 Apr 95 00:33 AM
Report Created on: 01 May 95 12:47 PM
Last Recalib on : 18 APR 95 07:56 AM
Multiplier : 10

Page Number : 1
Vial Number : 21
Injection Number : 1
Sequence Line : 9
Instrument Method: BX20408.MTH
Analysis Method : BX20408.MTH
Sample Amount : 0
ISTD Amount :

MW56-10

EVERGREEN ANALYTICAL, INC.
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(303) 425-6021

Method 602 Data Report

MD32-MW10 6PW 8/28/95

Client Sample Number	: ~~MW56-10~~	Client Project No.	: 722450.21020/Macl
Lab Sample Number	: X04852	Lab Project No.	: 95-0983
Date Sampled	: 3/26/95	Dilution Factor	: 1.00
Date Received	: 3/28/95	Method	: 602
Date Prepared	: 4/6/95	Matrix	: Water
Date Analyzed	: 4/6/95	Lab File No.	: BX2040613
		Method Blank No.	: MB040695

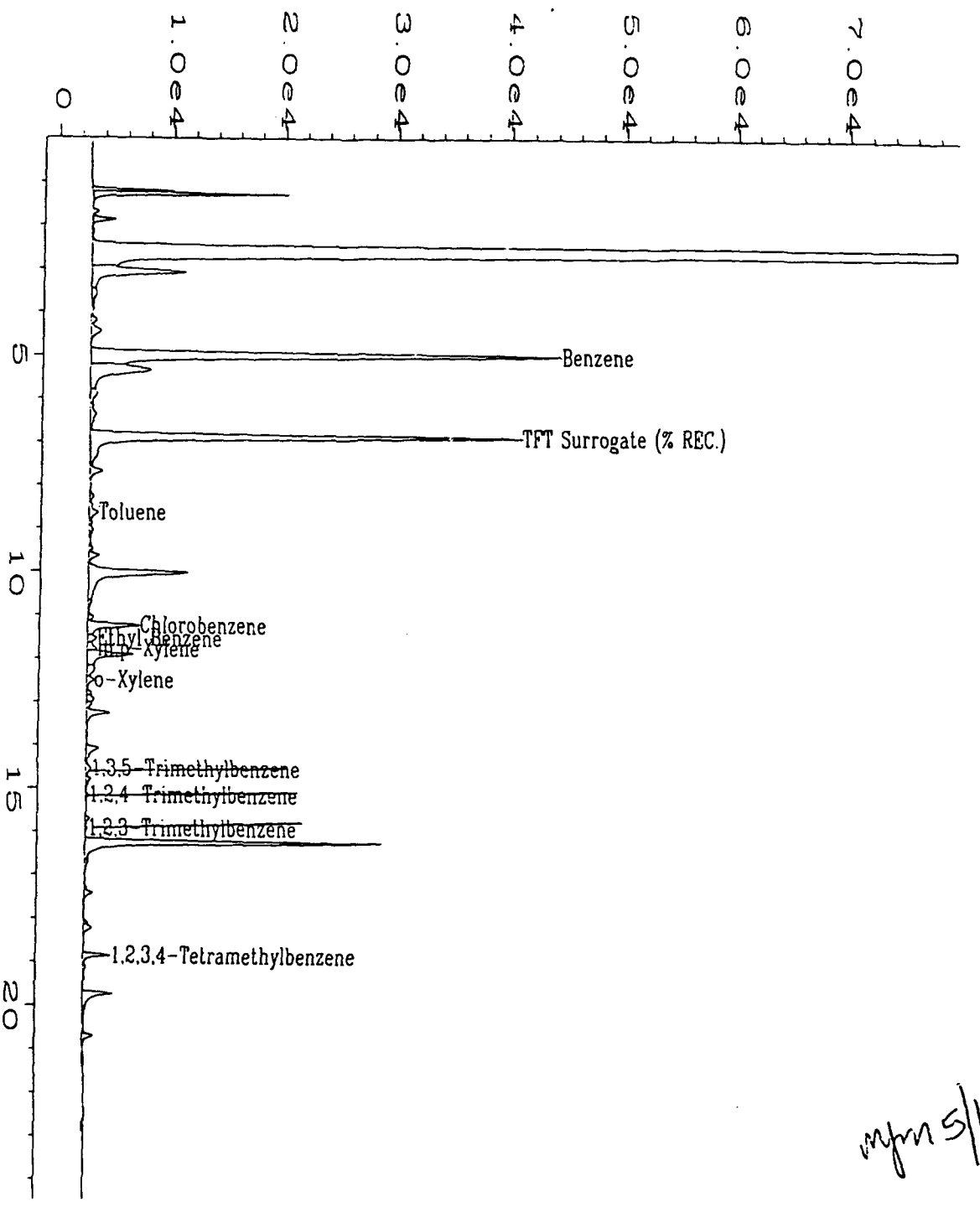
Compound Name	Cas Number	Sample Concentration ug/L		RL ug/L
Benzene	71-43-2	36		0.4
Toluene	108-88-3	1.1		0.4
Chlorobenzene	108-90-7	4.3		0.4
Ethyl Benzene	100-41-4	0.8		0.4
Total Xylenes (m, p & o)	108-38-3, 106-42-3 and 95-47-6	1.3	B	0.4
1,3,5-Trimethylbenzene	108-67-8		U	0.4
1,2,4-Trimethylbenzene	95-63-6		U	0.4
1,2,3-Trimethylbenzene	526-73-8		U	0.4
1,2,3,4-Tetramethylbenzene	488-23-3	1.8		0.4
Surrogate Recovery (α,α,α-Trifluorotoluene):		93%		70%-130% (QC limi

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene RL is for a single peak.

QUALIFIERS:
E = Extrapolated value.
U = Compound analyzed for, but not detected.
B = Compound also found in the blank.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit (RL).
RL = Reporting Limit.
NA = Not Available/Not Applicable.

K. Cone
Analyst

Approved



mfm 5/1/95

Data File Name : C:\HPCHEM\2\DATA\BX20406\013R0801.D
Operator : C.J. Cook
Instrument : BTEX2
Sample Name : X04852;1;5
n Time Bar Code:
quired on : 06 Apr 95 05:50 PM
Report Created on: 30 Apr 95 08:32 PM
Last Recalib on : 30 APR 95 08:02 PM
Multiplier : 1
Sample Info : Project#: 95-0983 Client#: MW 56-10 ,Water

Page Number : 1
Vial Number : 13
Injection Number : 1
Sequence Line : 8
Instrument Method: BX20406.MTH
Analysis Method : BX20406B.MTH
Sample Amount : 0
ISTD Amount :

EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303) 425-6021

Method 602 Data Report

MW32-MW10 6/2/95

Client Sample Number	: ~~MW56-10~~	Client Project No.	: 722450.21020/MacD
Lab Sample Number	: X04852DUP	Lab Project No.	: 95-0983
Date Sampled	: 3/26/95	Dilution Factor	: 1.00
Date Received	: 3/28/95	Method	: 602
Date Prepared	: 4/6/95	Matrix	: Water
Date Analyzed	: 4/6/95	Lab File No.	: BX2040614
		Method Blank No.	: MB040695

Compound Name	Cas Number	Sample Concentration ug/L		RL ug/L
Benzene	71-43-2	38		0.4
Toluene	108-88-3	1.2		0.4
Chlorobenzene	108-90-7	5.9		0.4
Ethyl Benzene	100-41-4	0.9		0.4
Total Xylenes (m, p & o)	108-38-3, 106-42-3 and 95-47-6	1.5	B	0.4
1,3,5-Trimethylbenzene	108-67-8		U	0.4
1,2,4-Trimethylbenzene	95-63-6		U	0.4
1,2,3-Trimethylbenzene	526-73-8		U	0.4
1,2,3,4-Tetramethylbenzene	488-23-3	2.0		0.4

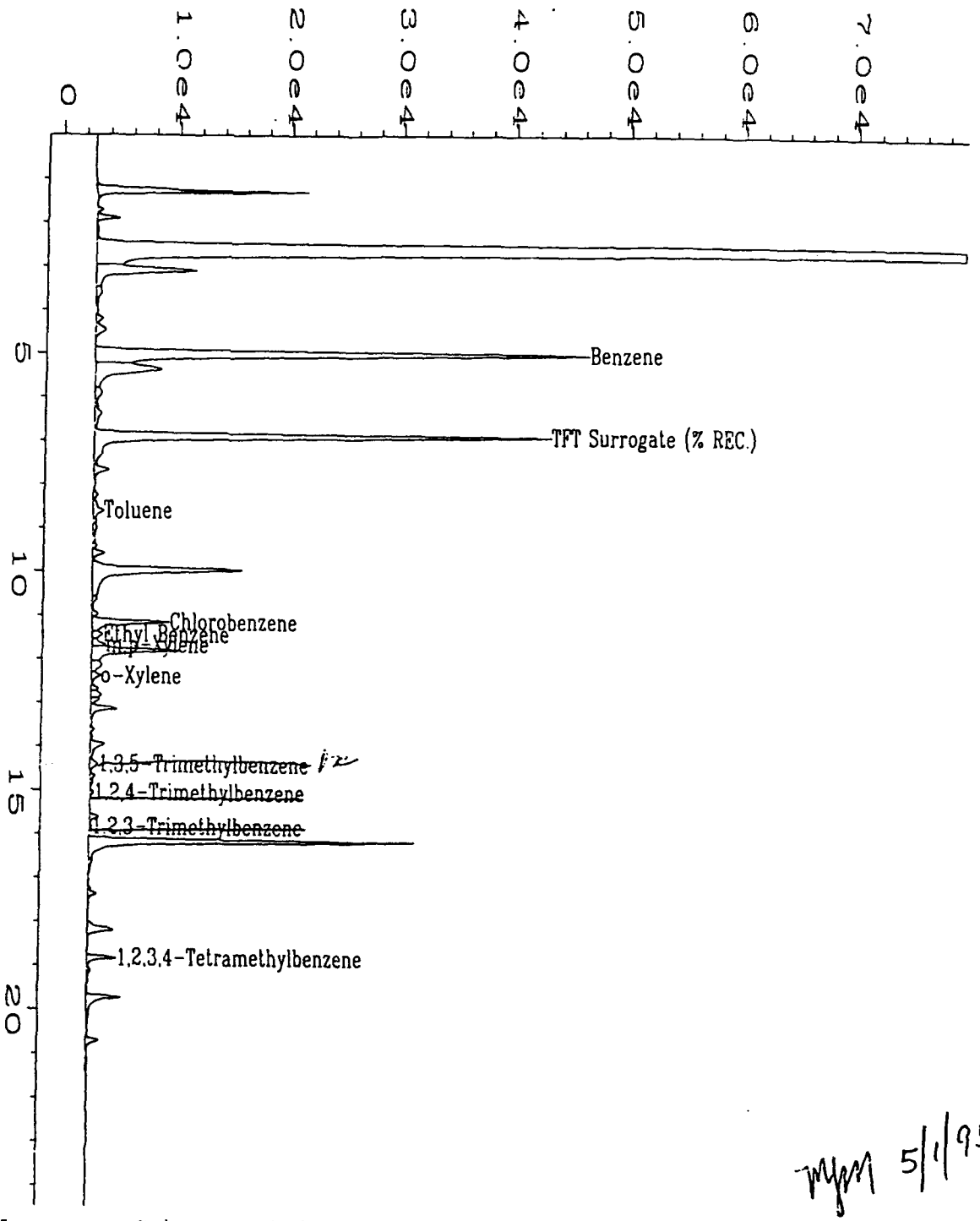
Surrogate Recovery (α,α,α-Trifluorotoluene):	96%	70%-130% (QC limits

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene RL is for a single peak.

QUALIFIERS:
E = Extrapolated value.
U = Compound analyzed for, but not detected.
B = Compound also found in the blank.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit (RL).
RL = Reporting Limit.
NA = Not Available/Not Applicable.

K. Cone
Analyst

Approved



mgm 5/1/95

Data File Name : C:\HPCHEM\2\DATA\BX20406\014R0801.D
Operator : C.J. Cook
Instrument : BTEX2
Sample Name : X04852DUP;1;5
Bar Code Time:
Acquired on : 06 Apr 95 06:36 PM
Report Created on: 30 Apr 95 08:32 PM
Last Recalib on : 30 APR 95 08:02 PM
Multiplier : 1
Sample Info : Project#: 95-0983 Client#: MW 56-10 Water

Page Number : 1
Vial Number : 14
Injection Number : 1
Sequence Line : 8
Instrument Method: BX20406.MTH
Analysis Method : BX20406B.MTH
Sample Amount : 0
ISTD Amount :

EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303) 425-6021

Method 602 Data Report

Client Sample Number	: MW56-12	Client Project No.	: 722450.21020/MacD
Lab Sample Number	: X04863	Lab Project No.	: 95-0983
Date Sampled	: 3/27/95	Dilution Factor	: 1.00
Date Received	: 3/28/95	Method	: 602
Date Prepared	: 4/7/95	*Matrix*	: Water
Date Analyzed	: 4/7/95	Lab File No.	: BX2040713
		Method Blank No.	: MB040795

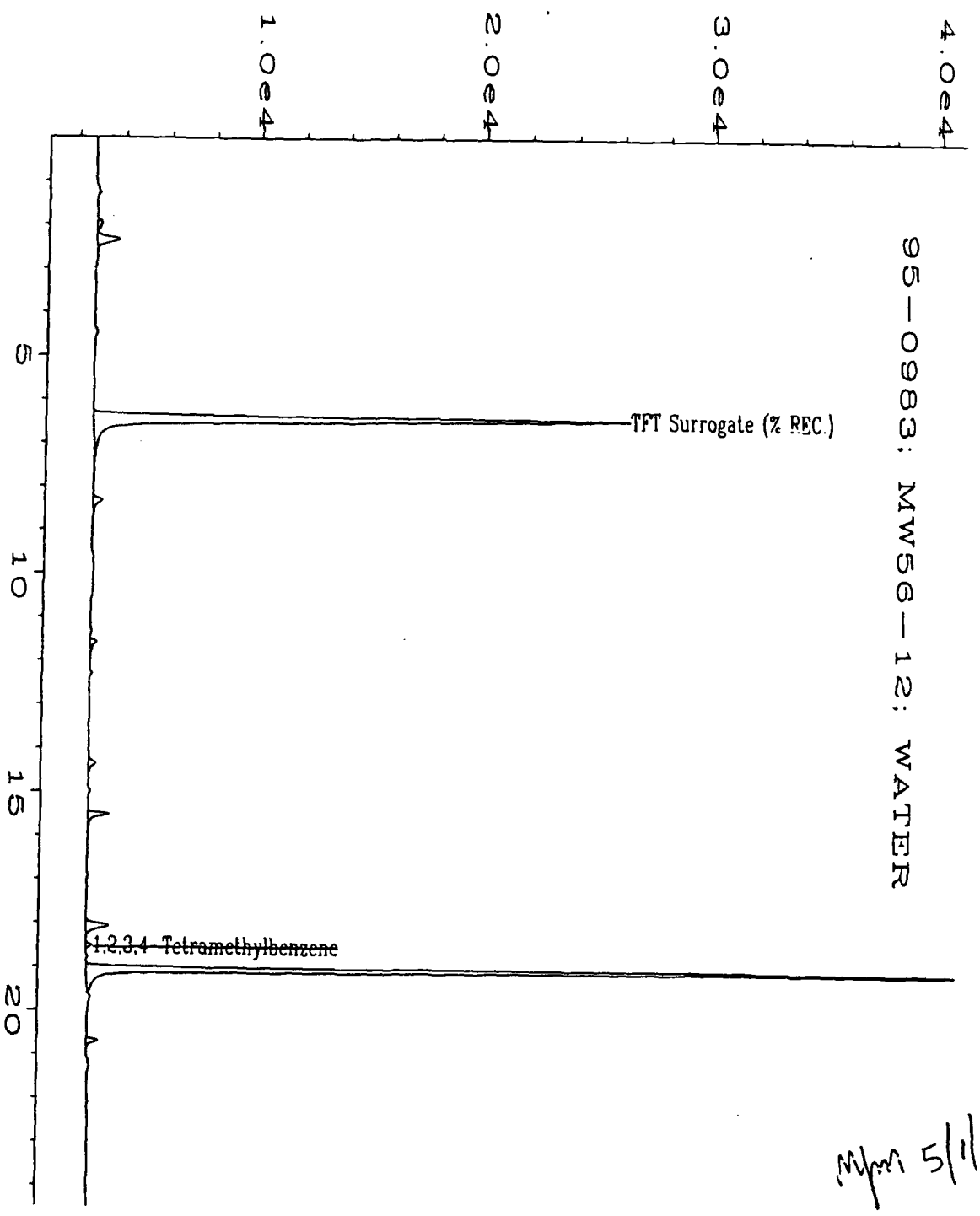
Compound Name	Cas Number	Sample Concentration ug/L	RL ug/L
Benzene	71-43-2	U	0.4
Toluene	108-88-3	U	0.4
Chlorobenzene	108-90-7	U	0.4
Ethyl Benzene	100-41-4	U	0.4
Total Xylenes (m, p & o)	108-38-3, 106-42-3 and 95-47-6	U	0.4
1,3,5-Trimethylbenzene	108-67-8	U	0.4
1,2,4-Trimethylbenzene	95-63-6	U	0.4
1,2,3-Trimethylbenzene	526-73-8	U	0.4
1,2,3,4-Tetramethylbenzene	488-23-3	U	0.4
Surrogate Recovery (α,α,α-Trifluorotoluene):		88%	70%-130% (QC limi

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene RL is for a single peak.

QUALIFIERS:
E = Extrapolated value.
U = Compound analyzed for, but not detected.
B = Compound also found in the blank.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit (RL).
RL = Reporting Limit.
NA = Not Available/Not Applicable.

K. Cone
Analyst

Approved



MJM 5/1/95

Data File Name	: D:\2\DATA\BX20407\013R0901.D		
Operator	: C.J. Cook		
Instrument	: BTEX2		
Sample Name	: X04863;1;5		
n Time Bar Code:			
quired on	: 07 Apr 95 06:09 PM		
Report Created on:	01 May 95 10:25 AM		
Last Recalib on	: 10 APR 95 07:26 AM		
Multiplier	: 1		
		Page Number	: 1
		Vial Number	: 13
		Injection Number	: 1
		Sequence Line	: 9
		Instrument Method	: BX20407.MTH
		Analysis Method	: BX20407B.MTH
		Sample Amount	: 0
		ISTD Amount	:

EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303) 425-6021

Method 602 Data Report

Client Sample Number	: MW56-12	Client Project No.	: 722450.21020/MacDi
Lab Sample Number	: X04863DUP	Lab Project No.	: 95-0983
Date Sampled	: 3/27/95	Dilution Factor	: 1.00
Date Received	: 3/28/95	Method	: 602
Date Prepared	: 4/7/95	Matrix	: Water
Date Analyzed	: 4/7/95	Lab File No.	: BX2040714
		Method Blank No.	: MB040795

Compound Name	Cas Number	Sample Concentration ug/L		RL ug/L
Benzene	71-43-2		U	0.4
Toluene	108-88-3		U	0.4
Chlorobenzene	108-90-7		U	0.4
Ethyl Benzene	100-41-4		U	0.4
Total Xylenes (m, p & o)	108-38-3, 106-42-3 and 95-47-6		U	0.4
1,3,5-Trimethylbenzene	108-67-8		U	0.4
1,2,4-Trimethylbenzene	95-63-6		U	0.4
1,2,3-Trimethylbenzene	526-73-8		U	0.4
1,2,3,4-Tetramethylbenzene	488-23-3	0.6		0.4

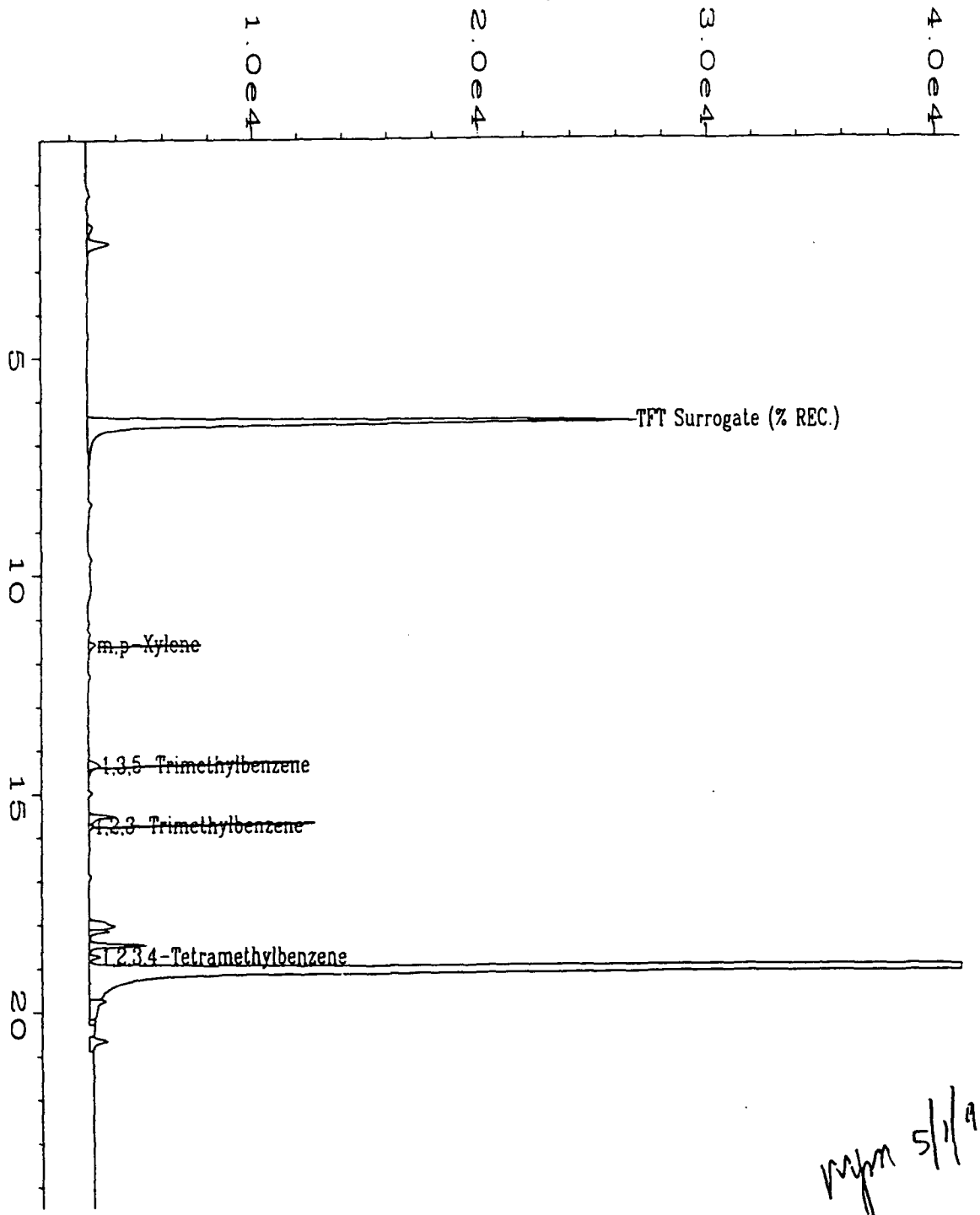
Surrogate Recovery (α,α,α-Trifluorotoluene):	88%	70%-130% (QC limits

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene RL is for a single peak.

QUALIFIERS:
E = Extrapolated value.
U = Compound analyzed for, but not detected.
B = Compound also found in the blank.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit (RL).
RL = Reporting Limit.
NA = Not Available/Not Applicable.

K. Cone
Analyst

Approved



wwjm 5/1/95

Data File Name	: C:\HPCHEM\2\DATA\BX20407\014R0901.D		
Operator	: C.J. Cook	Page Number	: 1
Instrument	: BTEX2	Vial Number	: 14
Sample Name	: X04863DUP;1;5	Injection Number	: 1
In Time Bar Code:		Sequence Line	: 9
Acquired on	: 07 Apr 95 06:50 PM	Instrument Method	: BX20407.MTH
Report Created on	: 01 May 95 00:47 AM	Analysis Method	: BX20407B.MTH
Last Recalib on	: 10 APR 95 07:26 AM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:
Sample Info	: Project#: 95-0983 Client#: MW56-12 Water		

EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303) 425-6021

Method 602 Data Report

Client Sample Number	: MW56-21	Client Project No.	: 722450.21020/MacDi
Lab Sample Number	: X04856	Lab Project No.	: 95-0983
Date Sampled	: 3/26/95	Dilution Factor	: 1.00
Date Received	: 3/28/95	Method	: 602
Date Prepared	: 4/6/95	Matrix	: Water
Date Analyzed	: 4/7/95	Lab File No.	: BX2040622
		Method Blank No.	: MB040695

Compound Name	Cas Number	Sample Concentration ug/L	RL ug/L
Benzene	71-43-2	U	0.4
Toluene	108-88-3	U	0.4
Chlorobenzene	108-90-7	U	0.4
Ethyl Benzene	100-41-4	U	0.4
Total Xylenes (m, p & o)	108-38-3, 106-42-3 and 95-47-6	U	0.4
1,3,5-Trimethylbenzene	108-67-8	U	0.4
1,2,4-Trimethylbenzene	95-63-6	U	0.4
1,2,3-Trimethylbenzene	526-73-8	U	0.4
1,2,3,4-Tetramethylbenzene	488-23-3	U	0.4

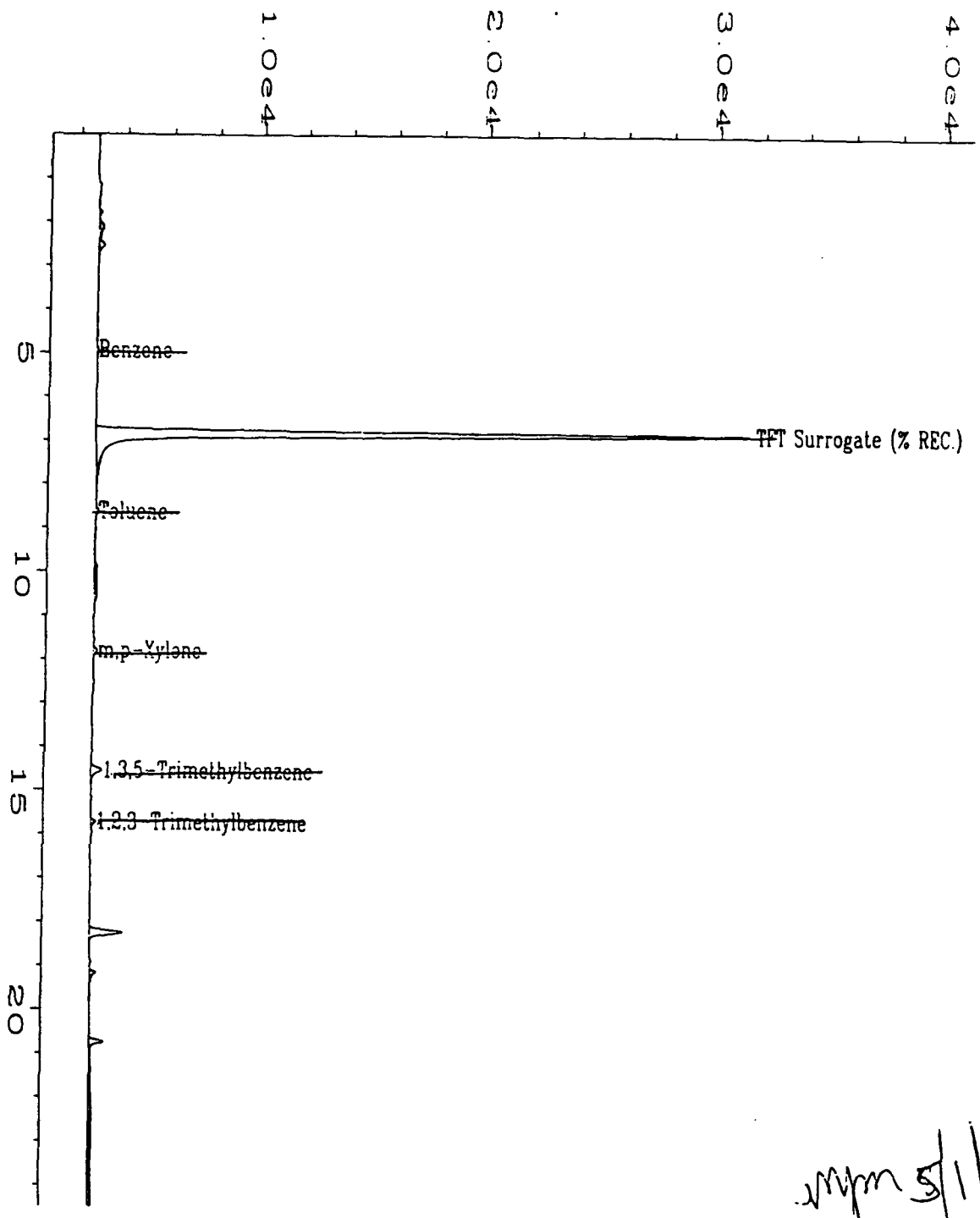
Surrogate Recovery (α,α,α-Trifluorotoluene):	74%	70%-130% (QC limits)

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene RL is for a single peak.

QUALIFIERS:
E = Extrapolated value.
U = Compound analyzed for, but not detected.
B = Compound also found in the blank.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit (RL).
RL = Reporting Limit.
NA = Not Available/Not Applicable.

K. Cone
Analyst

Approved



mpm 5/1/95

Data File Name	: C:\HPCHEM\2\DATA\BX20406\022R0101.D		
Operator	: C.J. Cook	Page Number	: 1
Instrument	: BTEX2	Vial Number	: 22
Sample Name	: X04856;1;5	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 1
Acquired on	: 07 Apr 95 03:30 AM	Instrument Method	: BX20406.MTH
Report Created on	: 30 Apr 95 08:27 PM	Analysis Method	: BX20406B.MTH
Last Recalib on	: 30 APR 95 08:02 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:
Sample Info	: Project#: 95-0983 Client#: MW 56-21 Water		

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4036 Youngfield St. Wheat Ridge, CO 80033
(303) 425-6021

Method 602 Data Report

Client Sample Number	: 56MP-4S	Client Project No.	: 722450.21020/MacDill
Lab Sample Number	: X04862	Lab Project No.	: 95-0983
Date Sampled	: 3/27/95	Dilution Factor	: 100.00
Date Received	: 3/28/95	Method	: 602
Date Prepared	: 4/8/95	Matrix	: Water
Date Analyzed	: 4/8/95	Lab File No.	: BX2040813
		Method Blank No.	: MB040895

Compound Name	Cas Number	Sample Concentration ug/L		RL ug/L
Benzene	71-43-2	4500		40
Toluene	108-88-3	>80 **		40
Chlorobenzene	108-90-7		U	40
Ethyl Benzene	100-41-4	2200		40
Total Xylenes (m, p & o)	108-38-3, 106-42-3 and 95-47-6	11000		40
1,3,5-Trimethylbenzene	108-67-8	720		40
1,2,4-Trimethylbenzene	95-63-6	2300		40
1,2,3-Trimethylbenzene	526-73-8	560		40
1,2,3,4-Tetramethylbenzene	488-23-3	140		40

Surrogate Recovery (α,α,α-Trifluorotoluene):	97%	70%-130% (QC limits)

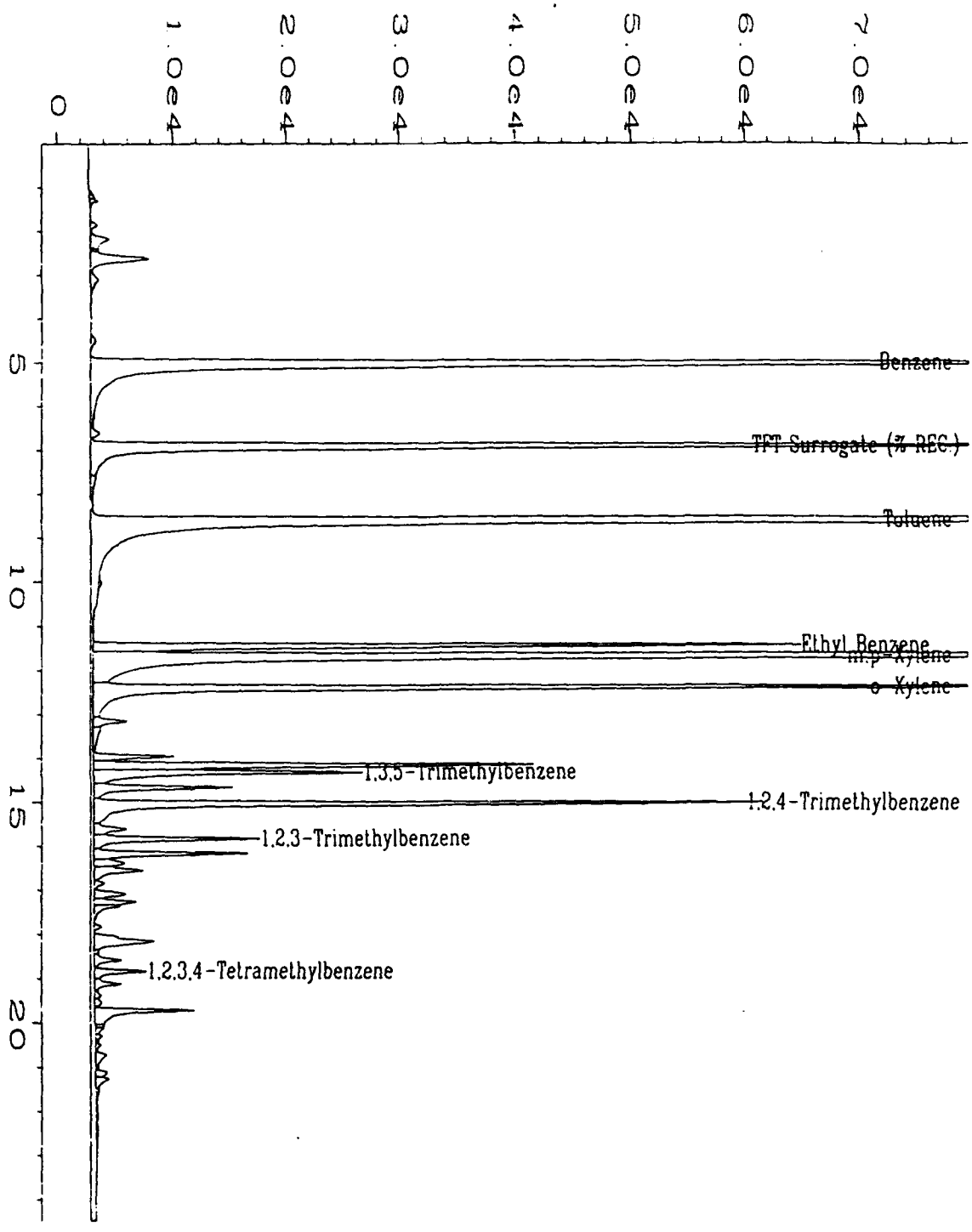
Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene RL is for a single peak.

** = Greater than 10% of calibration range. See BX1041312 (DF=250) run past holding time.

QUALIFIERS:
E = Extrapolated value.
U = Compound analyzed for, but not detected.
B = Compound also found in the blank.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit (RL).
RL = Reporting Limit.
NA = Not Available/Not Applicable.

K. Cone
Analyst

Approved



Data File Name	: C:\HPCHEM\2\DATA\BX20408\013R0901.D		
Operator	: S.W. Tyson	Page Number	: 1
Instrument	: BTEX2	Vial Number	: 13
Sample Name	: X04862;100;0.05	Injection Number	: 1
In Time Bar Code:		Sequence Line	: 9
Acquired on	: 08 Apr 95 06:28 PM	Instrument Method	: BX20408.MTH
Report Created on	: 09 Apr 95 02:26 PM	Analysis Method	: BX20408.MTH
Last Recalib on	: 09 Apr 95 02:21 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:

56MP-45

EVERGREEN ANALYTICAL, INC.
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(303) 425-6021

Method 602 Data Report

Client Sample Number	: 56MP-5S	Client Project No.	: 722450.21020/MacDill
Lab Sample Number	: X04865	Lab Project No.	: 95-0983
Date Sampled	: 3/27/95	Dilution Factor	: 50.00
Date Received	: 3/28/95	Method	: 602
Date Prepared	: 4/8/95	Matrix	: Water
Date Analyzed	: 4/8/95	Lab File No.	: BX2040815
		Method Blank No.	: MB040895

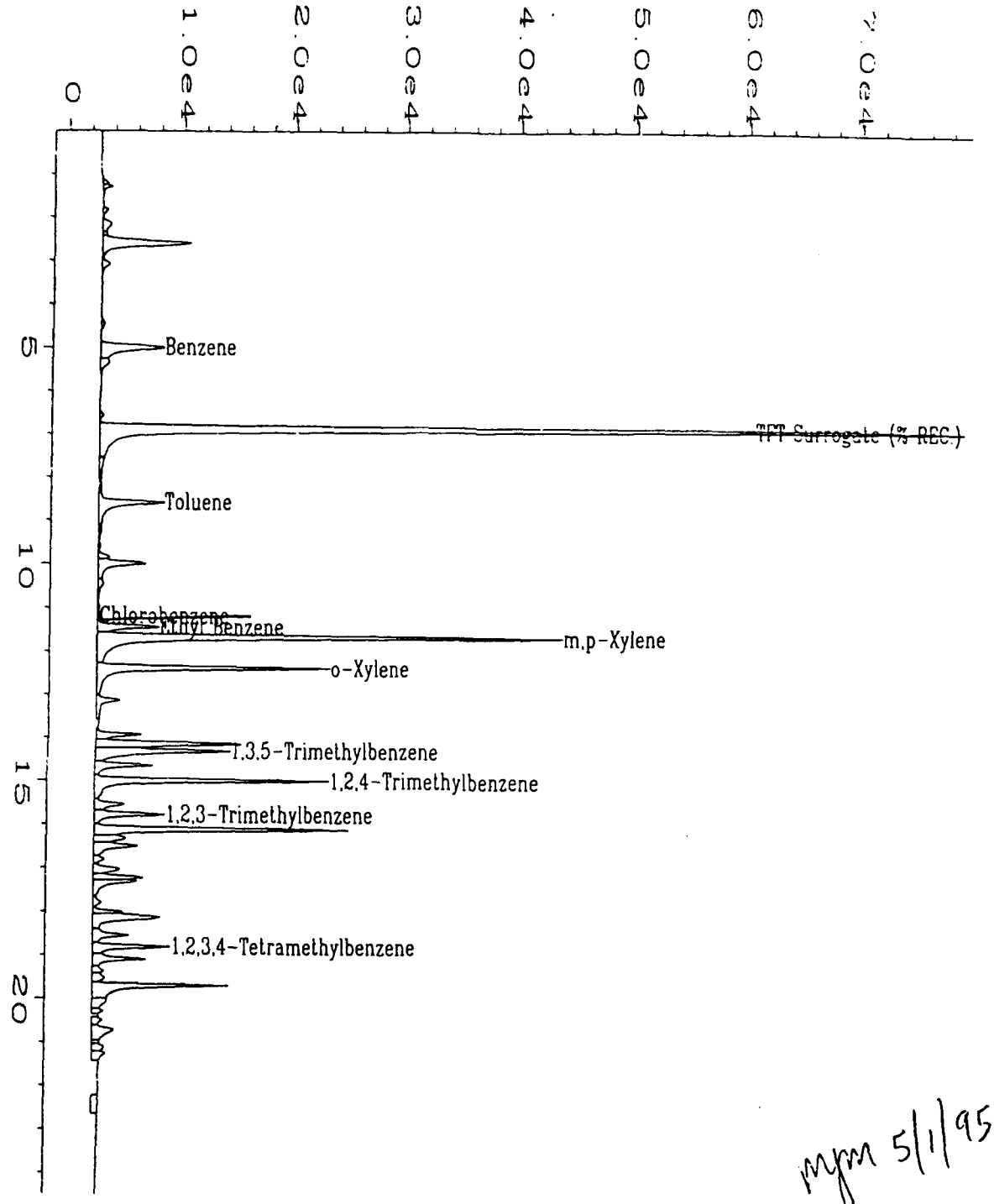
Compound Name	Cas Number	Sample Concentration ug/L	RL ug/L
Benzene	71-43-2	100	20
Toluene	108-88-3	120	20
Chlorobenzene	108-90-7	U	20
Ethyl Benzene	100-41-4	75	20
Total Xylenes (m, p & o)	108-38-3, 106-42-3 and 95-47-6	1100	20
1,3,5-Trimethylbenzene	108-67-8	190	20
1,2,4-Trimethylbenzene	95-63-6	400	20
1,2,3-Trimethylbenzene	526-73-8	96	20
1,2,3,4-Tetramethylbenzene	488-23-3	130	20
Surrogate Recovery (α,α,α-Trifluorotoluene):		88%	70%-130% (QC limits)

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene RL is for a single peak.

QUALIFIERS:
E = Extrapolated value.
U = Compound analyzed for, but not detected.
B = Compound also found in the blank.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit (RL).
RL = Reporting Limit.
NA = Not Available/Not Applicable.

K. Cone
Analyst

Approved



mgm 5/1/95

Data File Name : C:\HPCHEM\2\DATA\BX20408\015R0901.D
Operator : S.W. Tyson
Instrument : BTEX2
Sample Name : X04865;50;0.1
Run Time Bar Code:
uired on : 08 Apr 95 08:00 PM
port Created on: 09 Apr 95 02:28 PM
Last Recalib on : 09 Apr 95 02:21 PM
Multiplier : 1

Page Number : 1
Vial Number : 15
Injection Number : 1
Sequence Line : 9
Instrument Method: BX20408.MTH
Analysis Method : BX20408.MTH
Sample Amount : 0
ISTD Amount :

56MP-5S

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4036 Youngfield St. Wheat Ridge, CO 80033
(303) 425-6021

Method 602 Data Report

Client Sample Number	: 56MP-5D	Client Project No.	: 722450.21020/MacDi
Lab Sample Number	: X04866	Lab Project No.	: 95-0983
Date Sampled	: 3/27/95	Dilution Factor	: 1.00
Date Received	: 3/28/95	Method	: 602
Date Prepared	: 4/7/95	Matrix	: Water
Date Analyzed	: 4/7/95	Lab File No.	: BX2040720
		Method Blank No.	: MB040795

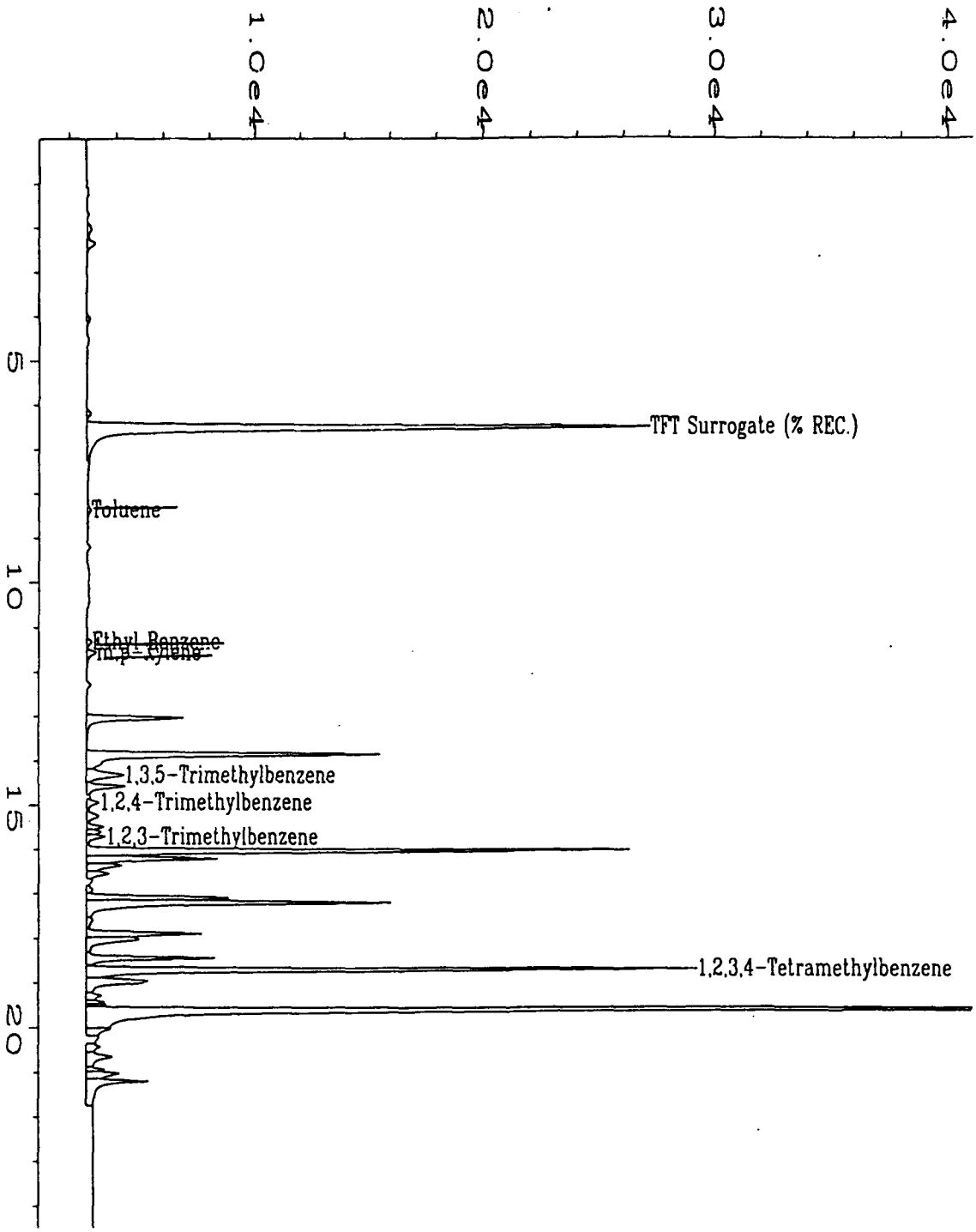
Compound Name	Cas Number	Sample Concentration ug/L		RL ug/L
Benzene	71-43-2		U	0.4
Toluene	108-88-3		U	0.4
Chlorobenzene	108-90-7		U	0.4
Ethyl Benzene	100-41-4		U	0.4
Total Xylenes (m, p & o)	108-38-3, 106-42-3 and 95-47-6		U	0.4
1,3,5-Trimethylbenzene	108-67-8	1.5		0.4
1,2,4-Trimethylbenzene	95-63-6	0.7		0.4
1,2,3-Trimethylbenzene	526-73-8	0.9		0.4
1,2,3,4-Tetramethylbenzene	488-23-3	30		0.4
Surrogate Recovery (α,α,α-Trifluorotoluene):		86%		70%-130% (QC limits

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene RL is for a single peak.

QUALIFIERS:
E = Extrapolated value.
U = Compound analyzed for, but not detected.
B = Compound also found in the blank.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit (RL).
RL = Reporting Limit.
NA = Not Available/Not Applicable.

K. Cone
Analyst

Approved



Data File Name : C:\HPCHEM\2\DATA\BX20407\020F0901.D
Operator : C.J. Cook
Instrument : BTEX2
Sample Name : X04866;1;5
n Time Bar Code:
quired on : 07 Apr 95 10:55 PM
Report Created on: 01 May 95 00:50 AM
Last Recalib on : 10 APR 95 07:26 AM
Multiplier : 1
Sample Info : Project#: 95-0983 Client#: 56MP-5D Water

Page Number : 1
Vial Number : 20
Injection Number : 1
Sequence Line : 9
Instrument Method: BX20407.MTH
Analysis Method : BX20407B.MTH
Sample Amount : 0
ISTD Amount :

EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303) 425-6021

Method 602 Data Report

Client Sample Number	: 56MP-6S	Client Project No.	: 722450.21020/MacD
Lab Sample Number	: X04854	Lab Project No.	: 95-0983
Date Sampled	: 3/26/95	Dilution Factor	: 1.00
Date Received	: 3/28/95	Method	: 602
Date Prepared	: 4/6/95	Matrix	: Water
Date Analyzed	: 4/6/95	Lab File No.	: BX2040618
		Method Blank No.	: MB040695

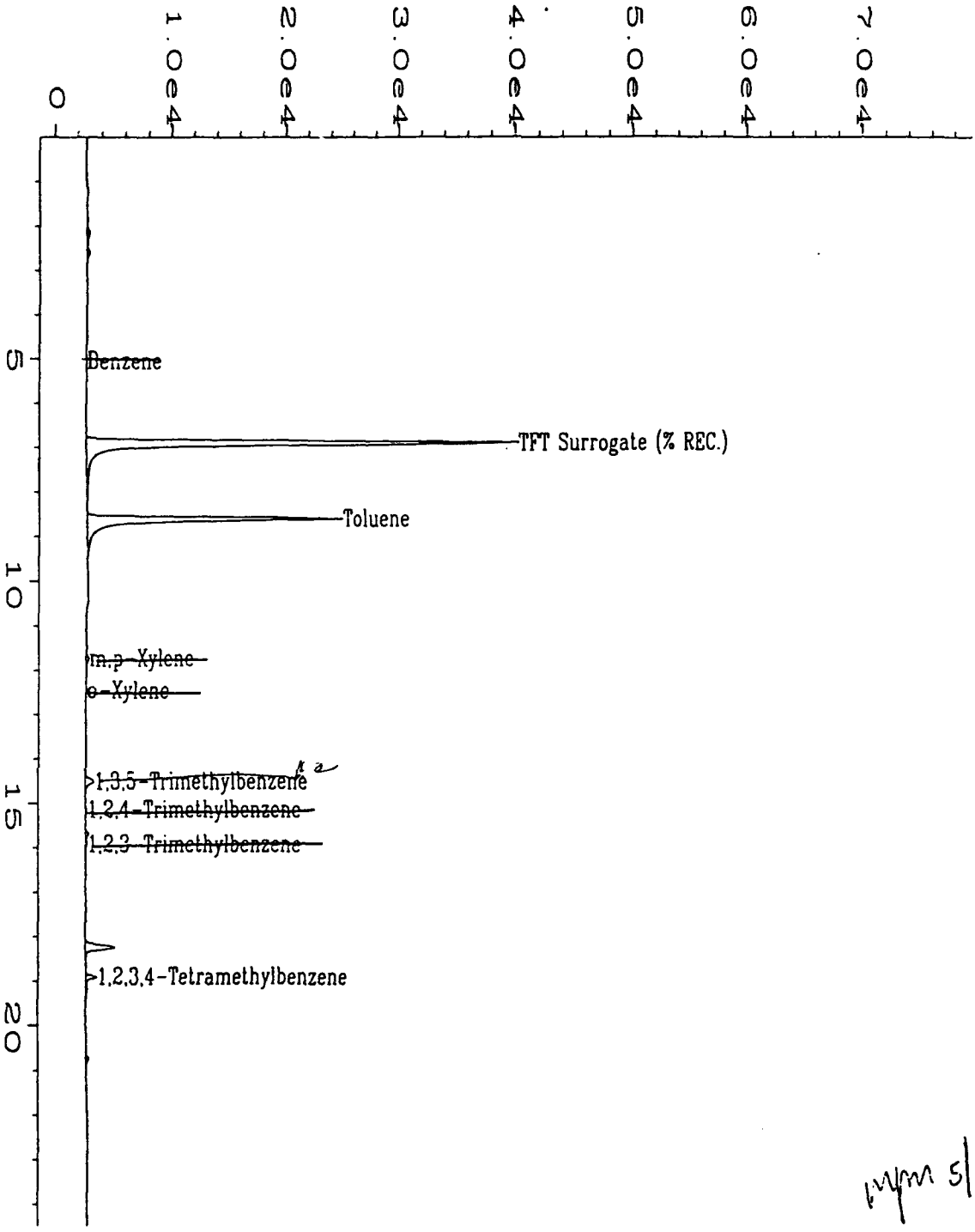
Compound Name	Cas Number	Sample Concentration ug/L		RL ug/L
Benzene	71-43-2		U	0.4
Toluene	108-88-3	18		0.4
Chlorobenzene	108-90-7		U	0.4
Ethyl Benzene	100-41-4		U	0.4
Total Xylenes (m, p & o)	108-38-3, 106-42-3 and 95-47-6		U	0.4
1,3,5-Trimethylbenzene	108-67-8		U	0.4
1,2,4-Trimethylbenzene	95-63-6		U	0.4
1,2,3-Trimethylbenzene	526-73-8		U	0.4
1,2,3,4-Tetramethylbenzene	488-23-3	0.7		0.4
Surrogate Recovery (α,α,α-Trifluorotoluene):		91%		70%-130% (QC limits

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene RL is for a single peak.

QUALIFIERS:
E = Extrapolated value.
U = Compound analyzed for, but not detected.
B = Compound also found in the blank.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit (RL).
RL = Reporting Limit.
NA = Not Available/Not Applicable.

K. Cone
Analyst

Approved



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Data File Name	: C:\HPCHEM\2\DATA\BX20406\018R0801.D		
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Instrument	: BTEX2	Vial Number	: 18
Sample Name	: X04854;1;5	Injection Number	: 1
ı Time Bar Code:		Sequence Line	: 8
ɹuired on	: 06 Apr 95 09:43 PM	Instrument Method	: BX20406.MTH
Report Created on	: 30 Apr 95 08:35 PM	Analysis Method	: BX20406B.MTH
Last Recalib on	: 30 APR 95 08:02 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:
Sample Info	: Project#: 95-0983 Client#: 56 MP-6S Water		

EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303) 425-6021

Method 602 Data Report

Client Sample Number	: 56MP-6D	**Client Project No.**	: 722450.21020/MacD
Lab Sample Number	: X04853	**Lab Project No.**	: 95-0983
Date Sampled	: 3/26/95	**Dilution Factor**	: 1.00
Date Received	: 3/28/95	**Method**	: 602
Date Prepared	: 4/6/95	**Matrix**	: Water
Date Analyzed	: 4/6/95	**Lab File No.**	: BX2040617
		Method Blank No.	: MB040695

Compound Name	Cas Number	Sample Concentration ug/L	RL ug/L
Benzene	71-43-2	U	0.4
Toluene	108-88-3	U	0.4
Chlorobenzene	108-90-7	U	0.4
Ethyl Benzene	100-41-4	U	0.4
Total Xylenes (m, p & o)	108-38-3, 106-42-3 and 95-47-6	U	0.4
1,3,5-Trimethylbenzene	108-67-8	U	0.4
1,2,4-Trimethylbenzene	95-63-6	U	0.4
1,2,3-Trimethylbenzene	526-73-8	U	0.4
1,2,3,4-Tetramethylbenzene	488-23-3	U	0.4

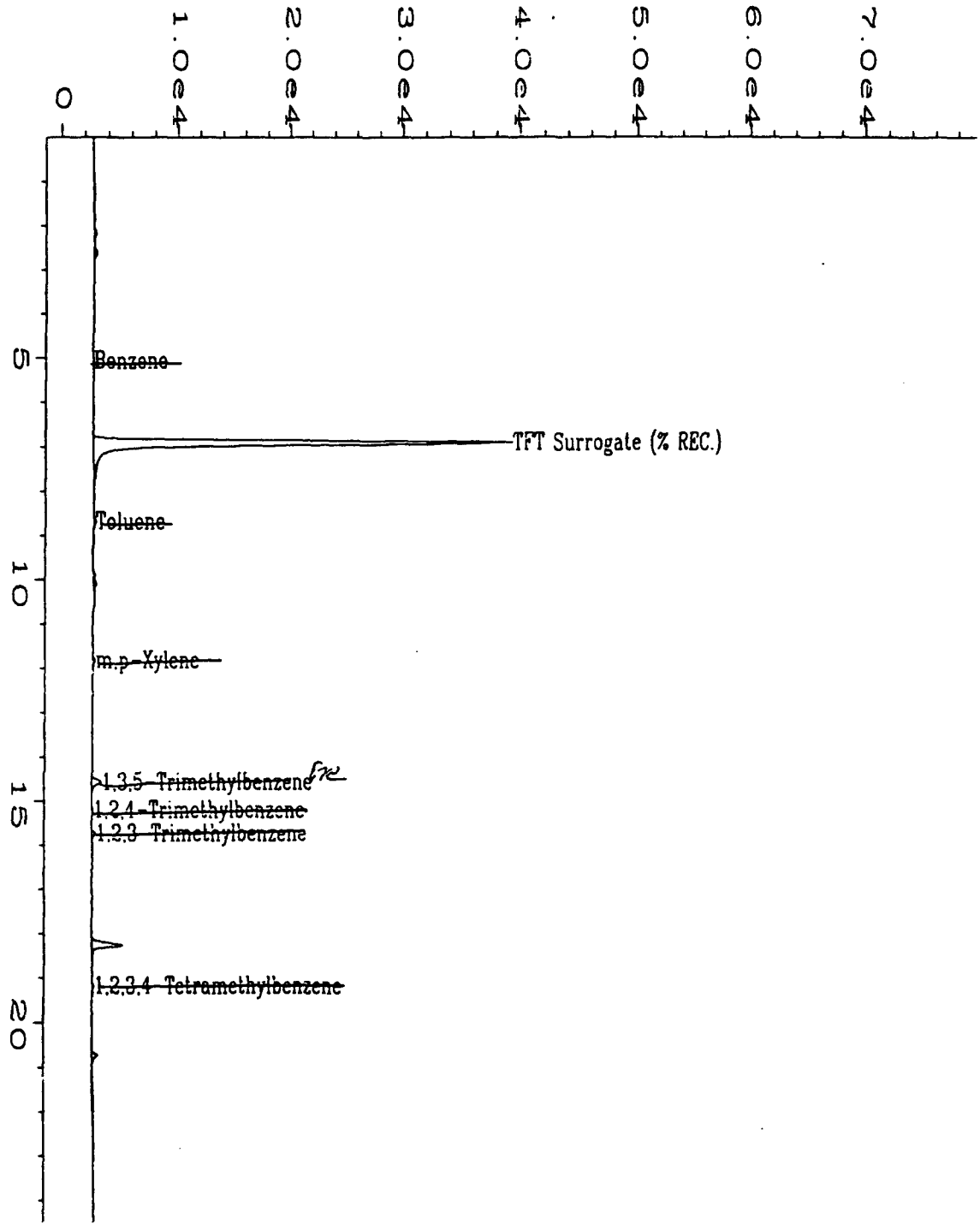
Surrogate Recovery (α,α,α-Trifluorotoluene):	91%	70%-130% (QC limits

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene RL is for a single peak.

QUALIFIERS:
E = Extrapolated value.
U = Compound analyzed for, but not detected.
B = Compound also found in the blank.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit (RL).
RL = Reporting Limit.
NA = Not Available/Not Applicable.

K. Cone
Analyst

Approved



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Operator	: C.J. Cook	Page Number	: 1
Instrument	: BTEX2	Vial Number	: 17
Sample Name	: X04853;1;5	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 8
Acquired on	: 06 Apr 95 08:57 PM	Instrument Method	: BX20406.MTH
Report Created on	: 30 Apr 95 08:34 PM	Analysis Method	: BX20406B.MTH
Last Recalib on	: 30 APR 95 08:02 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:
Sample Info	: Project#: 95-0983 Client#: 56 MP-6D Water		

EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303) 425-6021

Method 602 Data Report

Client Sample Number	: 56MP-7D	Client Project No.	: 722450.21020/MacD
Lab Sample Number	: X04869	Lab Project No.	: 95-0983
Date Sampled	: 3/27/95	Dilution Factor	: 1.00
Date Received	: 3/28/95	Method	: 602
Date Prepared	: 4/7/95	Matrix	: Water
Date Analyzed	: 4/8/95	Lab File No.	: BX2040724
		Method Blank No.	: MB040795

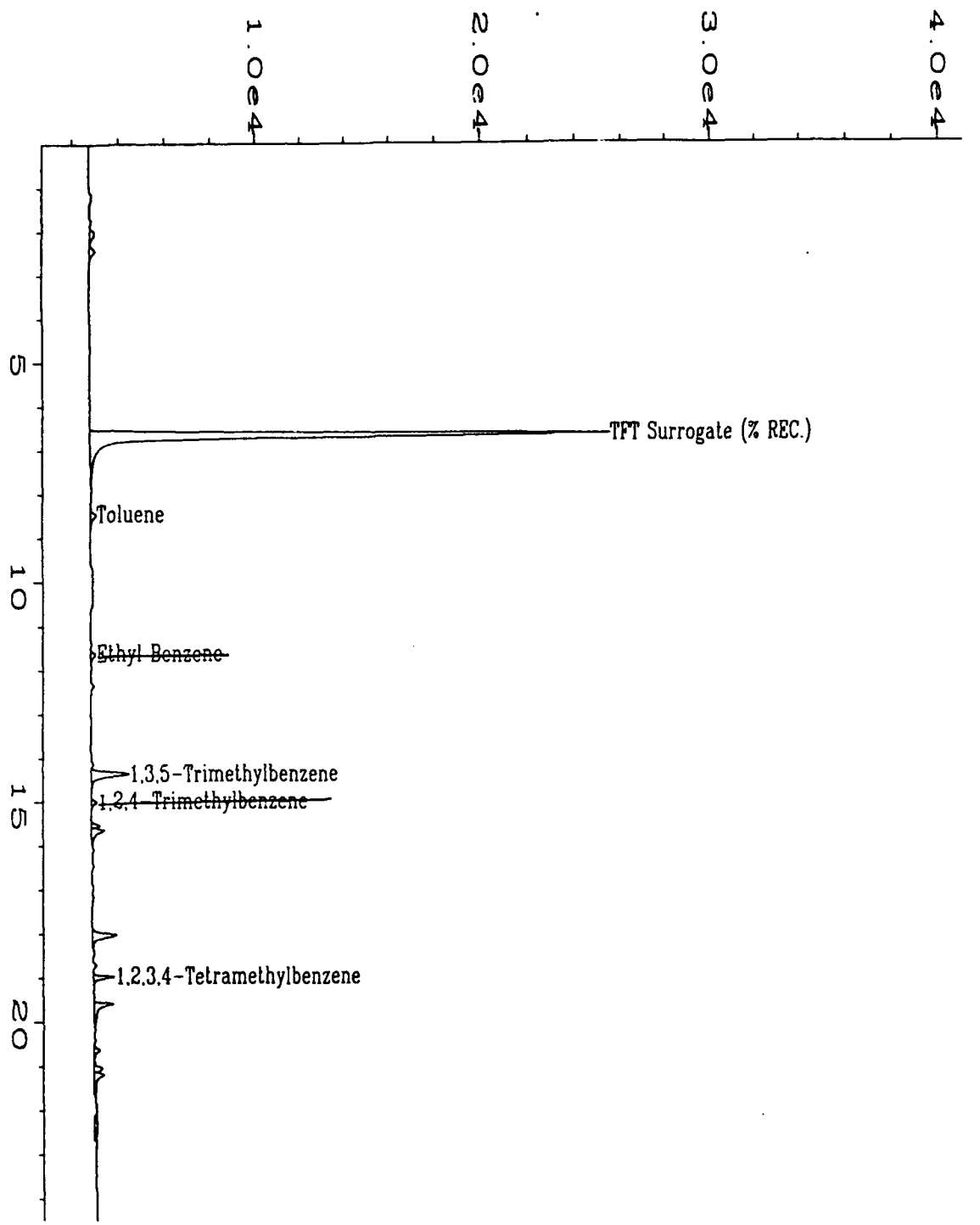
Compound Name	Cas Number	Sample Concentration ug/L		RL ug/L
Benzene	71-43-2		U	0.4
Toluene	108-88-3	0.4		0.4
Chlorobenzene	108-90-7		U	0.4
Ethyl Benzene	100-41-4		U	0.4
Total Xylenes (m, p & o)	108-38-3, 106-42-3 and 95-47-6		U	0.4
1,3,5-Trimethylbenzene	108-67-8	1.4		0.4
1,2,4-Trimethylbenzene	95-63-6		U	0.4
1,2,3-Trimethylbenzene	526-73-8		U	0.4
1,2,3,4-Tetramethylbenzene	488-23-3	0.9		0.4
Surrogate Recovery (α,α,α-Trifluorotoluene):		79%		70%-130% (QC limits)

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene RL is for a single peak.

QUALIFIERS:
E = Extrapolated value.
U = Compound analyzed for, but not detected.
B = Compound also found in the blank.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit (RL).
RL = Reporting Limit.
NA = Not Available/Not Applicable.

K. Cone
Analyst

Approved



Data File Name : C:\HPCHEM\2\DATA\BX20407\024R0901.D
Operator : C.J. Cook
Instrument : BTEX2
Sample Name : X04869;1;5
Run Time Bar Code:
Acquired on : 08 Apr 95 01:39 AM
Report Created on: 01 May 95 00:52 AM
Last Recalib on : 10 APR 95 07:26 AM
Multiplier : 1
Sample Info : Project#: 95-0983 Client#: 56MP-7 Water

Page Number : 1
Vial Number : 24
Injection Number : 1
Sequence Line : 9
Instrument Method: BX20407.MTH
Analysis Method : BX20407B.MTH
Sample Amount : 0
ISTD Amount :

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EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303) 425-6021

Method 602 Data Report

Client Sample Number	: 56MP-8S	**Client Project No.**	: 722450.21020/MacD
Lab Sample Number	: X04857	**Lab Project No.**	: 95-0983
Date Sampled	: 3/26/95	**Dilution Factor**	: 1.00
Date Received	: 3/28/95	**Method**	: 602
Date Prepared	: 4/6/95	**Matrix**	: Water
Date Analyzed	: 4/7/95	**Lab File No.**	: BX2040623
		Method Blank No.	: MB040695

Compound Name	Cas Number	Sample Concentration ug/L		RL ug/L
Benzene	71-43-2		U	0.4
Toluene	108-88-3	1.6		0.4
Chlorobenzene	108-90-7		U	0.4
Ethyl Benzene	100-41-4		U	0.4
Total Xylenes (m, p & o)	108-38-3, 106-42-3 and 95-47-6		U	0.4
1,3,5-Trimethylbenzene	108-67-8		U	0.4
1,2,4-Trimethylbenzene	95-63-6		U	0.4
1,2,3-Trimethylbenzene	526-73-8		U	0.4
1,2,3,4-Tetramethylbenzene	488-23-3		U	0.4
Surrogate Recovery (α,α,α-Trifluorotoluene):		80%		70%-130% (QC limit:

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene RL is for a single peak.

QUALIFIERS:
E = Extrapolated value.
U = Compound analyzed for, but not detected.
B = Compound also found in the blank.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit (RL).
RL = Reporting Limit.
NA = Not Available/Not Applicable.

K. Cone
Analyst

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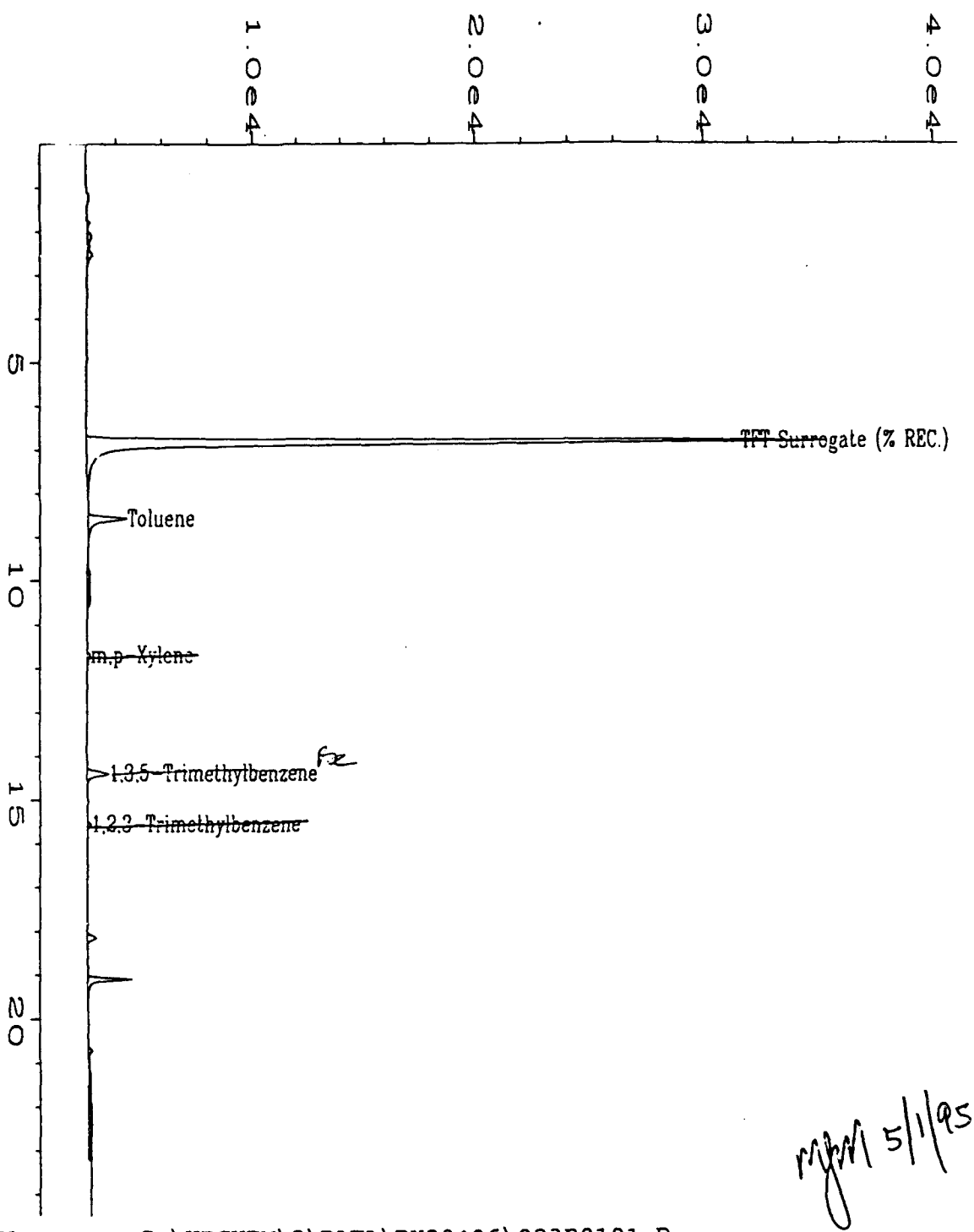

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ample Name	: X04857;1;5	Injection Number	: 1
n Time Bar Code	:	Sequence Line	: 1
quired on	: 07 Apr 95 04:14 AM	Instrument Method	: BX20406.MTH
eport Created on	: 30 Apr 95 08:28 PM	Analysis Method	: BX20406B.MTH
ast Recalib on	: 30 APR 95 08:02 PM	Sample Amount	: 0
ultiplier	: 1	ISTD Amount	:
ample Info	: Project#: 95-0983 Client#: 56 MP-8S Water		

EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303) 425-6021

Method 602 Data Report

Client Sample Number	: 56MP-10S	Client Project No.	: 722450.21020/MacDi
Lab Sample Number	: X04858	Lab Project No.	: 95-0983
Date Sampled	: 3/26/95	Dilution Factor	: 1.00
Date Received	: 3/28/95	Method	: 602
Date Prepared	: 4/6/95	Matrix	: Water
Date Analyzed	: 4/7/95	Lab File No.	: BX2040624
		Method Blank No.	: MB040695

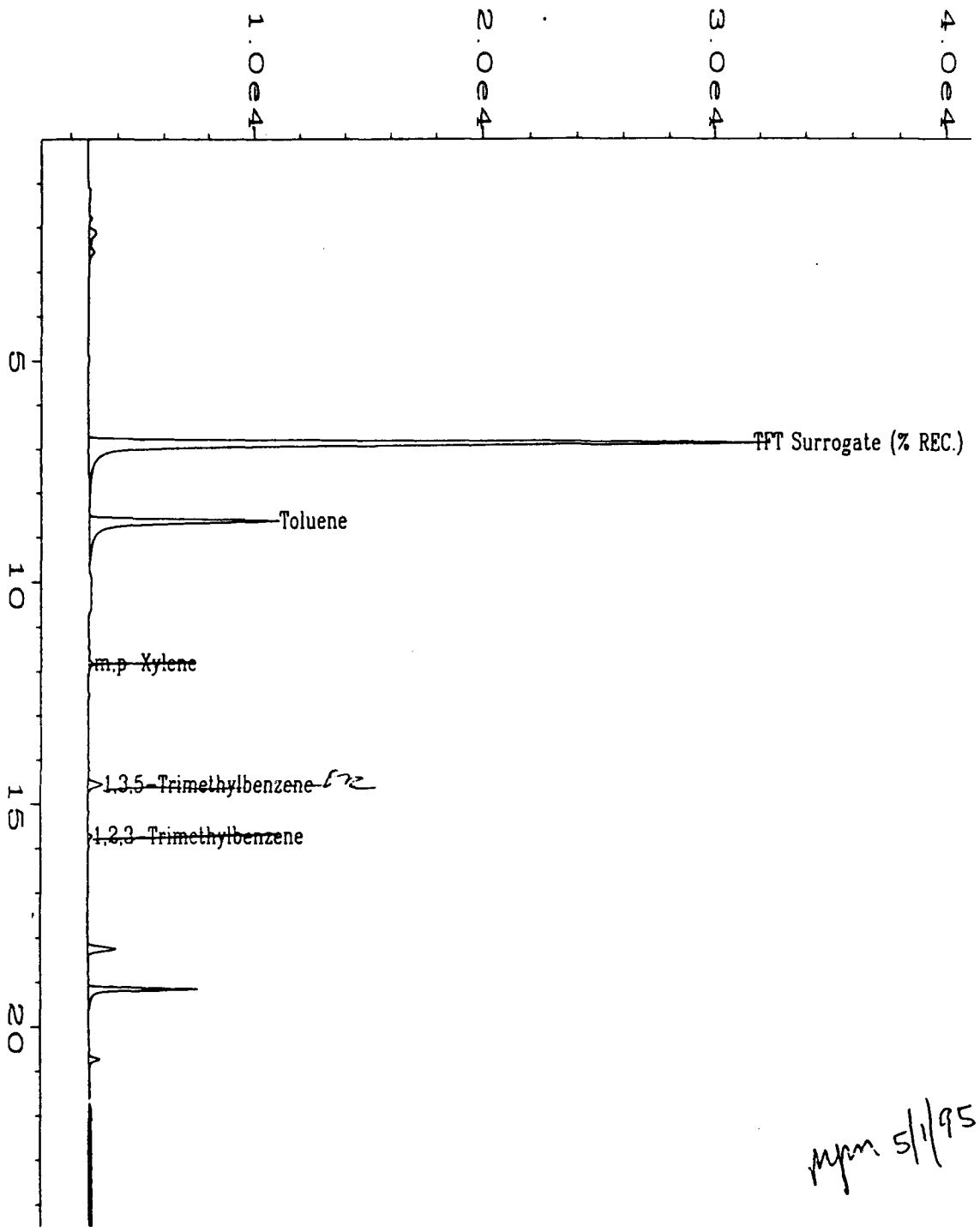
Compound Name	Cas Number	Sample Concentration ug/L		RL ug/L
Benzene	71-43-2		U	0.4
Toluene	108-88-3	7.3		0.4
Chlorobenzene	108-90-7		U	0.4
Ethyl Benzene	100-41-4		U	0.4
Total Xylenes (m, p & o)	108-38-3, 106-42-3 and 95-47-6		U	0.4
1,3,5-Trimethylbenzene	108-67-8		U	0.4
1,2,4-Trimethylbenzene	95-63-6		U	0.4
1,2,3-Trimethylbenzene	526-73-8		U	0.4
1,2,3,4-Tetramethylbenzene	488-23-3		U	0.4
Surrogate Recovery (α,α,α-Trifluorotoluene):		73%		70%-130% (QC limits)

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene RL is for a single peak.

QUALIFIERS:
E = Extrapolated value.
U = Compound analyzed for, but not detected.
B = Compound also found in the blank.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit (RL).
RL = Reporting Limit.
NA = Not Available/Not Applicable.

K. Cone
Analyst

Approved



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ta File Name : C:\HPCHEM\2\DATA\BX20406\024R0101.D
erator : C.J. Cook
strument : BTEX2
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Time Bar Code:
quired on : 07 Apr 95 04:56 AM
port Created on: 30 Apr 95 08:28 PM
st Recalib on : 30 APR 95 08:02 PM
tiplier : 1
mple Info : Project#: 95-0983 Client#: 56 MP-10S Water

Page Number : 1
Vial Number : 24
Injection Number : 1
Sequence Line : 1
Instrument Method: BX20406.MTH
Analysis Method : BX20406B.MTH
Sample Amount : 0
ISTD Amount :

EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303) 425-6021

Method 602 Data Report

Client Sample Number	: 56MP-15D	Client Project No.	: 722450.21020/MacD
Lab Sample Number	: X04867	Lab Project No.	: 95-0983
Date Sampled	: 3/27/95	Dilution Factor	: 1.00
Date Received	: 3/28/95	Method	: 602
Date Prepared	: 4/7/95	Matrix	: Water
Date Analyzed	: 4/7/95	Lab File No.	: BX2040721
		Method Blank No.	: MB040795

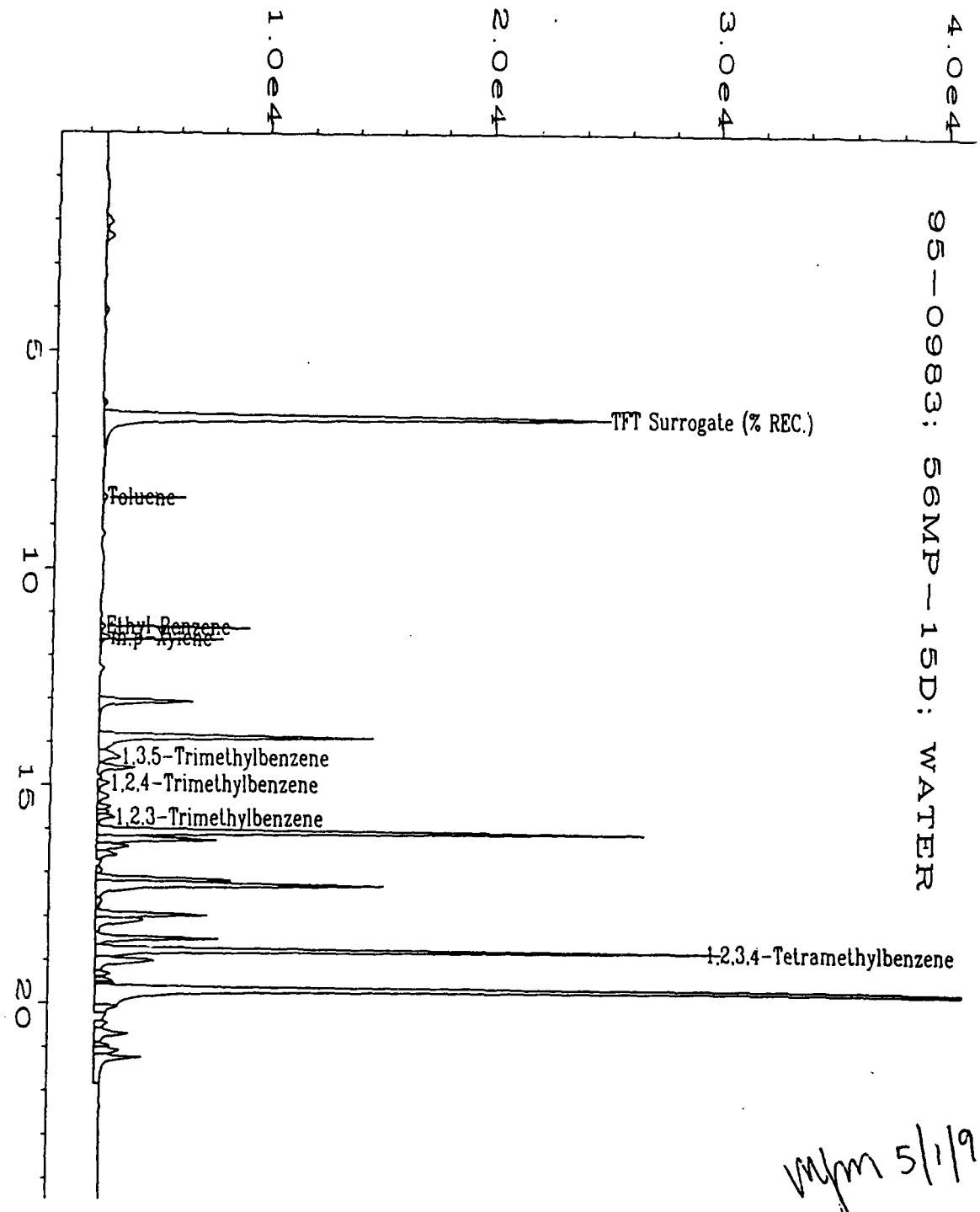
Compound Name	Cas Number	Sample Concentration ug/L		RL ug/L
Benzene	71-43-2		U	0.4
Toluene	108-88-3		U	0.4
Chlorobenzene	108-90-7		U	0.4
Ethyl Benzene	100-41-4		U	0.4
Total Xylenes (m, p & o)	108-38-3, 106-42-3 and 95-47-6		U	0.4
1,3,5-Trimethylbenzene	108-67-8	0.8		0.4
1,2,4-Trimethylbenzene	95-63-6	0.6		0.4
1,2,3-Trimethylbenzene	526-73-8	0.9		0.4
1,2,3,4-Tetramethylbenzene	488-23-3	29		0.4
Surrogate Recovery (α,α,α-Trifluorotoluene):		80%		70%-130% (QC limits)

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene RL is for a single peak.

QUALIFIERS:
E = Extrapolated value.
U = Compound analyzed for, but not detected.
B = Compound also found in the blank.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit (RL).
RL = Reporting Limit.
NA = Not Available/Not Applicable.

K. Cone
Analyst

Approved



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Data File Name : D:\2\DATA\BX20407\021R0901.D
Operator : C.J. Cook
Instrument : BTEX2
Sample Name : X04867;1;5
Run Time Bar Code:
Acquired on : 07 Apr 95 11:36 PM
Report Created on: 01 May 95 09:39 AM
Last Recalib on : 10 APR 95 07:26 AM
Multiplier : 1

Page Number : 1
Vial Number : 21
Injection Number : 1
Sequence Line : 9
Instrument Method: BX20407.MTH
Analysis Method : BX20407B.MTH
Sample Amount : 0
ISTD Amount :

56MP-15D

EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303) 425-6021

Method 602 Data Report

Client Sample Number	: 56MP-15D	Client Project No.	: 722450.21020/MacDil
Lab Sample Number	: X04867DUP	Lab Project No.	: 95-0983
Date Sampled	: 3/27/95	Dilution Factor	: 1.00
Date Received	: 3/28/95	Method	: 602
Date Prepared	: 4/7/95	Matrix	: Water
Date Analyzed	: 4/8/95	Lab File No.	: BX2040722
		Method Blank No.	: MB040795

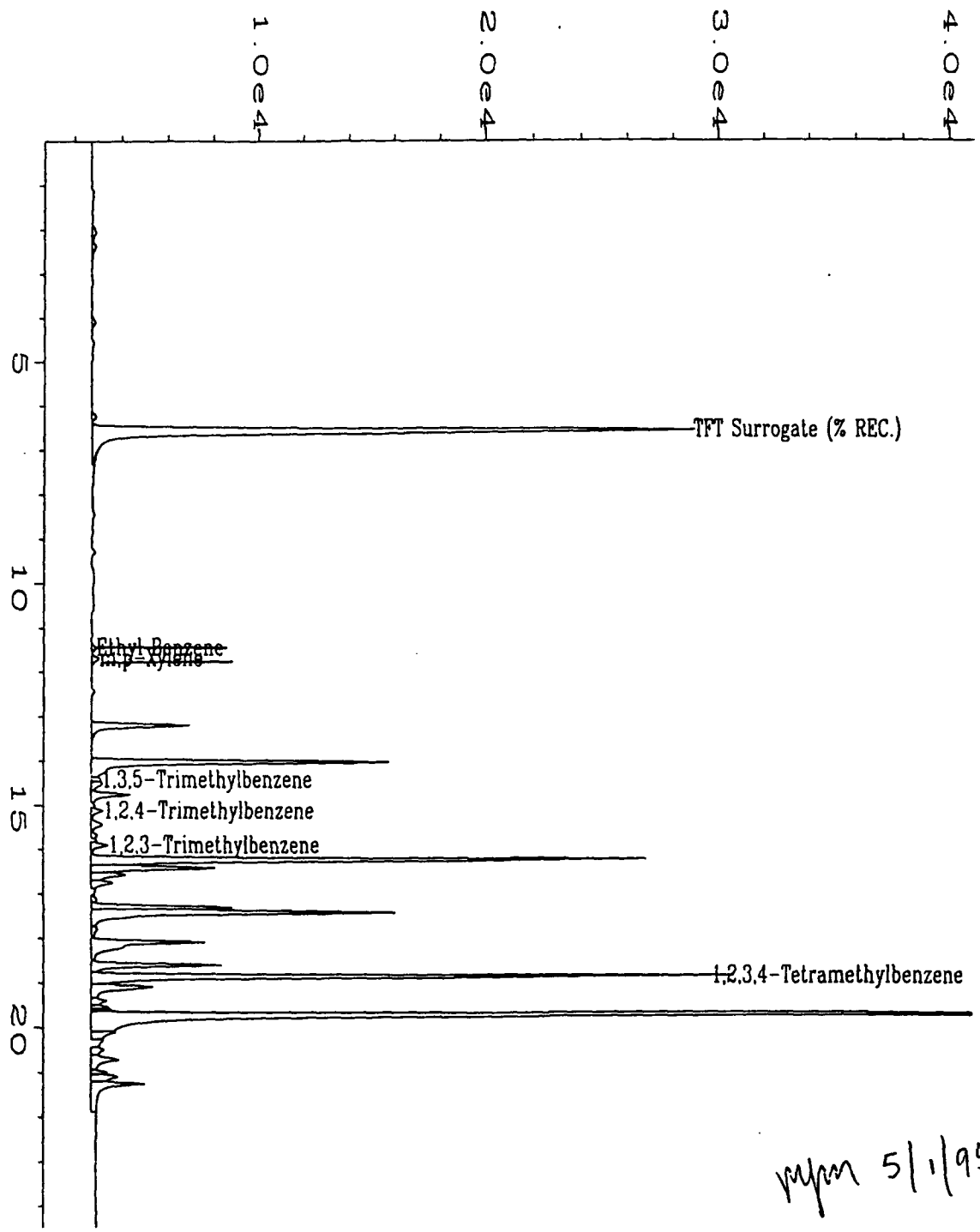
Compound Name	Cas Number	Sample Concentration ug/L		RL ug/L
Benzene	71-43-2		U	0.4
Toluene	108-88-3		U	0.4
Chlorobenzene	108-90-7		U	0.4
Ethyl Benzene	100-41-4		U	0.4
Total Xylenes (m, p & o)	108-38-3, 106-42-3 and 95-47-6		U	0.4
1,3,5-Trimethylbenzene	108-67-8		U	0.4
1,2,4-Trimethylbenzene	95-63-6	0.6		0.4
1,2,3-Trimethylbenzene	526-73-8	0.9		0.4
1,2,3,4-Tetramethylbenzene	488-23-3	29		0.4
Surrogate Recovery (α,α,α-Trifluorotoluene):		91%		70%-130% (QC limits)

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene RL is for a single peak.

QUALIFIERS:
E = Extrapolated value.
U = Compound analyzed for, but not detected.
B = Compound also found in the blank.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit (RL).
RL = Reporting Limit.
NA = Not Available/Not Applicable.

K Cone
Analyst

Approved



mpm 5/1/95

Data File Name	: C:\HPCHEM\2\DATA\BX20407\022R0901.D		
Operator	: C.J. Cook	Page Number	: 1
Instrument	: BTEX2	Vial Number	: 22
Sample Name	: X04867DUP;1;5	Injection Number	: 1
Bin Time Bar Code:		Sequence Line	: 9
Acquired on	: 08 Apr 95 00:17 AM	Instrument Method	: BX20407.MTH
Report Created on	: 01 May 95 00:51 AM	Analysis Method	: BX20407B.MTH
Last Recalib on	: 10 APR 95 07:26 AM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:
Sample Info	: Project#: 95-0983 Client#: 56MP-15D Water		

Evergreen Analytical, Inc.
4036 Youngfield, Wheat Ridge, CO 80033
(303) 425-6021

BTEX Matrix Spike/Matrix Spike Duplicate Data Report

Client Sample No.	: MW56-10	Client Project No.	: 722450.21020/MacDill
Lab Sample No.	: X04852	Lab Project No.	: 95-0983
Date Sampled	: 3/26/95	EPA Method No.	: 602
Date Received	: 3/28/95	Matrix	: Water
Date Prepared	: 4/6/95	Lab File Number(s)	: BX2040615,16
Date Analyzed	: 4/6/95	Method Blank	: MB040695

Compound	Spike Added (ug/L)	Sample Concentration (ug/L)	MS Concentration (ug/L)	MS %REC	QC Limits %REC
Benzene	20.0	36.3	54.7	92	50-150
Toluene	20.0	1.1	17.0	80	50-148
Ethyl Benzene	20.0	0.8	16.8	80	50-150
m,p-Xylene	40.0	0.6	37.2	92	50-150
o-Xylene	20.0	0.7	16.5	79	50-150
Chlorobenzene	20.0	4.3	22.0	89	55-135
1,3,5-TMB	20.0	0.0	14.8	74	50-150
1,2,4-TMB	20.0	0.0	16.2	81	50-150
1,2,3-TMB	20.0	0.0	15.4	77	50-150
1,2,3,4-TeMB	20.0	1.8	19.4	88	50-150

Compound	Spike Added (ug/L)	MSD Concentration (ug/L)	MSD %REC	RPD	QC Limits RPD	QC Limits %REC
Benzene	20.0	53.6	87	6.2	25	50-150
Toluene	20.0	17.1	80	0.6	25	50-148
Ethyl Benzene	20.0	16.6	79	1.3	25	50-150
m,p-Xylene	40.0	35.7	88	4.2	25	50-150
o-Xylene	20.0	16.3	78	1.3	25	50-150
Chlorobenzene	20.0	21.0	84	5.8	25	55-135
1,3,5-TMB	20.0	14.6	73	1.4	25	50-150
1,2,4-TMB	20.0	15.7	79	3.1	25	50-150
1,2,3-TMB	20.0	15.0	75	2.6	25	50-150
1,2,3,4-TeMB	20.0	18.4	83	5.8	25	50-150

* = Values outside of QC limits.

RPD: 0 out of (10) outside limits.

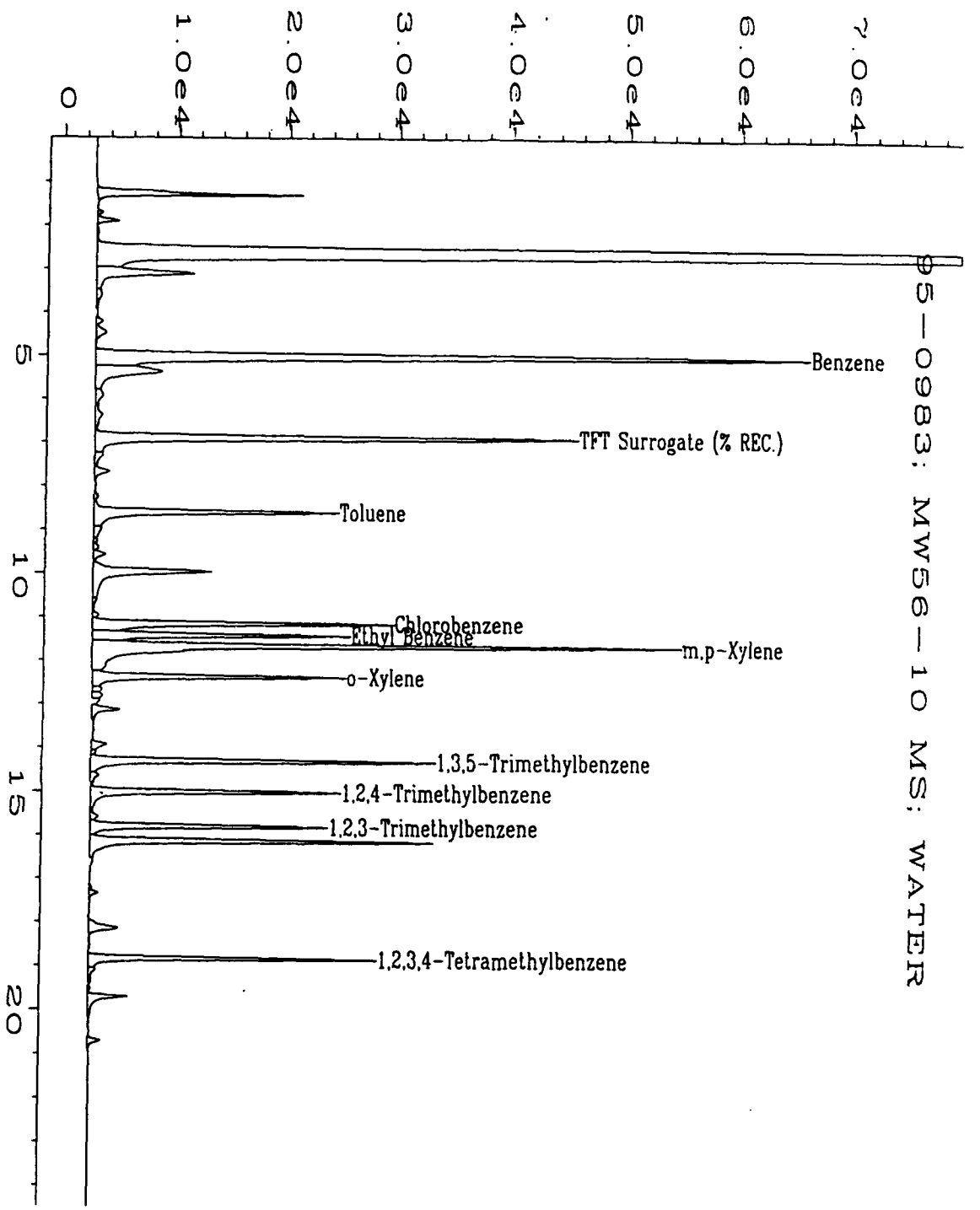
Spike Recovery: 0 out of (20) outside limits.

Comments:

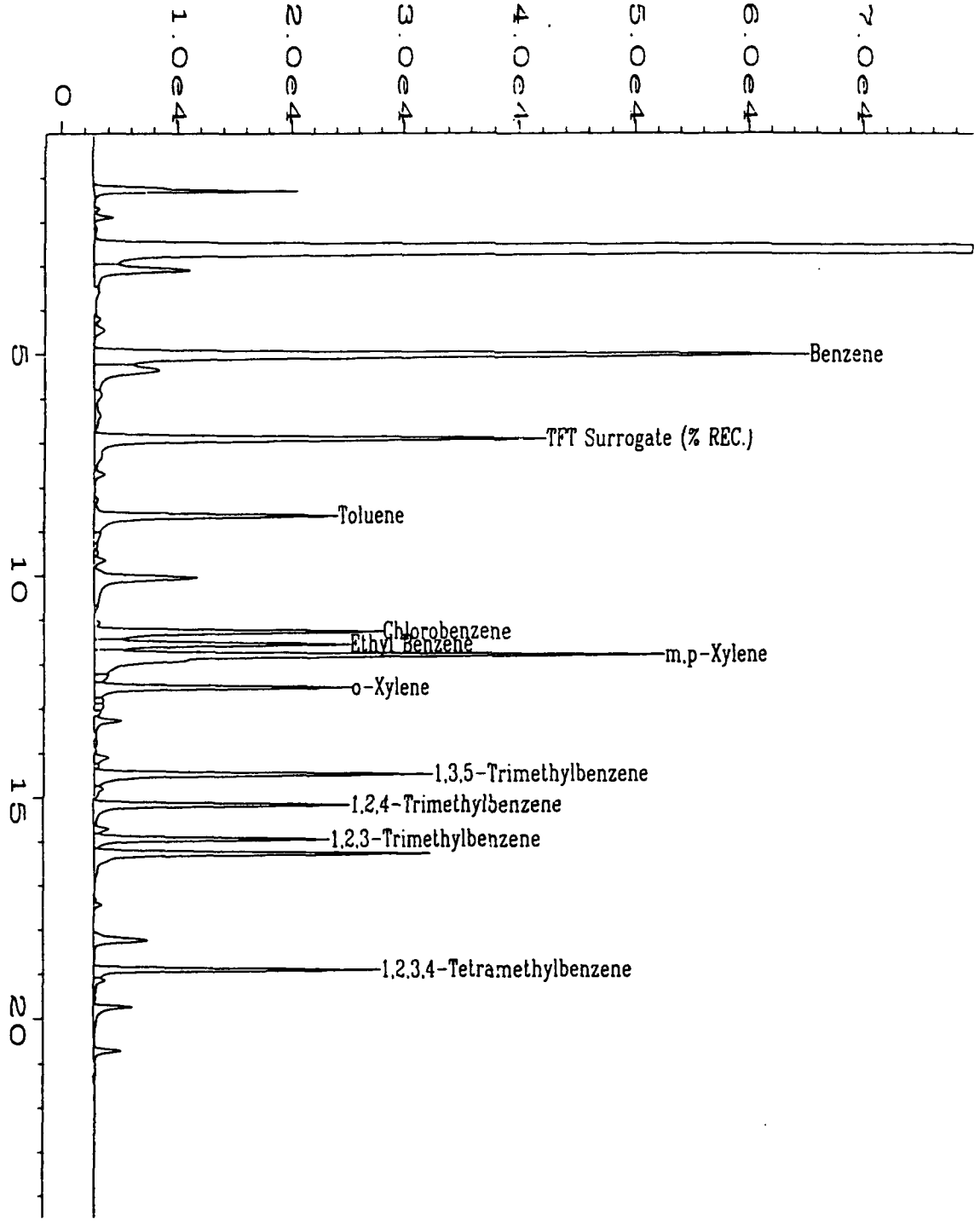
K. Cone
Analyst

Approved

MS0983B.XLS



Data File Name	: C:\HPCHEM\2\DATA\BX20406\015R0801.D		
Operator	: C.J. Cook	Page Number	: 1
Instrument	: BTEX2	Vial Number	: 15
Sample Name	: X04852MS;1;5	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 8
Acquired on	: 06 Apr 95 07:23 PM	Instrument Method	: BX20406.MTH
Report Created on	: 30 Apr 95 08:50 PM	Analysis Method	: BX20406B.MTH
Last Recalib on	: 30 APR 95 08:02 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:



Data File Name	: C:\HPCHEM\2\DATA\BX20406\016R0801.D		
Operator	: C.J. Cook	Page Number	: 1
Instrument	: BTEX2	Vial Number	: 16
Sample Name	: X04852MSD;1;5	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 8
Acquired on	: 06 Apr 95 08:10 PM	Instrument Method	: BX20406
Report Created on	: 30 Apr 95 08:33 PM	Analysis Method	: BX20406
Last Recalib on	: 30 APR 95 08:02 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:
Sample Info	: Project#: 95-0983 Client#: MW 56-10 Water		

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TOTAL VOLATILE HYDROCARBONS
TVH Matrix Spike/Matrix Spike Duplicate Data Report

Client Sample No.	: 56MP-6D	Client Project No.	: 722450.21020/PARSONS
Lab Sample No.	: X04853	Lab Project No.	: 95-0983
Date Sampled	: 3/26/95	EPA Method No.	: 5030/8015 Mod.
Date Received	: 3/28/95	Matrix	: Water
Date Prepared	: 4/7/95	Method Blank	: MB040895
Date Analyzed	: 4/7/95		

Compound	Spike Added (mg/L)	Sample Concentration (mg/L)	MS Concentration (mg/L)	MS %REC	QC Limits %REC
Gasoline	2.00	0.00	2.14	107%	60-140

Compound	Spike Added (mg/L)	MSD Concentration (mg/L)	MS %REC	RPD	QC Limits RPD	QC Limits %REC
Gasoline	2.00	1.69	85%	23	50	60-140

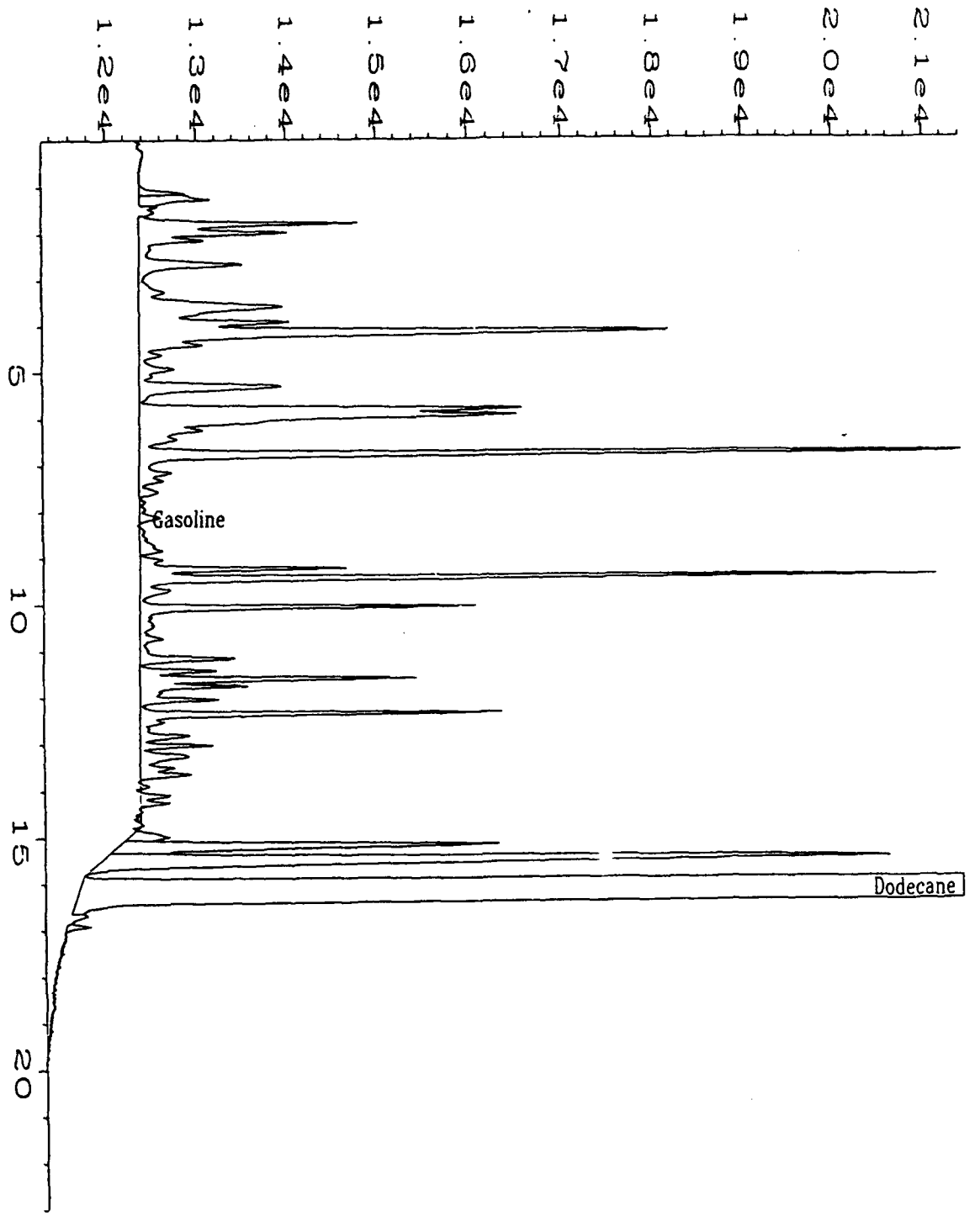
* = Values outside of QC limits.

RPD: 0 out of (1) outside limits.

Spike Recovery: 0 out of (2) outside limits.

Comments: NA = Not analyzed/not applicable.

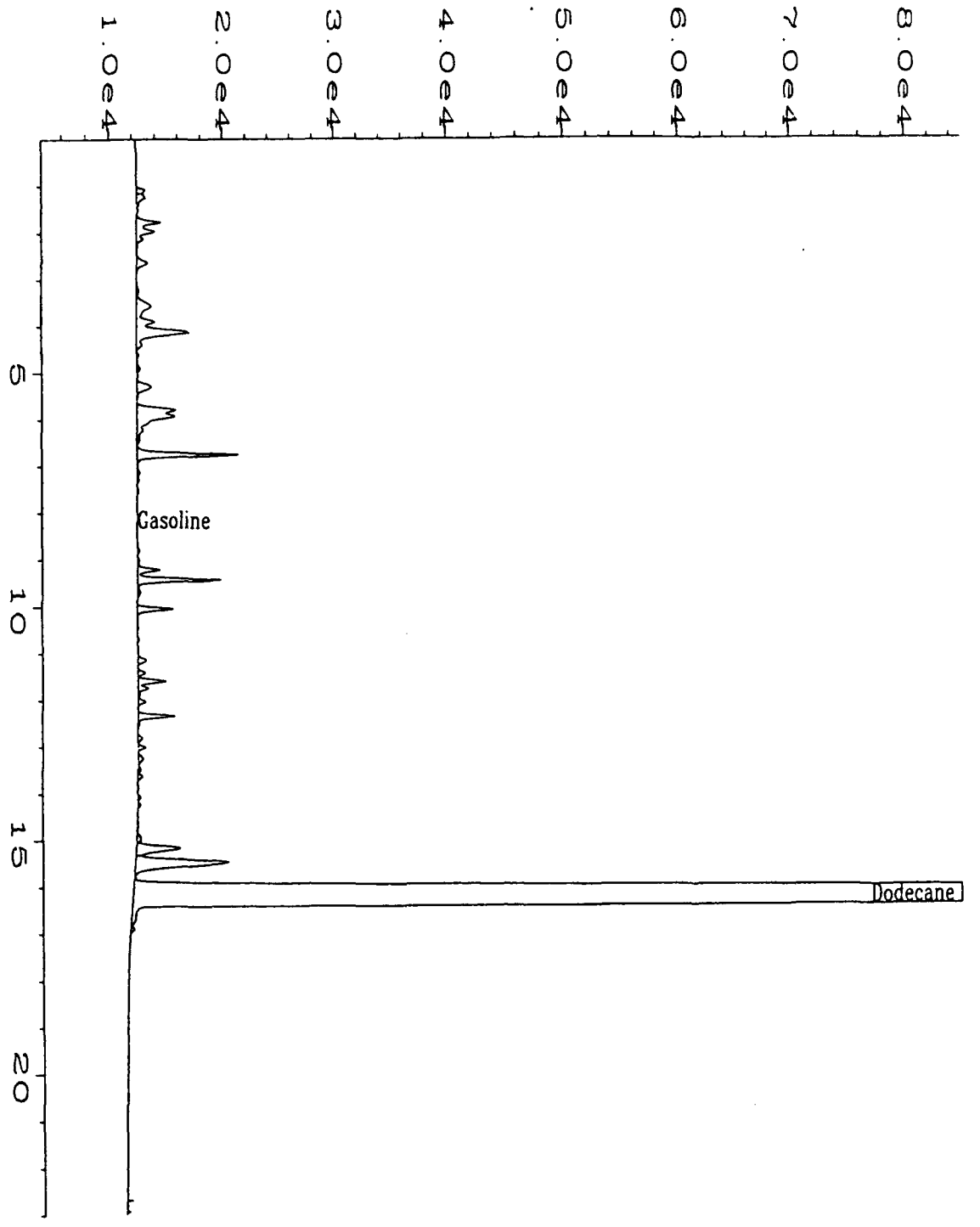
ejc



Data File Name : C:\HPCHEM\1\DATA\tvh0408\012F0101.D
Operator : Dawn N. Guildner
Instrument : TVH
Sample Name : X04853 MS
Run Time Bar Code:
Acquired on : 07 Apr 95 06:35 PM
Report Created on: 10 Apr 95 09:55 AM
Last Recalib on : 07 APR 95 04:22 PM
Multiplier : 1

Page Number : 1
Vial Number : 12
Injection Number : 1
Sequence Line : 1
Instrument Method: TVH1BA_
Analysis Method : TVH0408.M
Sample Amount : 0
ISTD Amount :

56MP-6D MS



Data File Name : C:\HPCHEM\1\DATA\tvh0408\013F0101.D
Operator : Dawn N. Guildner
Instrument : TVH
Sample Name : X04853 MSD
Run Time Bar Code:
Acquired on : 07 Apr 95 07:11 PM
Report Created on: 10 Apr 95 09:55 AM
Last Recalib on : 07 APR 95 04:22 PM
Multiplier : 1

Page Number : 1
Vial Number : 13
Injection Number : 1
Sequence Line : 1
Instrument Method: TVH1BASE.MTH
Analysis Method : TVH0408.MTH
Sample Amount : 0
ISTD Amount :

56MP-6D MSD

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4036 Youngfield, Wheat Ridge, CO 80033
(303) 425-6021

TOTAL VOLATILE HYDROCARBONS
TVH Matrix Spike/Matrix Spike Duplicate Data Report

Client Sample No.	: MW56-9	Client Project No.	: 722450.21020
Lab Sample No.	: X04861	Lab Project No.	: 95-0983
Date Sampled	: 3/27/95	EPA Method No.	: 5030/8015 Mod.
Date Received	: 3/28/95	Matrix	: Water
Date Prepared	: 4/10/95	Method Blank	: MB041095
Date Analyzed	: 4/10/95		

Compound	Spike Added (mg/L)	Sample Concentration (mg/L)	MS Concentration (mg/L)	MS %REC	QC Limits %REC
Gasoline	2.00	0.00	2.20	110%	60-140

Compound	Spike Added (mg/L)	MSD Concentration (mg/L)	MS %REC	RPD	QC Limits RPD	QC Limits %REC
Gasoline	2.00	1.74	87%	23	50	60-140

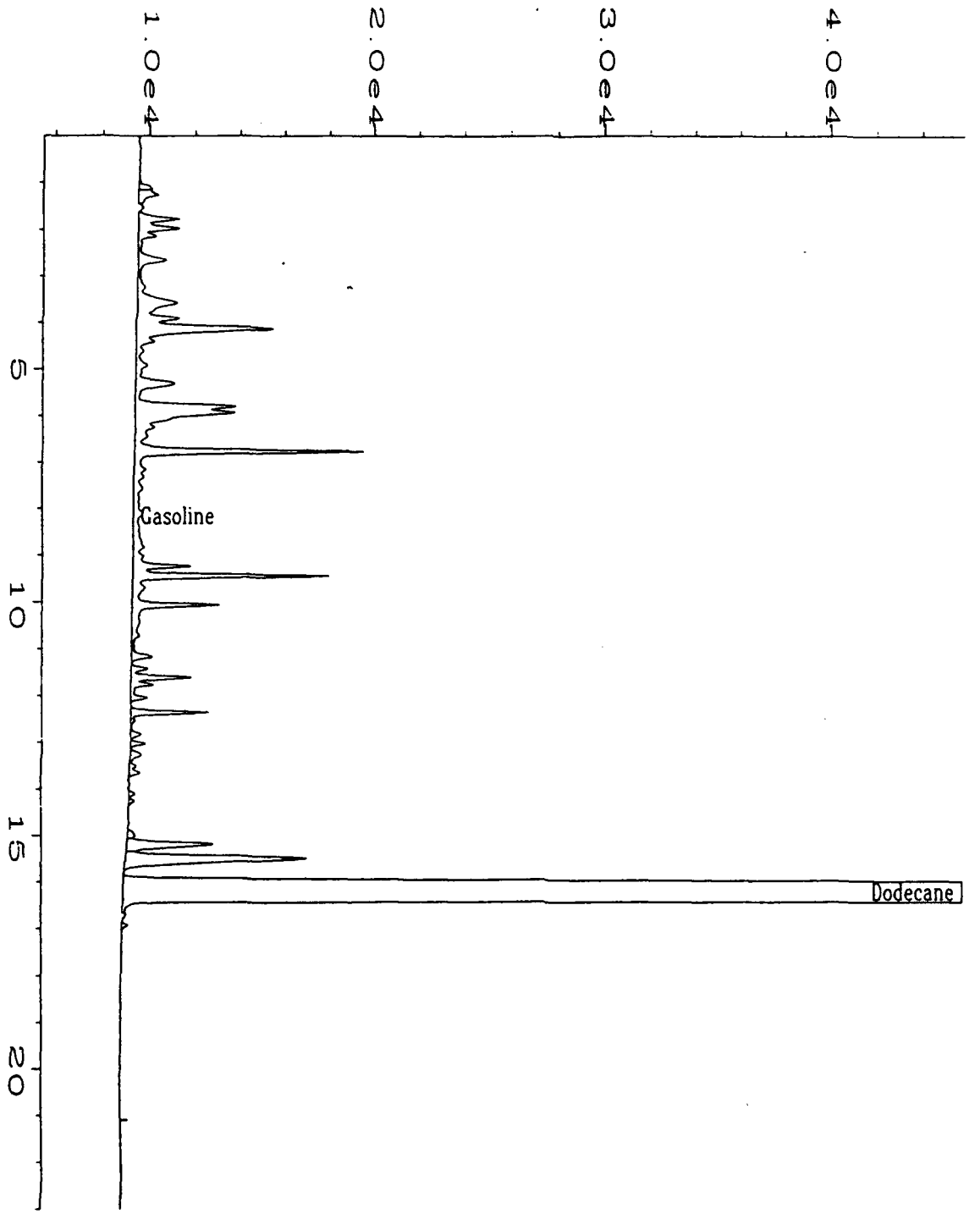
* = Values outside of QC limits.

RPD: 0 out of (1) outside limits.

Spike Recovery: 0 out of (2) outside limits.

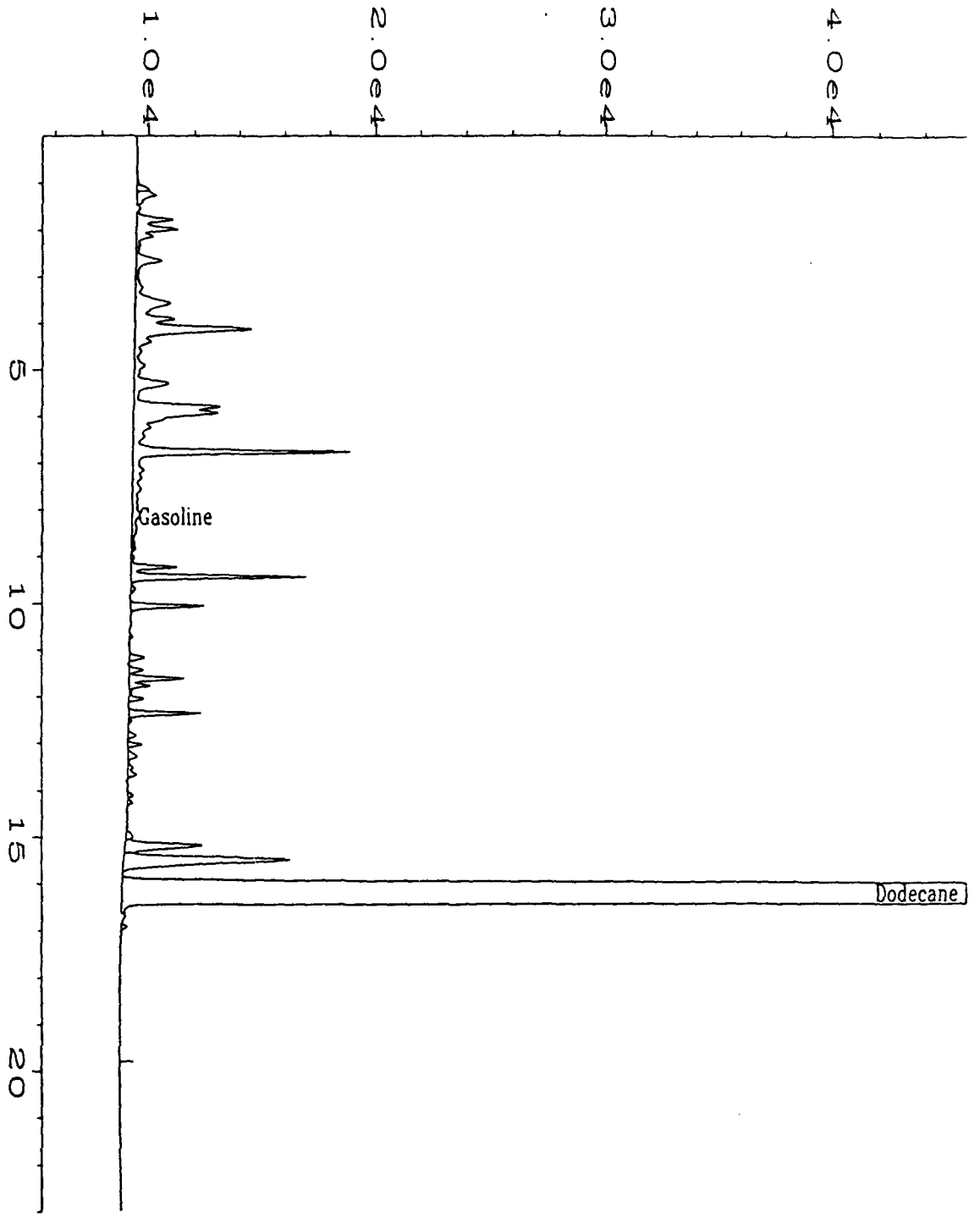
Comments: NA = Not analyzed/not applicable.

fjc



Data File Name	: C:\HPCHEM\1\DATA\tvh0410\013F0101.D		
Operator	: Dawn N. Guildner	Page Number	: 1
Instrument	: TVH	Vial Number	: 13
Sample Name	: X04861 MS	Injection Number	: 1
n Time Bar Code:		Sequence Line	: 1
quired on	: 10 Apr 95 04:52 PM	Instrument Method	: TVH1BASE.MTH
Report Created on	: 10 Apr 95 10:45 PM	Analysis Method	: TVH0410.MTH
Last Recalib on	: 10 APR 95 01:08 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:

MW56-9 MS



Data File Name	: C:\HPCHEM\1\DATA\tvh0410\014F0101.D		
Operator	: Dawn N. Guildner	Page Number	: 1
Instrument	: TVH	Vial Number	: 14
Sample Name	: X04861 MSD	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 1
Acquired on	: 10 Apr 95 05:28 PM	Instrument Method	: TVH1B
Report Created on	: 10 Apr 95 10:45 PM	Analysis Method	: TVH0410
Last Recalib on	: 10 APR 95 01:08 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:

MW56-9 MSD

Evergreen Analytical, Inc.
4036 Youngfield, Wheat Ridge, CO 80033
(303) 425-6021

TOTAL VOLATILE HYDROCARBONS

TVH Matrix Spike/Matrix Spike Duplicate Data Report

Client Sample No.	: 56MP-5D	Client Project No.	: 722450.21020
Lab Sample No.	: X04866	Lab Project No.	: 95-0983
Date Sampled	: 3/27/95	EPA Method No.	: 5030/8015 Mod.
Date Received	: 3/28/95	Matrix	: Water
Date Prepared	: 4/10/95	Method Blank	: MB041095
Date Analyzed	: 4/10/95		

Compound	Spike Added (mg/L)	Sample Concentration (mg/L)	MS Concentration (mg/L)	MS %REC	QC Limits %REC
Gasoline	2.00	0.00	1.93	97%	60-140

Compound	Spike Added (mg/L)	MSD Concentration (mg/L)	MS %REC	RPD	QC Limits RPD	QC Limits %REC
Gasoline	2.00	1.99	100%	3	50	60-140

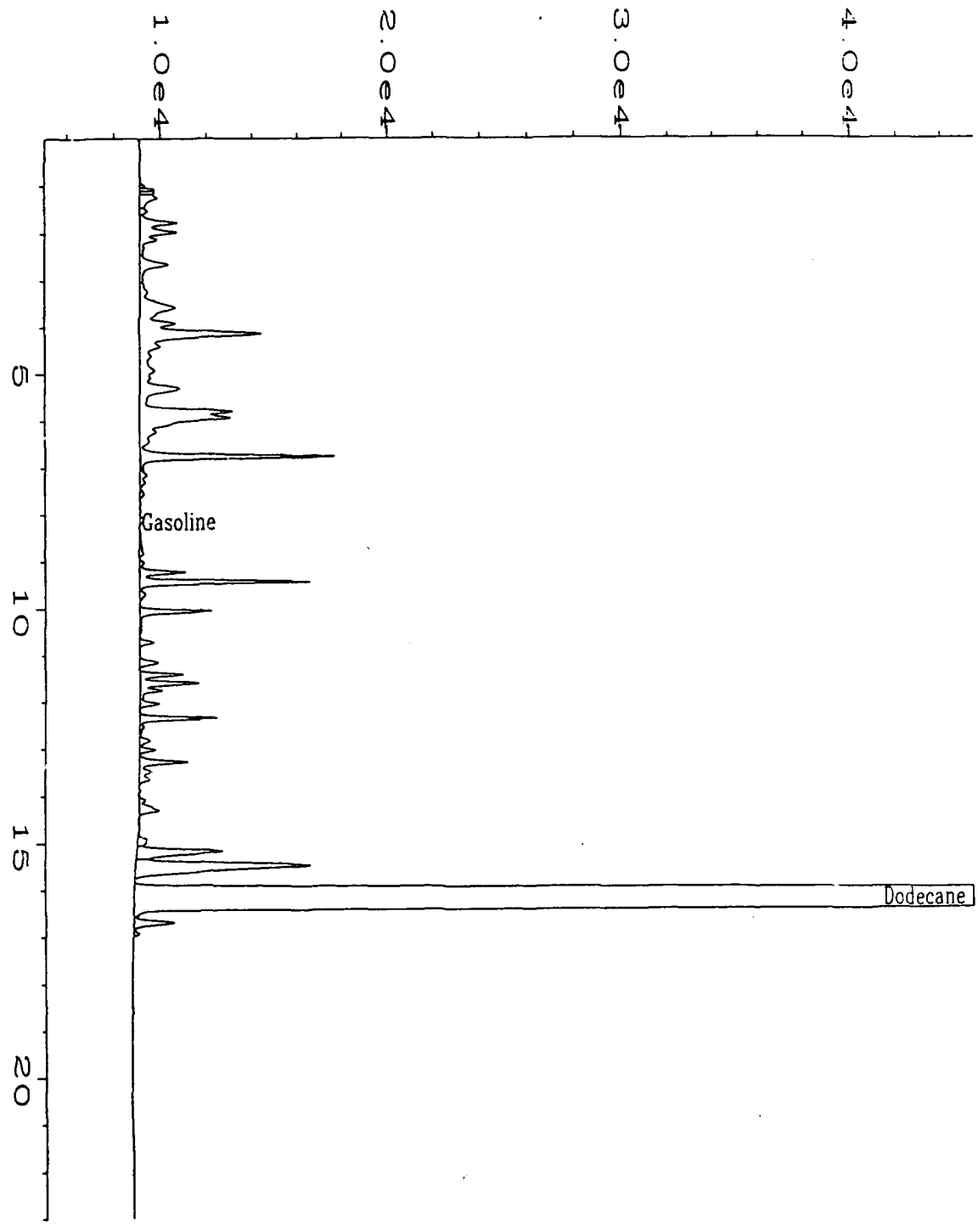
* = Values outside of QC limits.

RPD: 0 out of (1) outside limits.

Spike Recovery: 0 out of (2) outside limits.

Comments: NA = Not analyzed/not applicable.

F12



Data File Name : C:\HPCHEM\1\DATA\tvh0410\022F0101.D
Operator : Dawn N. Guildner
Instrument : TVH
Sample Name : X04866 MS
Run Time Bar Code:
Acquired on : 10 Apr 95 10:16 PM
Report Created on: 10 Apr 95 10:47 PM
Last Recalib on : 10 APR 95 01:08 PM
Multiplier : 1

Page Number : 1
Vial Number : 22
Injection Number : 1
Sequence Line : 1
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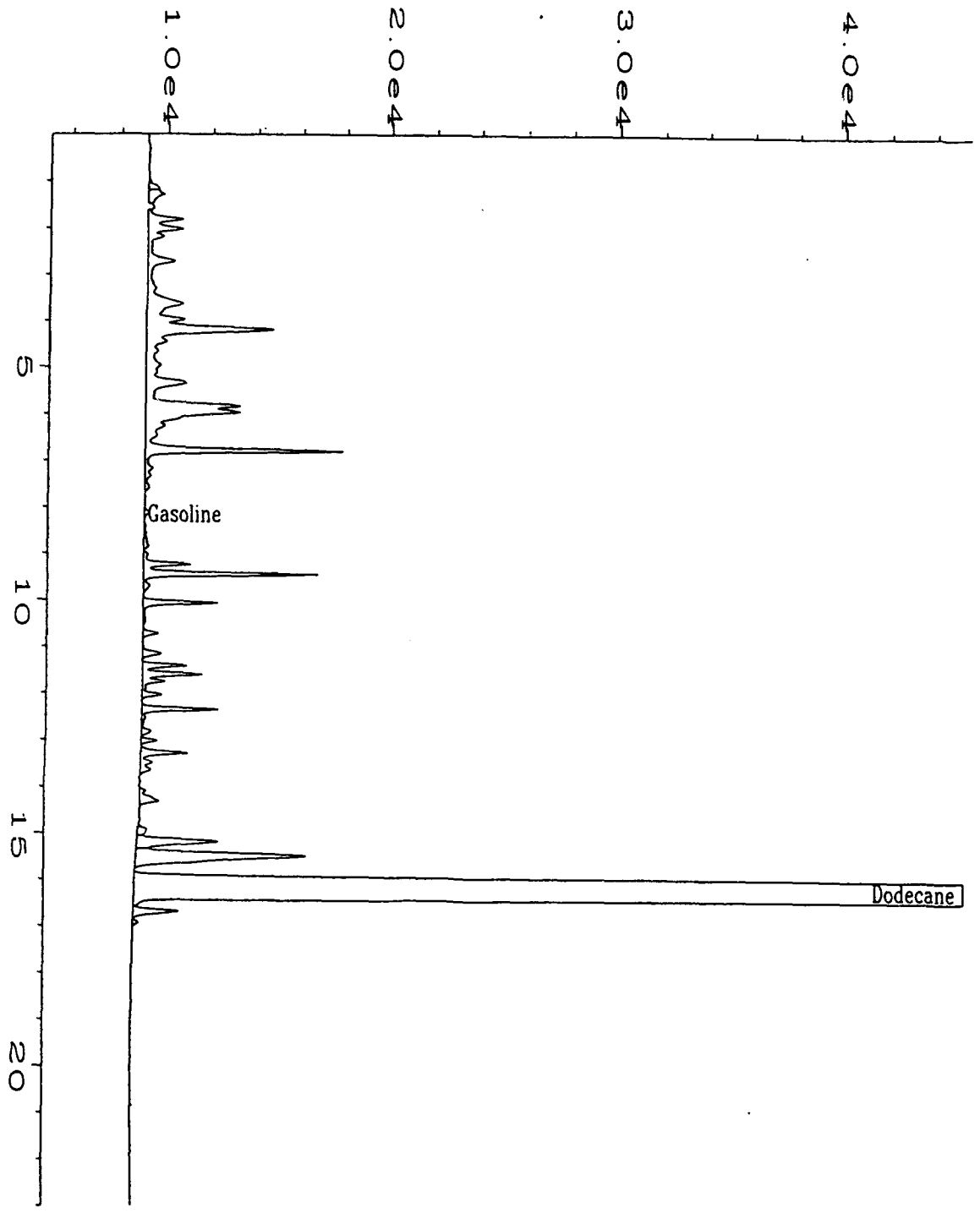
Analysis Method : TVH0410...
Sample Amount : 0
ISTD Amount :

56MP-5D MS



Data File Name : C:\HPCHEM\1\DATA\tvh0410\023F0101.D
Operator : Dawn N. Guildner
Instrument : TVH
Sample Name : X04866 MSD
Run Time Bar Code:
Acquired on : 10 Apr 95 10:52 PM
Report Created on: 11 Apr 95 10:09 AM
Last Recalib on : 10 APR 95 01:08 PM
Multiplier : 1

Page Number : 1
Vial Number : 23
Injection Number : 1
Sequence Line : 1
Instrument Method: TVH1BASE.MTH
Analysis Method : TVH0410.MTH
Sample Amount : 0
ISTD Amount :

56 MP-5D MSD

EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303) 425-6021

Method 602 Data Report
Method Blank Report

Method Blank Number	: MB040595	Client Project No.	: 722450.21020/MacDill
Date Prepared	: 4/5/95	Lab Project No.	: 95-0983
Date Analyzed	: 4/5/95	Dilution Factor	: 1.00
		Method	: 602/8020
		Matrix	: Water
		Lab File No.	: BX2040509

Compound Name	Cas Number	Sample Concentration ug/L	RL ug/L
Benzene	71-43-2	U	0.4
Toluene	108-88-3	U	0.4
Chlorobenzene	108-90-7	U	0.4
Ethyl Benzene	100-41-4	U	0.4
Total Xylenes (m, p & o)	108-38-3, 106-42-3 and 95-47-6	U	0.4
1,3,5-Trimethylbenzene	108-67-8	U	0.4
1,2,4-Trimethylbenzene	95-63-6	U	0.4
1,2,3-Trimethylbenzene	526-73-8	U	0.4
1,2,3,4-Tetramethylbenzene	488-23-3	U	0.4

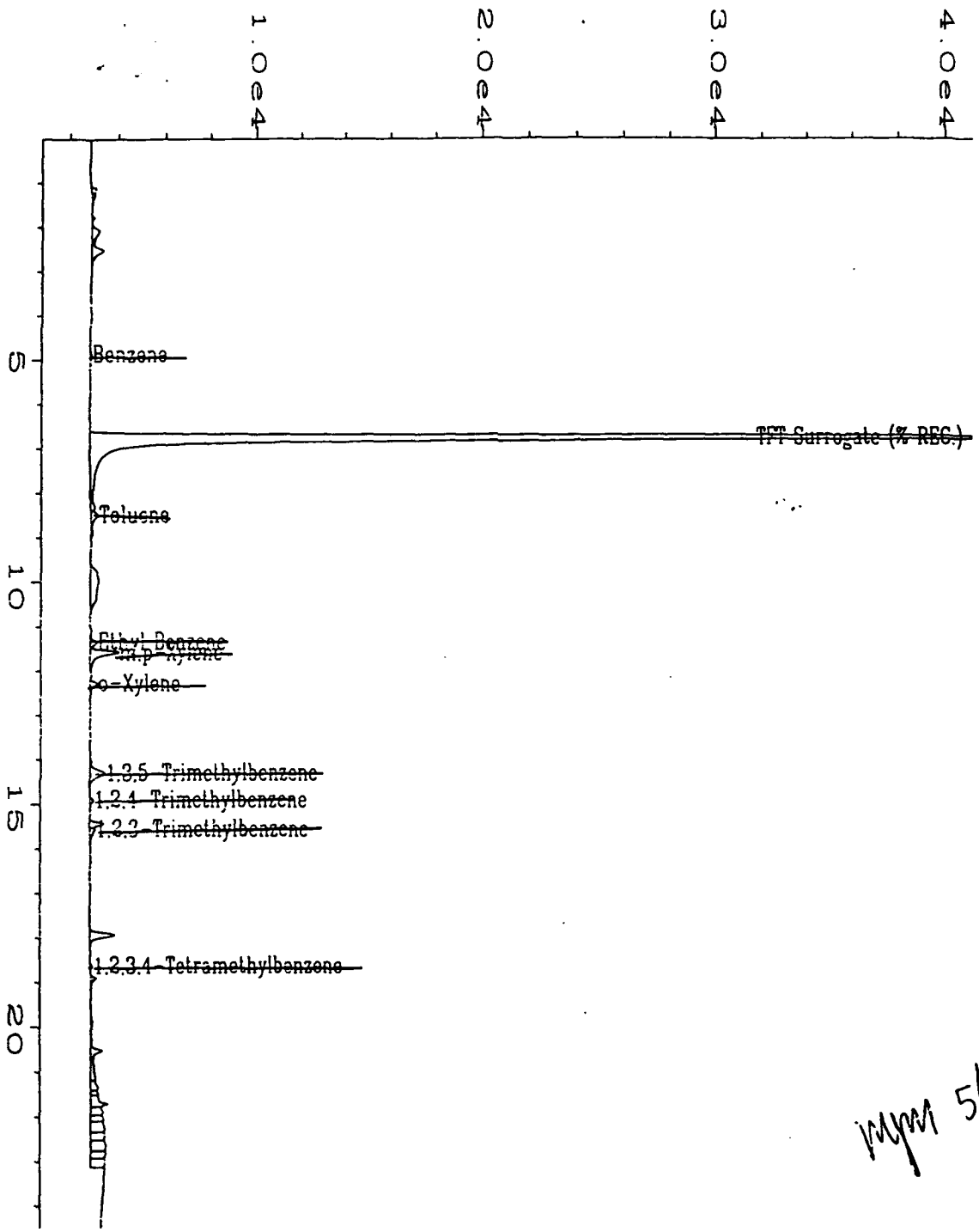
Surrogate Recovery (α,α,α-Trifluorotoluene):	93%	70%-130% (QC limits)

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene RL is for a single peak.

QUALIFIERS:
E = Extrapolated value.
U = Compound analyzed for, but not detected.
B = Compound also found in the blank.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit (RL).
RL = Reporting Limit.
NA = Not Available/Not Applicable.

Analyst

Approved



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)ata File Name	: C:\HPCHEM\2\DATA\BX20405\009R0901.D		
)perator	: SW Tyson	Page Number	: 1
nstrument	: BTEX2	Vial Number	: 9
ample Name	: MB040595	Injection Number	: 1
Time Bar Code:		Sequence Line	: 9
ired on	: 05 Apr 95 04:21 PM	Instrument Method	: BX20405.MTH
eport Created on	: 06 Apr 95 08:31 AM	Analysis Method	: BX20405.MTH
ast Recalib on	: 06 APR 95 08:23 AM	Sample Amount	: 0
ultiplier	: 1	ISTD Amount	:

EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303) 425-6021

Method 602 Data Report
Method Blank Report

Method Blank Number	: MB040695	Client Project No.	: 722450.21020/MacD
Date Prepared	: 4/6/95	Lab Project No.	: 95-0983
Date Analyzed	: 4/6/95	Dilution Factor	: 1.00
		Method	: 602/8020
		Matrix	: Water
		Lab File No.	: BX2040609

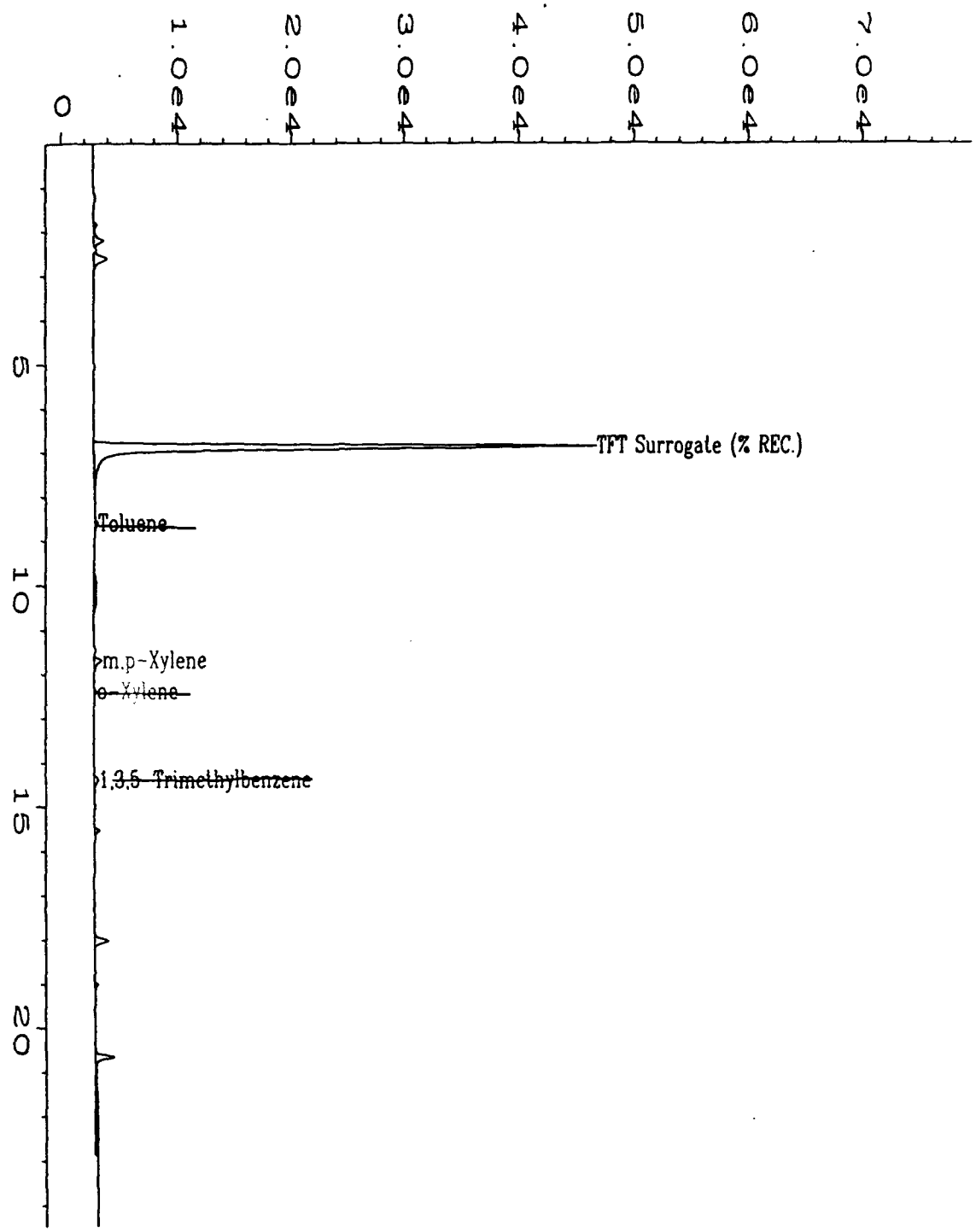
Compound Name	Cas Number	Sample Concentration ug/L		RL ug/L
Benzene	71-43-2		U	0.4
Toluene	108-88-3		U	0.4
Chlorobenzene	108-90-7		U	0.4
Ethyl Benzene	100-41-4		U	0.4
Total Xylenes (m, p & o)	108-38-3, 106-42-3 and 95-47-6	0.6		0.4
1,3,5-Trimethylbenzene	108-67-8		U	0.4
1,2,4-Trimethylbenzene	95-63-6		U	0.4
1,2,3-Trimethylbenzene	526-73-8		U	0.4
1,2,3,4-Tetramethylbenzene	488-23-3		U	0.4
Surrogate Recovery (α,α,α-Trifluorotoluene):		105%		70%-130% (QC limits

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene RL is for a single peak.

QUALIFIERS:
E = Extrapolated value.
U = Compound analyzed for, but not detected.
B = Compound also found in the blank.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit (RL).
RL = Reporting Limit.
NA = Not Available/Not Applicable.

K. Cone
Analyst

Approved



Data File Name : D:\2\DATA\BX20406\009R0801.D
Operator : C.J. Cook
Instrument : BTEX2
Sample Name : MB040695
n Time Bar Code:
..equired on : 06 Apr 95 02:47 PM
Report Created on: 30 Apr 95 08:14 PM
Last Recalib on : 30 Apr 95 08:02 PM
Multiplier : 1

Page Number : 1
Vial Number : 9
Injection Number : 1
Sequence Line : 8
Instrument Method: BX20406.MTH
Analysis Method : BX20406B.MTH
Sample Amount : 0
ISTD Amount :

EVERGREEN ANALYTICAL, INC.
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(303) 425-6021

Method 602 Data Report
Method Blank Report

Method Blank Number	: MB040795	Client Project No.	: 722450.21020/MacDil
Date Prepared	: 4/7/95	Lab Project No.	: 95-0983
Date Analyzed	: 4/7/95	Dilution Factor	: 1.00
		Method	: 602/8020
		Matrix	: Water
		Lab File No.	: BX2040709

Compound Name	Cas Number	Sample Concentration ug/L	RL ug/L
Benzene	71-43-2	U	0.4
Toluene	108-88-3	U	0.4
Chlorobenzene	108-90-7	U	0.4
Ethyl Benzene	100-41-4	U	0.4
Total Xylenes (m, p & o)	108-38-3, 106-42-3 and 95-47-6	U	0.4
1,3,5-Trimethylbenzene	108-67-8	U	0.4
1,2,4-Trimethylbenzene	95-63-6	U	0.4
1,2,3-Trimethylbenzene	526-73-8	U	0.4
1,2,3,4-Tetramethylbenzene	488-23-3	U	0.4

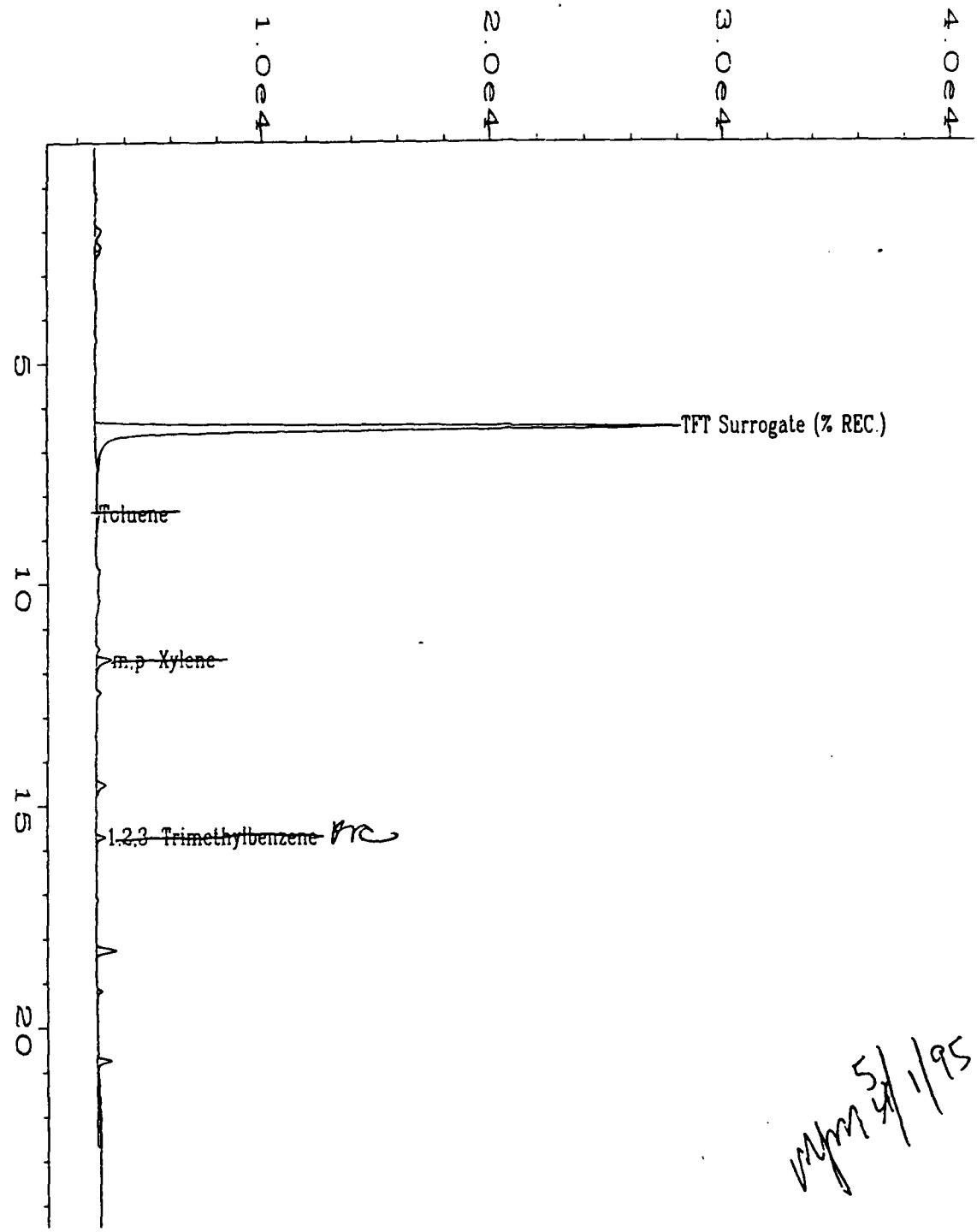
Surrogate Recovery (α,α,α-Trifluorotoluene):	96%	70%-130% (QC limits)

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene RL is for a single peak.

QUALIFIERS:
E = Extrapolated value.
U = Compound analyzed for, but not detected.
B = Compound also found in the blank.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit (RL).
RL = Reporting Limit.
NA = Not Available/Not Applicable.

Analyst

K. Cone
Approved



5/1/95

Data File Name	: C:\HPCHEM\2\DATA\BX20407\009R0901.D		
Operator	: C.J. Cook	Page Number	: 1
Instrument	: BTEX2	Vial Number	: 9
Sample Name	: MB040795	Injection Number	: 1
n Time Bar Code:		Sequence Line	: 9
quired on	: 07 Apr 95 03:26 PM	Instrument Method	: BX20407.MTH
Report Created on	: 01 May 95 00:45 AM	Analysis Method	: BX20407B.MTH
Last Recalib on	: 10 APR 95 07:26 AM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:

EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303) 425-6021

Method 602 Data Report
Method Blank Report

Method Blank Number	: MB040895	Client Project No.	: 722450.21020/MacDi
Date Prepared	: 4/8/95	Lab Project No.	: 95-0983
Date Analyzed	: 4/8/95	Dilution Factor	: 1.00
		Method	: 602/8020
		Matrix	: Water
		Lab File No.	: BX2040810

Compound Name	Cas Number	Sample Concentration ug/L	RL ug/L
Benzene	71-43-2	U	0.4
Toluene	108-88-3	U	0.4
Chlorobenzene	108-90-7	U	0.4
Ethyl Benzene	100-41-4	U	0.4
Total Xylenes (m, p & o)	108-38-3, 106-42-3 and 95-47-6	U	0.4
1,3,5-Trimethylbenzene	108-67-8	U	0.4
1,2,4-Trimethylbenzene	95-63-6	U	0.4
1,2,3-Trimethylbenzene	526-73-8	U	0.4
1,2,3,4-Tetramethylbenzene	488-23-3	U	0.4

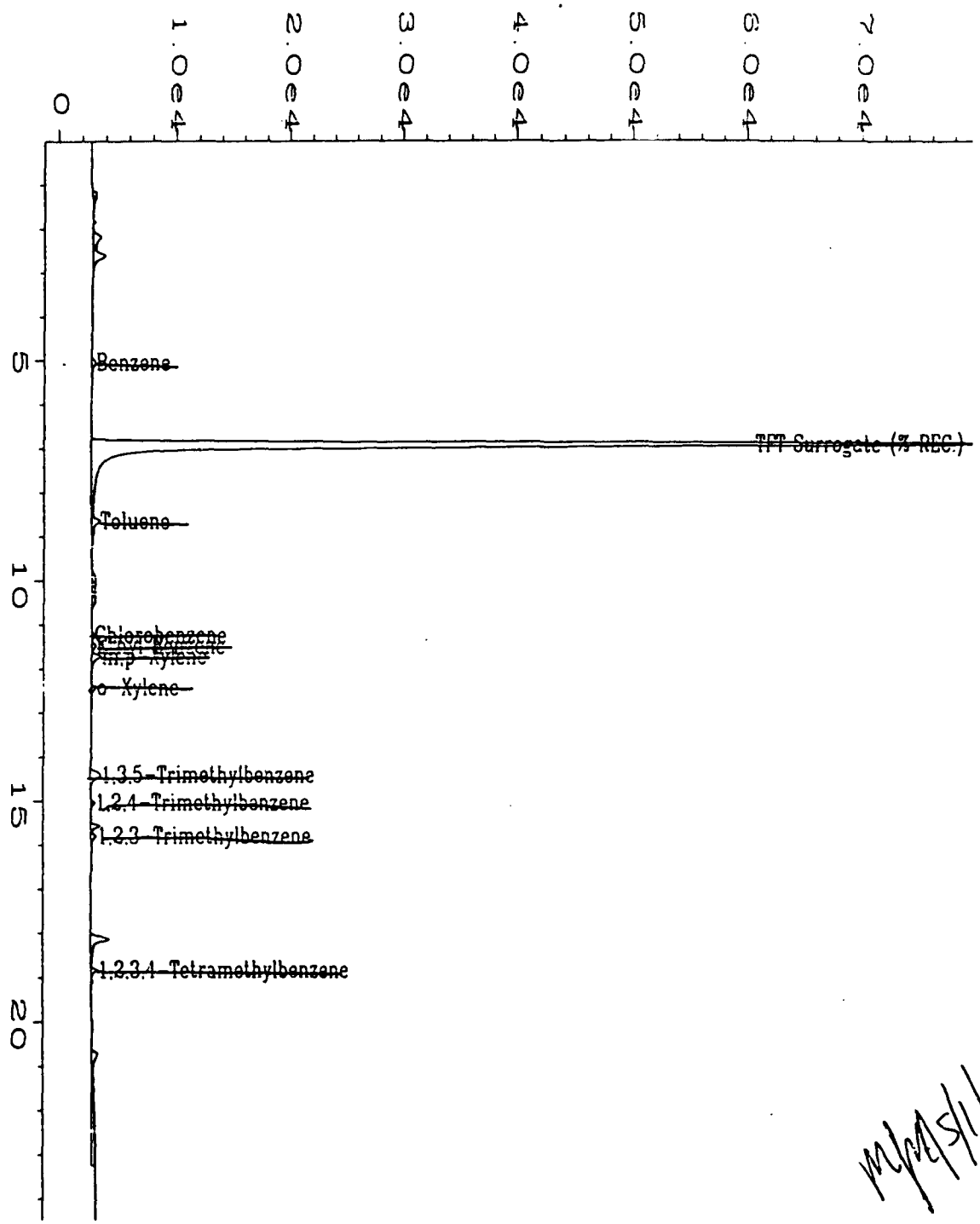
Surrogate Recovery (α,α,α-Trifluorotoluene):	104%	70%-130% (QC limits

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene RL is for a single peak.

QUALIFIERS:
E = Extrapolated value.
U = Compound analyzed for, but not detected.
B = Compound also found in the blank.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit (RL).
RL = Reporting Limit.
NA = Not Available/Not Applicable.

Analyst

K. Cone
Approved



4/9/95

Data File Name	: C:\HPCHEM\2\DATA\BX20408\010R0901.D		
Operator	: S.W. Tyson	Page Number	: 1
Instrument	: BTEX2	Vial Number	: 10
Sample Name	: MB040895	Injection Number	: 1
P Time Bar Code:		Sequence Line	: 9
A ired on	: 08 Apr 95 04:07 PM	Instrument Method	: BX20408.MTH
Report Created on	: 09 Apr 95 02:24 PM	Analysis Method	: BX20408.MTH
Last Recalib on	: 09 Apr 95 02:21 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:

EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303) 425-6021

Method 602 Data Report

Client Sample Number	: Trip Blank	**Client Project No.**	: 722450.21020/MacDi
Lab Sample Number	: X04870	**Lab Project No.**	: 95-0983
Date Sampled	: NA	**Dilution Factor**	: 1.00
Date Received	: 3/28/95	**Method**	: 602
Date Prepared	: 4/7/95	**Matrix**	: Water
Date Analyzed	: 4/8/95	**Lab File No.**	: BX2040725
		Method Blank No.	: MB040795

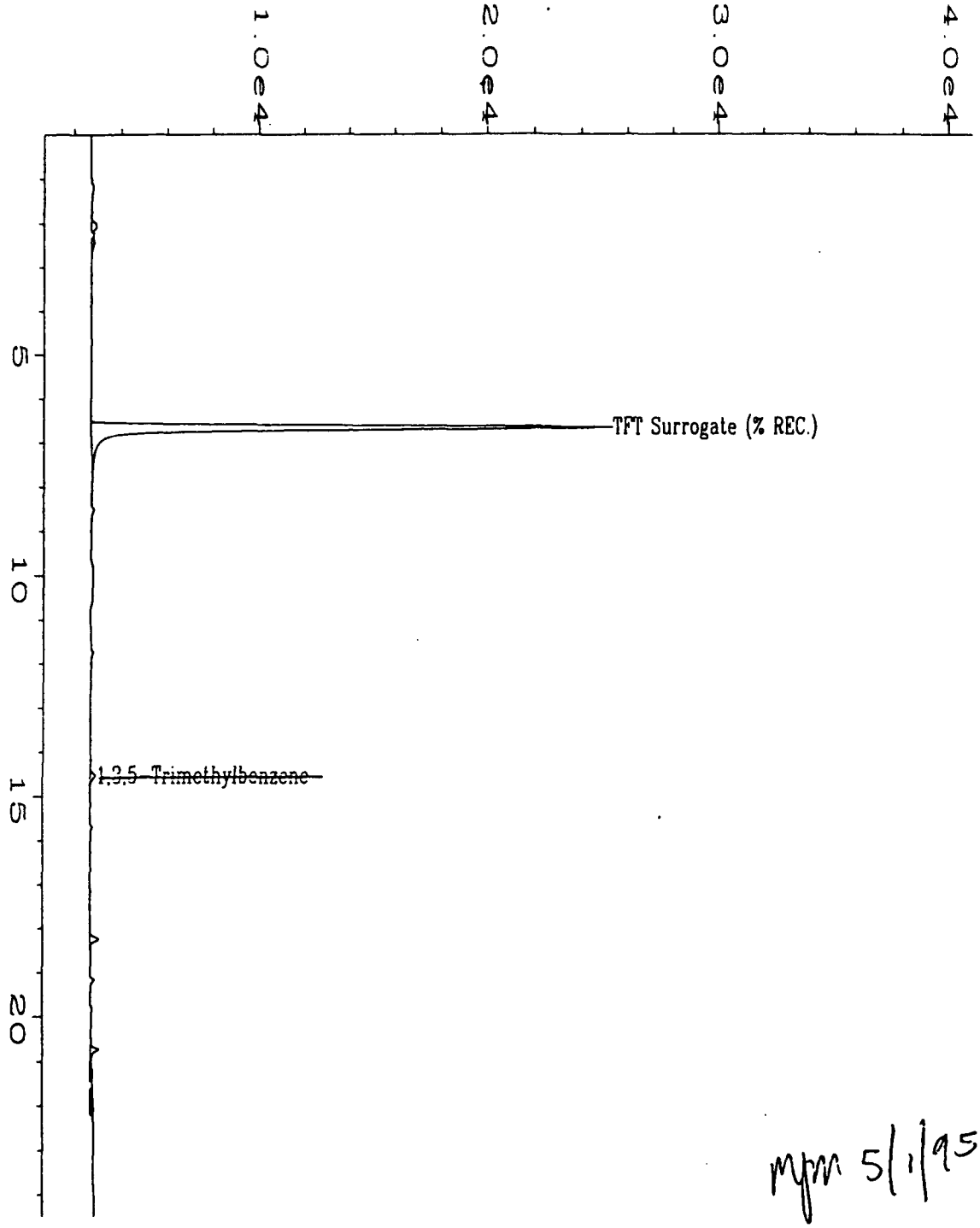
Compound Name	Cas Number	Sample Concentration ug/L		RL ug/L
Benzene	71-43-2	U		0.4
Toluene	108-88-3	U		0.4
Chlorobenzene	108-90-7	U		0.4
Ethyl Benzene	100-41-4	U		0.4
Total Xylenes (m, p & o)	108-38-3, 106-42-3 and 95-47-6	U		0.4
1,3,5-Trimethylbenzene	108-67-8	U		0.4
1,2,4-Trimethylbenzene	95-63-6	U		0.4
1,2,3-Trimethylbenzene	526-73-8	U		0.4
1,2,3,4-Tetramethylbenzene	488-23-3	U		0.4
Surrogate Recovery (α,α,α-Trifluorotoluene):		79%		70%-130% (QC limits)

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene RL is for a single peak.

QUALIFIERS:
E = Extrapolated value.
U = Compound analyzed for, but not detected.
B = Compound also found in the blank.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit (RL).
RL = Reporting Limit.
NA = Not Available/Not Applicable.

K. Cone
Analyst

Approved



mpm 5/1/95

Data File Name	: C:\HPCHEM\2\DATA\BX20407\025R0901.D		
Operator	: C.J. Cook	Page Number	: 1
Instrument	: BTEX2	Vial Number	: 25
Sample Name	: X04870;1;5	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 9
uired on	: 08 Apr 95 02:19 AM	Instrument Method	: BX20407.MTH
port Created on	: 01 May 95 00:53 AM	Analysis Method	: BX20407B.MTH
Last Recalib on	: 10 APR 95 07:26 AM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:
Sample Info	: Project#: 95-0983 Client#: Trip Blank Water		

EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303) 425-6021

BTEX Data Report
Laboratory Control Sample (LCS)

LCS Number	: LCS040595	Dilution Factor	: 1.00
Date Extracted/Prepared	: 4/5/95	Method	: 602
Date Analyzed	: 4/5/95	Matrix	: Water
Spike Amount (ug/L)	: 20.0	Lab File No.	: BX2040510

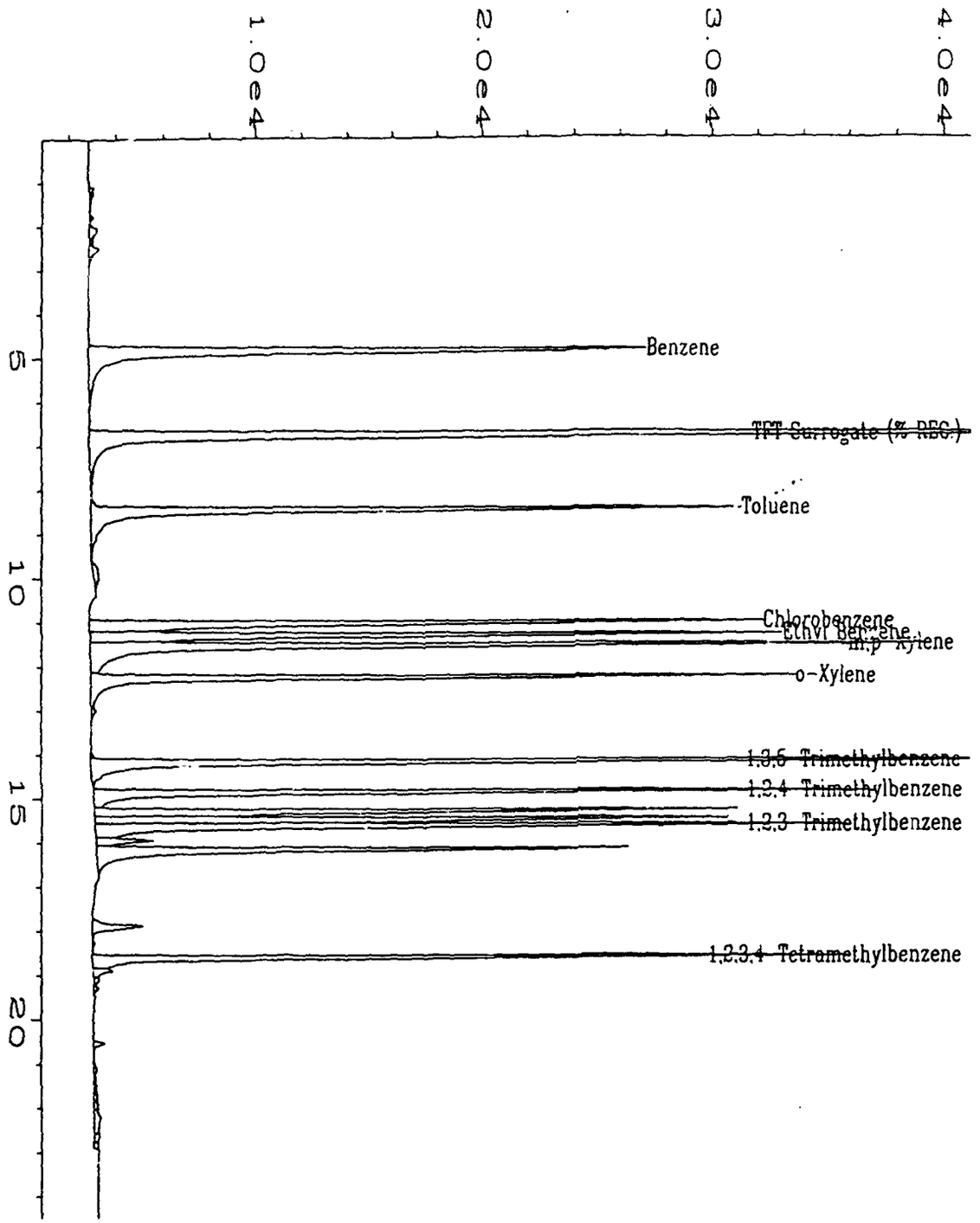
Compound Name	Cas Number	LCS Concentration ug/L	LCS % Recovery	QC Limit % Recovery
Benzene	71-43-2	15.8	79.0	71.0-119.0*
Toluene	108-88-3	16.2	81.0	73.0-111.0*
Chlorobenzene	108-90-7	16.3	81.5	64.0-119.0*
Ethyl Benzene	100-41-4	16.6	83.0	75.0-114.0*
m,p-Xylene	108-38-3 106-42-3	17.6	88.0	75.0-114.0*
o-Xylene	95-47-6	16.7	83.5	64.0-1
1,3,5-Trimethylbenzene	108-67-8	16.9	84.5	50.0-150.0
1,2,4-Trimethylbenzene	95-63-6	17.4	87.0	50.0-150.0
1,2,3-Trimethylbenzene	526-73-8	20.1	100.5	50.0-150.0
1,2,3,4-Tetramethylbenzene	488-23-3	17.9	89.5	50.0-150.0
Surrogate Recovery (α,α,α-Trifluorotoluene):		93%	70%-130% (QC limits)	

* = Limits established 4/3/95 KSC

QUALIFIERS:
E = Extrapolated value
U = Compound analyzed for, but not detected.
B = Compound found in blank and sample. Compare blank and sample data.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit (RL).
NA = Not available/Not analyzed.

K. Cone
Analyst

Approved



ta File Name	: C:\HPCHEM\2\DATA\BX20405\010R0901.D		
erator	: SW Tyson	Page Number	: 1
strument	: BTEX2	Vial Number	: 10
mple Name	: LCS040595	Injection Number	: 1
n Time Bar Code:		Sequence Line	: 9
' red on	: 05 Apr 95 05:07 PM	Instrument Method	: BX20405.MTH
t Created on	: 06 Apr 95 08:32 AM	Analysis Method	: BX20405.MTH
st Recalib on	: 06 APR 95 08:23 AM	Sample Amount	: 0
ltiplier	: 1	ISTD Amount	:

EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303) 425-6021

BTEX Data Report
Laboratory Control Sample (LCS)

LCS Number	: LCS040695	Dilution Factor	: 1.00
Date Extracted/Prepared	: 4/6/95	Method	: 602
Date Analyzed	: 4/6/95	Matrix	: Water
Spike Amount (ug/L)	: 20.0	Lab File No.	: BX2040610

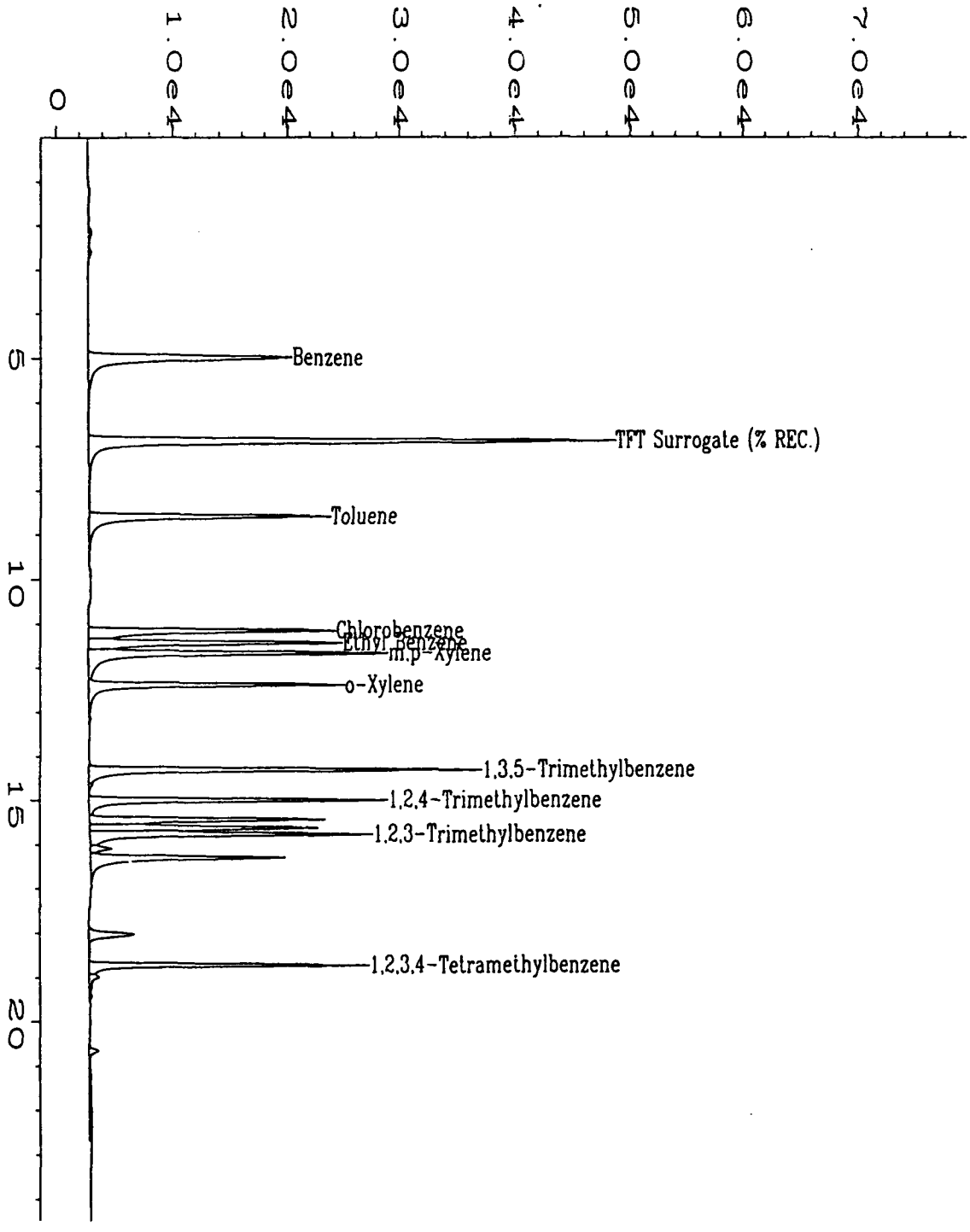
Compound Name	Cas Number	LCS Concentration ug/L	LCS % Recovery	QC Limit % Recovery
Benzene	71-43-2	16.8	84.0	71.0-119.0*
Toluene	108-88-3	16.5	82.5	73.0-111.0*
Chlorobenzene	108-90-7	17.5	87.5	64.0-119.0*
Ethyl Benzene	100-41-4	16.5	82.5	75.0-114.0*
m,p-Xylene	108-38-3	18.0	90.0	75.0-114.0*
o-Xylene	106-42-3 95-47-6	16.6	83.0	64.0-11[illegible]
1,3,5-Trimethylbenzene	108-67-8	16.0	80.0	50.0-150.0
1,2,4-Trimethylbenzene	95-63-6	17.5	87.5	50.0-150.0
1,2,3-Trimethylbenzene	526-73-8	19.8	99.0	50.0-150.0
1,2,3,4-Tetramethylbenzene	488-23-3	17.9	89.5	50.0-150.0
Surrogate Recovery (α,α,α-Trifluorotoluene):		106%	70%-130% (QC limits)	

* = Limits established 4/3/95 KSC

QUALIFIERS:
E = Extrapolated value
U = Compound analyzed for, but not detected.
B = Compound found in blank and sample. Compare blank and sample data.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit (RL).
NA = Not available/Not analyzed.

K. Cone
Analyst

Approved



Data File Name	: D:\2\DATA\BX20406\010R0801.D		
Operator	: C.J. Cook	Page Number	: 1
Instrument	: BTEX2	Vial Number	: 10
Sample Name	: LCS040695	Injection Number	: 1
In Time Bar Code:		Sequence Line	: 8
Acquired on	: 06 Apr 95 03:32 PM	Instrument Method	: BX20406.MTH
Report Created on	: 30 Apr 95 08:13 PM	Analysis Method	: BX20406B.MTH
Last Recalib on	: 30 Apr 95 08:02 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:

EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303) 425-6021

BTEX Data Report
Laboratory Control Sample (LCS)

LCS Number	: LCS040795	Dilution Factor	: 1.00
Date Extracted/Prepared	: 4/7/95	Method	: 602
Date Analyzed	: 4/7/95	Matrix	: Water
Spike Amount (ug/L)	: 20.0	Lab File No.	: BX2040710

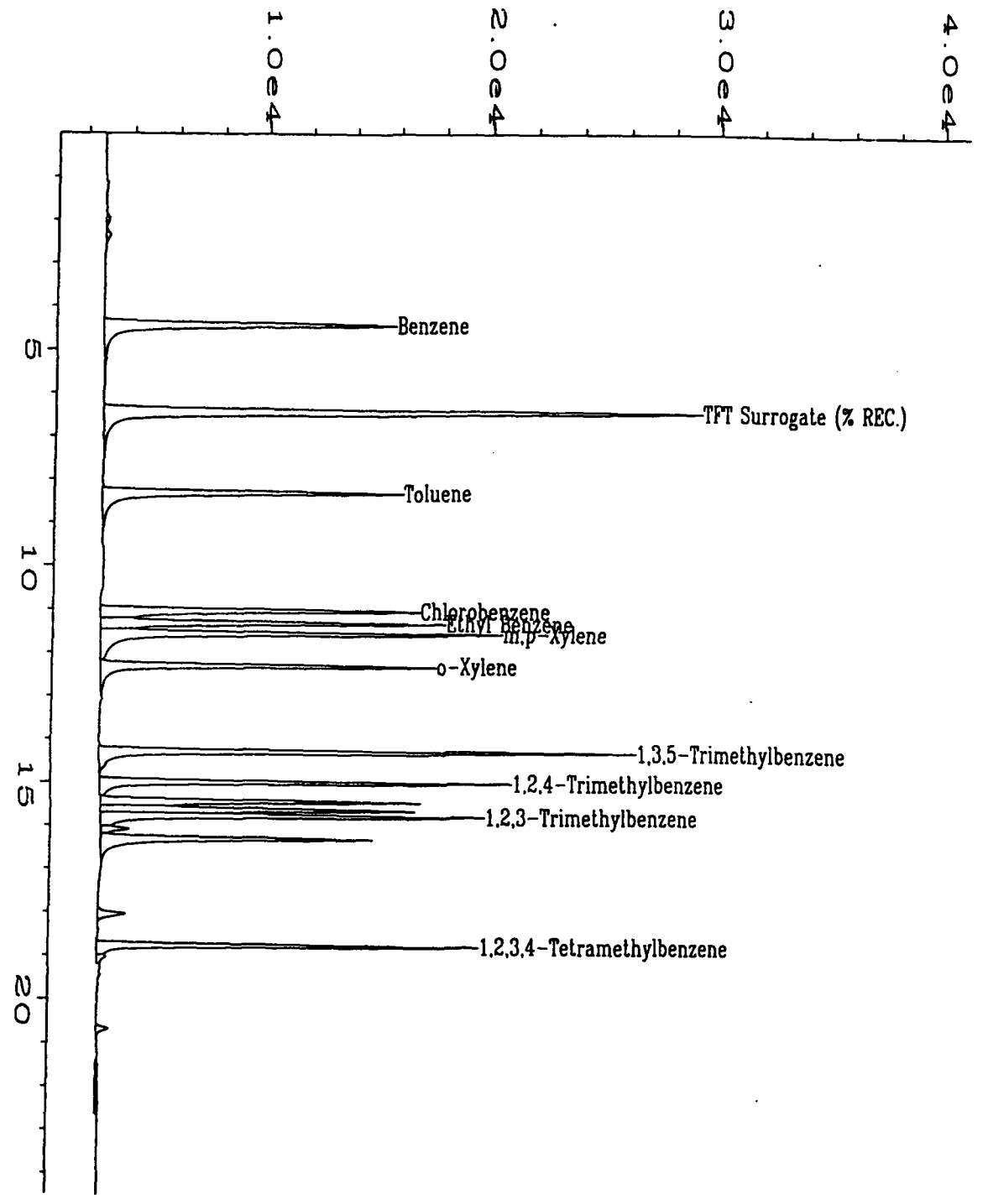
Compound Name	Cas Number	LCS Concentration ug/L	LCS % Recovery	QC Limit % Recovery
Benzene	71-43-2	16.7	83.5	71.0-119.0*
Toluene	108-88-3	16.4	82.0	73.0-111.0*
Chlorobenzene	108-90-7	18.1	90.5	64.0-119.0*
Ethyl Benzene	100-41-4	17.1	85.5	75.0-114.0*
m,p-Xylene	108-38-3	18.3	91.5	75.0-114.0*
o-Xylene	106-42-3 95-47-6	17.1	85.5	64.0-11[illegible]
1,3,5-Trimethylbenzene	108-67-8	17.8	89.0	50.0-150.0
1,2,4-Trimethylbenzene	95-63-6	17.9	89.5	50.0-150.0
1,2,3-Trimethylbenzene	526-73-8	20.8	104.0	50.0-150.0
1,2,3,4-Tetramethylbenzene	488-23-3	18.6	93.0	50.0-150.0
Surrogate Recovery (α,α,α-Trifluorotoluene):		97%	70%-130% (QC limits)	

* = Limits established 4/3/95 KSC

QUALIFIERS:
E = Extrapolated value
U = Compound analyzed for, but not detected.
B = Compound found in blank and sample. Compare blank and sample data.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit (RL).
NA = Not available/Not analyzed.

K. Cone
Analyst

Approved



Data File Name	: C:\HPCHEM\2\DATA\BX20407\010R0901.D		
Operator	: C.J. Cook	Page Number	: 1
Instrument	: BTEX2	Vial Number	: 10
Sample Name	: LCS040795	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 9
uired on	: 07 Apr 95 04:06 PM	Instrument Method	: BX20407.MTH
Report Created on	: 01 May 95 00:39 AM	Analysis Method	: BX20407B.MTH
Last Recalib on	: 10 APR 95 07:26 AM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:

EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303) 425-6021

BTEX Data Report
Laboratory Control Sample (LCS)

LCS Number	: LCS040795	Dilution Factor	: 1.00
Date Extracted/Prepared	: 4/7/95	Method	: 602
Date Analyzed	: 4/7/95	Matrix	: Water
Spike Amount (ug/L)	: 20.0	Lab File No.	: BX2040710

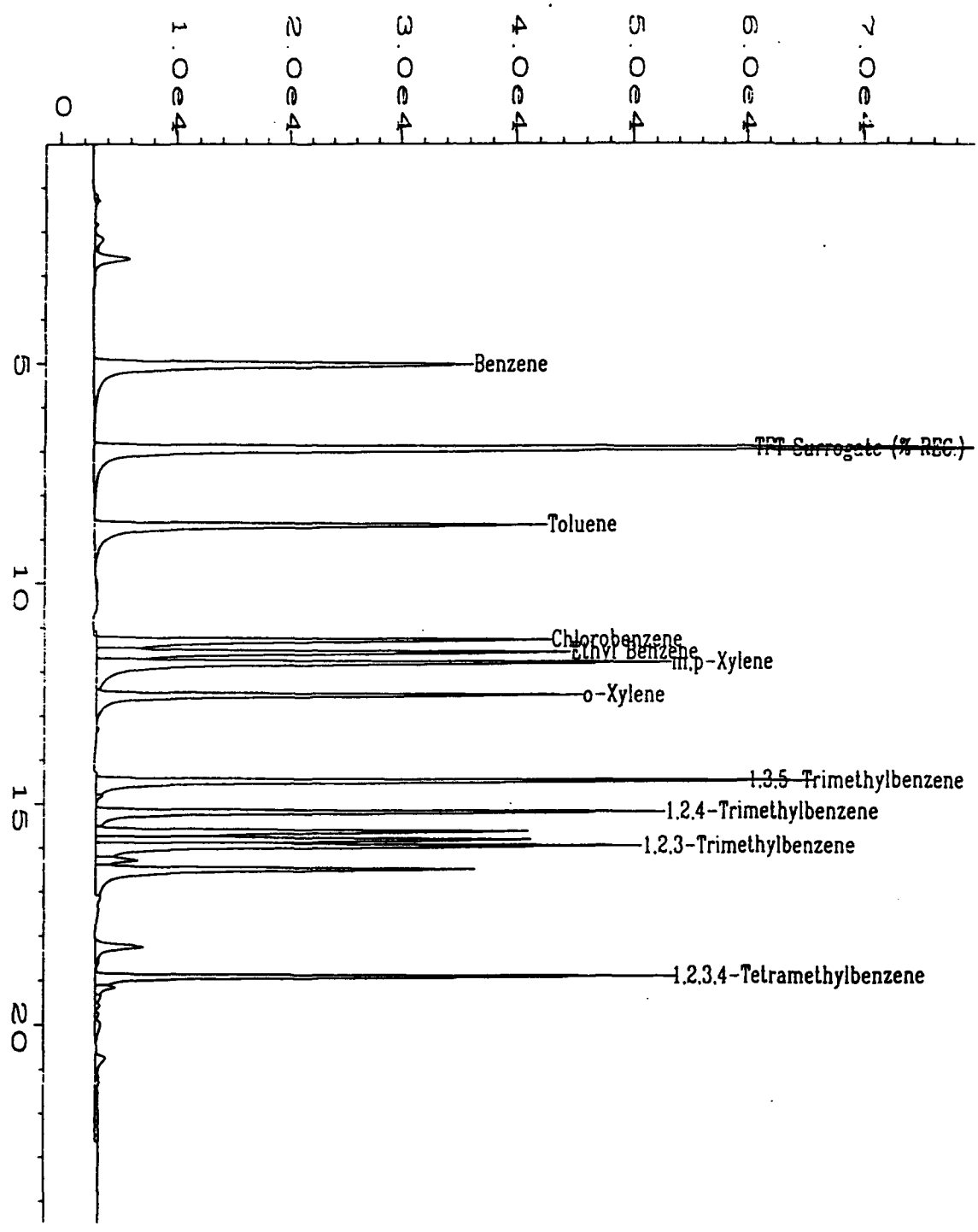
Compound Name	Cas Number	LCS Concentration ug/L	LCS % Recovery	QC Limit % Recovery
Benzene	71-43-2	16.7	83.5	71.0-119.0*
Toluene	108-88-3	16.4	82.0	73.0-111.0*
Chlorobenzene	108-90-7	18.1	90.5	64.0-119.0*
Ethyl Benzene	100-41-4	17.1	85.5	75.0-114.0*
m,p-Xylene	108-38-3 106-42-3	18.3	91.5	75.0-114.0*
o-Xylene	95-47-6	17.1	85.5	64.0-11
1,3,5-Trimethylbenzene	108-67-8	17.8	89.0	50.0-150.0
1,2,4-Trimethylbenzene	95-63-6	17.9	89.5	50.0-150.0
1,2,3-Trimethylbenzene	526-73-8	20.8	104.0	50.0-150.0
1,2,3,4-Tetramethylbenzene	488-23-3	18.6	93.0	50.0-150.0
Surrogate Recovery (α,α,α-Trifluorotoluene):		97%	70%-130% (QC limits)	

* = Limits established 4/3/95 KSC

QUALIFIERS:
E = Extrapolated value
U = Compound analyzed for, but not detected.
B = Compound found in blank and sample. Compare blank and sample data.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit (RL).
NA = Not available/Not analyzed.

K. Cone
Analyst

Approved



Data File Name	: C:\HPCHEM\2\DATA\BX20408\011R0901.D		
Operator	: S.W. Tyson	Page Number	: 1
Instrument	: BTEX2	Vial Number	: 11
Sample Name	: LCS040895	Injection Number	: 1
Time Bar Code:		Sequence Line	: 9
Acquired on	: 08 Apr 95 04:54 PM	Instrument Method	: BX20408.MTH
Report Created on	: 09 Apr 95 02:25 PM	Analysis Method	: BX20408.MTH
Last Recalib on	: 09 Apr 95 02:21 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:

EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303) 425-6021

BTEX Data Report
Laboratory Control Sample (LCS)

LCS Number	: LCS040895	Dilution Factor	: 1.00
Date Extracted/Prepared	: 4/8/95	Method	: 602
Date Analyzed	: 4/8/95	Matrix	: Water
Spike Amount (ug/L)	: 20.0	Lab File No.	: BX2040811

Compound Name	Cas Number	LCS Concentration ug/L	LCS % Recovery	QC Limit % Recovery
Benzene	71-43-2	15.9	79.5	71.0-119.0*
Toluene	108-88-3	16.4	82.0	73.0-111.0*
Chlorobenzene	108-90-7	15.9	79.5	64.0-119.0*
Ethyl Benzene	100-41-4	16.6	83.0	75.0-114.0*
m,p-Xylene	108-38-3 106-42-3	16.9	84.5	75.0-114.0*
o-Xylene	95-47-6	15.2	76.0	64.0-11
1,3,5-Trimethylbenzene	108-67-8	16.2	81.0	50.0-150.0
1,2,4-Trimethylbenzene	95-63-6	17.9	89.5	50.0-150.0
1,2,3-Trimethylbenzene	526-73-8	21.7	108.5	50.0-150.0
1,2,3,4-Tetramethylbenzene	488-23-3	17.6	88.0	50.0-150.0
Surrogate Recovery (α,α,α-Trifluorotoluene):		98%	70%-130% (QC limits)	

* = Limits established 4/3/95 KSC

QUALIFIERS:
E = Extrapolated value
U = Compound analyzed for, but not detected.
B = Compound found in blank and sample. Compare blank and sample data.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit (RL).
NA = Not available/Not analyzed.

K. Cone
Analyst

Approved

EVERGREEN ANALYTICAL, INC.
4036 Youngfield, Wheat Ridge, CO 80033
(303) 425-6021

TOTAL VOLATILE HYDROCARBONS (TVH-GASOLINE)

Date Sampled	: 3/27/95	Client Project Number	: 722450.21020
Date Received	: 3/28/95	Lab Project Number	: 95-0983
Date Prepared	: 4/10/95	Matrix	: Water
Date Analyzed	: 4/10,11/95	Method Number	: 5030/Mod.8015

Evergreen Sample #		Client Sample #	Surrogate Recovery	TVH mg/L	RL mg/L
X04861		MW56-9	90%	U	0.1
X04862		56MP-4S	99%	94E	0.5
X04862 DUP		56MP-4S	98%	93E	0.5
X04863		MW56-12	100%	U	0.1
X04864		MW56-6	99%	91E	0.5
X04865		56MP-5S	97%	8.6	0.1
X04866		56MP-5D	97%	U	0.1
X04867		56MP-15D	97%	0.2	0.1
X04867 DUP	*	56MP-15D	97%	0.3	0.1
X04868	*	MW56-10	95%	5.1	0.1
X04869	*	56MP-7D	94%	U	0.1
X04870		TRIP BLANK	95%	U	0.1

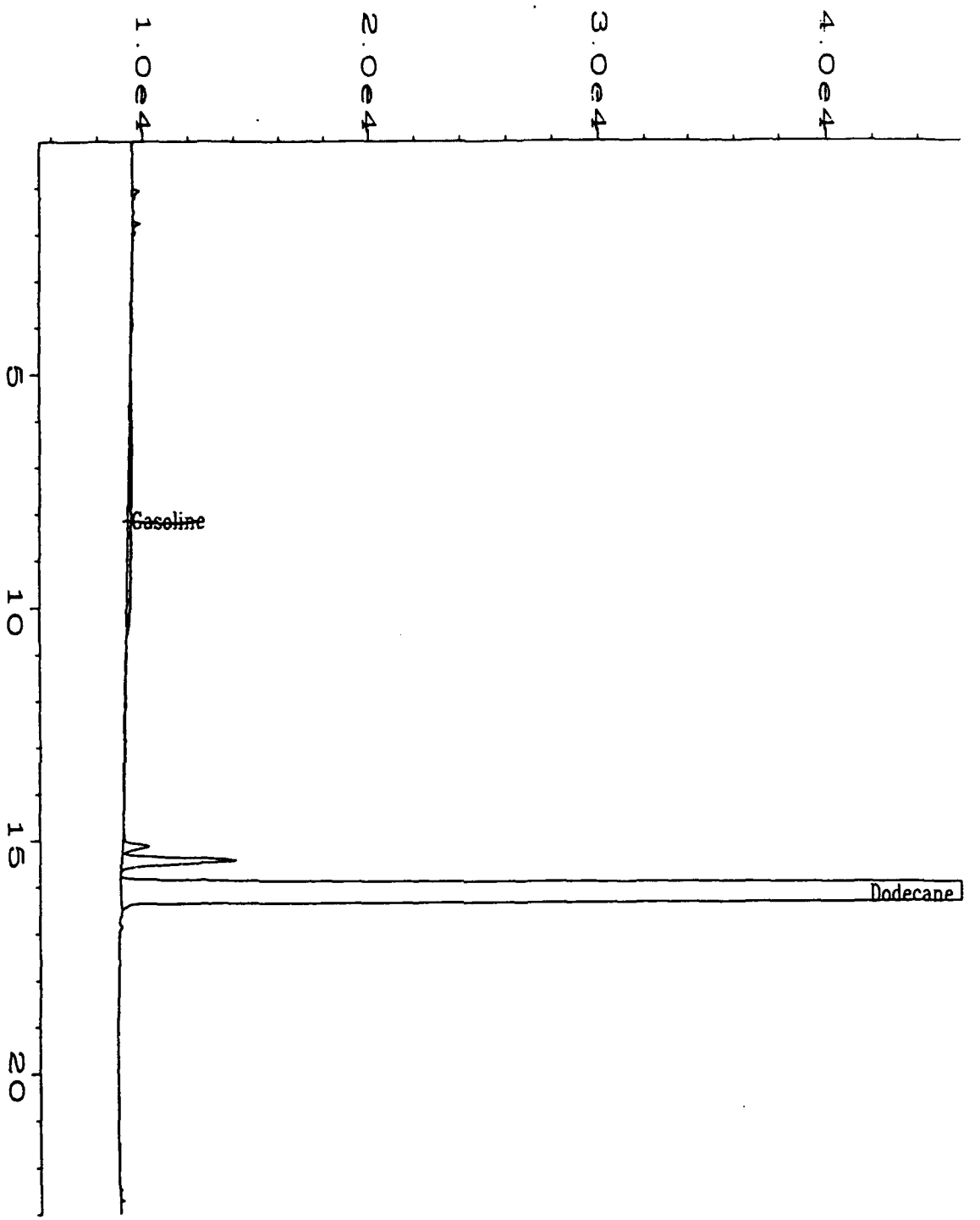
* = Sample analysis was initiated befire the holding time expired. The analyses were completed shortly after midnight.

QUALIFIERS
U = TVH analyzed for but not detected.
B = TVH found in blank.
E = Extrapolated value; Concentration exceeds that of the calibration.
RL = Reporting Limit.

Analyst

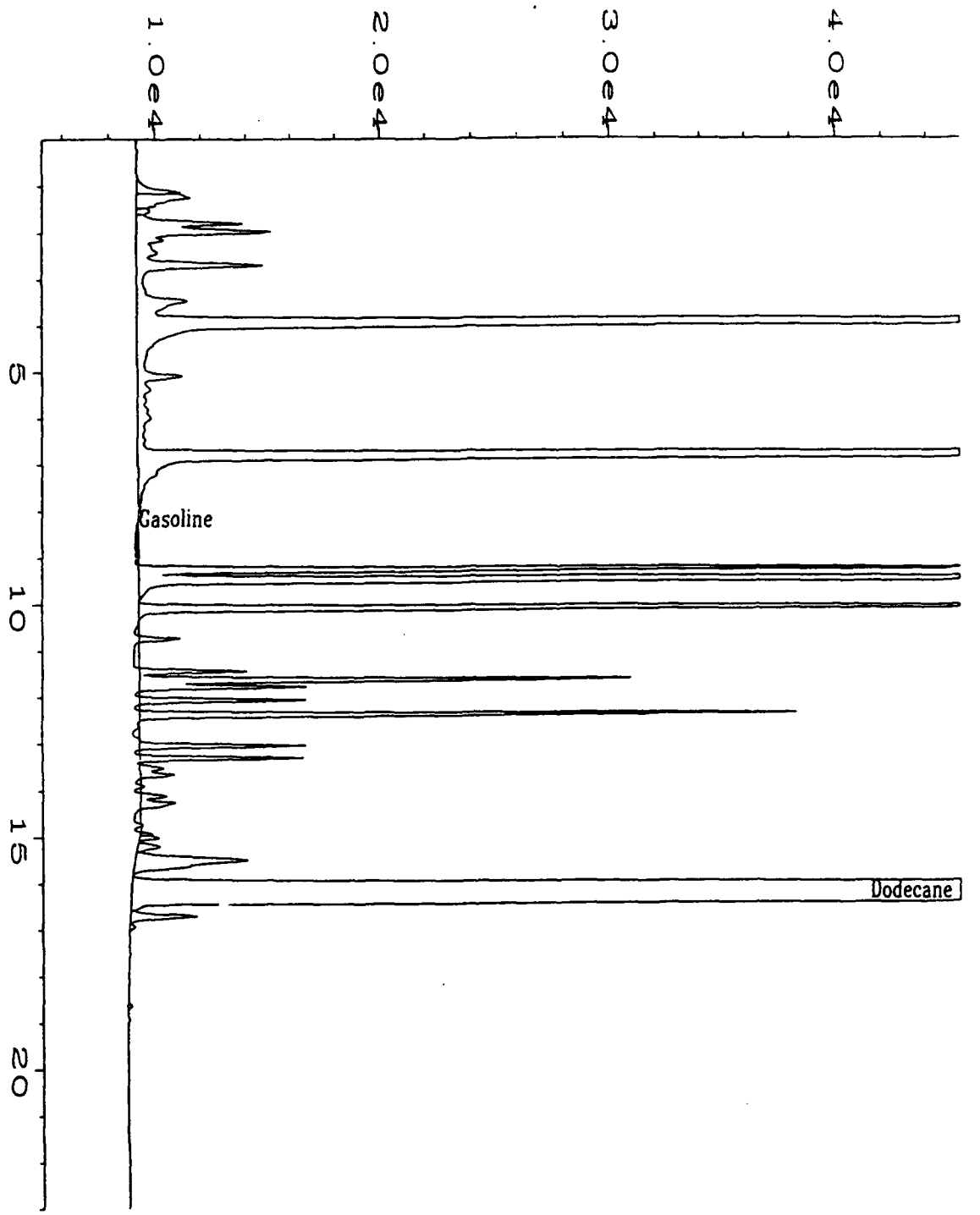
Approved

TVH0983B.XLS



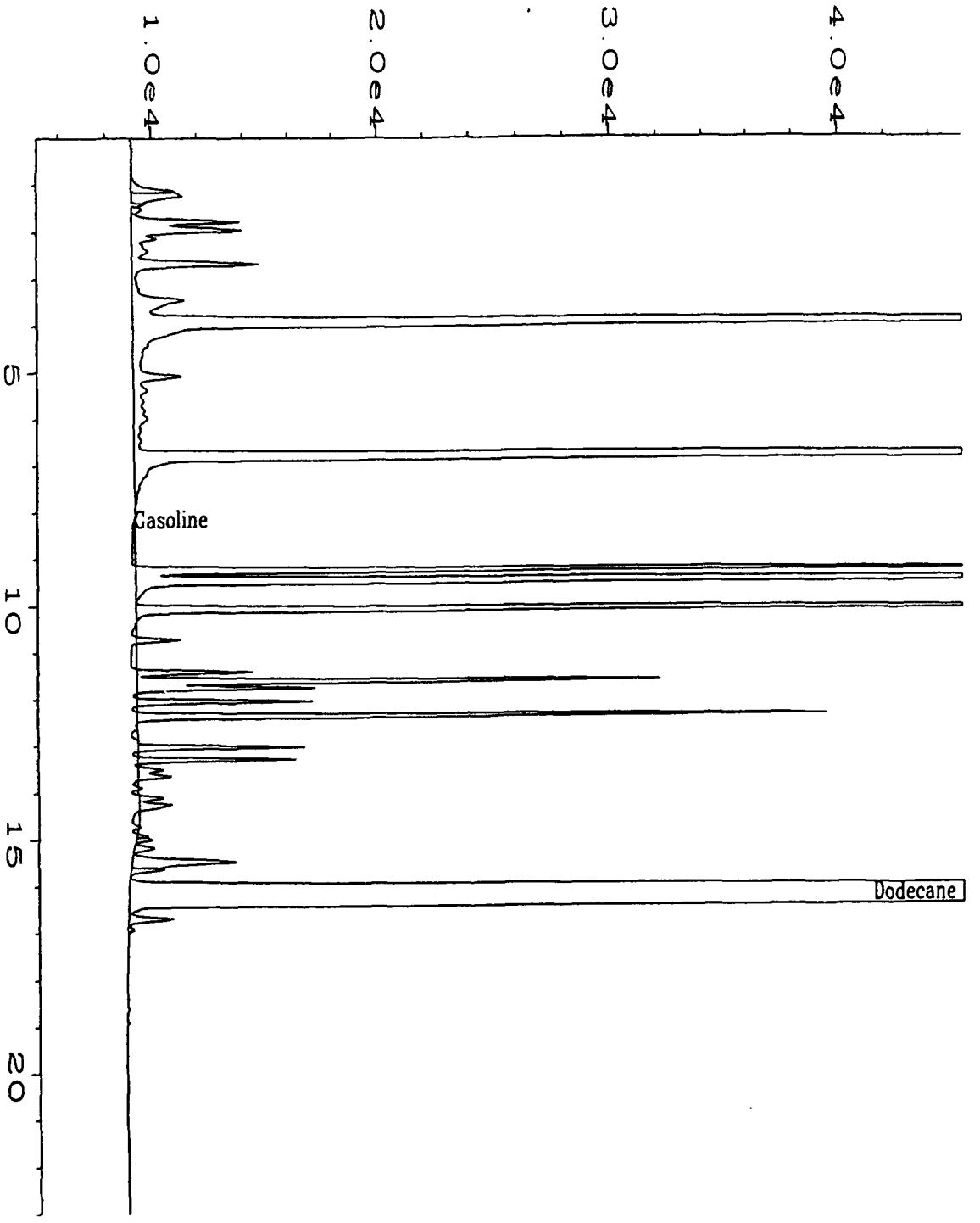
Data File Name	: C:\HPCHEM\1\DATA\tvh0410\012F0101.D		
Operator	: Dawn N. Guildner	Page Number	: 1
Instrument	: TVH	Vial Number	: 12
Sample Name	: X04861;1;5	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 1
Acquired on	: 10 Apr 95 04:16 PM	Instrument Method	: TVH1BAS...
Report Created on	: 10 Apr 95 10:45 PM	Analysis Method	: TVH0410.M...
Last Recalib on	: 10 APR 95 01:08 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:
Sample Info	: PROJECT # 95-0983 CLIENT # MW56-9 WATER		

DM 4/20/95



Data File Name	: C:\HPCHEM\1\DATA\tvh0410\015F0101.D		
Operator	: Dawn N. Guildner	Page Number	: 1
Instrument	: TVH	Vial Number	: 15
Sample Name	: X04862;5;1	Injection Number	: 1
:n Time Bar Code:		Sequence Line	: 1
:quired on	: 10 Apr 95 06:04 PM	Instrument Method	: TVH1BASE.MT
Report Created on:	10 Apr 95 10:45 PM	Analysis Method	: TVH0410.MTH
Last Recalib on	: 10 APR 95 01:08 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:

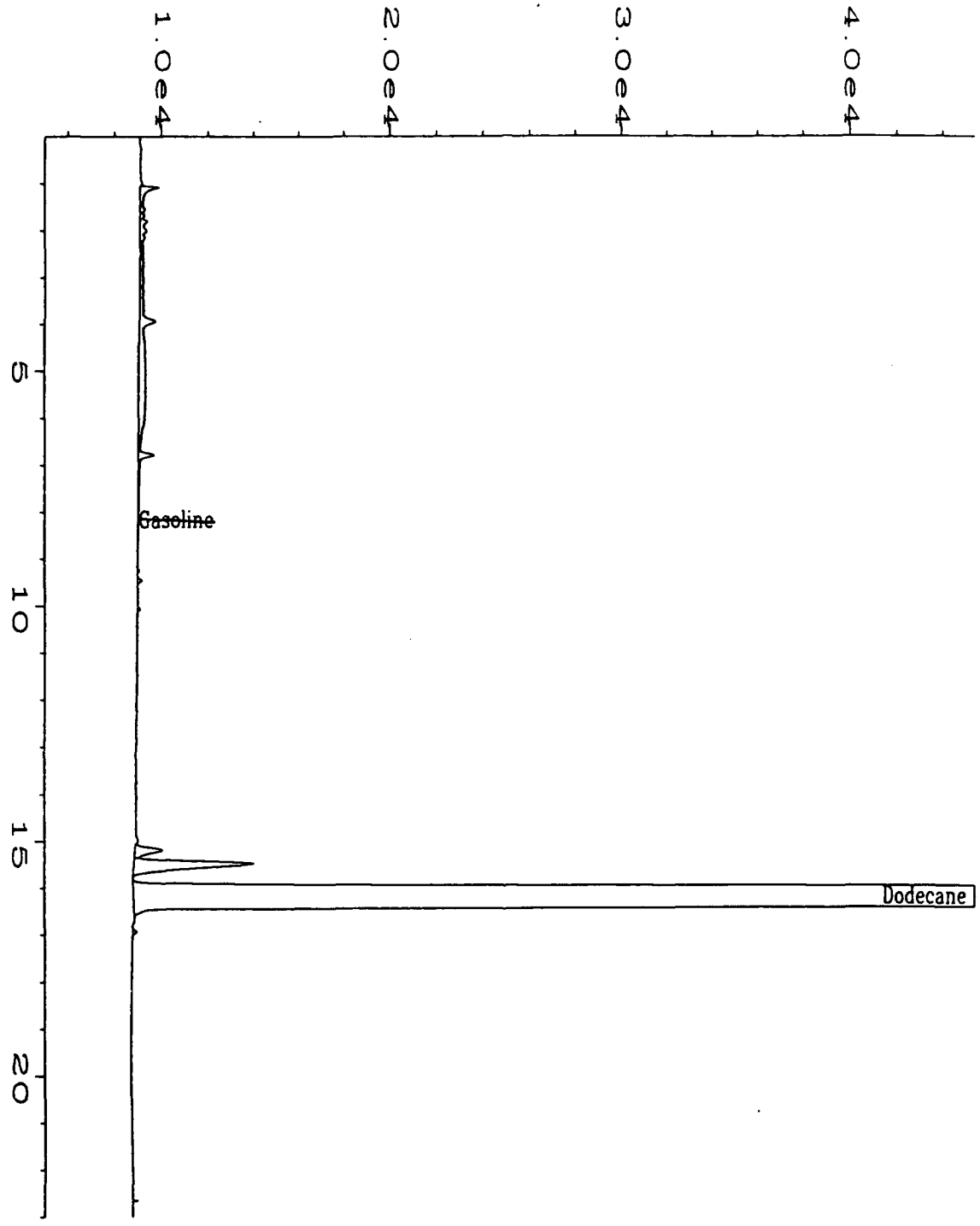
56MP-45



Data File Name : C:\HPCHEM\1\DATA\tvh0410\016F0101.D
Operator : Dawn N. Guildner
Instrument : TVH
Sample Name : X04862 DUP
Run Time Bar Code:
Acquired on : 10 Apr 95 06:40 PM
Report Created on: 10 Apr 95 10:45 PM
Last Recalib on : 10 APR 95 01:08 PM
Multiplier : 1

Page Number : 1
Vial Number : 16
Injection Number : 1
Sequence Line : 1
Instrument Method: TVH1BAS_
Analysis Method : TVH0410.MT
Sample Amount : 0
ISTD Amount :

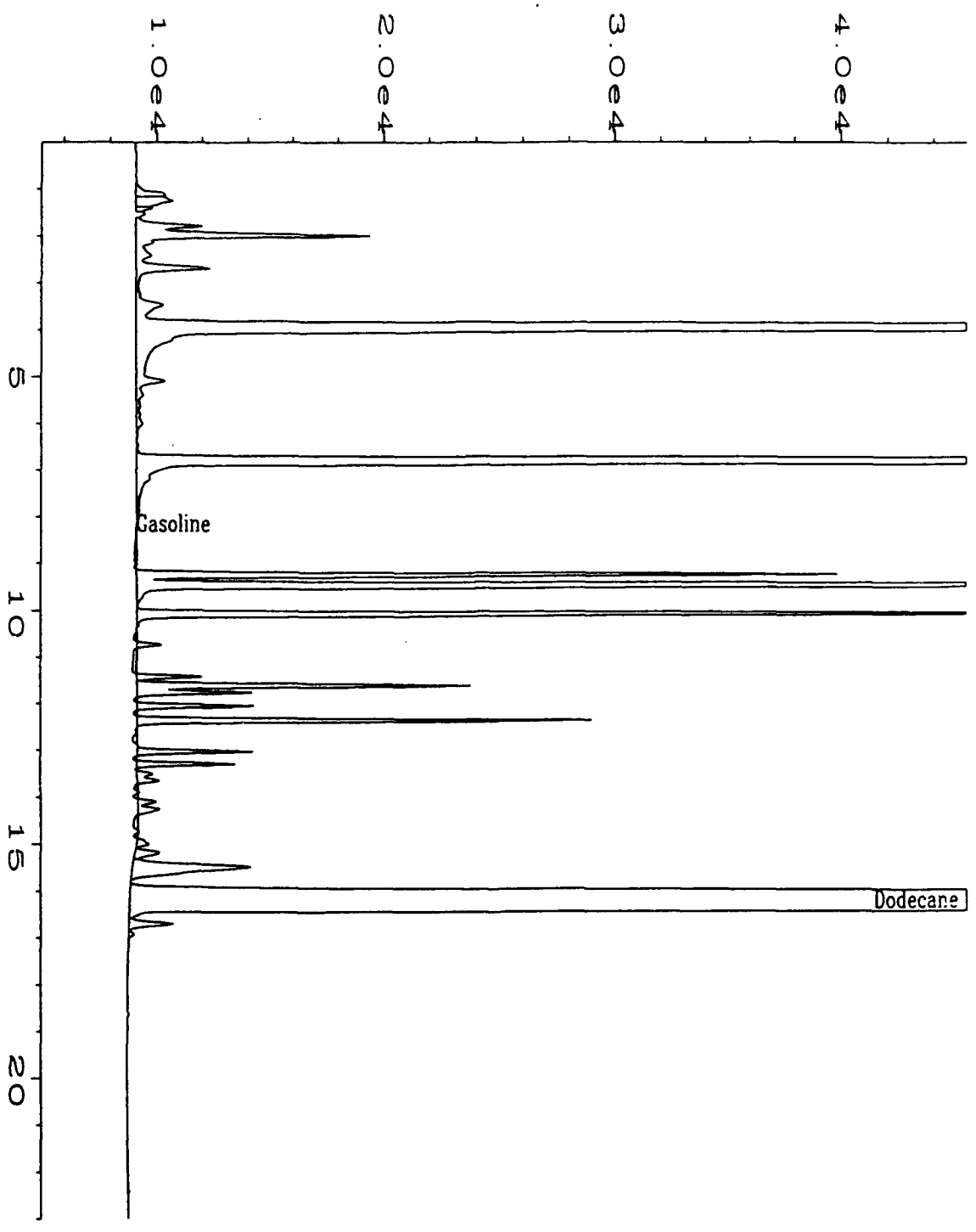
56MP-45



Data File Name	: C:\HPCHEM\1\DATA\tvh0410\018F0101.D		
Operator	: Dawn N. Guildner	Page Number	: 1
Instrument	: TVH	Vial Number	: 18
Sample Name	: X04863;1;5	Injection Number	: 1
In Time Bar Code:		Sequence Line	: 1
Acquired on	: 10 Apr 95 07:52 PM	Instrument Method	: TVH1BASE.MTH
Report Created on	: 10 Apr 95 10:46 PM	Analysis Method	: TVH0410.MTH
Last Recalib on	: 10 APR 95 01:08 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:

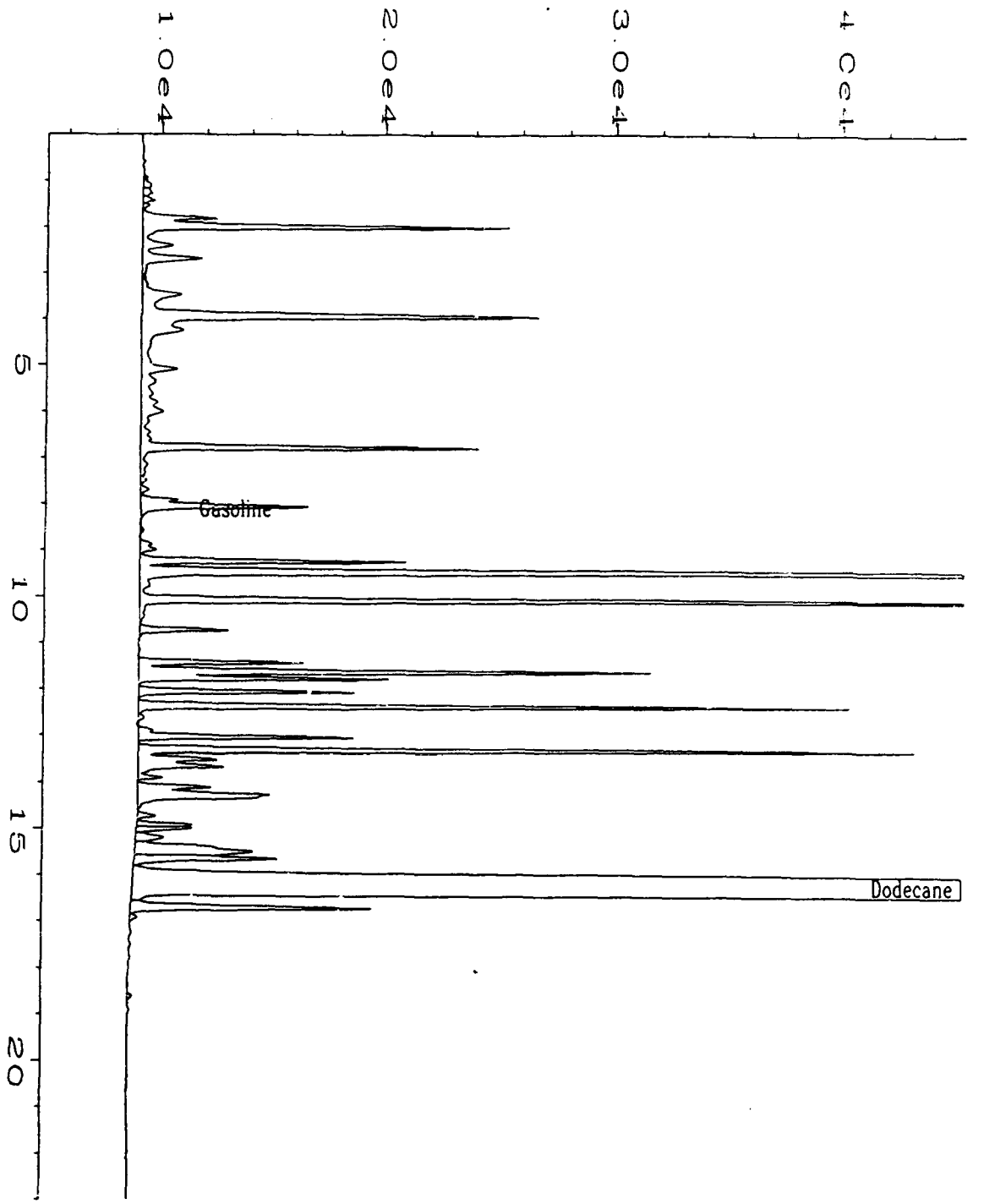
pm 4/20/95

MW56-12



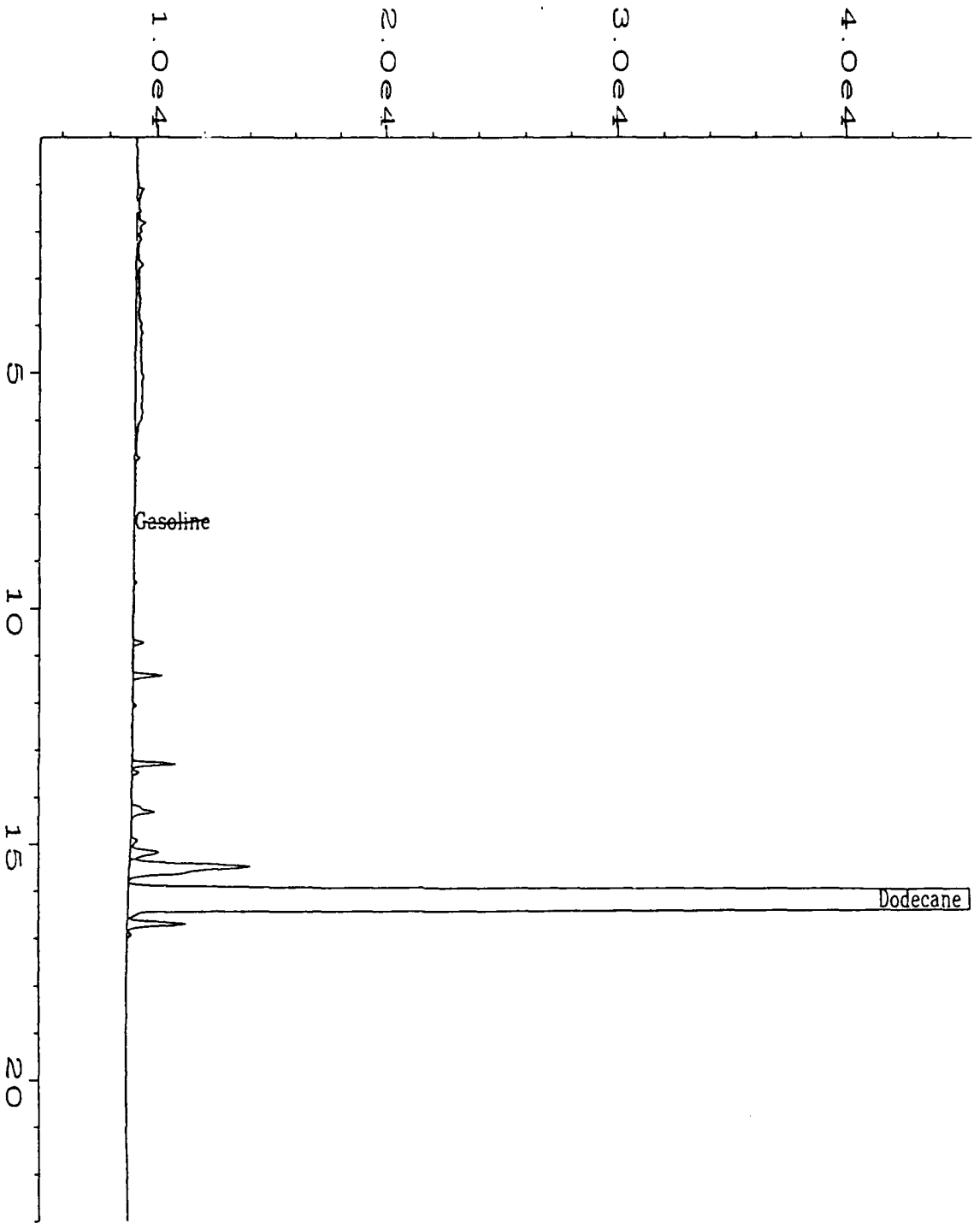
Data File Name	: C:\HPCHEM\1\DATA\tvh0410\019F0101.D		
Operator	: Dawn N. Guildner	Page Number	: 1
Instrument	: TVH	Vial Number	: 19
Sample Name	: X04864;5;1	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 1
Acquired on	: 10 Apr 95 08:28 PM	Instrument Method	: TVH1BASE.M
Report Created on:	10 Apr 95 10:46 PM	Analysis Method	: TVH0410.MT
Last Recalib on	: 10 APR 95 01:08 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:

MW56-6



Data File Name	: F:\HPCHEM\1\DATA\TVH0410\020F0101.D		
Operator	: Dawn N. Guildner	Page Number	: 1
Instrument	: TVH	Vial Number	: 20
Sample Name	: X04865;1;5	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 1
Acquired on	: 10 Apr 95 09:04 PM	Instrument Method	: TVH1BASE.MTH
Report Created on	: 12 Apr 95 06:22 PM	Analysis Method	: TVH0410.MTH
Last Recalib on	: 10 APR 95 01:08 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:

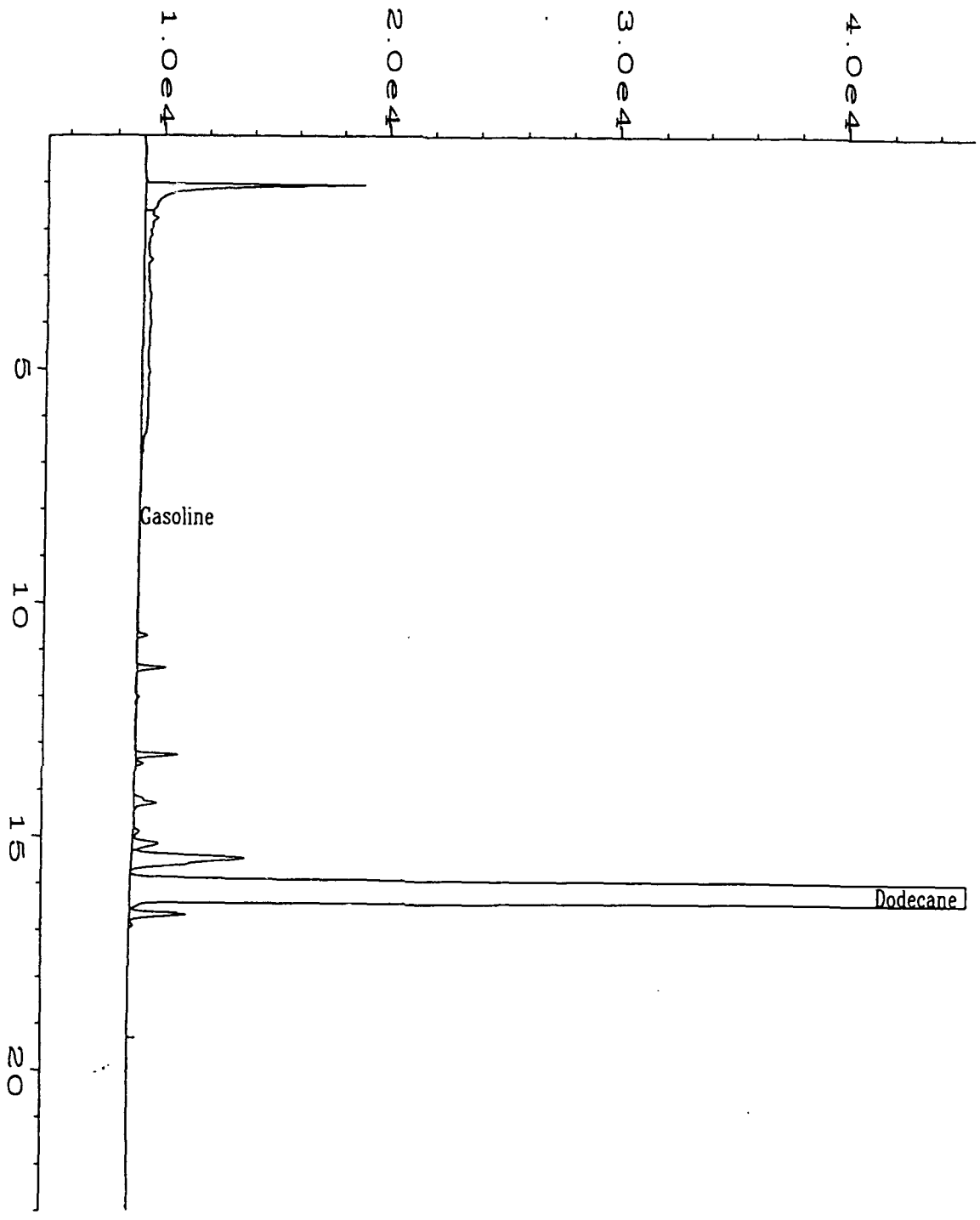
56MP-SS



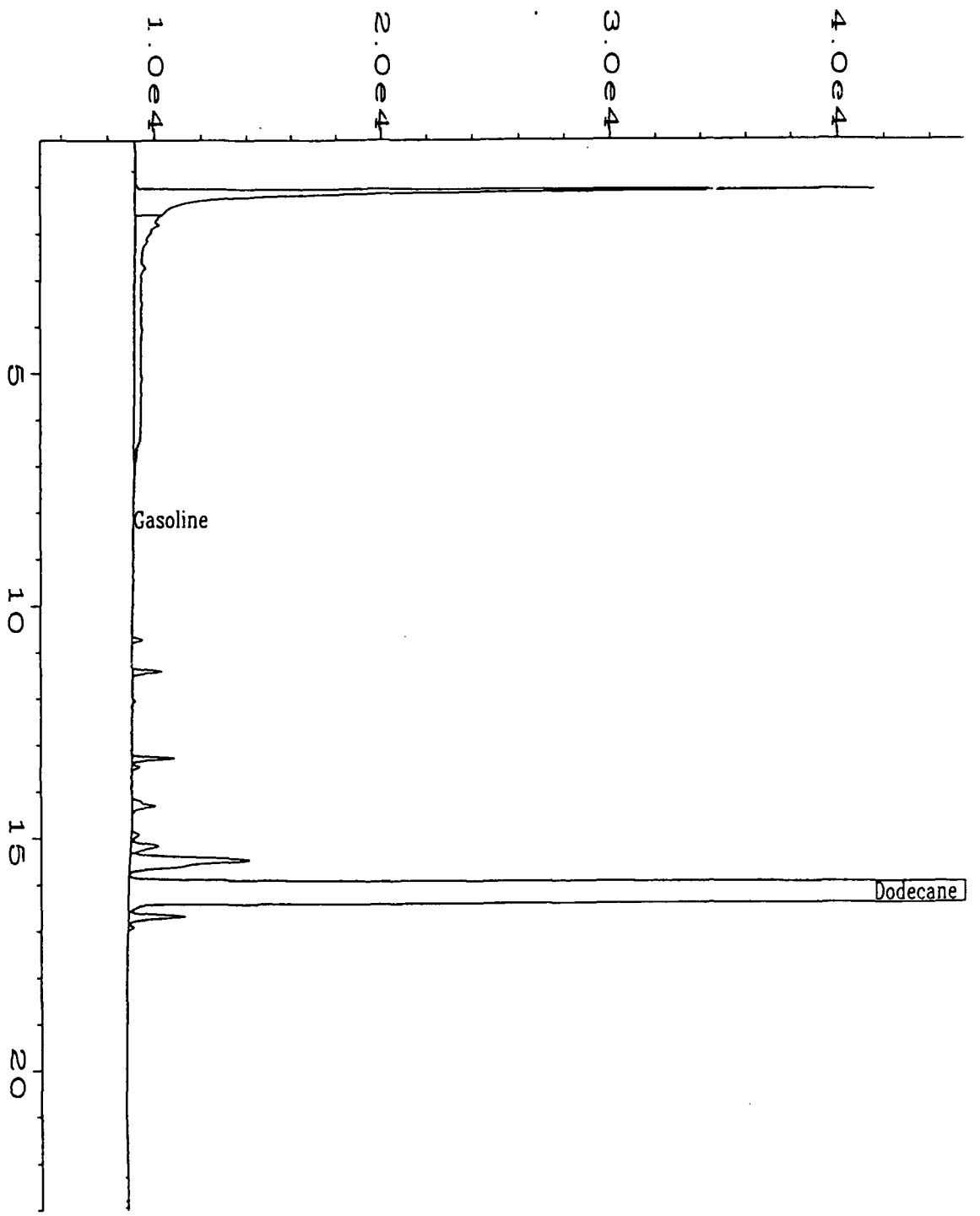
Data File Name	: C:\HPCHEM\1\DATA\tvh0410\021F0101.D		
Operator	: Dawn N. Guildner	Page Number	: 1
Instrument	: TVH	Vial Number	: 21
Sample Name	: X04866;1;5	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 1
Acquired on	: 10 Apr 95 09:40 PM	Instrument Method	: TVH1BA
Report Created on	: 10 Apr 95 10:47 PM	Analysis Method	: TVH0410.M
Last Recalib on	: 10 APR 95 01:08 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:

DM 4/26/95

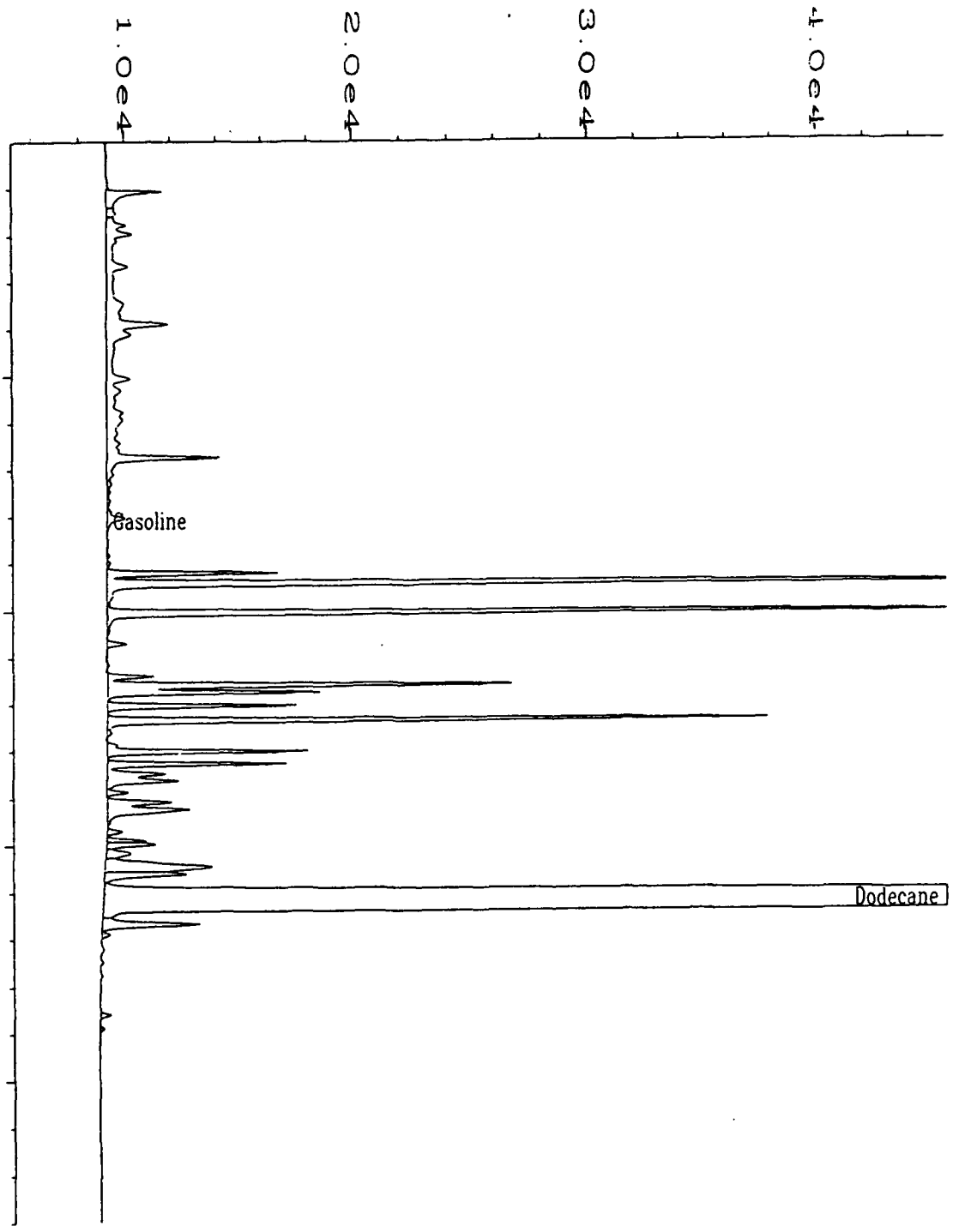
56MP-5D



Data File Name	: C:\HPCHEM\1\DATA\tvh0410\024F0101.D		
Operator	: Dawn N. Guildner	Page Number	: 1
Instrument	: TVH	Vial Number	: 24
Sample Name	: X04867;1;5	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 1
Acquired on	: 10 Apr 95 11:28 PM	Instrument Method	: TVH1BASE.MTH
Report Created on	: 11 Apr 95 10:09 AM	Analysis Method	: TVH0410.MTH
Last Recalib on	: 10 APR 95 01:08 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:
Sample Info	: PROJECT # 95-0983 CLIENT # 56MP-15D WATER		



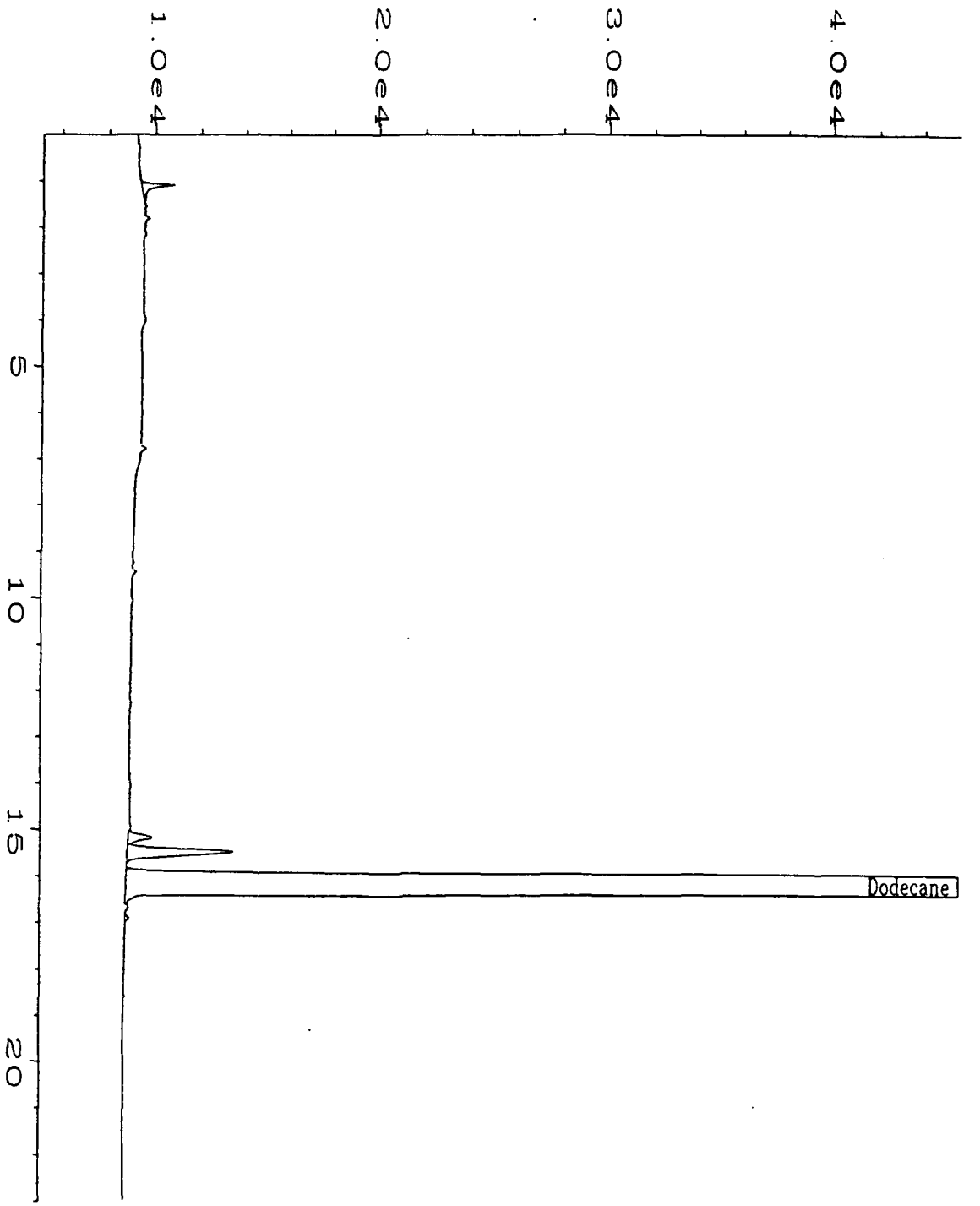
Data File Name	: C:\HPCHEM\1\DATA\tvh0410\025F0101.D		
Operator	: Dawn N. Guildner	Page Number	: 1
Instrument	: TVH	Vial Number	: 25
Sample Name	: X04867 DUP	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 1
Acquired on	: 11 Apr 95 00:04 AM	Instrument Method	: TVH1BAS...
Report Created on	: 11 Apr 95 10:09 AM	Analysis Method	: TVH0410.M...
Last Recalib on	: 10 APR 95 01:08 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:



Data File Name : F:\HPCHEM\1\DATA\TVH0410\026F0101.D
Operator : Dawn N. Guildner
Instrument : TVH
Sample Name : X04868;1;5
Bin Time Bar Code:
Acquired on : 11 Apr 95 00:40 AM
Report Created on: 12 Apr 95 06:26 PM
Last Recalib on : 10 APR 95 01:08 PM
Multiplier : 1

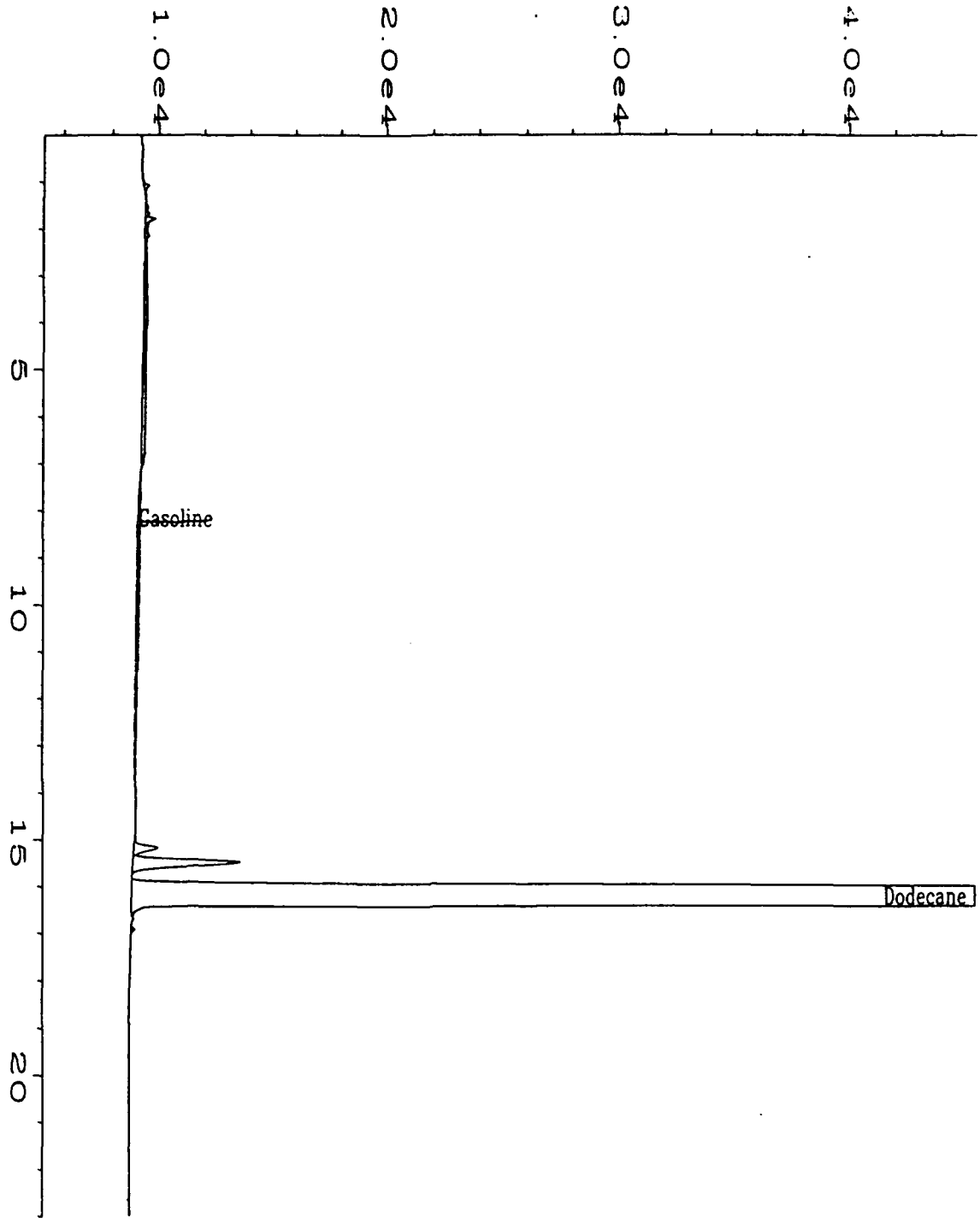
Page Number : 1
Vial Number : 26
Injection Number : 1
Sequence Line : 1
Instrument Method: TVH1BASE.MTH
Analysis Method : TVH0410.MTH
Sample Amount : 0
ISTD Amount :

MW56-10



Data File Name	: F:\HPCHEM\1\DATA\TVH0410\027F0101.D		
Operator	: Dawn N. Guildner	Page Number	: 1
Instrument	: TVH	Vial Number	: 27
Sample Name	: X04869;1;5	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 1
Acquired on	: 11 Apr 95 01:16 AM	Instrument Method	: TVH1BAS
Report Created on	: 12 Apr 95 06:28 PM	Analysis Method	: TVH0410.M
Last Recalib on	: 10 APR 95 01:08 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:

56MP-7D



Data File Name	: C:\HPCHEM\1\DATA\tvh0410\028F0101.D		
Operator	: Dawn N. Guildner	Page Number	: 1
Instrument	: TVH	Vial Number	: 28
Sample Name	: X04870;1;5	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 1
quired on	: 11 Apr 95 01:52 AM	Instrument Method	: TVH1BASE.MTH
port Created on	: 11 Apr 95 10:09 AM	Analysis Method	: TVH0410.MTH
Last Recalib on	: 10 APR 95 01:08 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:
Sample Info	: PROJECT # 95-0983 CLIENT # TRIP BLANK WATER		

fm 4/20/95

EVERGREEN ANALYTICAL, INC.
4036 Youngfield, Wheat Ridge, CO 80033
(303) 425-6021

TOTAL VOLATILE HYDROCARBONS (TVH-GASOLINE)

Date Sampled	: 3/24,26/95	Client Project Number	: 722450.21020
Date Received	: 3/28/95	Lab Project Number	: 95-0983
Date Prepared	: 4/3,7/95	Matrix	: Water
Date Analyzed	: 4/3,4,7,8/95	Method Number	: 5030/Mod.8015

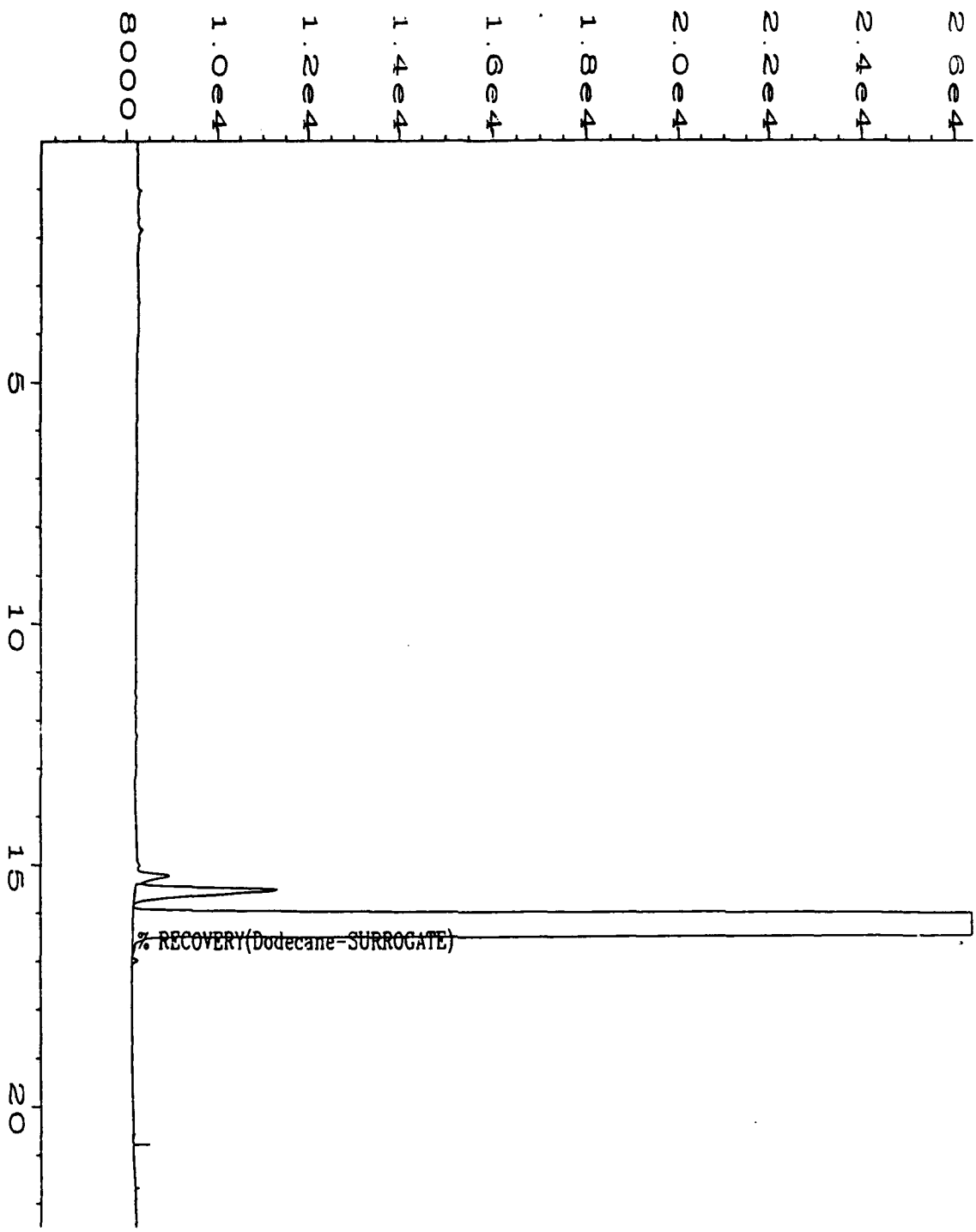
Evergreen Sample #	Client Sample #	Surrogate Recovery	TVH mg/L	RL mg/L
MB040395	METHOD BLANK	100%	U	0.1
MB040895	METHOD BLANK	100%	U	0.1
MB041095	METHOD BLANK	100%	U	0.1
X04848	24 PZ-1S	98%	0.5	0.1
X04849	24 PZ-1D	99%	U	0.1
X04850	24 MP-6S	100%	U	0.1
X04851	MD32-3	96%	U	0.1
X04852	MW56-10	101%	1.0	0.1
X04853	56MP-6D	98%	U	0.1
X04854	56MP-6S	94%	U	0.1
X04854 DUP	56MP-6S	92%	U	0.1
X04855	MW56-1	90%	U	0.1
X04856	MW56-21	92%	U	0.1
X04857	56MP-8S	97%	U	0.1
X04858	56MP-10S	96%	U	0.1
X04859	MW56-2	92%	U	0.1
X04859 DUP	MW56-2	91%	U	0.1
X04860	MW56-8	91%	0.2	0.1

QUALIFIERS
U = TVH analyzed for but not detected.
B = TVH found in blank.
E = Extrapolated value.
RL = Reporting Limit.

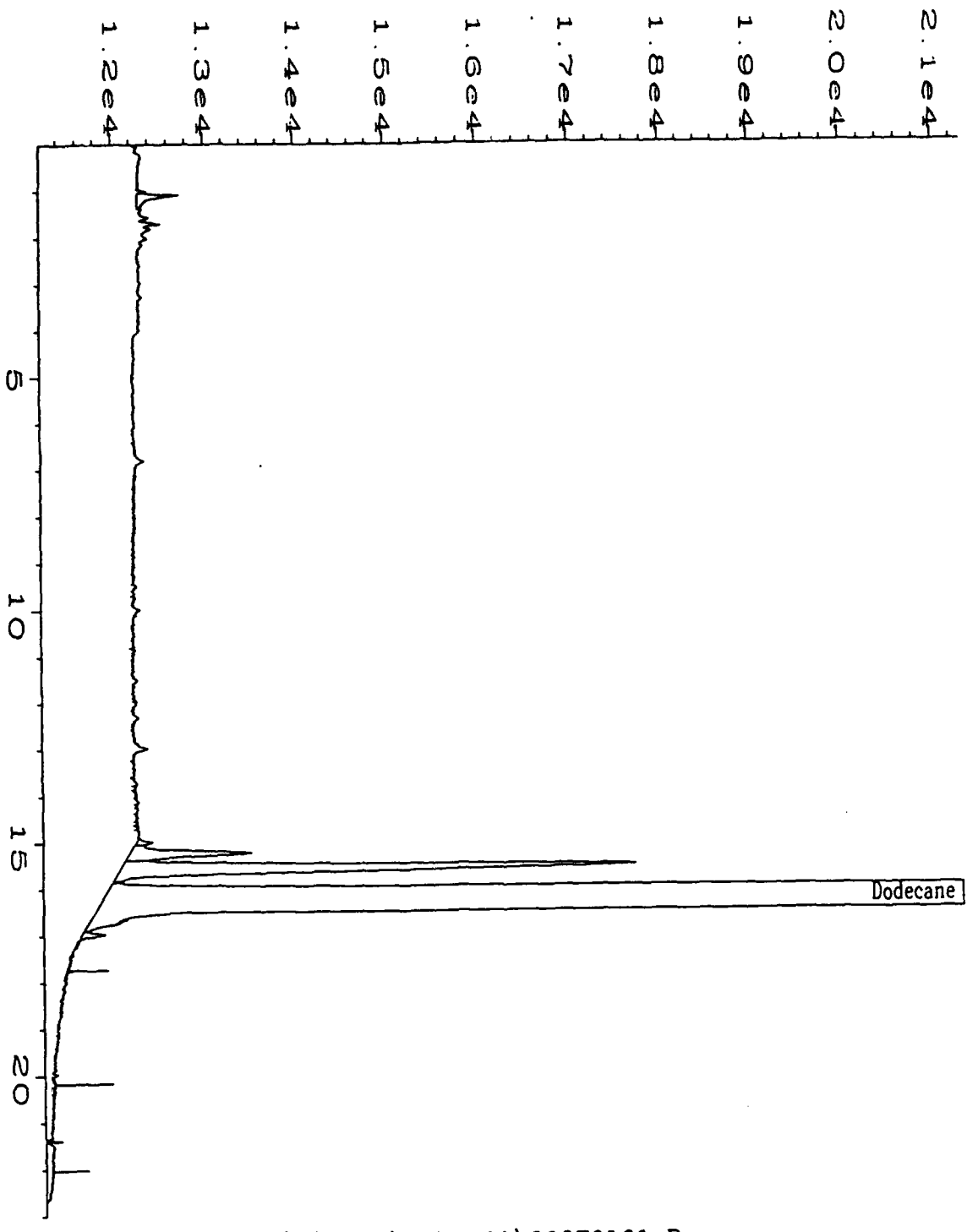
Analyst

Approved

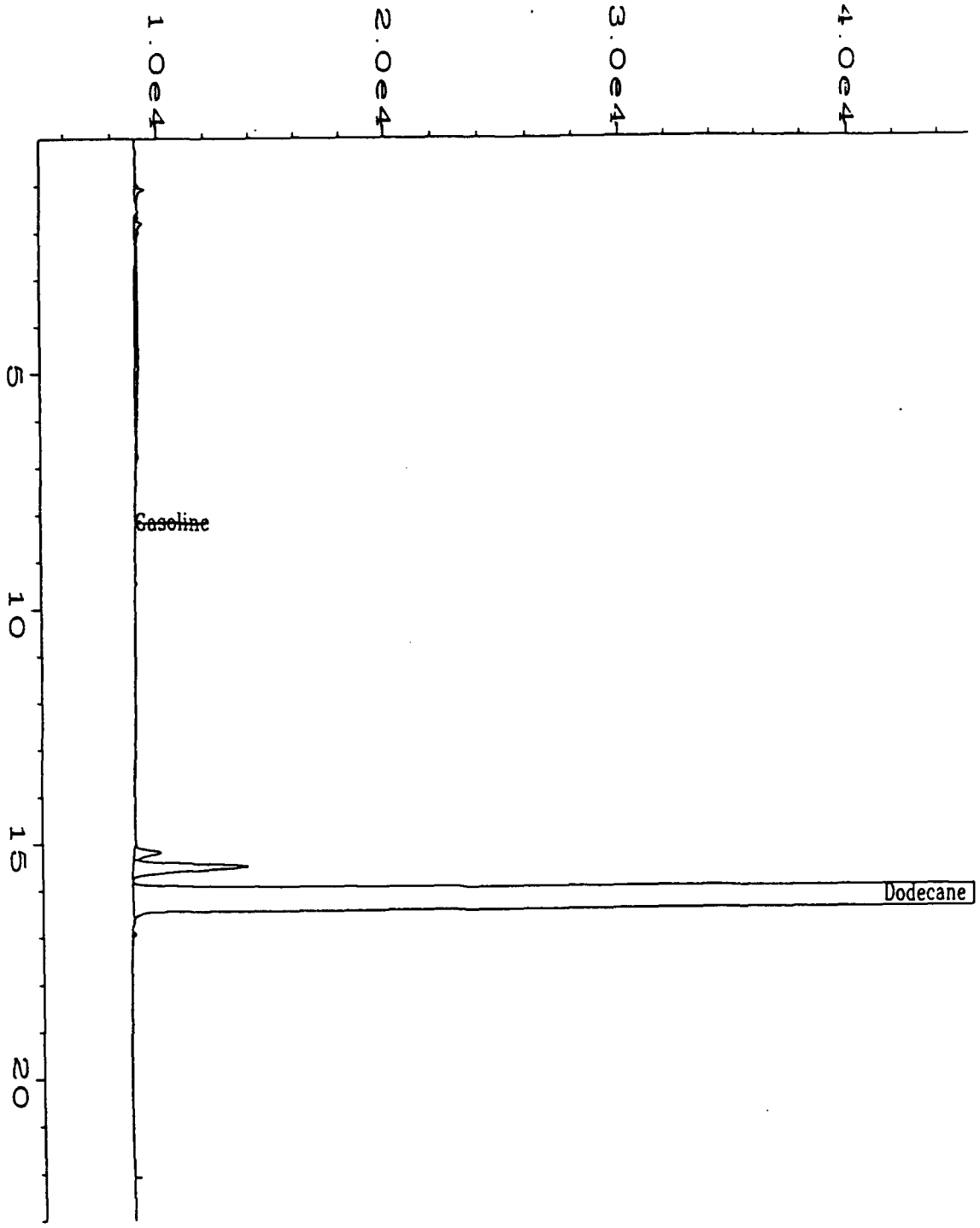
TVH0983.XLS



Data File Name	: C:\HPCHEM\1\DATA\TVH0402\050F0801.D		
Operator	: S.W. Tyson	Page Number	: 1
Instrument	: TVH	Vial Number	: 50
Sample Name	: MB040395	Injection Number	: 1
[illegible]n Time Bar Code:		Sequence Line	: 8
[illegible]quired on	: 03 Apr 95 08:52 PM	Instrument Method	: TVH0402.MTH
Report Created on	: 11 Apr 95 11:16 AM	Analysis Method	: TVH0402.MTH
Last Recalib on	: 02 APR 95 01:38 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:

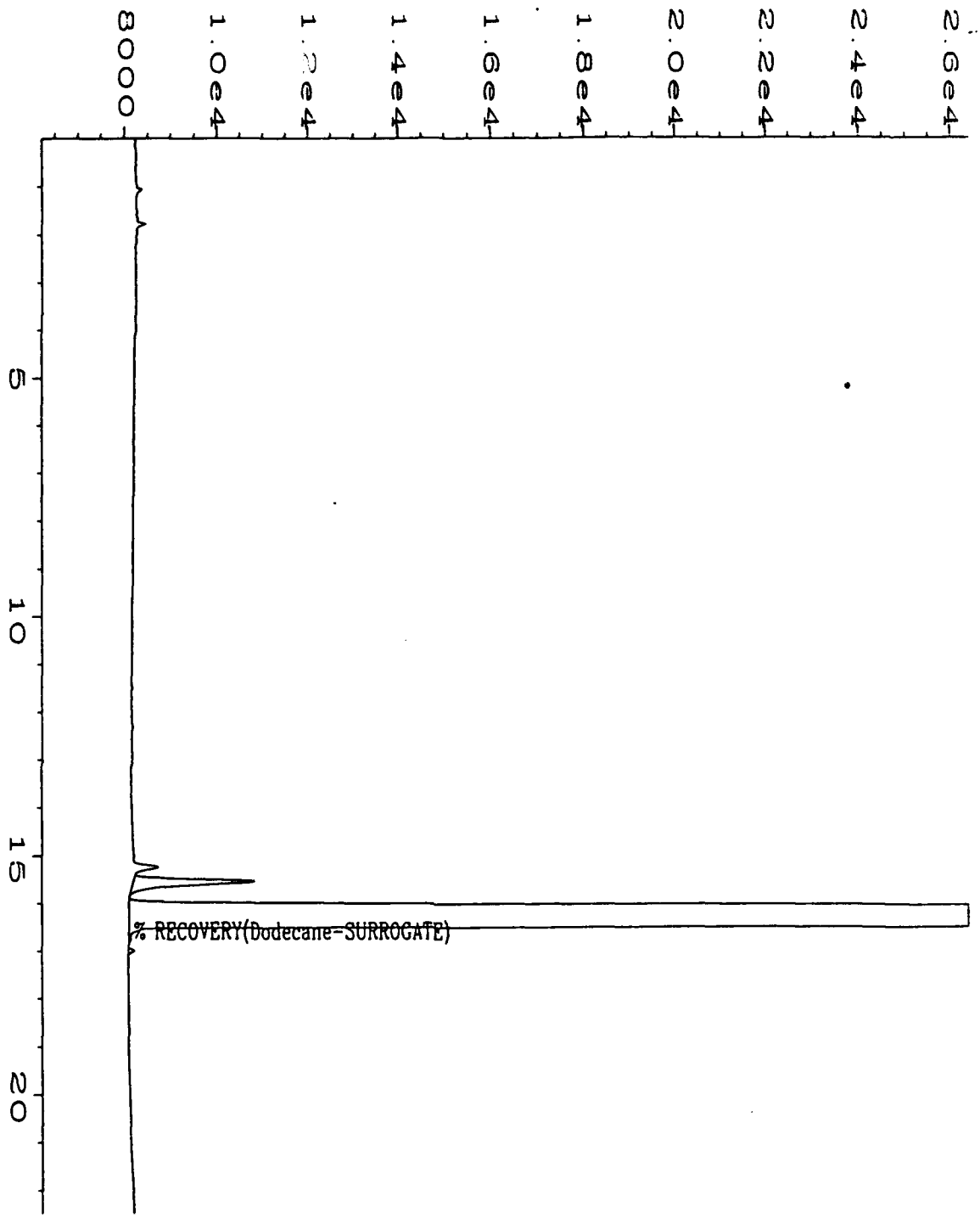


Data File Name	: C:\HPCHEM\1\DATA\tvh0408\009F0101.D		
Operator	: Dawn N. Guildner	Page Number	: 1
Instrument	: TVH	Vial Number	: 9
Sample Name	: MB040895	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 1
Acquired on	: 07 Apr 95 04:47 PM	Instrument Method	: TVH1BA.
Report Created on:	10 Apr 95 09:55 AM	Analysis Method	: TVH0408.MT
Last Recalib on	: 07 APR 95 04:22 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:



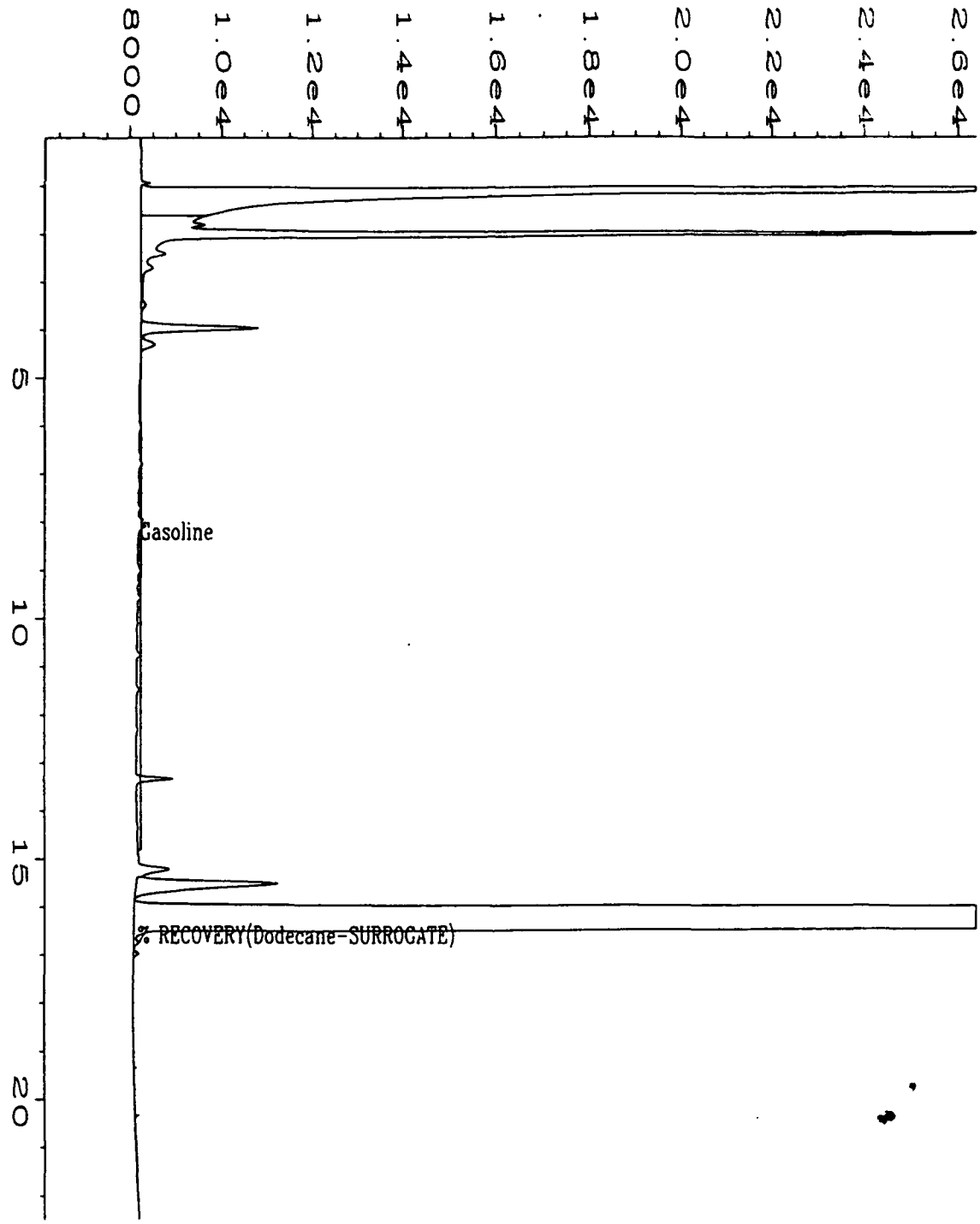
Data File Name	: C:\HPCHEM\1\DATA\tvh0410\008F0101.D		
Operator	: Dawn N. Guildner	Page Number	: 1
Instrument	: TVH	Vial Number	: 8
Sample Name	: MB041095	Injection Number	: 1
[illegible]n Time Bar Code:		Sequence Line	: 1
[illegible]uired on	: 10 Apr 95 01:52 PM	Instrument Method	: TVH1BASE.MTH
Report Created on	: 10 Apr 95 03:05 PM	Analysis Method	: TVH0410.MTH
Last Recalib on	: 10 APR 95 01:08 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:

DNG 4/20/95



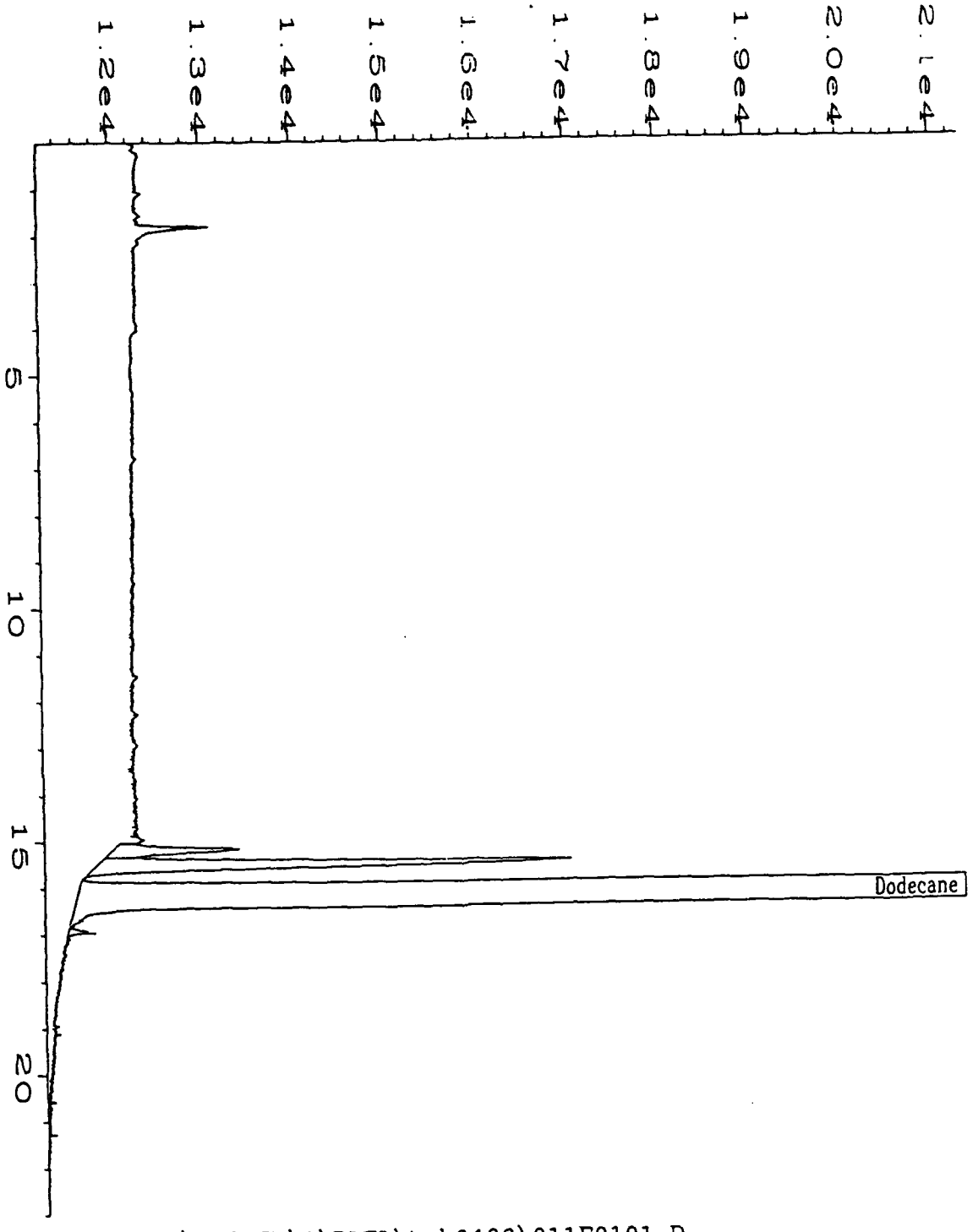
Data File Name	: C:\HPCHEM\1\DATA\TVH0402\064F0801.D		
Operator	: S.W. Tyson	Page Number	: 1
Instrument	: TVH	Vial Number	: 64
Sample Name	: X04851;1;5	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 8
Acquired on	: 04 Apr 95 04:47 AM	Instrument Method	: TVH0402
Report Created on:	11 Apr 95 11:15 AM	Analysis Method	: TVH0402.M
Last Recalib on	: 02 APR 95 01:38 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:

MD32-3

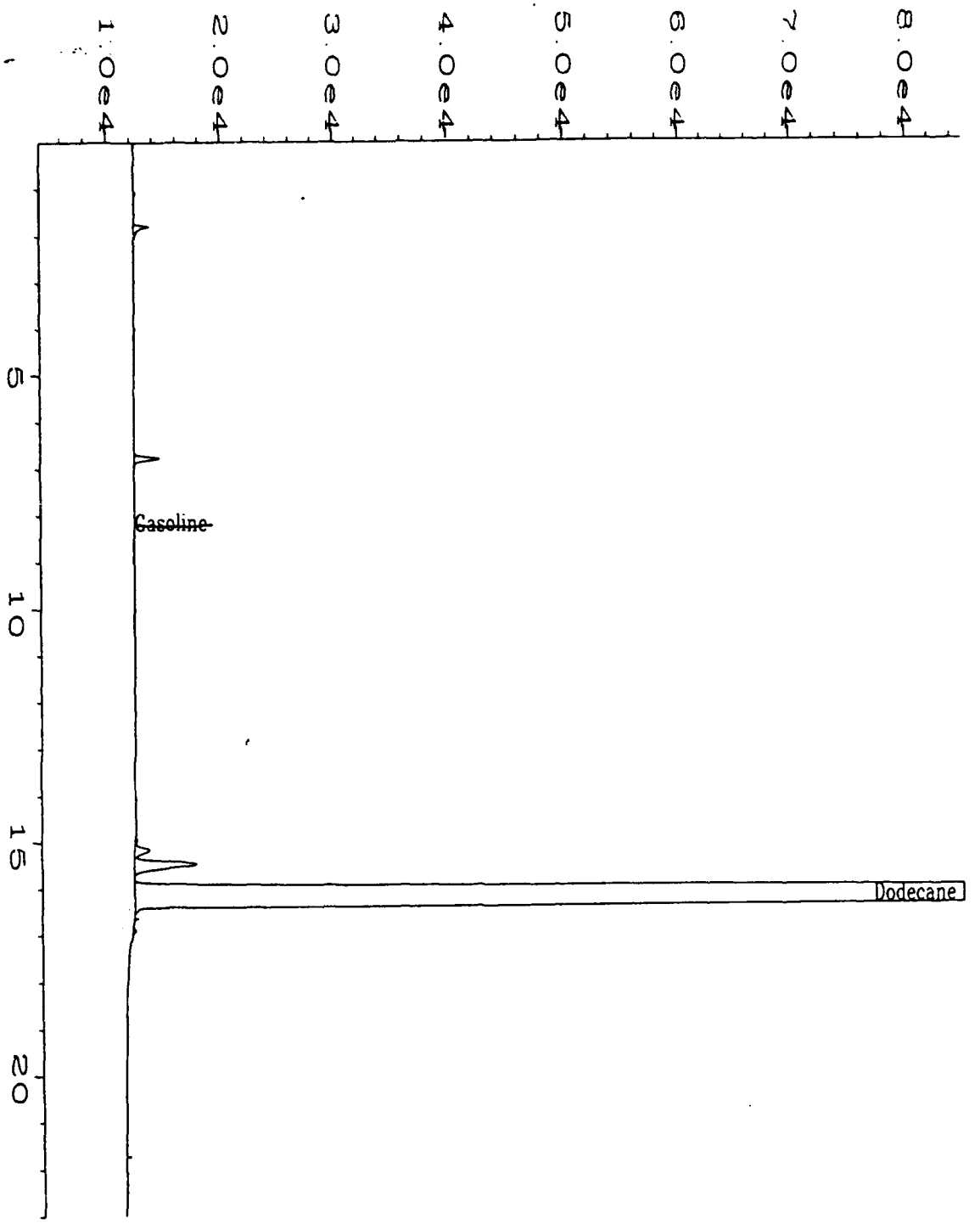


Data File Name	: C:\HPCHEM\1\DATA\TVH0402\065F0801.D		
Operator	: S.W. Tyson	Page Number	: 1
Instrument	: TVH	Vial Number	: 65
Sample Name	: X04852;1;5	Injection Number	: 1
Bar Time Bar Code:		Sequence Line	: 8
Acquired on	: 04 Apr 95 05:21 AM	Instrument Method	: TVH0402.MTH
Report Created on	: 11 Apr 95 11:16 AM	Analysis Method	: TVH0402.MTH
Last Recalib on	: 02 APR 95 01:38 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:

MW56-10

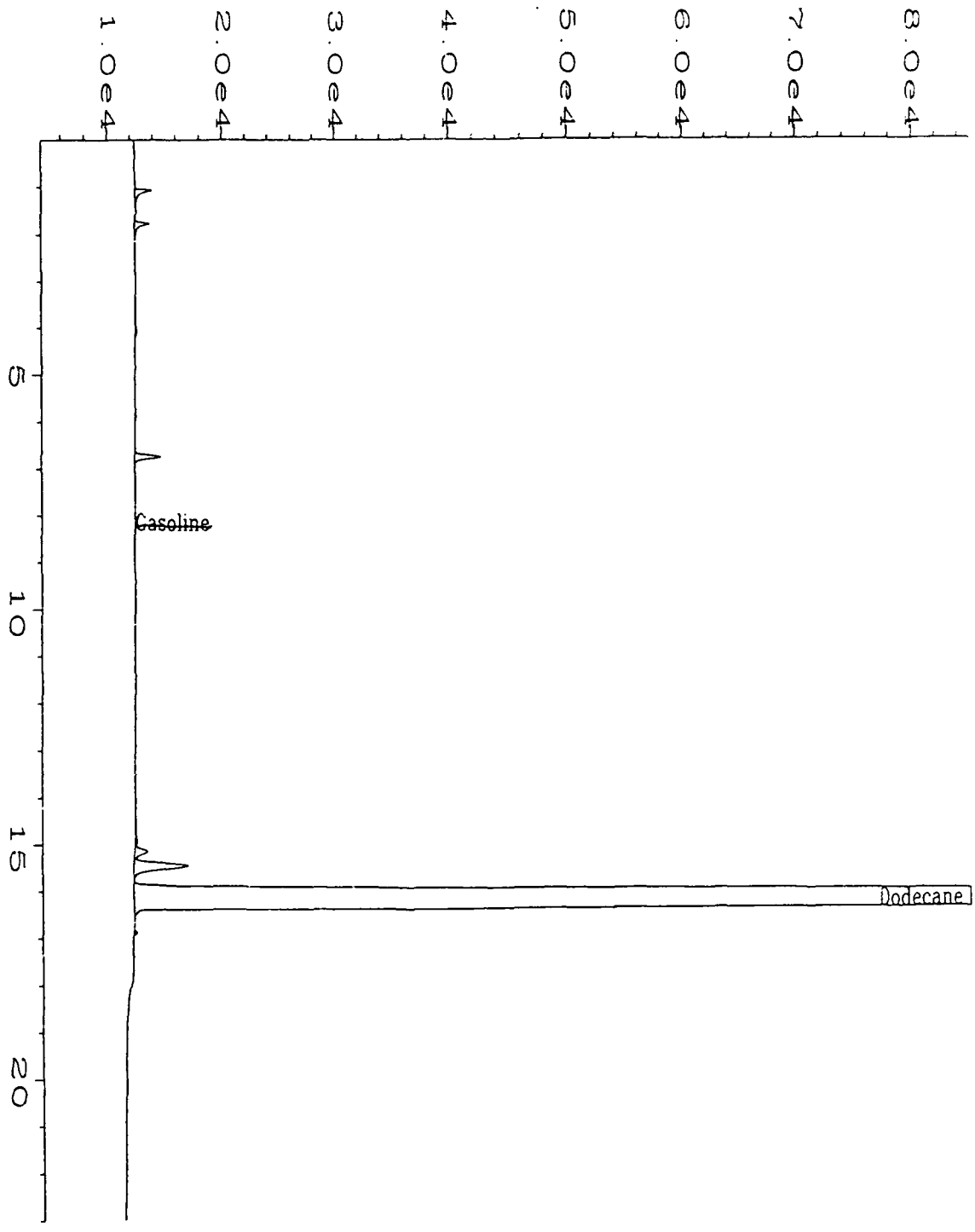


Data File Name	: C:\HPCHEM\1\DATA\tvh0408\011F0101.D		
Operator	: Dawn N. Guildner	Page Number	: 1
Instrument	: TVH	Vial Number	: 11
Sample Name	: X04853 DF=1	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 1
Acquired on	: 07 Apr 95 05:59 PM	Instrument Method	: TVH1BA
Report Created on:	10 Apr 95 09:55 AM	Analysis Method	: TVH0408.M
Last Recalib on	: 07 APR 95 04:22 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:
Sample Info	: PROJECT # 95-0983 CLIENT # 56MP-6D WATER		



Data File Name	: C:\HPCHEM\1\DATA\tvh0408\014F0101.D		
Operator	: Dawn N. Guildner	Page Number	: 1
Instrument	: TVH	Vial Number	: 14
Sample Name	: X04854;1;5	Injection Number	: 1
In Time Bar Code:		Sequence Line	: 1
Acquired on	: 07 Apr 95 07:47 PM	Instrument Method	: TVH1BASE.MTH
Report Created on	: 10 Apr 95 09:56 AM	Analysis Method	: TVH0408.MTH
Last Recalib on	: 07 APR 95 04:22 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:
Sample Info	: PROJECT # 95-0983 CLIENT # 56MP-6S WATER		

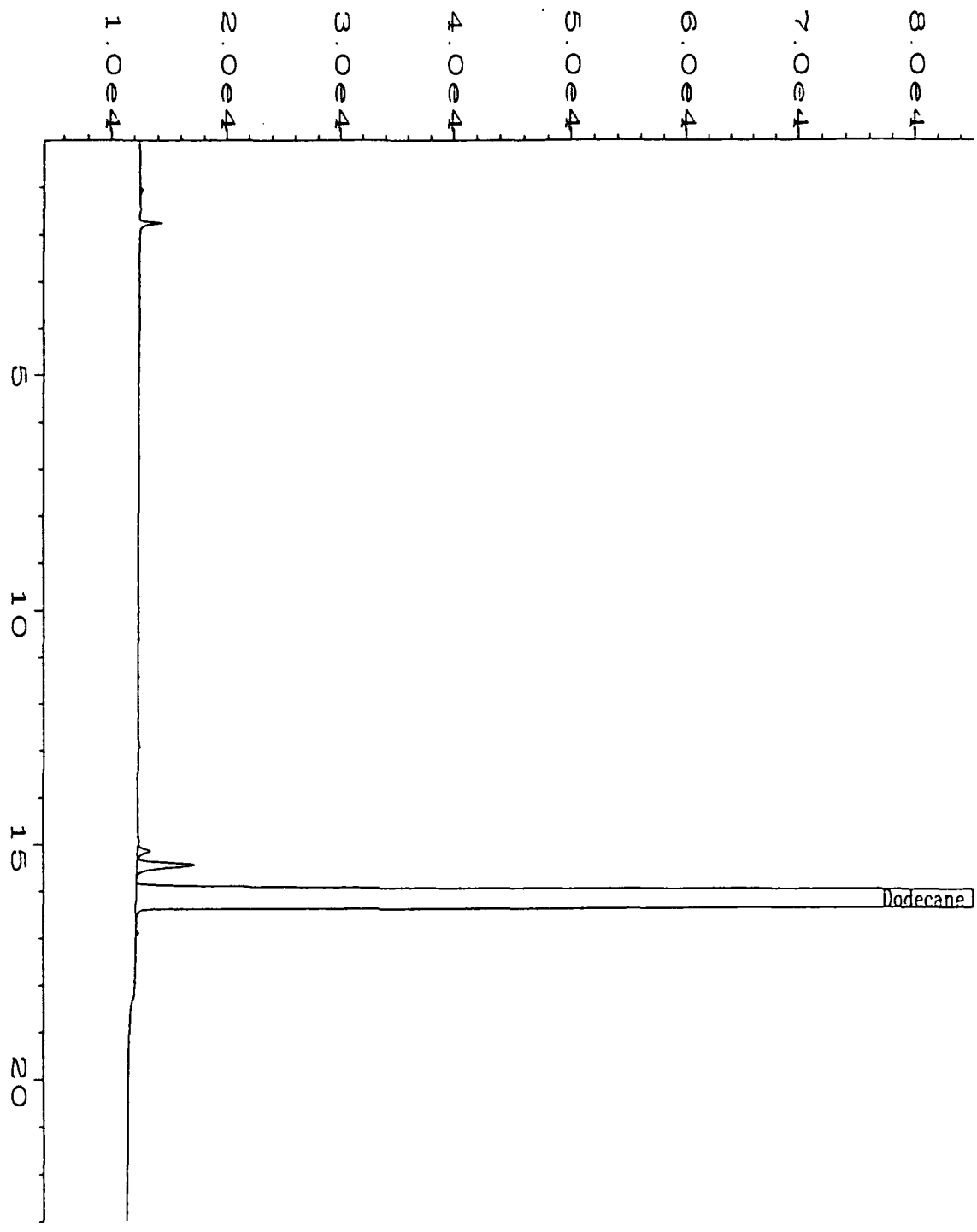
Dm 4/20/95



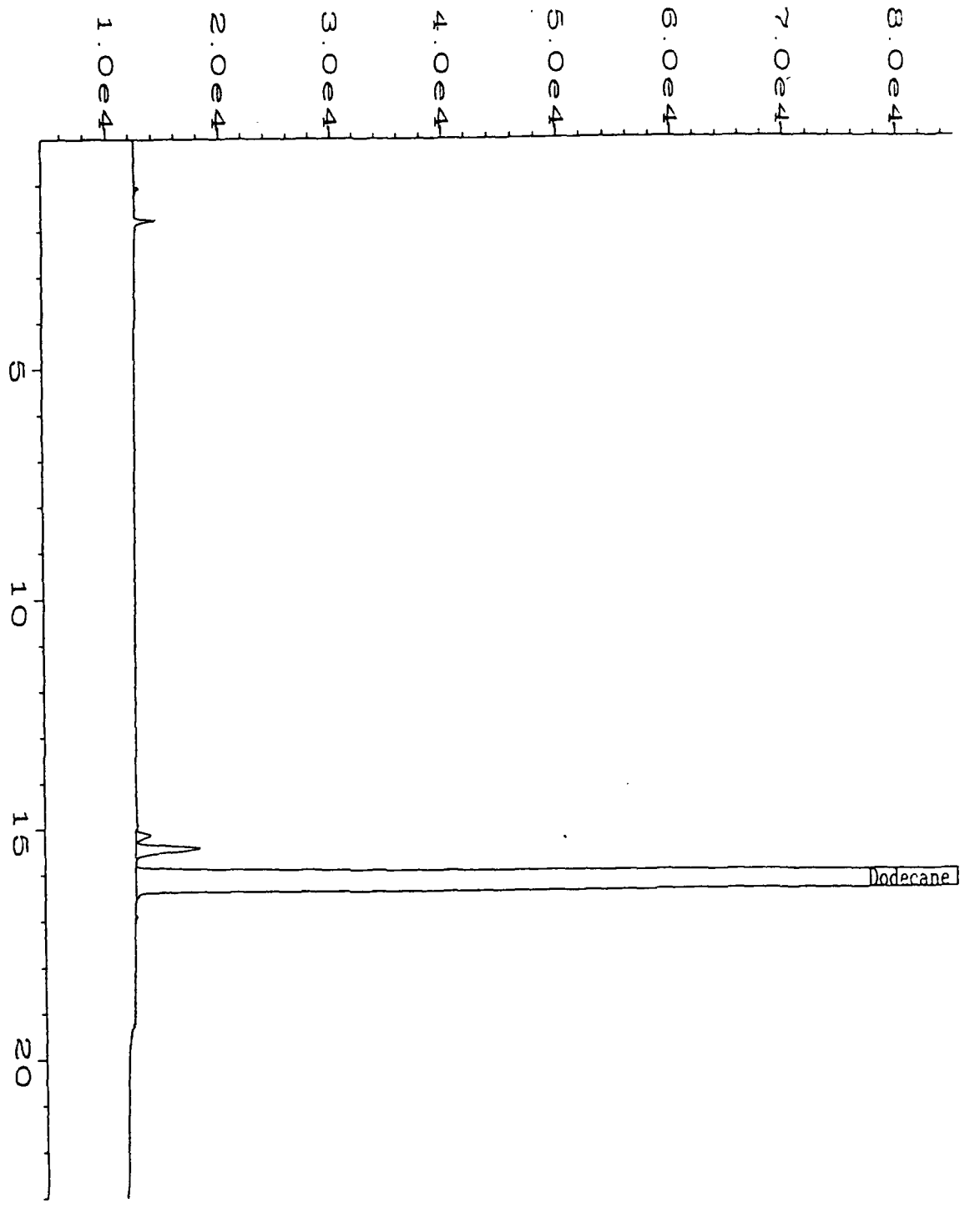
Data File Name	: C:\HPCHEM\1\DATA\tvh0408\015F0101.D		
Operator	: Dawn N. Guildner	Page Number	: 1
Instrument	: TVH	Vial Number	: 15
Sample Name	: X04554 DUP	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 1
Acquired on	: 07 Apr 95 08:23 PM	Instrument Method	: TVH1BA
Report Created on	: 10 Apr 95 09:56 AM	Analysis Method	: TVH0408.M
Last Recalib on	: 07 APR 95 04:22 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:

pm 4/20/95

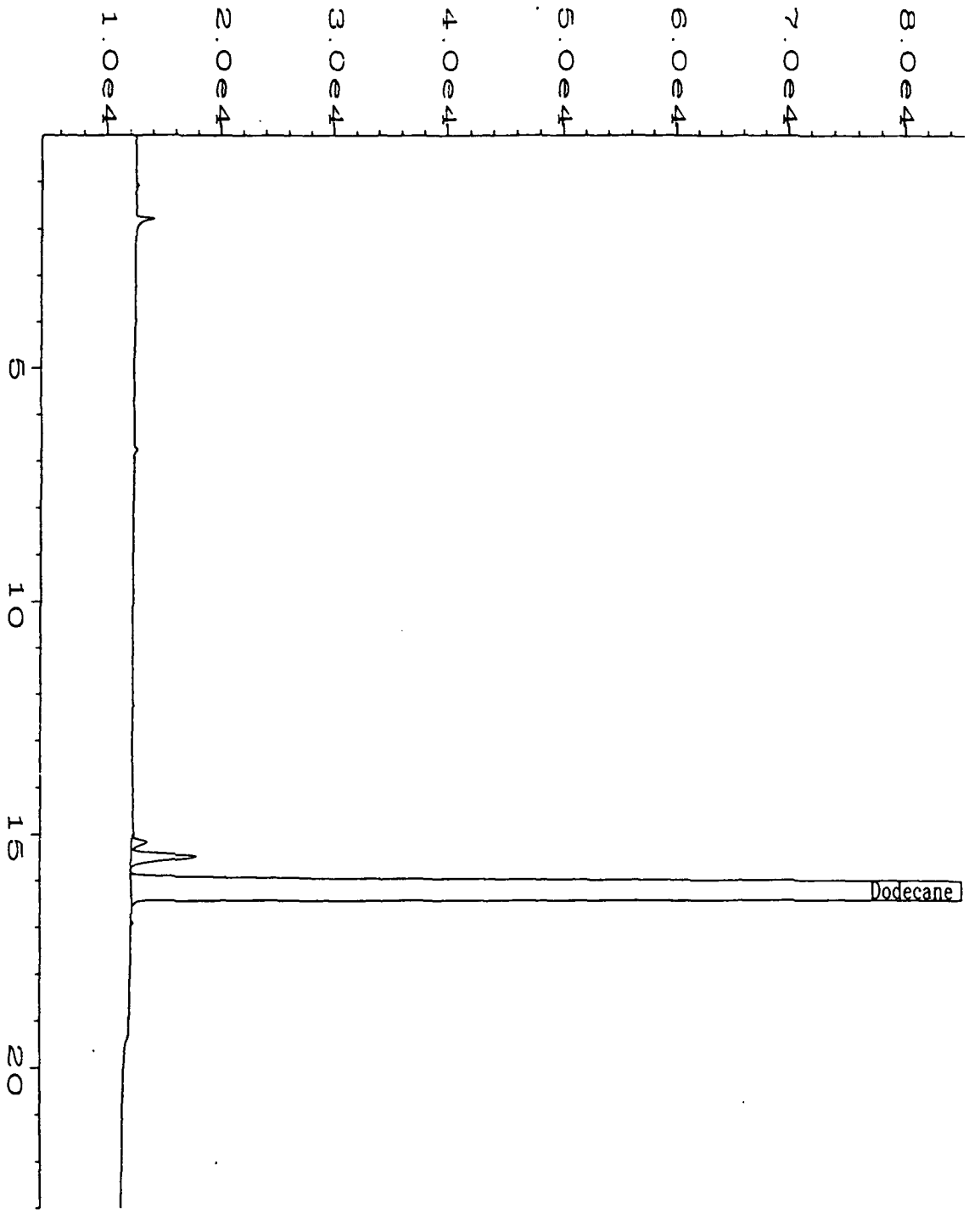
S6MP-65 Dup



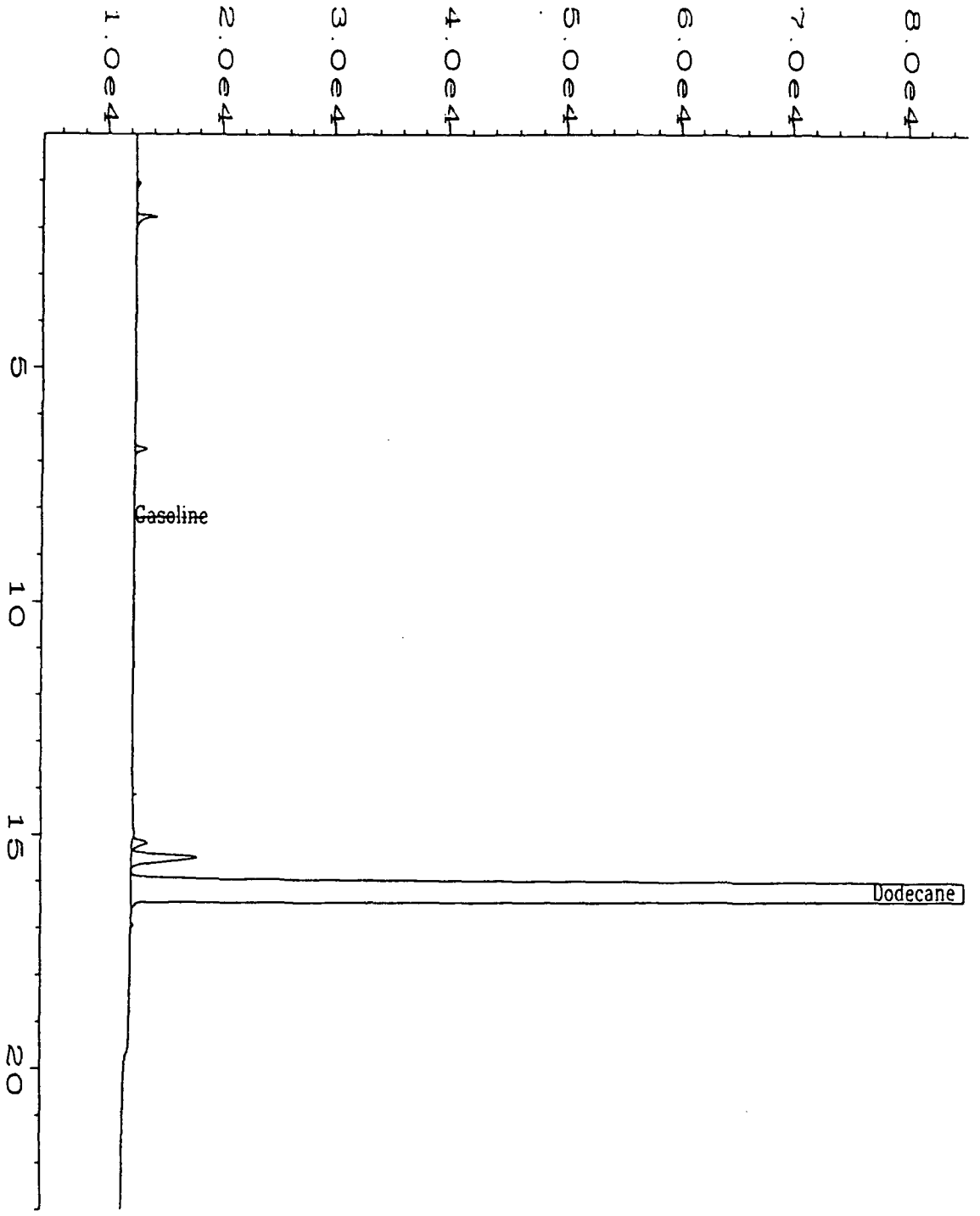
Data File Name	: C:\HPCHEM\1\DATA\tvh0408\016F0101.D		
Operator	: Dawn N. Guildner	Page Number	: 1
Instrument	: TVH	Vial Number	: 16
Sample Name	: X04555;1;5	Injection Number	: 1
:n Time Bar Code:		Sequence Line	: 1
:quired on	: 07 Apr 95 08:59 PM	Instrument Method	: TVH1BASE.MTH
Report Created on	: 10 Apr 95 09:56 AM	Analysis Method	: TVH0408.MTH
Last Recalib on	: 07 APR 95 04:22 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:
Sample Info	: PROJECT # 95-0983 CLIENT # MW56-1 WATER		



Data File Name	: C:\HPCHEM\1\DATA\tvh0408\017F0101.D		
Operator	: Dawn N. Guildner	Page Number	: 1
Instrument	: TVH	Vial Number	: 17
Sample Name	: X04556;1;5	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 1
Acquired on	: 07 Apr 95 09:35 PM	Instrument Method	: TVH1BA
Report Created on	: 10 Apr 95 09:56 AM	Analysis Method	: TVH0408.M
Last Recalib on	: 07 APR 95 04:22 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:
Sample Info	: PROJECT # 95-0983 CLIENT # MW56-21 WATER		

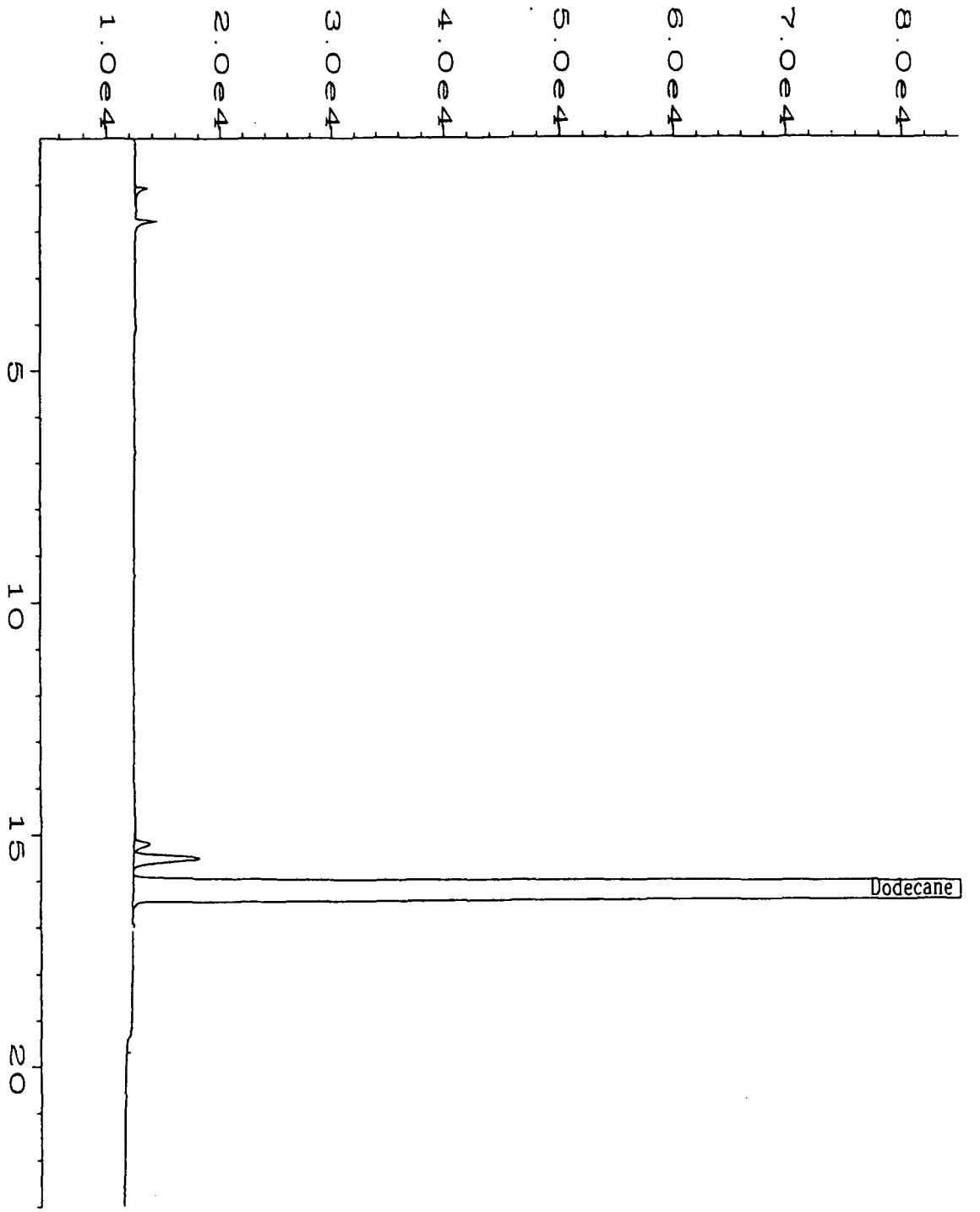


Data File Name	: C:\HPCHEM\1\DATA\tvh0408\018F0101.D		
Operator	: Dawn N. Guildner	Page Number	: 1
Instrument	: TVH	Vial Number	: 18
Sample Name	: X04557;1;5	Injection Number	: 1
In Time Bar Code:		Sequence Line	: 1
Acquired on	: 07 Apr 95 10:11 PM	Instrument Method	: TVH1BASE.MTH
Report Created on:	10 Apr 95 09:56 AM	Analysis Method	: TVH0408.MTH
Last Recalib on	: 07 APR 95 04:22 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:
Sample Info	: PROJECT # 95-0983 CLIENT # 56MP-85 WATER		

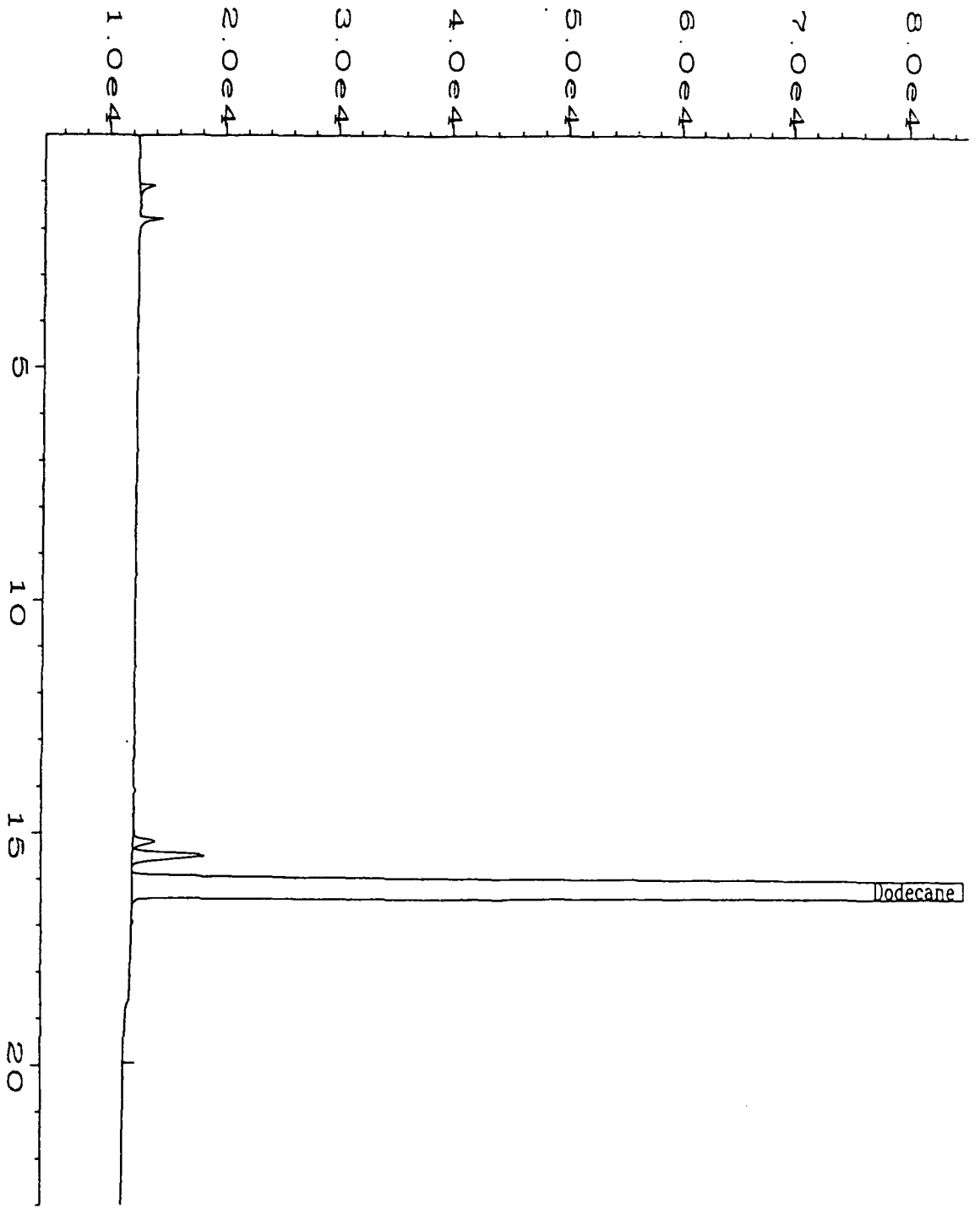


Data File Name	: C:\HPCHEM\1\DATA\tvh0408\019F0101.D		
Operator	: Dawn N. Guildner	Page Number	: 1
Instrument	: TVH	Vial Number	: 19
Sample Name	: X04558;1;5	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 1
Acquired on	: 07 Apr 95 10:47 PM	Instrument Method	: TVH1BA_
Report Created on	: 10 Apr 95 09:56 AM	Analysis Method	: TVH0408.MT
Last Recalib on	: 07 APR 95 04:22 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:
Sample Info	: PROJECT # 95-0983 CLIENT # 56MP-10S WATER		

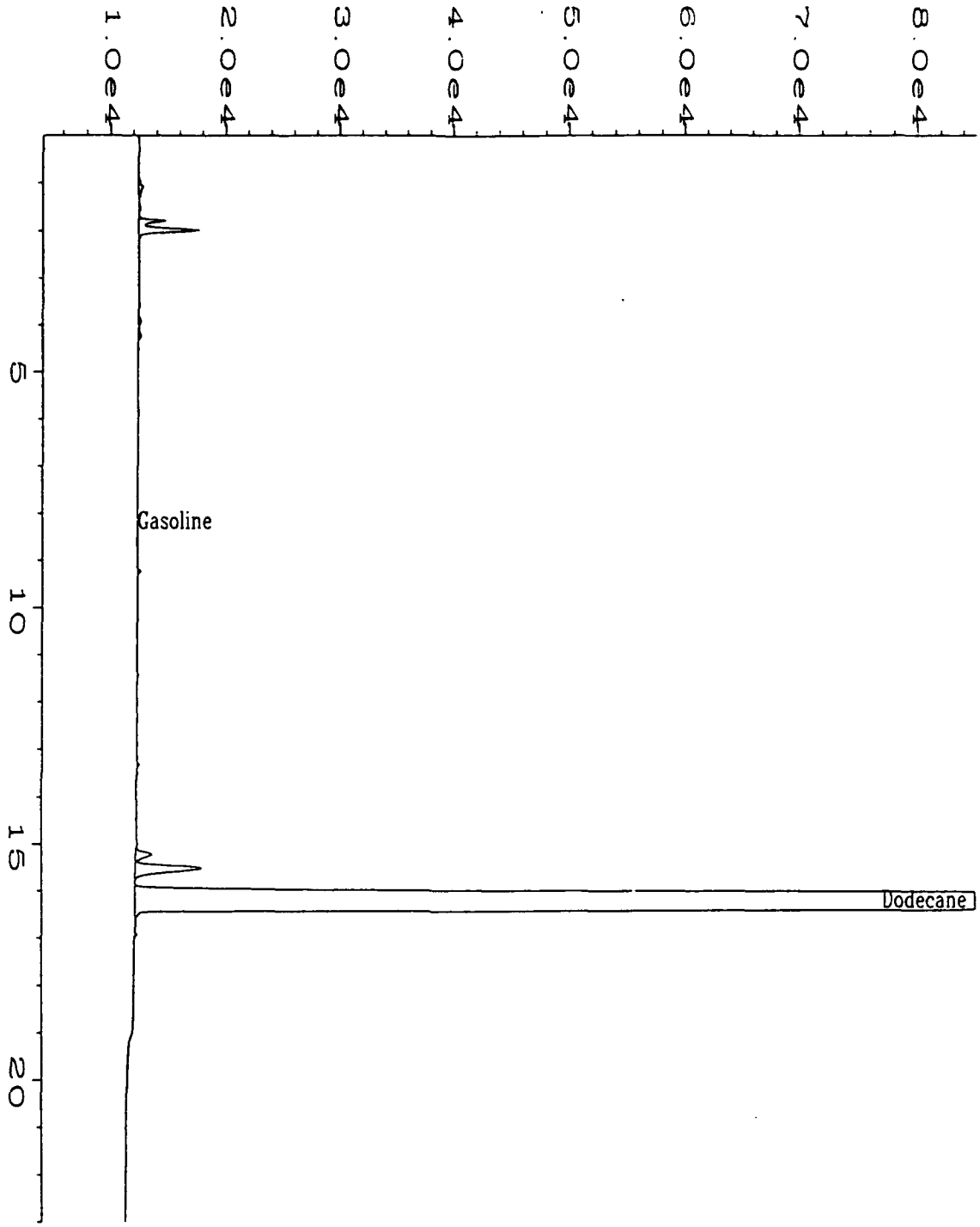
Dm 4/20/95



Data File Name	: C:\HPCHEM\1\DATA\tvh0408\021F0101.D		
Operator	: Dawn N. Guildner	Page Number	: 1
Instrument	: TVH	Vial Number	: 21
Sample Name	: X04559;1;5	Injection Number	: 1
Bar Time Bar Code:		Sequence Line	: 1
Acquired on	: 07 Apr 95 11:59 PM	Instrument Method	: TVH1BASE.MTH
Report Created on	: 10 Apr 95 09:57 AM	Analysis Method	: TVH0408.MTH
Last Recalib on	: 07 APR 95 04:22 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:
Sample Info	: PROJECT # 95-0983 CLIENT # MW56-2 WATER		



Data File Name	: C:\HPCHEM\1\DATA\tvh0408\022F0101.D		
Operator	: Dawn N. Guildner	Page Number	: 1
Instrument	: TVH	Vial Number	: 22
Sample Name	: X04559 DUP	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 1
Acquired on	: 08 Apr 95 00:35 AM	Instrument Method	: TVH1BA[illegible]
Report Created on:	10 Apr 95 09:57 AM	Analysis Method	: TVH0408.M[illegible]
Last Recalib on	: 07 APR 95 04:22 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:



Data File Name	: C:\HPCHEM\1\DATA\tvh0408\023F0101.D		
Operator	: Dawn N. Guildner	Page Number	: 1
Instrument	: TVH	Vial Number	: 23
Sample Name	: X04660;1;5	Injection Number	: 1
Run Time Bar Code	:	Sequence Line	: 1
Acquired on	: 08 Apr 95 01:11 AM	Instrument Method	: TVH1BASE.MTH
Report Created on	: 10 Apr 95 09:57 AM	Analysis Method	: TVH0408.MTH
Last Recalib on	: 07 APR 95 04:22 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:
Sample Info	: PROJECT # 95-0983 CLIENT # MW56-8 WATER		

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TOTAL VOLATILE HYDROCARBONS (TVH)
Laboratory Control Sample (LCS)

LCS Number	: LCS040295	Matrix	: WATER
Date Prepared	: 4/1/95	Method Number	: 5030/MOD.8015
Date Analyzed	: 4/2/95		
Sequence Number	: TVH8		

Compound Name	Theoretical Concentration mg/L	LCS Concentration mg/ L	LCS % Recovery	QC Limit % Recovery
Gasoline	2.00	2.18	109%	70%-130%

QUALIFIERS
U = TVH analyzed for but not detected.
B = TVH found in blank as well as sample (blank data should be compared).
E = Extrapolated value.
NA = Not Available.

Analyst

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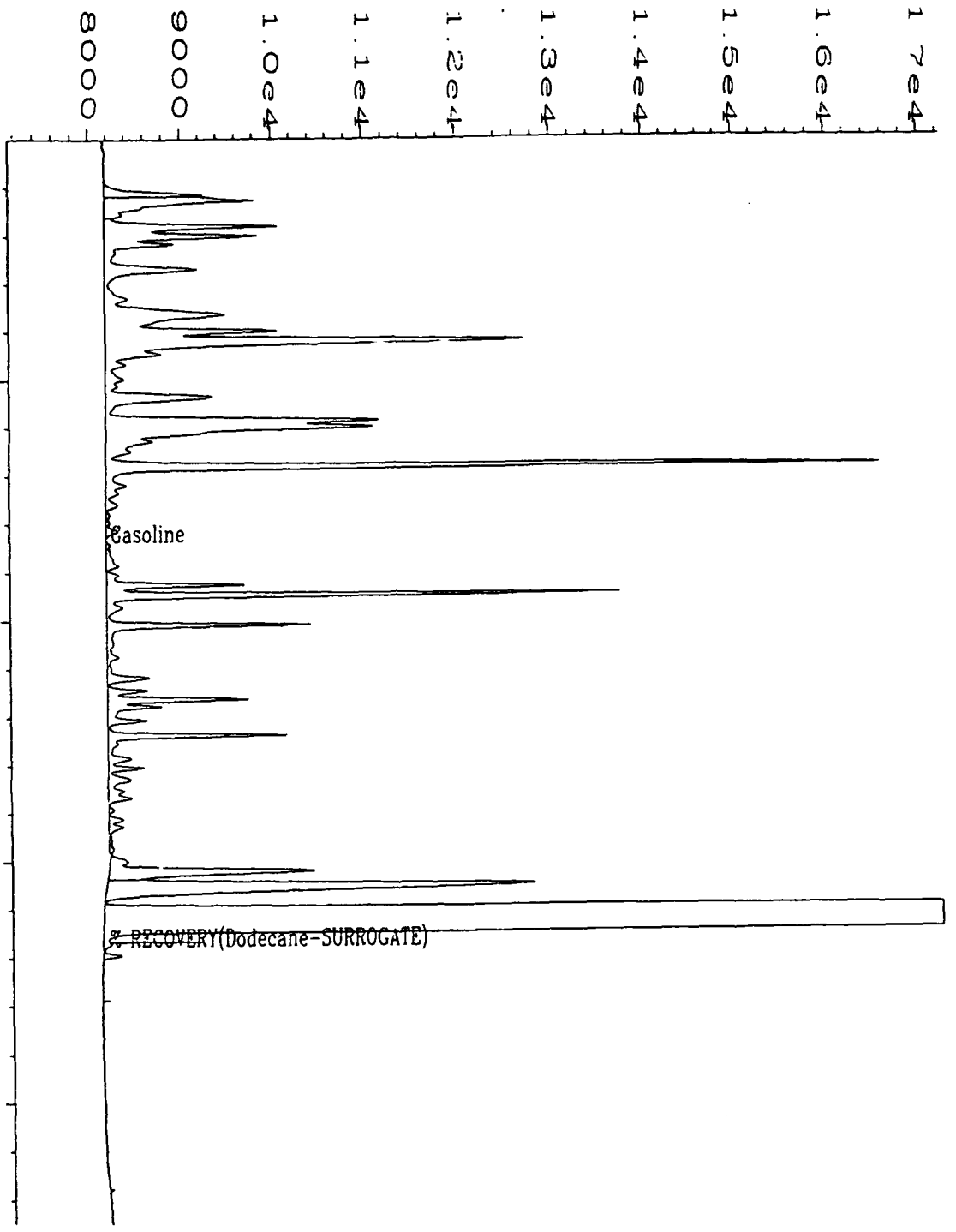

Data File Name	: C:\HPCHEM\1\DATA\TVH0402\008F0801.D		
Operator	: S.W. Tyson	Page Number	: 1
Instrument	: TVH	Vial Number	: 8
Sample Name	: LCS040295	Injection Number	: 1
Bar Code:		Sequence Line	: 8
Acquired on	: 02 Apr 95 02:20 PM	Instrument Method	: TVH0402.MTH
Report Created on	: 11 Apr 95 11:18 AM	Analysis Method	: TVH0402.MTH
Last Recalib on	: 02 APR 95 01:38 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:

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TOTAL VOLATILE HYDROCARBONS (TVH)
Laboratory Control Sample (LCS)

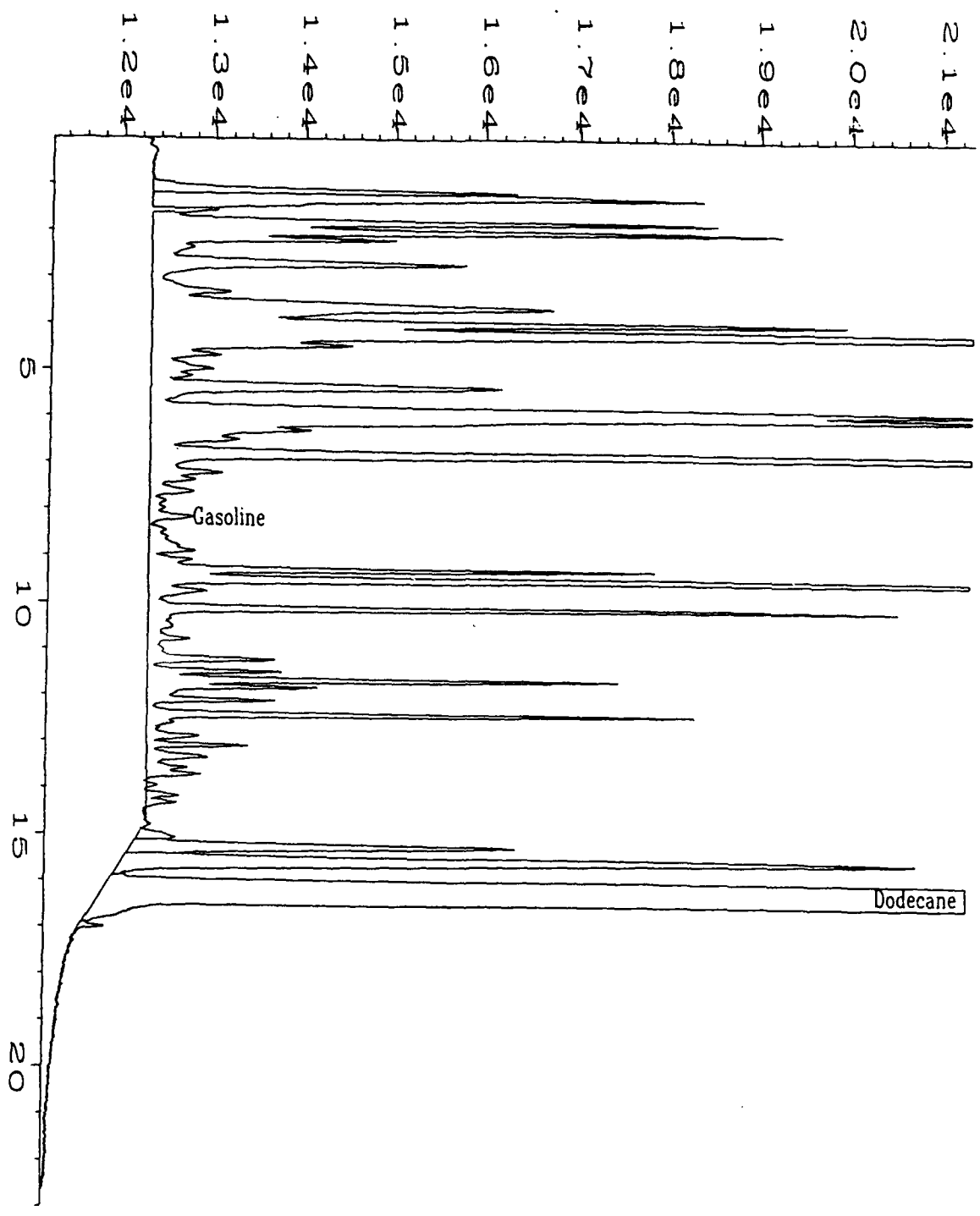
LCS Number	: LCS040895	Matrix	: WATER
Date Prepared	: 4/7/95	Method Number	: 5030/MOD.8015
Date Analyzed	: 4/7/95		
Sequence Number	: TVH8		

Compound Name	Theoretical Concentration mg/L	LCS Concentration mg/ L	LCS % Recovery	QC Limit % Recovery
Gasoline	5.00	5.38	108%	70%-130%

QUALIFIERS
U = TVH analyzed for but not detected.
B = TVH found in blank as well as sample (blank data should be compared).
E = Extrapolated value.
NA = Not Available.

K. Cone
Analyst

Approved



Data File Name	: C:\HPCHEM\1\DATA\tvh0408\008F0101.D		
Operator	: Dawn N. Guildner	Page Number	: 1
Instrument	: TVH	Vial Number	: 8
Sample Name	: LCS040895	Injection Number	: 1
n Time Bar Code:		Sequence Line	: 1
quired on	: 07 Apr 95 04:11 PM	Instrument Method	: TVH1BASE.MTH
Report Created on	: 10 Apr 95 09:54 AM	Analysis Method	: TVH0408.MTH
Last Recalib on	: 07 APR 95 04:22 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:

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TOTAL VOLATILE HYDROCARBONS (TVH)
Laboratory Control Sample (LCS)

LCS Number	: LCS041095	Matrix	: WATER
Date Prepared	: 4/10/95	Method Number	: 5030/MOD.8015
Date Analyzed	: 4/10/95		
Sequence Number	: TVH7		

Compound Name	Theoretical Concentration mg/L	LCS Concentration mg/ L	LCS % Recovery	QC Limit % Recovery
Gasoline	5.00	4.97	99%	70%-130%

QUALIFIERS
U = TVH analyzed for but not detected.
B = TVH found in blank as well as sample (blank data should be compared).
E = Extrapolated value.
NA = Not Available.

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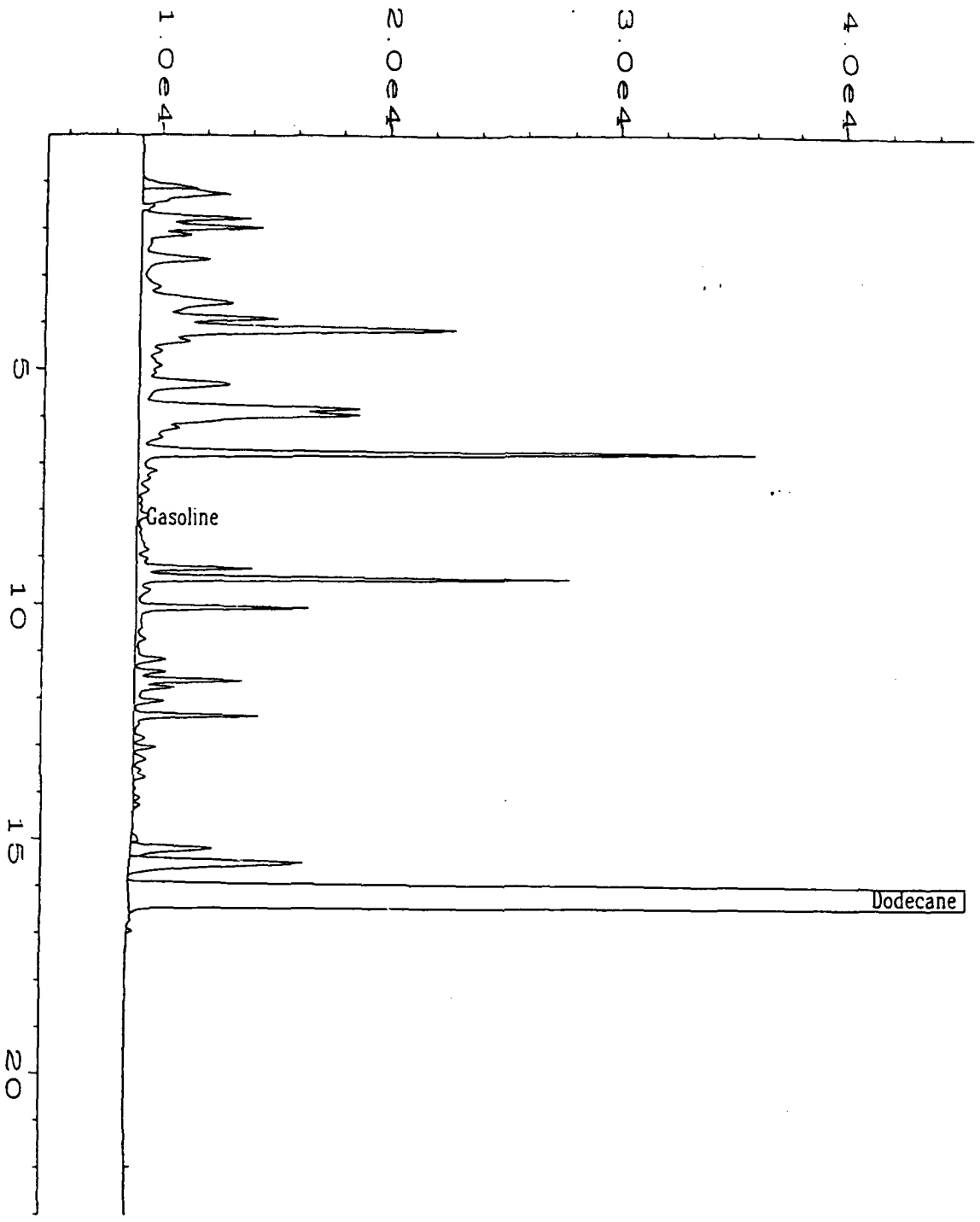

ata File Name	: C:\HPCHEM\1\DATA\tvh0410\007F0101.D		
perator	: Dawn N. Guildner	Page Number	: 1
nstrument	: TVH	Vial Number	: 7
ample Name	: LCS041095	Injection Number	: 1
un Time Bar Code:		Sequence Line	: 1
: red on	: 10 Apr 95 01:17 PM	Instrument Method	: TVH1BASE.MTH
eport Created on	: 10 Apr 95 03:04 PM	Analysis Method	: TVH0410.MTH
ast Recalib on	: 10 APR 95 01:08 PM	Sample Amount	: 0
ultiplier	: 1	ISTD Amount	:

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Anions

			722450.21020/
Date Sampled	: 3/24,26/95	Client Project ID.	: MacDill AFB
Date Received	: 3/28/95	Lab Project No.	: 95-0983
Date Prepared	: 3/28/95	Method	: EPA 300.0
Date Analyzed	: 3/28/95	Detection Limit	: 0.250 mg/L
		Matrix	: Water

Evergreen Sample #	Client Sample ID	Chloride (mg/L)
X04848	24PZ-1S	27.4
X04849	24PZ-1D	177
X04850	24MP-6S	42.6
X04851	MD32-3	32.8
X04852	MW56-10	11.5
X04853	56MP-6D	41.7
X04854	56MP-6S	27.5
X04855	MW56-1	28.3
X04856	MW56-21	27.8
X04857	56MP-8S	28.2
X04857dup	56MP-8Sdup	28.5
Method Blank 3-28-95		<0.250

Quality Assurance

		Spike Amount (mg/L)	Sample Result (mg/L)	Spike Result (mg/L)	% Recovery
X04857	56MP-8S Matrix Spike	10.0	28.2	39.1	110
X04857	56MP-8S Matrix Spike Dup	10.0	28.2	38.3	102
	MS/MSD RPD				7.5
X04857/X04857 Dup	RPD				9.7

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Anions

Date Sampled	: 3/26,27/95	Client Project ID.	: 722450.21020/ MacDill AFB
Date Received	: 3/28/95	Lab Project No.	: 95-0983
Date Prepared	: 3/28/95	Method	: EPA 300.0
Date Analyzed	: 3/28/95	Detection Limit	: 0.250 mg/L
		Matrix	: Water

Evergreen Sample #	Client Sample ID	Chloride (mg/L)
X04858	56MP-10S	7.90
X04859	MW56-2	24.7
X04860	MW56-8	10.8
X04861	MW56-9	17.6
X04862	56MP-4S	15.3
X04863	MW56-12	147
X04864	MW56-6	21.5
X04865	56MP-5S	10.7
X04866	56MP-5D	16.9
X04867	56MP-15D	16.4
X04868	MW56-10	23.4
X04869	56MP-7D	24.1
X04869Dup	56MP-7D dup	24.0
Method Blank 3-28-95		<0.250

Quality Assurance

		Spike Amount (mg/L)	Sample Result (mg/L)	Spike Result (mg/L)	% Recovery
X04869	56MP-7D Matrix Spike	10.0	24.1	33.6	94.8
X04869	56MP-7D Matrix Spike Dup	10.0	24.1	34.6	105
	MS/MSD RPD				10.3
X04869/X04869 Dup	RPD				0.457

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Anions

			722450.21020/
Date Sampled	: 3/24,26/95	Client Project ID.	: MacDill AFB
Date Received	: 3/28/95	Lab Project No.	: 95-0983
Date Prepared	: 3/28/95	Method	: EPA 300.0
Date Analyzed	: 3/28/95	Detection Limit	: 0.076 mg/L
		Matrix	: Water

Evergreen Sample #	Client Sample ID	Nitrite-N (mg/L)
X04848+	24PZ-1S	<0.076
X04849+	24PZ-1D	<0.760*
X04850+	24MP-6S	<0.076
X04851+	MD32-3	<0.076
X04852	MW56-10	<0.076
X04853	56MP-6D	<0.076
X04854	56MP-6S	<0.076
X04855	MW56-1	<0.076
X04856	MW56-21	<0.076
X04857	56MP-8S	<0.076
X04857dup	56MP-8Sdup	<0.076
Method Blank 3-28-95		<0.076

Quality Assurance**

		Spike Amount (mg/L)	Sample Result (mg/L)	Spike Result (mg/L)	% Recovery
X04857	56MP-8S Matrix Spike	10.0	<0.250	9.40	94.0
X04857	56MP-8S Matrix Spike Dup	10.0	<0.250	9.13	91.3
	MS/MSD RPD				2.91
X04857/X04857 Dup	RPD				NC

* = Increased detection limit due to matrix interference.
** = Quality assurance results reported as Nitrite (NO_2)
NC = Not calculated because sample and/or duplication results below detection limit.
\+ = Samples received outside of holding times for this analyte.

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(303)425-6021

Anions

			722450.21020/
Date Sampled	: 3/26,27/95	Client Project ID.	: MacDill AFB
Date Received	: 3/28/95	Lab Project No.	: 95-0983
Date Prepared	: 3/28/95	Method	: EPA 300.0
Date Analyzed	: 3/28/95	Detection Limit	: 0.076 mg/L
		Matrix	: Water

Evergreen Sample #	Client Sample ID	Nitrite-N (mg/L)
X04858	56MP-10S	<0.076
X04859	MW56-2	<0.076
X04860	MW56-8	<0.076
X04861	MW56-9	<0.076
X04862	56MP-4S	<0.076
X04863	MW56-12	<0.760*
X04864	MW56-6	<0.076
X04865	56MP-5S	<0.076
X04866	56MP-5D	<0.076
X04867	56MP-15D	<0.076
X04868	MW56-10	<0.076
X04869	56MP-7D	<0.076
X04869Dup	56MP-7D dup	<0.076
Method Blank 3-28-95		<0.076

Quality Assurance**

		Spike Amount (mg/L)	Sample Result (mg/L)	Spike Result (mg/L)	% Recovery
X04869	56MP-7D Matrix Spike	10.0	<0.250	9.07	90.7
X04869	56MP-7D Matrix Spike Dup	10.0	<0.250	8.88	88.8
	MS/MSD RPD				2.01
X04869/X04869 Dup	RPD				NC

* = Increased detection limit due to matrix interference.
** = Quality assurance results reported as Nitrite (NO_2)
NC = Not calculated because sample and/or duplication results below detection limit.

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Anions

722450.21020/

Date Sampled : 3/24,26/95
Date Received : 3/28/95
Date Prepared : 3/28/95
Date Analyzed : 3/28/95

Client Project ID. : MacDill AFB
Lab Project No. : 95-0983
Method : EPA 300.0
Detection Limit : 0.056 mg/L
Matrix : Water

Evergreen Sample #	Client Sample ID	Nitrate-N (mg/L)
X04848+	24PZ-1S	<0.056
X04849+	24PZ-1D	<0.056
X04850+	24MP-6S	<0.056
X04851+	MD32-3	<0.056
X04852	MW56-10	0.202
X04853	56MP-6D	<0.056
X04854	56MP-6S	<0.056
X04855	MW56-1	0.992
X04856	MW56-21	0.992
X04857	56MP-8S	<0.056
X04857dup	56MP-8Sdup	<0.056
Method Blank 3-28-95		<0.056

Quality Assurance**

		Spike Amount (mg/L)	Sample Result (mg/L)	Spike Result (mg/L)	% Recover
X04857	56MP-8S Matrix Spike	10.0	<0.250	9.21	92.1
X04857	56MP-8S Matrix Spike Dup	10.0	<0.250	8.92	89.2
	MS/MSD RPD				3.2
X04857/X04857 Dup	RPD				NC

** = Quality assurance results reported as Nitrate (NO_3)
NC = Not calculated because sample and/or duplication results below detection limit.
+ = Samples received outside of holding times for this analyte.

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Anions

Date Sampled	: 3/26,27/95	Client Project ID.	: 722450.21020/ MacDill AFB
Date Received	: 3/28/95	Lab Project No.	: 95-0983
Date Prepared	: 3/28/95	Method	: EPA 300.0
Date Analyzed	: 3/28/95	Detection Limit	: 0.056 mg/L
		Matrix	: Water

Evergreen Sample #	Client Sample ID	Nitrate-N (mg/L)
X04858	56MP-10S	<0.056
X04859	MW56-2	<0.056
X04860	MW56-8	<0.056
X04861	MW56-9	0.608
X04862	56MP-4S	<0.056
X04863	MW56-12	0.394
X04864	MW56-6	<0.056
X04865	56MP-5S	0.080
X04866	56MP-5D	<0.056
X04867	56MP-15D	<0.056
X04868	MW56-10	<0.056
X04869	56MP-7D	<0.056
X04869Dup	56MP-7D dup	<0.056
Method Blank 3-28-95		<0.056

Quality Assurance**

		Spike Amount (mg/L)	Sample Result (mg/L)	Spike Result (mg/L)	% Recovery
X04869	56MP-7D Matrix Spike	10.0	<0.250	8.75	87.5
X04869	56MP-7D Matrix Spike Dup	10.0	<0.250	8.73	87.3
	MS/MSD RPD				0.229
X04869/X04869 Dup	RPD				NC

** = Quality assurance results reported as Nitrate (NO_3)
NC = Not calculated because sample and/or duplication results below detection limit.

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Anions

Date Sampled	: 3/24,26/95	Client Project ID.	: 722450.21020/ MacDill AFB
Date Received	: 3/28/95	Lab Project No.	: 95-0983
Date Prepared	: 3/28/95	Method	: EPA 300.0
Date Analyzed	: 3/28/95	Detection Limit	: 0.250 mg/L
		Matrix	: Water

Evergreen Sample #	Client Sample ID	Sulfate (mg/L)
X04848	24PZ-1S	1.04
X04849	24PZ-1D	3.56
X04850	24MP-6S	8.12
X04851	MD32-3	99.2
X04852	MW56-10	17.8
X04853	56MP-6D	183
X04854	56MP-6S	67.3
X04855	MW56-1	80.0
X04856	MW56-21	79.4
X04857	56MP-8S	108
X04857dup	56MP-8Sdup	107
Method Blank 3-28-95		<0.250

Quality Assurance

		Spike Amount (mg/L)	Sample Result (mg/L)	Spike Result (mg/L)	% Recovery
X04857	56MP-8S Matrix Spike	10.0	108	20.4*	96.2
X04857	56MP-8S Matrix Spike Dup	10.0	108	20.0*	92.2
	MS/MSD RPD				4.25
X04857/X04857 Dup	RPD				0.344

* Spike result based on a 10x dilution factor.

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Anions

Date Sampled : 3/26,27/95
Date Received : 3/28/95
Date Prepared : 3/28/95
Date Analyzed : 3/28/95

Client Project ID. : 722450.21020/ MacDill AFB
Lab Project No. : 95-0983
Method : EPA 300.0
Detection Limit : 0.250 mg/L
Matrix : Water

Evergreen Sample #	Client Sample ID	Sulfate (mg/L)
X04858	56MP-10S	4.61
X04859	MW56-2	46.3
X04860	MW56-8	29.7
X04861	MW56-9	58.7
X04862	56MP-4S	0.395
X04863	MW56-12	42.4
X04864	MW56-6	2.92
X04865	56MP-5S	1.21
X04866	56MP-5D	50.4
X04867	56MP-15D	52.9
X04868	MW56-10	68.6
X04869	56MP-7D	65.1
X04869Dup	56MP-7D dup	65.4
Method Blank 3-28-95		<0.250

Quality Assurance

		Spike Amount (mg/L)	Sample Result (mg/L)	Spike Result (mg/L)	% Recovery
X04869	56MP-7D Matrix Spike	10.0	65.1	75.4	102
X04869	56MP-7D Matrix Spike Dup	10.0	65.1	75.5	104
	MS/MSD RPD				1.36
X04869/X04869 Dup	RPD				0.368

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Miscellaneous Analyses

722450.21020

Date Sampled	: 3/24,26,27/95	Client Project ID.	: /MacDill AFB
Date Received	: 3/28/95	Lab Project No.	: 95-0983
Date Prepared	: 3/30/95	Detection Limit	: 5.00 $mgCaCO_3/L$
Date Analyzed	: 3/30/95	Method	: EPA 310.1

Evergreen Sample #	Client Sample ID	Matrix	Total Alkalinity ($mgCaCO_3/L$)
X04851	MD32-3	Water	149
X04851 Dup	MD32-3 Dup	Water	150
X04853	56MP-6D	Water	154
X04854	56MP-6S	Water	131
X04866	56MP-5D	Water	123
X04867	56-MP-15D	Water	121
X04868	MW56-10	Water	152
Method blank (3/30/95)			<5.00

Quality Assurance

	True Value ($mgCaCO_3/L$)	Result ($mgCaCO_3/L$)	% Recovery
APG Minerals Reference Lot 13862	11.8	10.5	89.0
X04851/X04851 Dup RPD			0.575

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Total Organic Carbon

Date Sampled	: 3/24/95	Client Project ID.	: 722450.21020/ MacDill AFB
Date Received	: 3/28/95	Lab Project No.	: 95-0983
Date Prepared	: 3/31/95	Method	: EPA 415.1
Date Analyzed	: 3/31/95	Matrix	: Water
		Detection Limit	: 1.00 mg C/L

Evergreen Sample #	Client Sample ID	mg C/Liter
X04850	24MP-6S	30.1
X04851	MD32-3	8.55
95-1009		
X04936	56MP-3S	10.2
X04936 Dup	56MP-3S Dup	10.2
Method Blank (3/31/95)		<1.00

Quality Assurance

		Spike Amount (mg C/L)	Sample Result (mg C/L)	Spike Result (mg C/L)	% Recovery
95-1009					
X04936	Matrix Spike 56MP-3S	10.0	10.2	20.6	103
X04936	Matrix Spike Dup 56MP-3S	10.0	10.2	20.7	104
	MS/MSD RPD				1.15
X04936/X04936	RPD				0.098

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0983em.10

External Standard Report

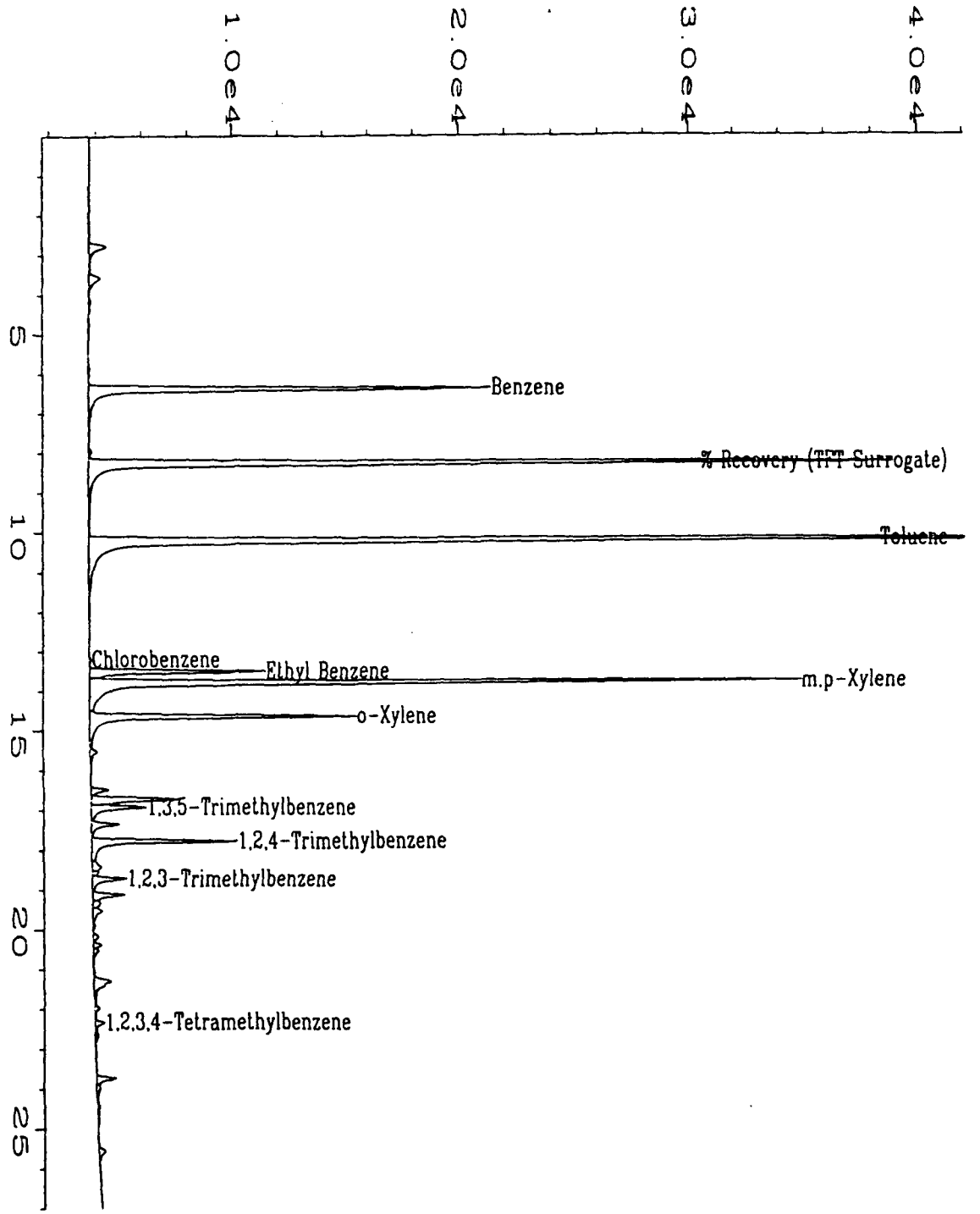
Data File Name	: C:\HPCHEM\1\DATA\BX10413\012F0101.D		
Operator	: C.J. Cook	Page Number	: 1
Instrument	: BTEX1	Vial Number	: 12
Sample Name	: X04862;250;0.02	Injection Number	: 1
Run Time Bar Code	:	Sequence Line	: 1
Acquired on	: 13 Apr 95 06:57 PM	Instrument Method	: BX10413A.M
Report Created on	: 13 Apr 95 07:24 PM	Analysis Method	: BX10413A.M
Last Recalib on	: 13 APR 95 04:13 PM	Sample Amount	: 0
Multiplier	: 250	ISTD Amount	:
Sample Info	: Project#: 95-0983 Client#: 56MP-4S Water		

Sig. 1 in C:\HPCHEM\1\DATA\BX10413\012F0101.D

Ret Time	Area	Type	Width	Ref#	ug/L	Name
6.362	120692	PV	0.104	1	3928.657	Benzene = 3929
8.244	238005	VV	0.104	1-R	19894.49	% Recovery (TFT Surrogate) = 83
10.177	327698	VV	0.096	1	11936.23	Toluene = 11936
13.184	614	PV	0.104	1	47.505	Chlorobenzene
13.485	44051	VV	0.087	1	1778.348	Ethyl Benzene = 1778
13.763	196208	VV	0.095	1	6512.699	m,p-Xylene = 6513
14.628	75627	VV	0.096	1	3061.683	o-Xylene = 3062
16.909	17557	VV	0.105	1	508.633	1,3,5-Trimethylbenzene
17.751	41320	VV	0.096	1	1743.240	1,2,4-Trimethylbenzene = 17
18.699	10682	VV	0.105	1	376.462	1,2,3-Trimethylbenzene
22.317	3080	VV	0.111	1	14.252	1,2,3,4-Tetramethylbenzene

Time Reference Peak	Expected RT	Actual RT	Difference
2	8.262	8.244	-0.018

Part holding time
DF = 100
see D.
4/18/95



Data File Name	: C:\HPCHEM\1\DATA\BX10413\012F0101.D		
Operator	: C.J. Cook	Page Number	: 1
Instrument	: BTEX1	Vial Number	: 12
Sample Name	: X04862;250;0.02	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 1
Acquired on	: 13 Apr 95 06:57 PM	Instrument Method	: BX10413A.MTH
Report Created on	: 13 Apr 95 07:24 PM	Analysis Method	: BX10413A.MTH
Last Recalib on	: 13 APR 95 04:13 PM	Sample Amount	: 0
Multiplier	: 250	ISTD Amount	:
Sample Info	: Project#: 95-0983 Client#: 56MP-4S Water		

External Standard Report

Data File Name : C:\HPCHEM\1\DATA\BX10413\013F0101.D
Operator : C.J. Cook
Instrument : BTEX1
Sample Name : X04864;250;0.02
Run Time Bar Code:
Acquired on : 13 Apr 95 07:36 PM
Report Created on: 13 Apr 95 08:04 PM
Last Recalib on : 13 APR 95 04:13 PM
Multiplier : 250
Sample Info : Project#: 95-0983 Client#: MW56-6 Water

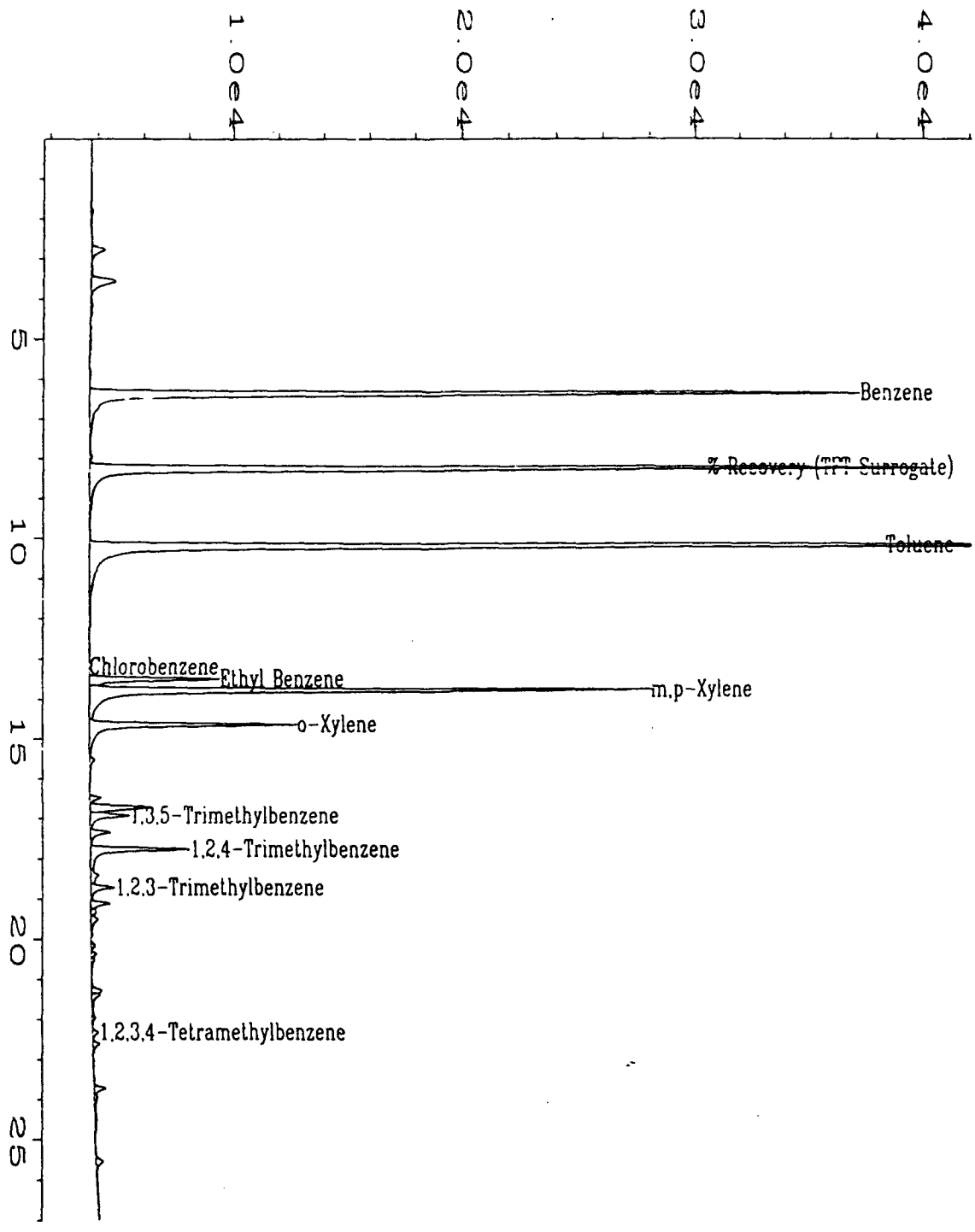
Page Number : 1
Vial Number : 13
Injection Number : 1
Sequence Line : 1
Instrument Method: BX10413A.M
Analysis Method : BX10413A.M
Sample Amount : 0
ISTD Amount :

Sig. 1 in C:\HPCHEM\1\DATA\BX10413\013F0101.D

Ret Time	Area	Type	Width	Ref#	ug/L	Name
6.357	229474	PV	0.105	1	7478.965	Benzene = 7479
8.242	250991	VV	0.105	1-R	20979.94	% Recovery (TFT Surrogate) = 8
10.178	349156	VV	0.097	1	12722.18	Toluene = 12722
13.188	114	PV	0.101	1	28.655	Chlorobenzene
13.487	33203	VV	0.089	1	1332.292	Ethyl Benzene = 1332
13.765	154670	VV	0.095	1	5092.296	m,p-Xylene = 5092
14.630	60075	VV	0.098	1	2418.316	o-Xylene = 2418
16.913	12749	VV	0.110	1	344.942	1,3,5-Trimethylbenzene
17.753	29116	VV	0.099	1	1205.224	1,2,4-Trimethylbenzene = 1
18.700	7388	VV	0.107	1	208.066	1,2,3-Trimethylbenzene
22.311	1739	VV	0.108	1	-65.020	1,2,3,4-Tetramethylbenzene

Time Reference Peak	Expected RT	Actual RT	Difference
2	8.262	8.242	-0.020

past holding time
ppc



Data File Name	: C:\HPCHEM\1\DATA\BX10413\013F0101.D		
Operator	: C.J. Cook	Page Number	: 1
Instrument	: BTEX1	Vial Number	: 13
Sample Name	: X04864;250;0.02	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 1
quired on	: 13 Apr 95 07:36 PM	Instrument Method	: BX10413A.MTH
port Created on	: 13 Apr 95 08:04 PM	Analysis Method	: BX10413A.MTH
Last Recalib on	: 13 APR 95 04:13 PM	Sample Amount	: 0
Multiplier	: 250	ISTD Amount	:
Sample Info	: Project#: 95-0983 Client#: MW56-6 Water		

Evergreen

CASE NARRATIVE

Evergreen Analytical Laboratory (EAL) Project #: 95-1009

Parsons Engineering Science, Inc. (PES) Project: MacDill AFB (722450.21020)

Sample Receipt

On March 29, 1995, nine water samples, one trip blank, one field blank and one rinseate blank were received in good condition at EAL. Refer to the EAL Sample Log Sheet for specific log-in information and cross-reference of EAL and PES sample identifications.

BTEX, Water Matrix, Method 602

Sample MW56-7 was analyzed at dilution factors of one and ten due to the presence of target analytes in the sample. The reporting limits have been raised accordingly.

There were no quality control anomalies to report.

Total Volatile Hydrocarbons (TVH), Water Matrix, Method 8015M

There were no quality control anomalies to report.

General Chemistry

There were no quality control anomalies to report.

Patricia A. McClellan, Project Manager

Evergreen Analytical Sample Log Sheet

Project # 95-1009

Date(s) Sampled: 3/28/95 COC

Date Due: 4/3-UST
4/12-OTHERS

Date Received: 3/29/95 1010

Holding Time(s): 4/11-BTEX,TVPH,A
3/30-NITRATE,NITRIT

Client Project I.D. 722450.21020 / MAC DILL

Rush STANDARD

Client: PARSONS ENGINEERING SCIENCE

Shipping Charges N/A

Address: 1700 BROADWAY, SUITE 900
DENVER, CO. 80290

E.A. Cooler # 320

Airbill # FEDEX-9581826365

Contact: TODD WIEDEMEIER

Custody Seal Intact? Y
Cooler Y Bottles N/A

Client P.O. _____

COC Present Y
Sample Tags Present? Y
Sample Tags Listed? Y
Sample(s) Sealed? Y

Phone #831-8100 Fax #831-8208

Special Invoicing/Billing _____

Special Instructions *INCLUDING CHLOROBENZENE, TMB AND TEMB UNLESS OTHERWIS NOTED. AN MS/MSD AND LAB DUPLICATE IS TO ANALYZED ON ALL PES PROJECTS.

Lab ID #	Client ID#	Analysis	Mtx	Btl	Loc
X04934A/B	MW56-11	*BTEX 602	W	40V	2
X04935A/B	MW56-7	*BTEX 602	W	40V	2
X04936A/B	56MP-3S	*BTEX 602	W	40V	2
X04937A/B	56MP-3D	*BTEX 602	W	40V	2
X04938A/B	56MP-1S	*BTEX 602	W	40V	2
X04939A/B	MW56-05	*BTEX 602	W	40V	2
X04940A/B	MD32-MW7	*BTEX 602	W	40V	2
X04941A/B	MW32-01	*BTEX 602	W	40V	2
X04942A/B	MW32-21	*BTEX 602	W	40V	2
X04943A	56-FIELD BLANK	*BTEX 602	W	40V	2
X04944A	TRIP BLANK	*BTEX 602	W	40V	2
X04945A	56-RINSEATE BLANK	*BTEX 602	W	40V	2
X04934C/D	MW56-11	TVPH	W	40V	2
X04935C/D	MW56-07	TVPH	W	40V	2
X04936C/D	56MP-3S	TVPH	W	40V	2
X04937C/D	56MP-3D	TVPH	W	40V	2
X04938C/D	56MP-1S	TVPH	W	40V	2

R=Sample to be returned

Route To: GC/MS __ GC 3 Metals __ Wet Chem 3 SxPrep __ Acct __
SxRec C QA/QC C Sales C File Orig

Custodian/Date: 4/1
4/10/95

X04939C/D	MW56-5	TVPH	W	40V	2
X04940C/D	MD32-MW7	TVPH	W	40V	2
X04941C/D	MW32-01	TVPH	W	40V	2
X04942C/D	MW32-21	TVPH	W	40V	2
X04936E	56MP-3S	ALKALINITY	W	250PA	A4
X04934E	MW56-11	ANIONS (Cl^-,SO4,$NO3^-$,$NO4^-$)	W	125P	A4
X04935E	MW56-07	ANIONS (Cl^-,SO4,$NO3^-$,$NO4^-$)	W	125P	A4
X04936F	56MP-3S	ANIONS (Cl^-,SO4,$NO3^-$,$NO4^-$)	W	125P	A4
X04937E	56MP-3D	ANIONS (Cl^-,SO4,$NO3^-$,$NO4^-$)	W	125P	A4
X04938E	56MP-1S	ANIONS (Cl^-,SO4,$NO3^-$,$NO4^-$)	W	125P	A4
X04939E	MW56-05	ANIONS (Cl^-,SO4,$NO3^-$,$NO4^-$)	W	125P	A4
X04940E	MD32-MW7	ANIONS (Cl^-,SO4,$NO3^-$,$NO4^-$)	W	125P	A4
X04941E	MW32-01	ANIONS (Cl^-,SO4,$NO3^-$,$NO4^-$)	W	125P	A4
X04942E	MW32-21	ANIONS (Cl^-,SO4,$N03^-$,$NO4^-$)	W	125V	A4
X04936G	56MP-3S	TOC	W	125A	A4

R=Sample to be returned

CHAIN OF CUSTODY RECORD / ANALYTICAL SERVICES REQUEST

Evergreen Analytical Inc.
4036 Youngfield St.
Wheat Ridge, Colorado 80033
(303) 425-6021
FAX (303) 425-6854
(800) 845-7400

COMPANY Parsons Engineering Science
ADDRESS 1700 Broadway, Suite 900
CITY Denver STATE CO ZIP ~~80116~~ 80290
PHONE# 303-831-8100 FAX # FAX RESULTS Y / N

CLIENT CONTACT (print) Jeff Wiedemeier
PROJECT I.D. 722450.210.20
EAL. QUOTE # P.O.#
TURNAROUND REQUIRED* ~~30 days~~ 5 days
*expedited turnaround subject to additional fee 1-3 days over 10 days

Sampler Name:
(signature) Mark Vessely
(print) MARK VESSELY
Evergreen Analytical Cooler No. 320
Cooler Received

Please **PRINT** all information:

SPECIAL INSTRUCTIONS

CLIENT SAMPLE IDENTIFICATION	DATE SAMPLED	TIME	No. of Containers	MATRIX: Water-Drinking/Discharge (Ground)* (circle)	MATRIX: Soil / Solid	MATRIX: Oil / Sludge	ANALYSIS REQUESTED: TCLP VOA/BNA/Pest/Herb/Metals (circle)	VOA 8260/624/524.2 (circle)	BNA 8270/625 (circle)	Pesticides 8080/608 (circle)	Pest/PCBs 8080/608/508 (circle)	Herbicides 8150/515 (circle)	PCB Screen	8020/602 (circle)/MTBE (circle) Trace MB	Oil & Grease 413.1 (circle)	TVPH 8015mod. (Gasoline)	TEPH 8015mod. (Diesel)	Total Metals-DW / NPDES / SW846 (circle & list metals below)	Dissolved Metals - DW / SW846 (circle & list metals below)	Alkalinity	Anions (Cl, NO3, SO4)	TOC	EAL Sample No.
MW56-11	3/28/95	800	5	X									X		X					X			X04934
MW56-7	3/28/95	8:45	5	X									X		X					X			35
56MP-3S	3/28/95	9:40	7	X									X		X				X	X	X		36
56MP-3 ~~DD~~	3/28/95	10:30	5	X									X		X					X			37
56MP-1S	3/28/95	11:30	5	X									X		X					X			38
MW56-5	3/28/95	12:30	5	X									X		X					X			39
MO32-MW7	3/28/95	13:30	5	X									X		X					X			40
MW32-1	3/28/95	14:30	5	X									X		X					X			41
MW32-21	3/28/95	14:30	5	X									X		X					X			42
56-Field Blank	3/28/95	14:30	1	·									X		~~X~~ -10-MV								43
HT:													V		V				42 days	125P	1254		Location 2, A4
DD:													40		40								Container Size

Instructions: Samples packed in Ice
ANALYZE BLANK'S for ~~4~~ BTEX

EAL use only
Do not write in shaded area

EAL Project # 1009
Custodian

CHAIN OF CUSTODY RECORD / ANALYTICAL SERVICES REQUEST

Evergreen Analytical Inc.

4036 Youngfield St.
Wheat Ridge, Colorado 80033
(303) 425-6021
FAX (303) 425-6854
(800) 845-7400

COMPANY Parsons Engineering Science
ADDRESS 1700 Broadway, Suite 900
CITY Denver STATE CO ZIP 80290
PHONE# (303) 831-8100 FAX # _____ FAX RESULTS Y / N

CLIENT CONTACT (print) Todd Wiedemeier
PROJECT I.D. 722450.21020
EAL. QUOTE # _____ P.O.# _____
TURNAROUND REQUIRED* 30 days
*expedited turnaround subject to additional fee

Sampler Name:
(signature) Mark Vessely
(print) MARK VESSELY

Evergreen Analytical Cooler No. 320
Cooler Received _____

Please **PRINT** all information:

CLIENT SAMPLE IDENTIFICATION	DATE SAMPLED	TIME	No. of Containers	MATRIX: Water-Drinking/Discharge/Ground (circle)	MATRIX: Soil / Solid	MATRIX: Oil / Sludge	TCLP VOA/BNA/Pest/Herb/Metals (circle)	VOA 8260/624/524.2 (circle)	BNA 8270/625 (circle)	Pesticides 8080/608 (circle)	Pest/PCBs 8080/608/508 (circle)	Herbicides 8150/515 (circle)	PCB Screen	BTEX 8020/602 (circle)/MTBE (circle) EPA 8260 mod. Tier 2	TRPH 418.1/Oil & Grease 413.1 (circle)	TVPH 8015mod. (Gasoline)	TEPH 8015mod. (Diesel)	Total Metals-DW / NPDES / SW846 (circle & list metals below)	Dissolved Metals - DW / SW846 (circle & list metals below)	EAL Sample No.
Trip Blank			1											X						X04944
Rinsate Blank	3/28/95	14:45	1											X						45

EAL use only
Do not write in shaded area

EAL Project # 1009
Custodian _____

HT:
DD:

Location 2, A4
Container Size

Instructions: See Page 1

Relinquished by: (Signature) | Date/Time | Received by: (Signature) | Date/Time | Relinquished by: (Signature)

Evergreen Analytical Sample Receipt/Check-in Record

Date & Time Rec'd: 3/29/95 10:10 Shipped Via: Fed EX 9581
(Airbill # if applicable)

Client : Parsons Eng. Science

Client Project ID(s): 722450.21020

EAL Project #(s): 95-1009 EAL Cooler(s): (Y) N

Cooler#	320								
Ice packs	(Y)	N	Y	N	Y	N	Y	N	Y	N
Temperature °C	cold								

	Y	N	N/
1. Custody seal(s) present:	✓		
Seals on cooler intact	✓		
Seals on bottle intact			✓
2. Chain of Custody present:	✓		
3. Containers broken or leaking: (Comment on COC if Y)		✓	
4. Containers labeled:	✓		
5. COC agrees w/ bottles received: (Comment on COC if N)	✓		
6. COC agrees w/ labels: (Comment on COC if N)	✓		
7. Headspace in VOA vials-waters only (comment on COC if Y)			
8. VOA samples preserved:			
9. pH measured on metals, cyanide or phenolics*:			✓
List discrepancies			
*Non-EAL provided containers only, water samples only.			
10. Metal samples present:			✓
Total _____ , Dissolved _____			
D or PD to be filtered:			
T,TR,D,PD to be Preserved:			
11. Short holding times:		✓	
Specify parameters			
12. Multi-phase sample(s) present:		✓	
13. COC signed w/ date/time:	✓		

Comments: _____

(Additional comments on back)
Custodian Signature/Date: Lee Connor 3/29/95

CHAIN OF CUSTODY RECORD / ANALYTICAL SERVICES REQUEST

Evergreen Analytical Inc.
4036 Youngfield St.
Wheat Ridge, Colorado 80033
(303) 425-6021
FAX (303) 425-6854
(800) 845-7400

COMPANY Parsons Engineering Science
ADDRESS 1700 Broadway, Suite 900
CITY Denver STATE CO ZIP ~~80290~~ 80290
PHONE# 303-831-8100 FAX # _____ FAX RESULTS Y / N

CLIENT CONTACT (print) Jeff Wiedmeier
PROJECT I.D. 722450.21020
EAL. QUOTE # _____ P.O.# _____
TURNAROUND REQUIRED* 30 days
*expedited turnaround subject to additional fee

Sampler Name:
(signature) Mark Vessely
(print) MARK VESSELY

Evergreen Analytical Cooler No. 320
Cooler Received _____

Please **PRINT** all information:

CLIENT SAMPLE IDENTIFICATION	DATE SAMPLED	TIME	No. of Containers	MATRIX: Water-Drinking/Discharge/(Ground) (circle)	MATRIX: Soil / Solid	MATRIX: Oil / Sludge	TCLP VOA/BNA/Pest/Herb/Metals (circle)	VOA 8260/624/524.2 (circle)	BNA 8270/625 (circle)	Pesticides 8080/608 (circle)	Pest/PCBs 8080/608/508 (circle)	Herbicides 8150/515 (circle)	PCB Screen	BTEX 8020/602 (circle)/MTBE (circle)	TRPH 418.1/Oil & Grease 413.1 (circle)	VPH 8015mod. (Gasoline)	TEPH 8015mod. (Diesel)	Total Metals-DW / NPDES / SW846 (circle & list metals below)	Dissolved Metals - DW / SW846 (circle & list metals below)	Alkalinity	Anions (Cl⁻, NO₃⁻, SO₄⁻⁻)	TOC					EAL Sample No.
MW 56-11	3/28/95	800	5	X										X		X					X					
MW 56-7	3/28/95	8:45	5	X										X		X					X					
56 MP-3 S	3/28/95	9:40	7	X										X		X				X	X	X				
56 MP-3 ~~MID~~ D	3/28/95	10:30	5	X										X		X					X					
56 MP-1 S	3/28/95	11:30	5	X										X		X					X					
MW 56-5	3/28/95	12:30	5	X										X		X					X					
MW32-MW 7	3/28/95	13:30	5	X										X		X					X					
MW 32-1	3/28/95	14:30	5	X										X		X					X					
MW 32-21	3/28/95	14:30	5	X										X		X					X					
Field Blank	3/28/95	14:30	1	X										X		~~X~~ -NO-MV										
HT:																										Location
DD:																										Container Size

EAL use only
Do not write in shaded area

EAL
Project # _____
Custodian _____

Instructions: Samples packed in ICE
ANALYZE BLANK'S for just BTEX

Relinquished by (Signature) _____ Date/Time _____ Received by (Signature) _____ Date/Time _____

CHAIN OF CUSTODY RECORD / ANALYTICAL SERVICES REQUEST

Evergreen Analytical Inc.
4036 Youngfield St.
Wheat Ridge, Colorado 80033
(303) 425-6021
FAX (303) 425-6854
(800) 845-7400

COMPANY: PARSONS ENGINEERING SCIENCE
ADDRESS: 1700 BROADWAY, SUITE 900
CITY: DENVER STATE: CO ZIP: 80290
PHONE#: (303) 831-8100 FAX #: FAX RESULTS Y / N

CLIENT CONTACT (print): Todd Wiedemeier
PROJECT I.D.: 722450.21020
EAL. QUOTE #: P.O.#:
TURNAROUND REQUIRED*: 30 DAYS
*expedited turnaround subject to additional fee

Sampler Name:
(signature)
(print): MARK VESSELY
Evergreen Analytical Cooler No.: 320
Cooler Received:

Please **PRINT** all information:

CLIENT SAMPLE IDENTIFICATION	DATE SAMPLED	TIME	No. of Containers	MATRIX: Water-Drinking/Discharge/Ground (circle)	MATRIX: Soil / Solid	MATRIX: Oil / Sludge	TCLP VOA/BNA/Pest/Herb/Metals (circle)	VOA 8260/624/524.2 (circle)	BNA 8270/625 (circle)	Pesticides 8080/608 (circle)	Pest/PCBs 8080/608/508 (circle)	Herbicides 8150/515 (circle)	PCB Screen	BTEX 8020/602 (circle)/MTBE (circle) Tme and Tetra 018	TRPH 418.1/Oil & Grease 413.1 (circle)	TVPH 8015mod. (Gasoline)	TEPH 8015mod. (Diesel)	Total Metals-DW / NPDES / SW846 (circle & list metals below)	Dissolved Metals - DW / SW846 (circle & list metals below)	EAL Sample No.
TRIP BLANK			1											X						
RINSEATE BLANK	3/28/95	14:45	1											X				NO NV		
HT:																				Location
DD:																				Container Size

EAL use only
Do not write in shaded area

EAL
Project #:
Custodian:

Instructions: See Page 1

EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303) 425-6021

Method 602 Data Report

Client Sample Number	: MD32-MW7	Client Project No.	: 722450.21020/MacD
Lab Sample Number	: X04940	Lab Project No.	: 95-1009
Date Sampled	: 3/28/95	Dilution Factor	: 1.00
Date Received	: 3/29/95	Method	: 602
Date Prepared	: 4/11/95	Matrix	: Water
Date Analyzed	: 4/11/95	Lab File No.	: BX1041043
		Method Blank No.	: MB041195

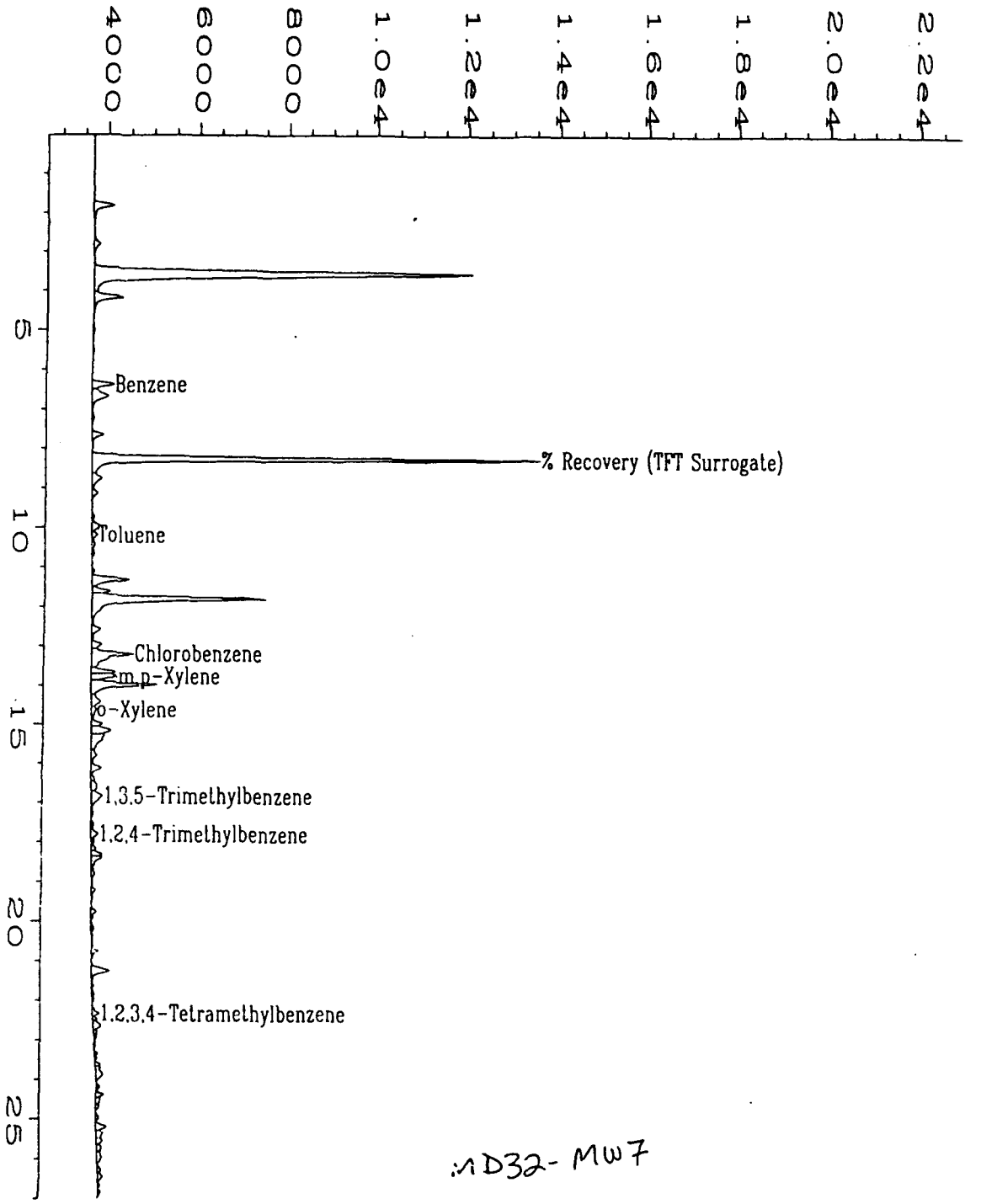
Compound Name	Cas Number	Sample Concentration ug/L		RL ug/L
Benzene	71-43-2	1.6		0.4
Toluene	108-88-3	0.5	B	0.4
Chlorobenzene	108-90-7	5.5		0.4
Ethyl Benzene	100-41-4		U	0.4
Total Xylenes (m, p & o)	108-38-3, 106-42-3 and 95-47-6	2.5		0.4
1,3,5-Trimethylbenzene	108-67-8	1.5		0.4
1,2,4-Trimethylbenzene	95-63-6	0.9		0.4
1,2,3-Trimethylbenzene	526-73-8		U	0.4
1,2,3,4-Tetramethylbenzene	488-23-3	0.8		0.4
Surrogate Recovery (α,α,α-Trifluorotoluene):		87%		70%-130% (QC limits

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene RL is for a single peak.

QUALIFIERS:
E = Extrapolated value.
U = Compound analyzed for, but not detected.
B = Compound also found in the blank.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit (RL).
RL = Reporting Limit.
NA = Not Available/Not Applicable.

Analyst

Approved



MD32-MW7

Data File Name	: C:\HPCHEM\1\DATA\BX10410\043F0101.D		
Operator	: Kaprie S. Cone	Page Number	: 1
Instrument	: BTEX1	Vial Number	: 43
Sample Name	: X05940;1;5	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 1
Acquired on	: 11 Apr 95 03:40 PM	Instrument Method	: BX1041
Report Created on	: 17 Apr 95 01:20 AM	Analysis Method	: BX1041.
Last Recalib on	: 11 APR 95 10:03 AM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:

EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303) 425-6021

Method 602 Data Report

Client Sample Number	: MD32-MW7	Client Project No.	: 722450.21020/MacDi
Lab Sample Number	: X04940DUP	Lab Project No.	: 95-1009
Date Sampled	: 3/28/95	Dilution Factor	: 1.00
Date Received	: 3/29/95	Method	: 602
Date Prepared	: 4/11/95	Matrix	: Water
Date Analyzed	: 4/11/95	Lab File No.	: BX1041044
		Method Blank No.	: MB041195

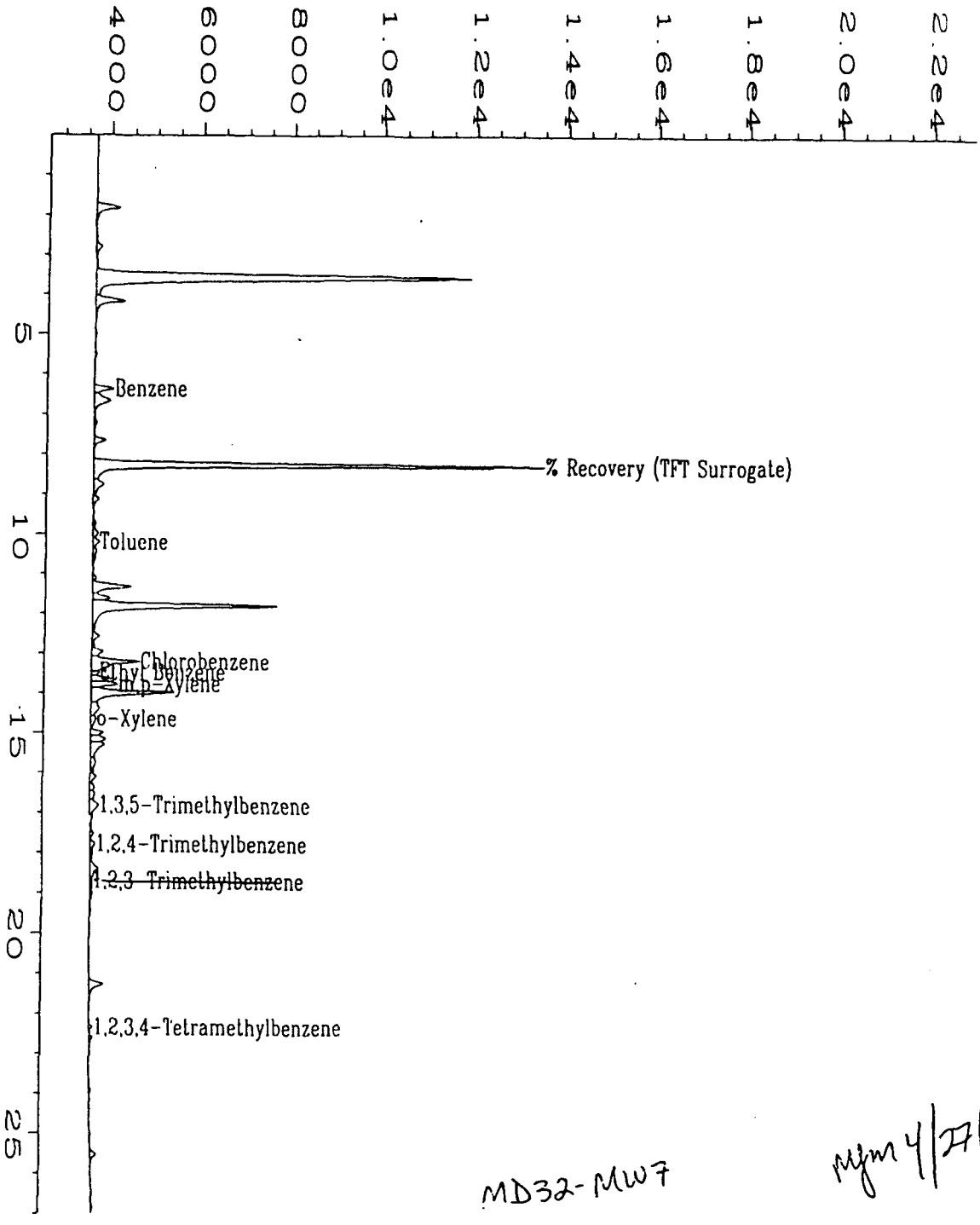
Compound Name	Cas Number	Sample Concentration ug/L		RL ug/L
Benzene	71-43-2	1.4		0.4
Toluene	108-88-3	0.6	B	0.4
Chlorobenzene	108-90-7	5.7		0.4
Ethyl Benzene	100-41-4	0.6		0.4
Total Xylenes (m, p & o)	108-38-3, 106-42-3 and 95-47-6	2.6		0.4
1,3,5-Trimethylbenzene	108-67-8	1.2		0.4
1,2,4-Trimethylbenzene	95-63-6	0.6		0.4
1,2,3-Trimethylbenzene	526-73-8		U	0.4
1,2,3,4-Tetramethylbenzene	488-23-3	0.5		0.4
Surrogate Recovery (α,α,α-Trifluorotoluene):		87%		70%-130% (QC limits)

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene RL is for a single peak.

QUALIFIERS:
E = Extrapolated value.
U = Compound analyzed for, but not detected.
B = Compound also found in the blank.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit (RL).
RL = Reporting Limit.
NA = Not Available/Not Applicable.

Analyst

Approved



MD32-MW7

mjm 4/17/95

Data File Name	: C:\HPCHEM\1\DATA\BX10410\044F0101.D		
Operator	: Kaprie S. Cone	Page Number	: 1
Instrument	: BTEX1	Vial Number	: 44
Sample Name	: X05940DUP;1;5	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 1
Acquired on	: 11 Apr 95 04:19 PM	Instrument Method	: BX1041
Report Created on	: 17 Apr 95 01:18 AM	Analysis Method	: BX10411A.
Last Recalib on	: 11 APR 95 10:03 AM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:

EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303) 425-6021

Method 602 Data Report

Client Sample Number	: MW32-01	Client Project No.	: 722450.21020/Macl
Lab Sample Number	: X04941	Lab Project No.	: 95-1009
Date Sampled	: 3/28/95	Dilution Factor	: 1.00
Date Received	: 3/29/95	Method	: 602
Date Prepared	: 4/11/95	Matrix	: Water
Date Analyzed	: 4/11/95	Lab File No.	: BX1041037
		Method Blank No.	: MB041195

Compound Name	Cas Number	Sample Concentration ug/L		RL ug/L
Benzene	71-43-2		U	0.4
Toluene	108-88-3	0.4	B	0.4
Chlorobenzene	108-90-7	1.2		0.4
Ethyl Benzene	100-41-4	0.5		0.4
Total Xylenes (m, p & o)	108-38-3, 106-42-3 and 95-47-6	1.9		0.4
1,3,5-Trimethylbenzene	108-67-8	1.0		0.4
1,2,4-Trimethylbenzene	95-63-6		U	0.4
1,2,3-Trimethylbenzene	526-73-8		U	0.4
1,2,3,4-Tetramethylbenzene	488-23-3		U	0.4

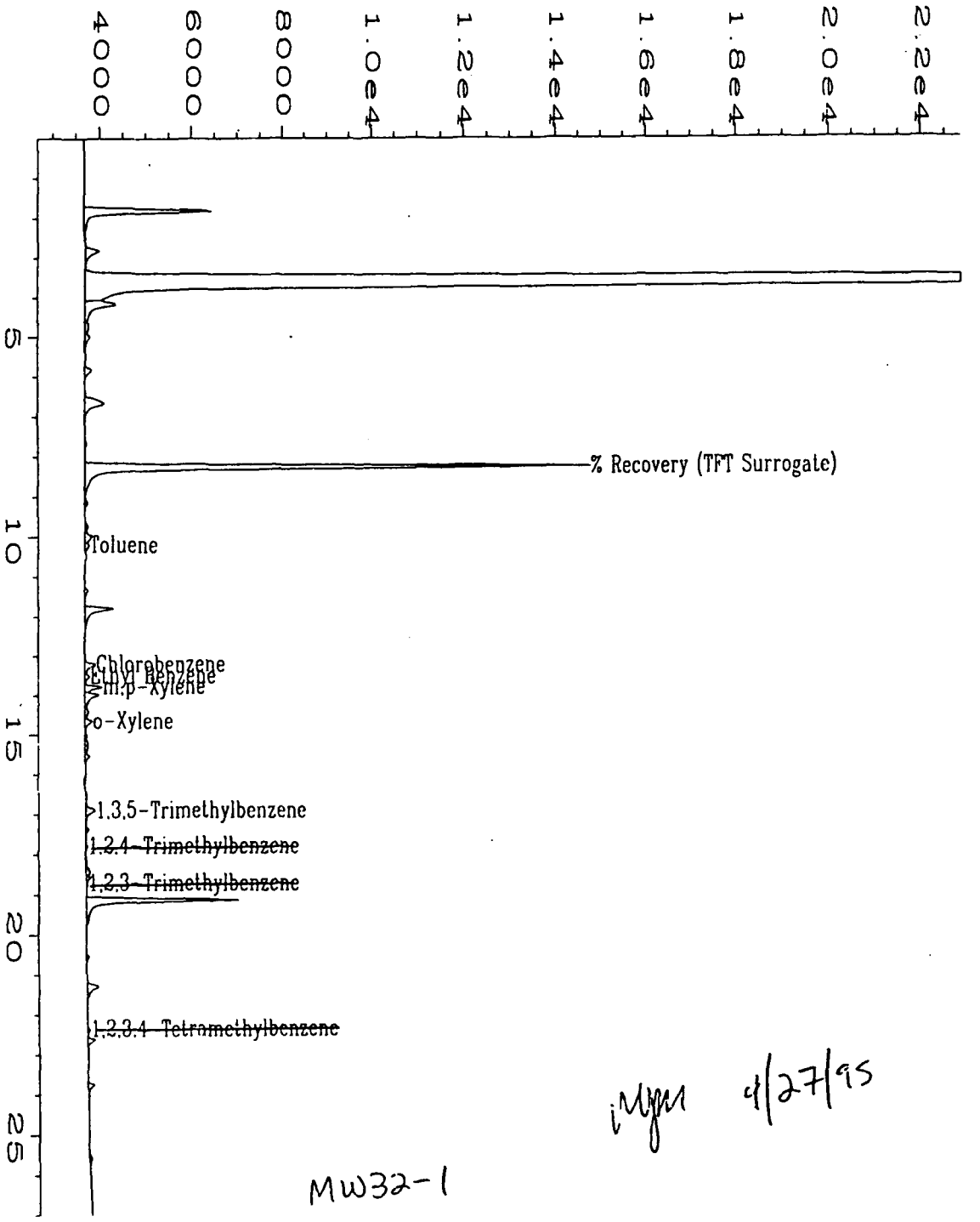
Surrogate Recovery (α,α,α-Trifluorotoluene):	100%	70%-130% (QC limits

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene RL is for a single peak.

QUALIFIERS:
E = Extrapolated value.
U = Compound analyzed for, but not detected.
B = Compound also found in the blank.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit (RL).
RL = Reporting Limit.
NA = Not Available/Not Applicable.

Analyst

Approved



MW32-1

MW 4/27/95

Data File Name	: C:\HPCHEM\1\DATA\BX10410\037F0101.D		
Operator	: Kaprie S. Cone	Page Number	: 1
Instrument	: BTEX1	Vial Number	: 37
Sample Name	: X04941;1;5	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 1
Acquired on	: 11 Apr 95 11:25 AM	Instrument Method	: BX1041.
Report Created on	: 11 Apr 95 06:12 PM	Analysis Method	: BX10411A.
Last Recalib on	: 11 APR 95 10:03 AM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:

EVERGREEN ANALYTICAL, INC.
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(303) 425-6021

Method 602 Data Report

Client Sample Number	: MW32-21	Client Project No.	: 722450.21020/MacDil
Lab Sample Number	: X04942	Lab Project No.	: 95-1009
Date Sampled	: 3/28/95	Dilution Factor	: 1.00
Date Received	: 3/29/95	Method	: 602
Date Prepared	: 4/11/95	Matrix	: Water
Date Analyzed	: 4/11/95	Lab File No.	: BX1041048
		Method Blank No.	: MB041195

Compound Name	Cas Number	Sample Concentration ug/L		RL ug/L
Benzene	71-43-2		U	0.4
Toluene	108-88-3		U	0.4
Chlorobenzene	108-90-7	0.9		0.4
Ethyl Benzene	100-41-4	0.6		0.4
Total Xylenes (m, p & o)	108-38-3, 106-42-3 and 95-47-6	2.5		0.4
1,3,5-Trimethylbenzene	108-67-8	0.9		0.4
1,2,4-Trimethylbenzene	95-63-6		U	0.4
1,2,3-Trimethylbenzene	526-73-8		U	0.4
1,2,3,4-Tetramethylbenzene	488-23-3		U	0.4

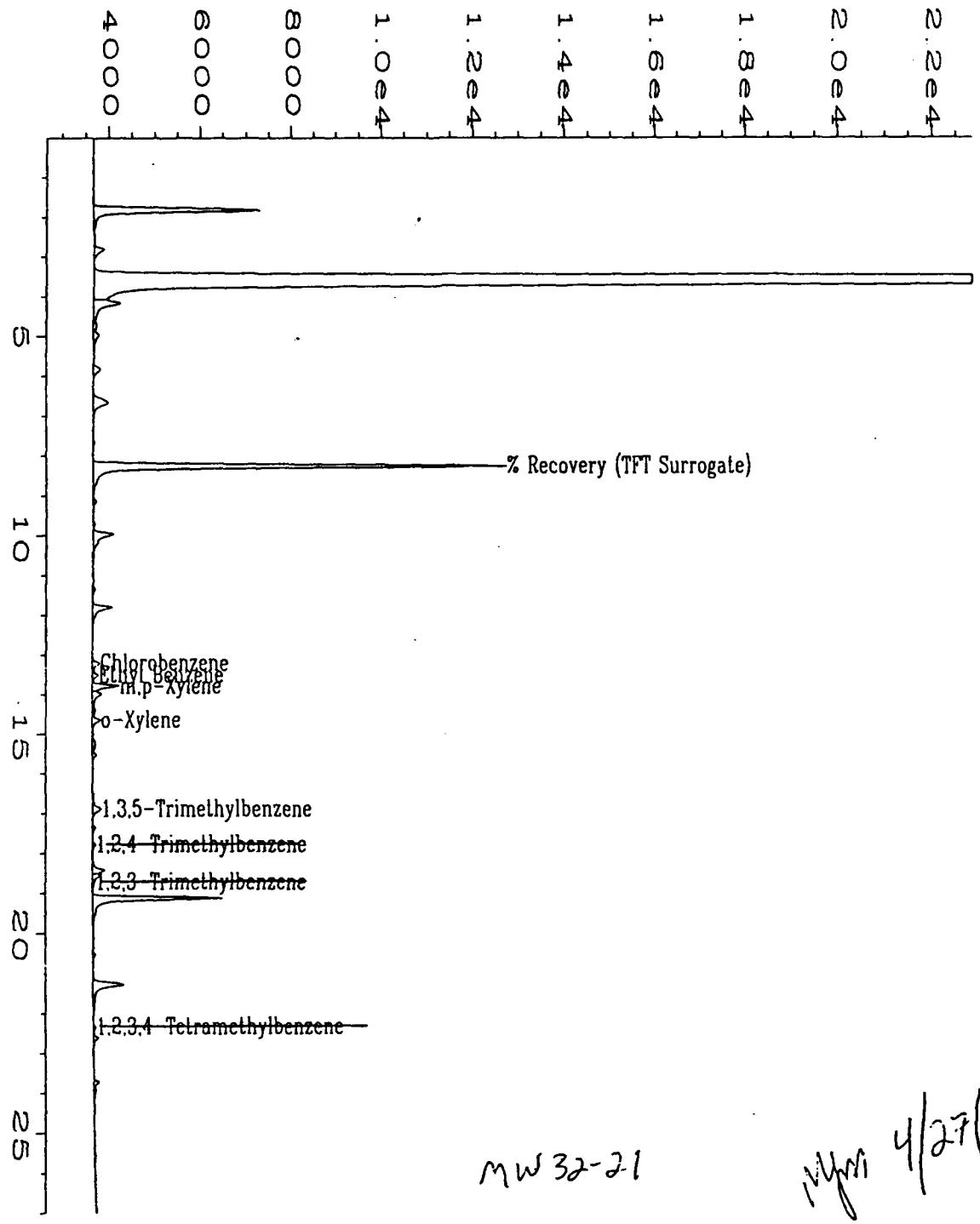
Surrogate Recovery (α,α,α-Trifluorotoluene):	82%	70%-130% (QC limits)

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene RL is for a single peak.

QUALIFIERS:
E = Extrapolated value.
U = Compound analyzed for, but not detected.
B = Compound also found in the blank.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit (RL).
RL = Reporting Limit.
NA = Not Available/Not Applicable.

Analyst

Approved



MW32-21

4/27/95

Data File Name	: C:\HPCHEM\1\DATA\BX10410\048F0101.D		
Operator	: Kaprie S. Cone	Page Number	: 1
Instrument	: BTEX1	Vial Number	: 48
Sample Name	: X04942;1;5	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 1
Acquired on	: 11 Apr 95 07:00 PM	Instrument Method	: BX104
Report Created on	: 11 Apr 95 07:27 PM	Analysis Method	: BX1041
Last Recalib on	: 11 APR 95 10:03 AM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:
Sample Info	: Project#: 95-1009 Client#: MW32-21 Water		

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Method 602 Data Report

Client Sample Number	: MW32-21	Client Project No.	: 722450.21020/MacD
Lab Sample Number	: X04942DUP	Lab Project No.	: 95-1009
Date Sampled	: 3/28/95	Dilution Factor	: 1.00
Date Received	: 3/29/95	Method	: 602
Date Prepared	: 4/11/95	Matrix	: Water
Date Analyzed	: 4/11/95	Lab File No.	: BX1041054
		Method Blank No.	: MB041195

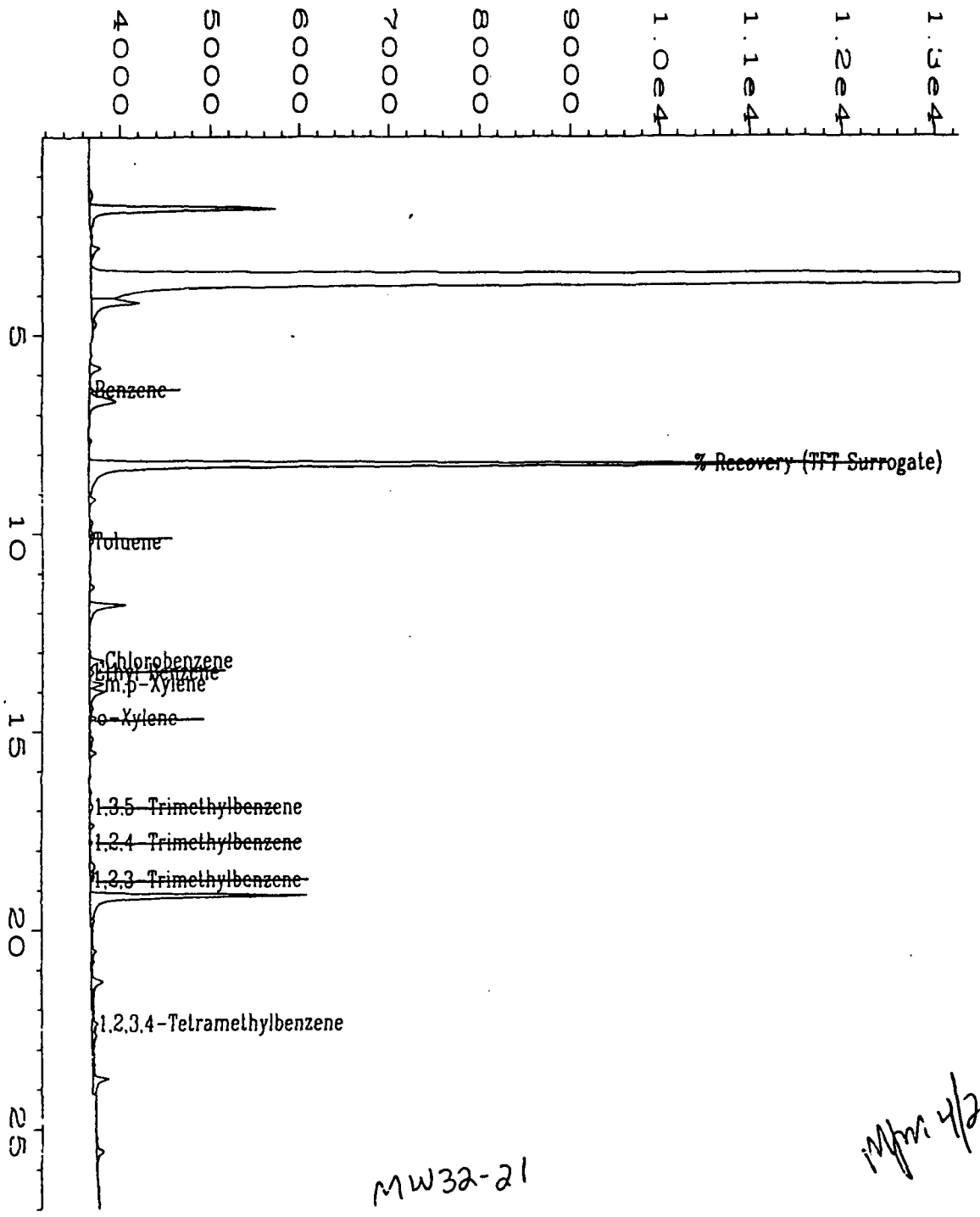
Compound Name	Cas Number	Sample Concentration ug/L		RL ug/L
Benzene	71-43-2		U	0.4
Toluene	108-88-3		U	0.4
Chlorobenzene	108-90-7	0.8		0.4
Ethyl Benzene	100-41-4		U	0.4
Total Xylenes (m, p & o)	108-38-3, 106-42-3 and 95-47-6	0.5		0.4
1,3,5-Trimethylbenzene	108-67-8		U	0.4
1,2,4-Trimethylbenzene	95-63-6		U	0.4
1,2,3-Trimethylbenzene	526-73-8		U	0.4
1,2,3,4-Tetramethylbenzene	488-23-3	0.6		0.4
Surrogate Recovery (α,α,α-Trifluorotoluene):		79%		70%-130% (QC limits

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene RL is for a single peak.

QUALIFIERS:
E = Extrapolated value.
U = Compound analyzed for, but not detected.
B = Compound also found in the blank.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit (RL).
RL = Reporting Limit.
NA = Not Available/Not Applicable.

Analyst

K. Caine
Approved



MW32-21

4/27

Data File Name : C:\HPCHEM\1\DATA\BX10410\054F0101.D
Operator : Kaprie S. Cone
Instrument : BTEX1
Sample Name : X04942DUP;1;5
Run Time Bar Code:
Acquired on : 11 Apr 95 10:51 PM
Report Created on: 11 Apr 95 11:18 PM
Last Recalib on : 11 APR 95 10:03 AM
Multiplier : 1
Sample Info : Project # 95-1009 Client # MW32-21 Water

Page Number : 1
Vial Number : 54
Injection Number : 1
Sequence Line : 1
Instrument Method: BX104
Analysis Method : BX104
Sample Amount : 0
ISTD Amount :

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(303) 425-6021

Method 602 Data Report

Client Sample Number	: 56MP-1S	Client Project No.	: 722450.21020/MacD
Lab Sample Number	: X04938	Lab Project No.	: 95-1009
Date Sampled	: 3/28/95	Dilution Factor	: 1.00
Date Received	: 3/29/95	Method	: 602
Date Prepared	: 4/8/95	Matrix	: Water
Date Analyzed	: 4/9/95	Lab File No.	: BX2040826
		Method Blank No.	: MB040895

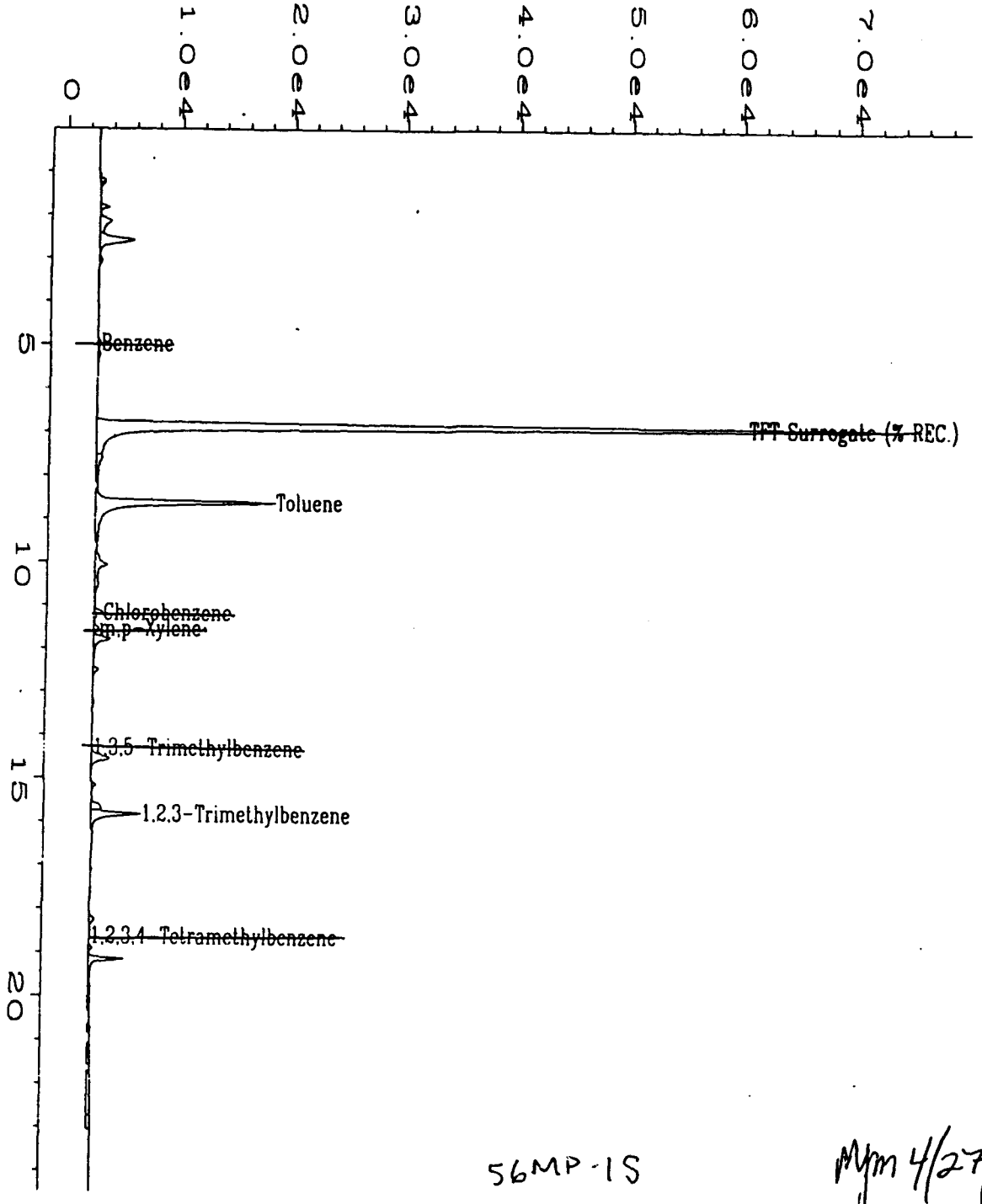
Compound Name	Cas Number	Sample Concentration ug/L		RL ug/L
Benzene	71-43-2		U	0.4
Toluene	108-88-3	7.2		0.4
Chlorobenzene	108-90-7		U	0.4
Ethyl Benzene	100-41-4		U	0.4
Total Xylenes (m, p & o)	108-38-3, 106-42-3 and 95-47-6		U	0.4
1,3,5-Trimethylbenzene	108-67-8		U	0.4
1,2,4-Trimethylbenzene	95-63-6		U	0.4
1,2,3-Trimethylbenzene	526-73-8	1.3		0.4
1,2,3,4-Tetramethylbenzene	488-23-3		U	0.4
Surrogate Recovery (α,α,α-Trifluorotoluene):		85%		70%-130% (QC limits

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene RL is for a single peak.

QUALIFIERS:
E = Extrapolated value.
U = Compound analyzed for, but not detected.
B = Compound also found in the blank.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit (RL).
RL = Reporting Limit.
NA = Not Available/Not Applicable.

Analyst

K. Cone
Approved



56MP-1S

Mym 4/27/

Data File Name	: C:\HPCHEM\2\DATA\BX20408\026R0901.D		
Operator	: S.W. Tyson	Page Number	: 1
Instrument	: BTEX2	Vial Number	: 26
Sample Name	: X04938;1;5	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 9
Acquired on	: 09 Apr 95 04:20 AM	Instrument Method	: BX2040
Report Created on	: 10 Apr 95 08:13 AM	Analysis Method	: BX2040b.M
Last Recalib on	: 09 APR 95 02:21 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:

EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303) 425-6021

Method 602 Data Report

Client Sample Number	: 56MP-3S	Client Project No.	: 722450.21020/MacD
Lab Sample Number	: X04936	Lab Project No.	: 95-1009
Date Sampled	: 3/28/95	Dilution Factor	: 1.00
Date Received	: 3/29/95	Method	: 602
Date Prepared	: 4/8/95	Matrix	: Water
Date Analyzed	: 4/9/95	Lab File No.	: BX2040823
		Method Blank No.	: MB040895

Compound Name	Cas Number	Sample Concentration ug/L		RL ug/L
Benzene	71-43-2		U	0.4
Toluene	108-88-3	11		0.4
Chlorobenzene	108-90-7		U	0.4
Ethyl Benzene	100-41-4		U	0.4
Total Xylenes (m, p & o)	108-38-3, 106-42-3 and 95-47-6		U	0.4
1,3,5-Trimethylbenzene	108-67-8		U	0.4
1,2,4-Trimethylbenzene	95-63-6		U	0.4
1,2,3-Trimethylbenzene	526-73-8		U	0.4
1,2,3,4-Tetramethylbenzene	488-23-3		U	0.4

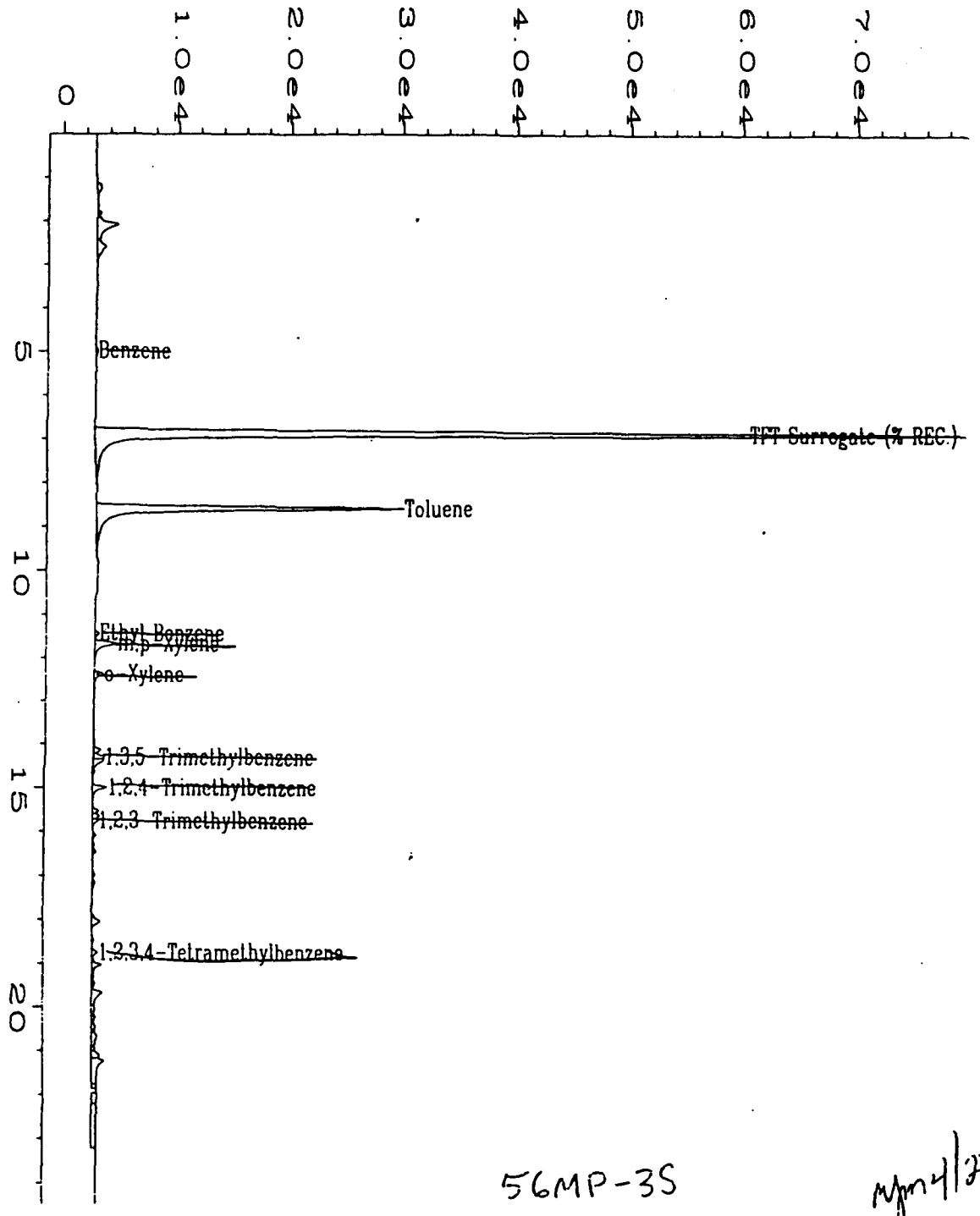
Surrogate Recovery (α,α,α-Trifluorotoluene):	87%	70%-130% (QC limits)

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene RL is for a single peak.

QUALIFIERS:
E = Extrapolated value.
U = Compound analyzed for, but not detected.
B = Compound also found in the blank.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit (RL).
RL = Reporting Limit.
NA = Not Available/Not Applicable.

Analyst

K. Conn
Approved



56MP-3S

mjm 4/27

Data File Name	: C:\HPCHEM\2\DATA\BX20408\023R0901.D		
Operator	: S.W. Tyson	Page Number	: 1
Instrument	: BTEX2	Vial Number	: 23
Sample Name	: X04936;1;5	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 9
Acquired on	: 09 Apr 95 02:04 AM	Instrument Method	: BX204(
Report Created on	: 09 Apr 95 02:35 PM	Analysis Method	: BX2040.
Last Recalib on	: 09 Apr 95 02:21 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:

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(303) 425-6021

Method 602 Data Report

Client Sample Number	: 56MP-3S	Client Project No.	: 722450.21020/MacDi
Lab Sample Number	: X04936DUP	Lab Project No.	: 95-1009
Date Sampled	: 3/28/95	Dilution Factor	: 1.00
Date Received	: 3/29/95	Method	: 602
Date Prepared	: 4/8/95	Matrix	: Water
Date Analyzed	: 4/9/95	Lab File No.	: BX2040824
		Method Blank No.	: MB040895

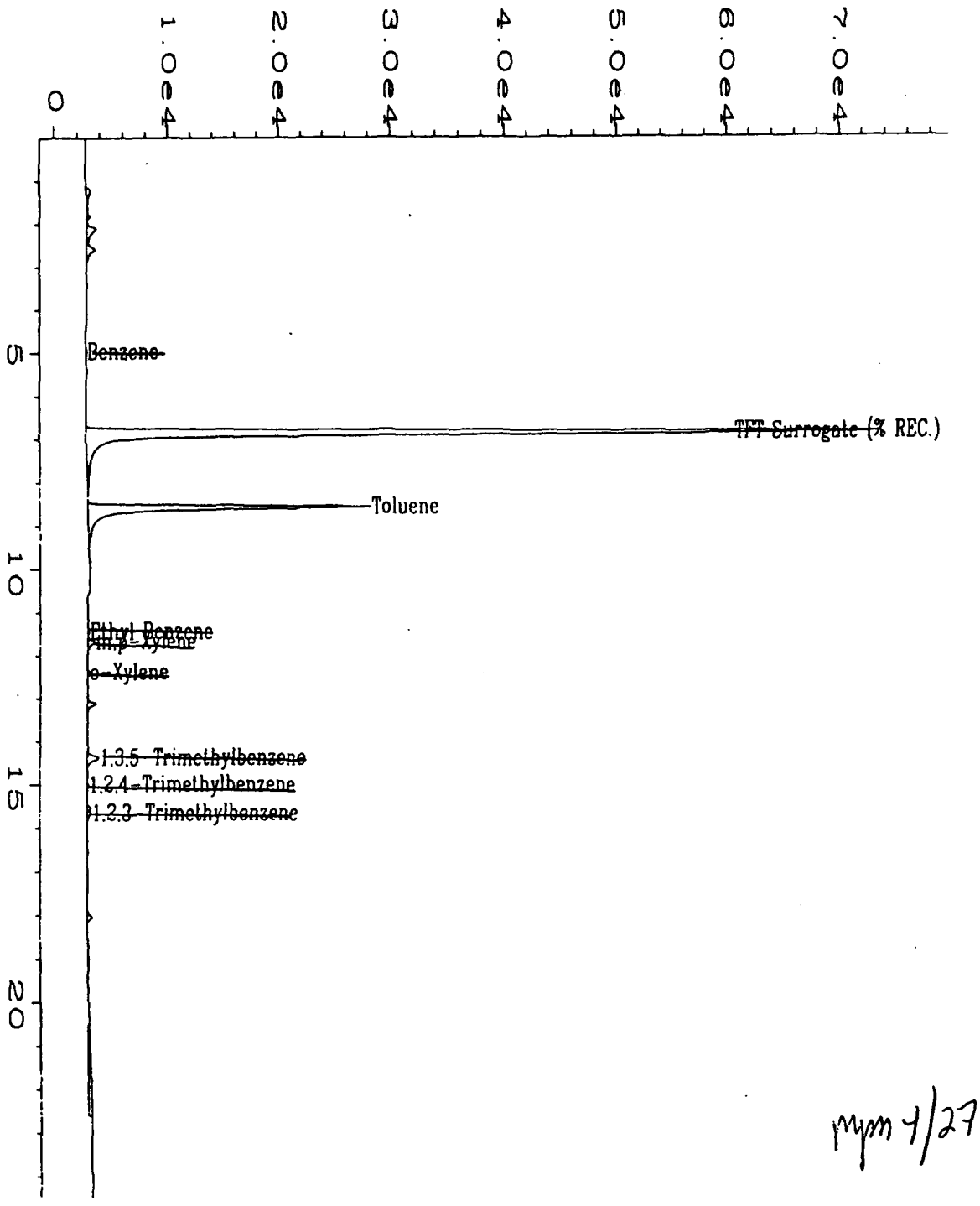
Compound Name	Cas Number	Sample Concentration ug/L		RL ug/L
Benzene	71-43-2		U	0.4
Toluene	108-88-3	10		0.4
Chlorobenzene	108-90-7		U	0.4
Ethyl Benzene	100-41-4		U	0.4
Total Xylenes (m, p & o)	108-38-3, 106-42-3 and 95-47-6		U	0.4
1,3,5-Trimethylbenzene	108-67-8		U	0.4
1,2,4-Trimethylbenzene	95-63-6		U	0.4
1,2,3-Trimethylbenzene	526-73-8		U	0.4
1,2,3,4-Tetramethylbenzene	488-23-3		U	0.4
Surrogate Recovery (α,α,α-Trifluorotoluene):		83%		70%-130% (QC limits

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene RL is for a single peak.

QUALIFIERS:
E = Extrapolated value.
U = Compound analyzed for, but not detected.
B = Compound also found in the blank.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit (RL).
RL = Reporting Limit.
NA = Not Available/Not Applicable.

Analyst

K. Cone
Approved



mpm 4/27/95

Data File Name	: C:\HPCHEM\2\DATA\BX20408\024R0901.D		
Operator	: S.W. Tyson	Page Number	: 1
Instrument	: BTEX2	Vial Number	: 24
Sample Name	: X04936DUP;1;5	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 9
Acquired on	: 09 Apr 95 02:49 AM	Instrument Method	: BX204C
Report Created on	: 09 Apr 95 02:36 PM	Analysis Method	: BX20408
Last Recalib on	: 09 Apr 95 02:21 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:

EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303) 425-6021

Method 602 Data Report

Client Sample Number	: 56MP-3D	Client Project No.	: 722450.21020/MacD
Lab Sample Number	: X04937	Lab Project No.	: 95-1009
Date Sampled	: 3/28/95	Dilution Factor	: 1.00
Date Received	: 3/29/95	Method	: 602
Date Prepared	: 4/11/95	Matrix	: Water
Date Analyzed	: 4/11/95	Lab File No.	: BX1041041
		Method Blank No.	: MB041195

Compound Name	Cas Number	Sample Concentration ug/L		RL ug/L
Benzene	71-43-2		U	0.4
Toluene	108-88-3		U	0.4
Chlorobenzene	108-90-7	0.5		0.4
Ethyl Benzene	100-41-4		U	0.4
Total Xylenes (m, p & o)	108-38-3, 106-42-3 and 95-47-6	1.4		0.4
1,3,5-Trimethylbenzene	108-67-8	0.7		0.4
1,2,4-Trimethylbenzene	95-63-6		U	0.4
1,2,3-Trimethylbenzene	526-73-8		U	0.4
1,2,3,4-Tetramethylbenzene	488-23-3		U	0.4

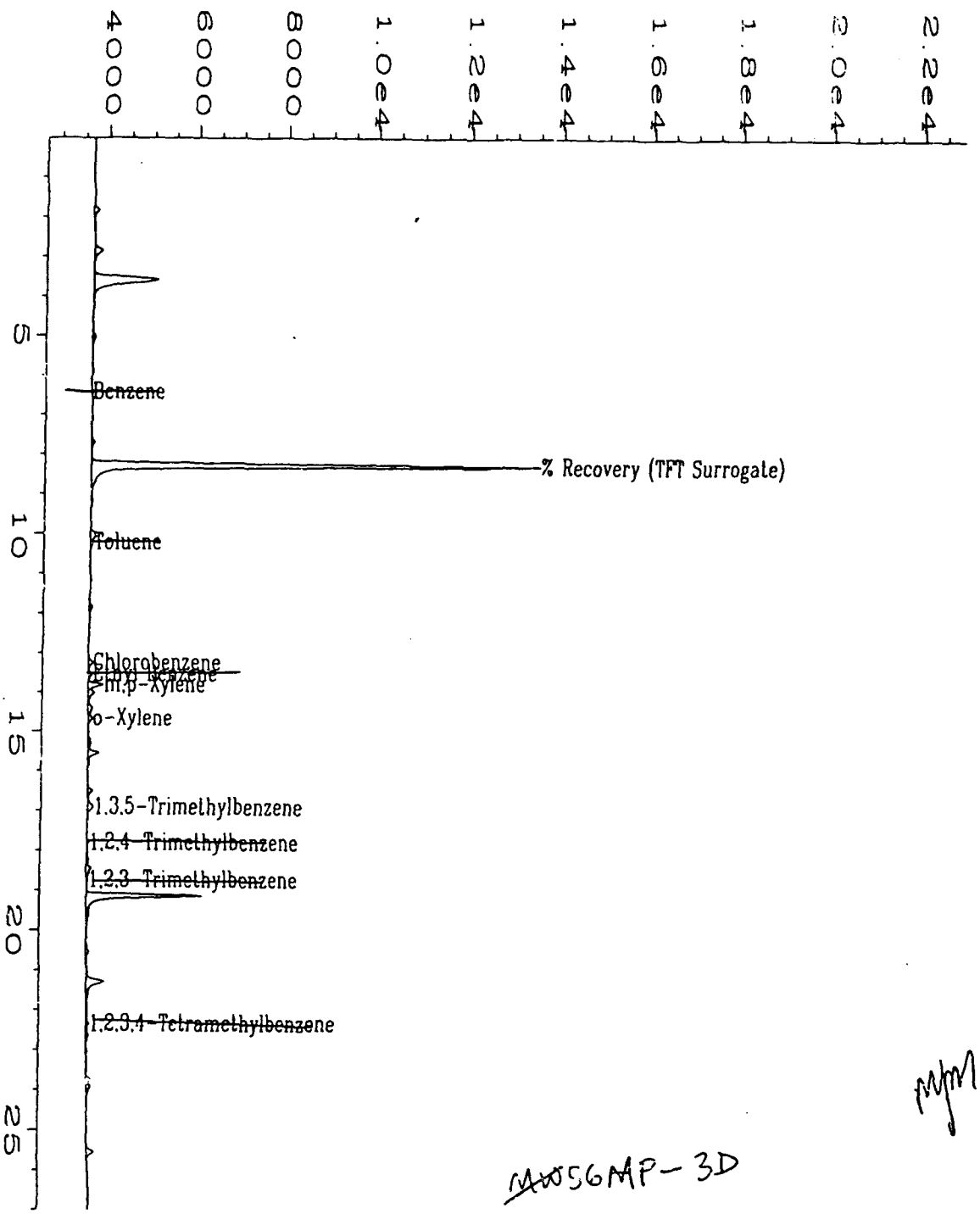
Surrogate Recovery (α,α,α-Trifluorotoluene):	89%	70%-130% (QC limits

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene RL is for a single peak.

QUALIFIERS:
E = Extrapolated value.
U = Compound analyzed for, but not detected.
B = Compound also found in the blank.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit (RL).
RL = Reporting Limit.
NA = Not Available/Not Applicable.

Analyst

Approved



MW56MP-3D

Data File Name : C:\HPCHEM\1\DATA\BX10410\041F0101.D
Operator : Kaprie S. Cone
Instrument : BTEX1
Sample Name : X05937;1;5
Run Time Bar Code:
Acquired on : 11 Apr 95 02:23 PM
Report Created on: 11 Apr 95 06:15 PM
Last Recalib on : 11 APR 95 10:03 AM
Multiplier : 1

Page Number : 1
Vial Number : 41
Injection Number : 1
Sequence Line : 1
Instrument Method: BX104
Analysis Method : BX1041
Sample Amount : 0
ISTD Amount :

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Method 602 Data Report

Client Sample Number	: MW56-05	Client Project No.	: 722450.21020/MacD
Lab Sample Number	: X04939	Lab Project No.	: 95-1009
Date Sampled	: 3/28/95	Dilution Factor	: 1.00
Date Received	: 3/29/95	Method	: 602
Date Prepared	: 4/11/95	Matrix	: Water
Date Analyzed	: 4/11/95	Lab File No.	: BX1041042
		Method Blank No.	: MB041195

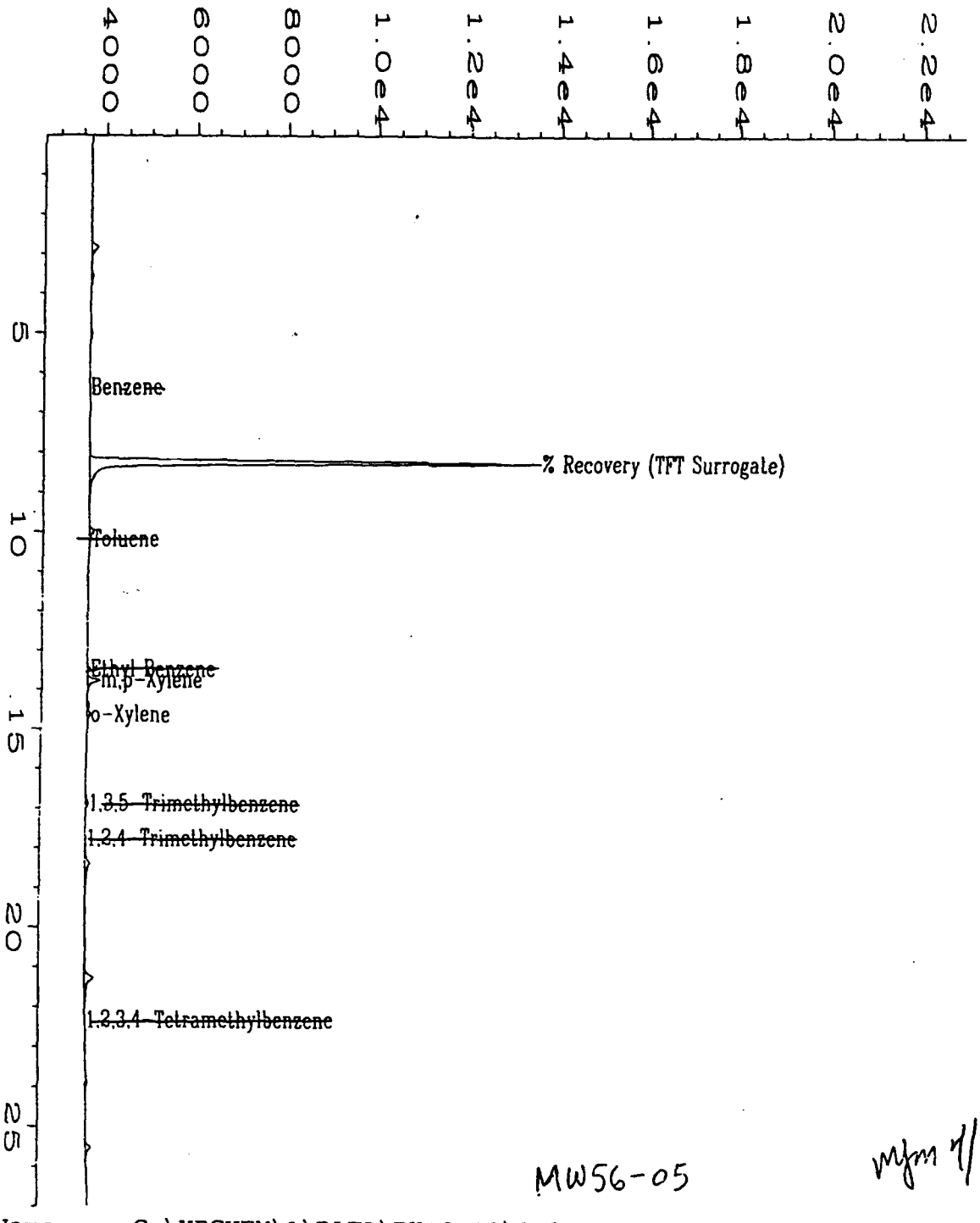
Compound Name	Cas Number	Sample Concentration ug/L		RL ug/L
Benzene	71-43-2		U	0.4
Toluene	108-88-3		U	0.4
Chlorobenzene	108-90-7		U	0.4
Ethyl Benzene	100-41-4		U	0.4
Total Xylenes (m, p & o)	108-38-3, 106-42-3 and 95-47-6	1.5		0.4
1,3,5-Trimethylbenzene	108-67-8		U	0.4
1,2,4-Trimethylbenzene	95-63-6		U	0.4
1,2,3-Trimethylbenzene	526-73-8		U	0.4
1,2,3,4-Tetramethylbenzene	488-23-3		U	0.4
Surrogate Recovery (α,α,α-Trifluorotoluene):		90%		70%-130% (QC limits)

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene RL is for a single peak.

QUALIFIERS:
E = Extrapolated value.
U = Compound analyzed for, but not detected.
B = Compound also found in the blank.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit (RL).
RL = Reporting Limit.
NA = Not Available/Not Applicable.

Analyst

Approved



MW56-05

mjm 4/2

Data File Name	: C:\HPCHEM\1\DATA\BX10410\042F0101.D		
Operator	: Kaprie S. Cone	Page Number	: 1
Instrument	: BTEX1	Vial Number	: 42
Sample Name	: X05939;1;5	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 1
Acquired on	: 11 Apr 95 03:02 PM	Instrument Method	: BX104
Report Created on	: 11 Apr 95 06:15 PM	Analysis Method	: BX1041A
Last Recalib on	: 11 APR 95 10:03 AM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:

EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303) 425-6021

Method 602 Data Report

Client Sample Number	: MW56-7	Client Project No.	: 722450.21020/MacD
Lab Sample Number	: X04935	Lab Project No.	: 95-1009
Date Sampled	: 3/28/95	Dilution Factor	: 1.00
Date Received	: 3/29/95	Method	: 602
Date Prepared	: 4/11/95	Matrix	: Water
Date Analyzed	: 4/11/95	Lab File No.	: BX1041038
		Method Blank No.	: MB041195

Compound Name	Cas Number	Sample Concentration ug/L		RL ug/L
Benzene	71-43-2	**		**
Toluene	108-88-3	47	B	0.4
Chlorobenzene	108-90-7	2.5		0.4
Ethyl Benzene	100-41-4	81		0.4
Total Xylenes (m, p & o)	108-38-3, 106-42-3 and 95-47-6	98		0.4
1,3,5-Trimethylbenzene	108-67-8	33		0.4
1,2,4-Trimethylbenzene	95-63-6	**		**
1,2,3-Trimethylbenzene	526-73-8	19		0.4
1,2,3,4-Tetramethylbenzene	488-23-3	15		0.4

Surrogate Recovery (α,α,α-Trifluorotoluene):	103%	70%-130% (QC limits

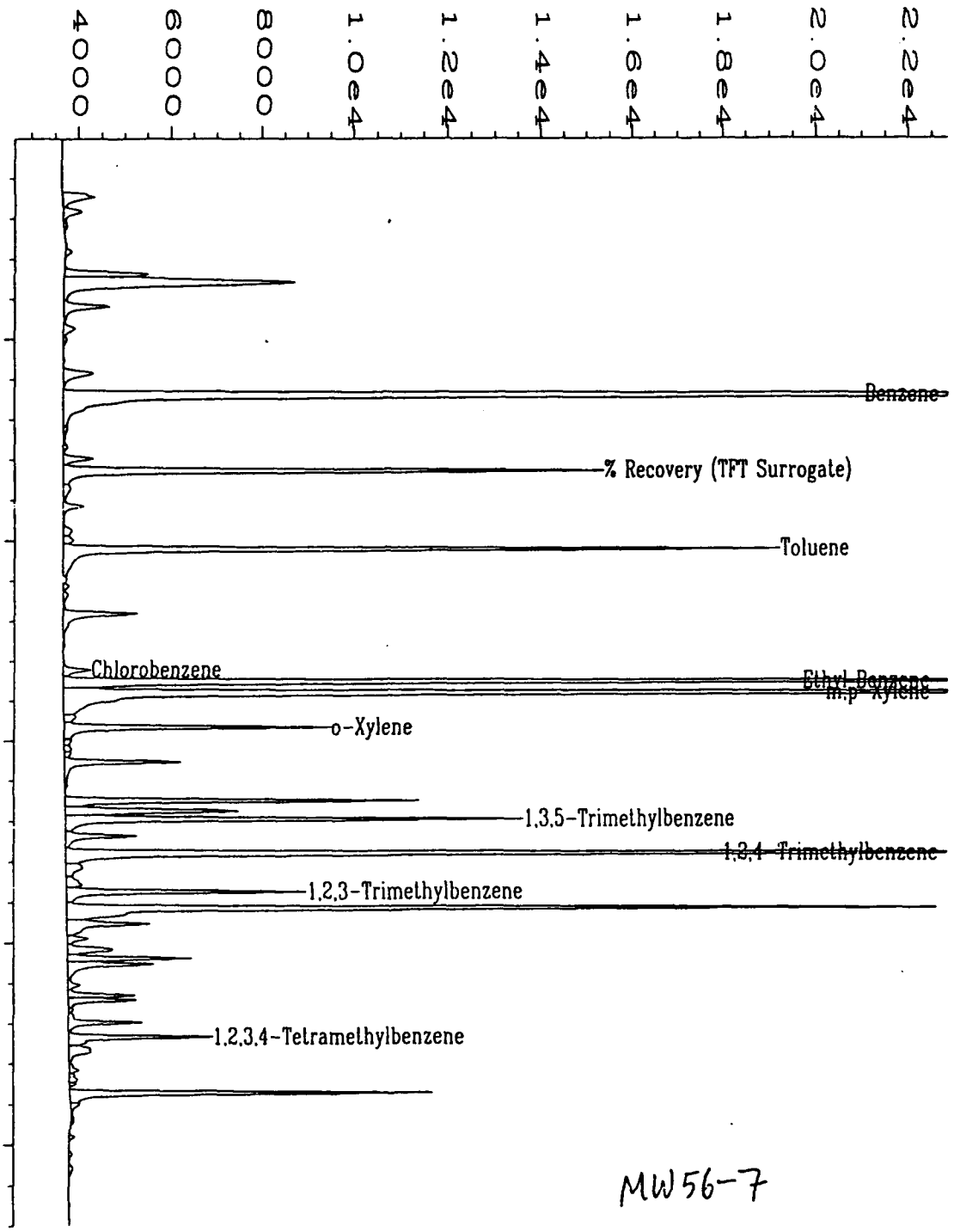
Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene RL is for a single peak.

** = See BX1041052 for noted values, df=10, 04/11/95.

QUALIFIERS:
E = Extrapolated value.
U = Compound analyzed for, but not detected.
B = Compound also found in the blank.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit (RL).
RL = Reporting Limit.
NA = Not Available/Not Applicable.

Analyst

K. Cone
Approved



MW56-7

Data File Name	: C:\HPCHEM\1\DATA\BX10410\038F0101.D		
Operator	: Kaprie S. Cone	Page Number	: 1
Instrument	: BTEX1	Vial Number	: 38
Sample Name	: X05935;1;5	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 1
Acquired on	: 11 Apr 95 12:28 PM	Instrument Method	: BX104
Report Created on	: 11 Apr 95 06:13 PM	Analysis Method	: BX1041
Last Recalib on	: 11 APR 95 10:03 AM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:

EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303) 425-6021

Method 602 Data Report

Client Sample Number	: MW56-7	Client Project No.	: 722450.21020/MacD
Lab Sample Number	: X04935	Lab Project No.	: 95-1009
Date Sampled	: 3/28/95	Dilution Factor	: 10.00
Date Received	: 3/29/95	Method	: 602
Date Prepared	: 4/11/95	Matrix	: Water
Date Analyzed	: 4/11/95	Lab File No.	: BX1041052
		Method Blank No.	: MB041195

Compound Name	Cas Number	Sample Concentration ug/L	RL ug/L
Benzene	71-43-2	80	4.0
Toluene	108-88-3	**	**
Chlorobenzene	108-90-7	**	**
Ethyl Benzene	100-41-4	**	**
Total Xylenes (m, p & o)	108-38-3, 106-42-3 and 95-47-6	**	**
1,3,5-Trimethylbenzene	108-67-8	**	**
1,2,4-Trimethylbenzene	95-63-6	32	4.0
1,2,3-Trimethylbenzene	526-73-8	**	**
1,2,3,4-Tetramethylbenzene	488-23-3	**	**
Surrogate Recovery (α,α,α-Trifluorotoluene):		77%	70%-130% (QC limits

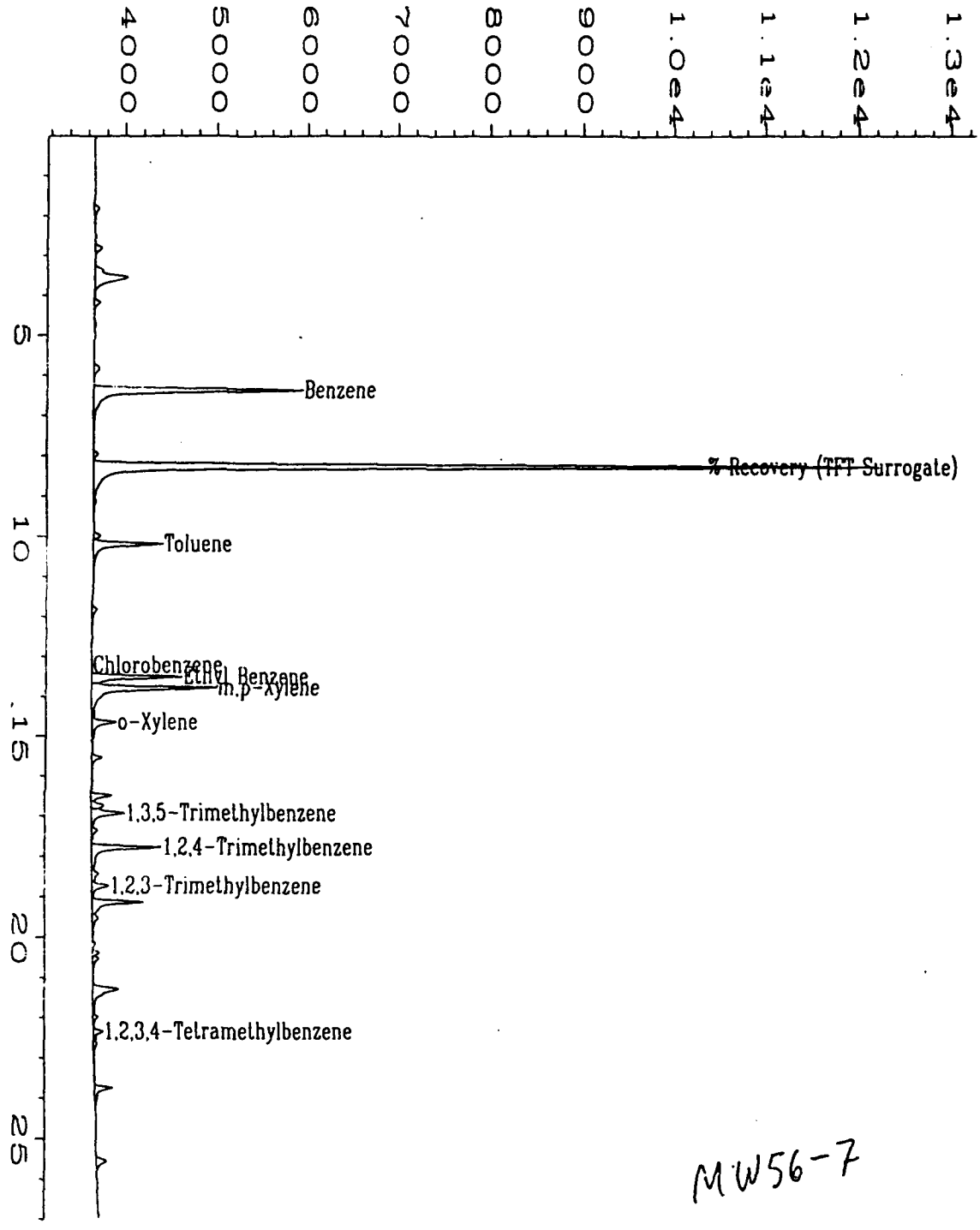
Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene RL is for a single peak.

** = See BX1041038 for noted values, df=1.0, 04/11/95.

QUALIFIERS:
E = Extrapolated value.
U = Compound analyzed for, but not detected.
B = Compound also found in the blank.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit (RL).
RL = Reporting Limit.
NA = Not Available/Not Applicable.

Analyst

K. Cone
Approved



MW56-7

Data File Name	: C:\HPCHEM\1\DATA\BX10410\052F0101.D		
Operator	: Kaprie S. Cone	Page Number	: 1
Instrument	: BTEX1	Vial Number	: 52
Sample Name	: X05935;10;0.5	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 1
Acquired on	: 11 Apr 95 09:34 PM	Instrument Method	: BX104
Report Created on	: 11 Apr 95 10:01 PM	Analysis Method	: BX104
Last Recalib on	: 11 APR 95 10:03 AM	Sample Amount	: 0
Multiplier	: 10	ISTD Amount	:
Sample Info	: Project#: 95-1009 Client#: 56MW-7 Water		

EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303) 425-6021

Method 602 Data Report

Client Sample Number	: MW56-11	Client Project No.	: 722450.21020/MacD
Lab Sample Number	: X04934	Lab Project No.	: 95-1009
Date Sampled	: 3/28/95	Dilution Factor	: 1.00
Date Received	: 3/29/95	Method	: 602
Date Prepared	: 4/8/95	Matrix	: Water
Date Analyzed	: 4/8/95	Lab File No.	: BX2040816
		Method Blank No.	: MB040895

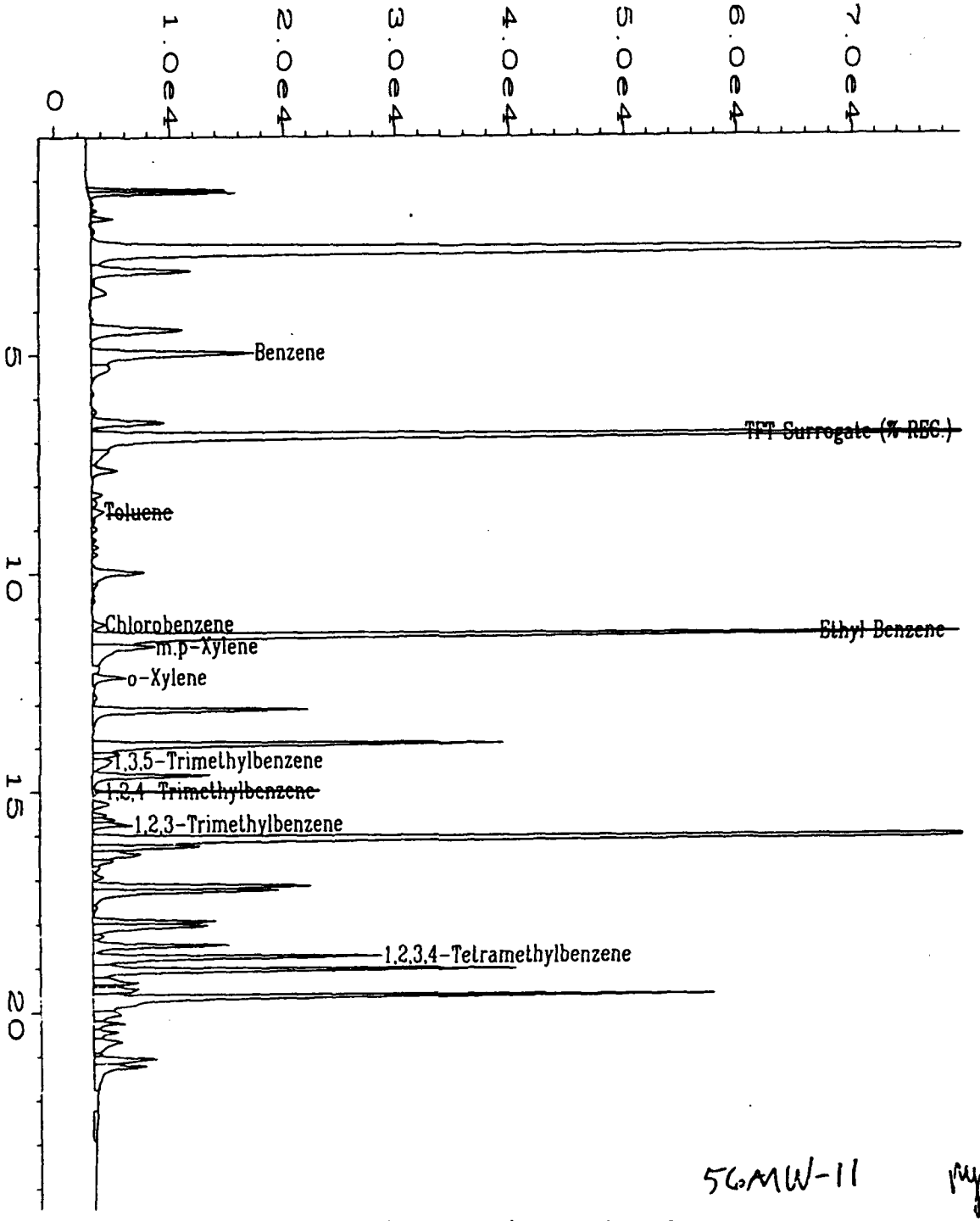
Compound Name	Cas Number	Sample Concentration ug/L		RL ug/L
Benzene	71-43-2	5.9		0.4
Toluene	108-88-3		U	0.4
Chlorobenzene	108-90-7	0.5		0.4
Ethyl Benzene	100-41-4	29		0.4
Total Xylenes (m, p & o)	108-38-3, 106-42-3 and 95-47-6	3.9		0.4
1,3,5-Trimethylbenzene	108-67-8	0.5		0.4
1,2,4-Trimethylbenzene	95-63-6		U	0.4
1,2,3-Trimethylbenzene	526-73-8	0.4		0.4
1,2,3,4-Tetramethylbenzene	488-23-3	11		0.4
Surrogate Recovery (α,α,α-Trifluorotoluene):		96%		70%-130% (QC limits)

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene RL is for a single peak.

QUALIFIERS:
E = Extrapolated value.
U = Compound analyzed for, but not detected.
B = Compound also found in the blank.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit (RL).
RL = Reporting Limit.
NA = Not Available/Not Applicable.

K. Cone
Analyst

Approved



5GMW-11

Data File Name	: C:\HPCHEM\2\DATA\BX20408\016R0901.D		
Operator	: S.W. Tyson	Page Number	: 1
Instrument	: BTEX2	Vial Number	: 16
Sample Name	: X04934;1;5	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 9
Acquired on	: 08 Apr 95 08:45 PM	Instrument Method	: BX204(
Report Created on	: 09 Apr 95 02:29 PM	Analysis Method	: BX2040.
Last Recalib on	: 09 Apr 95 02:21 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:

EVERGREEN ANALYTICAL, INC.
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(303) 425-6021

Method 602 Data Report

Client Sample Number	: MW56-11	Client Project No.	: 722450.21020/MacDill
Lab Sample Number	: X04934DUP	Lab Project No.	: 95-1009
Date Sampled	: 3/28/95	Dilution Factor	: 1.00
Date Received	: 3/29/95	Method	: 602
Date Prepared	: 4/8/95	Matrix	: Water
Date Analyzed	: 4/8/95	Lab File No.	: BX2040817
		Method Blank No.	: MB040895

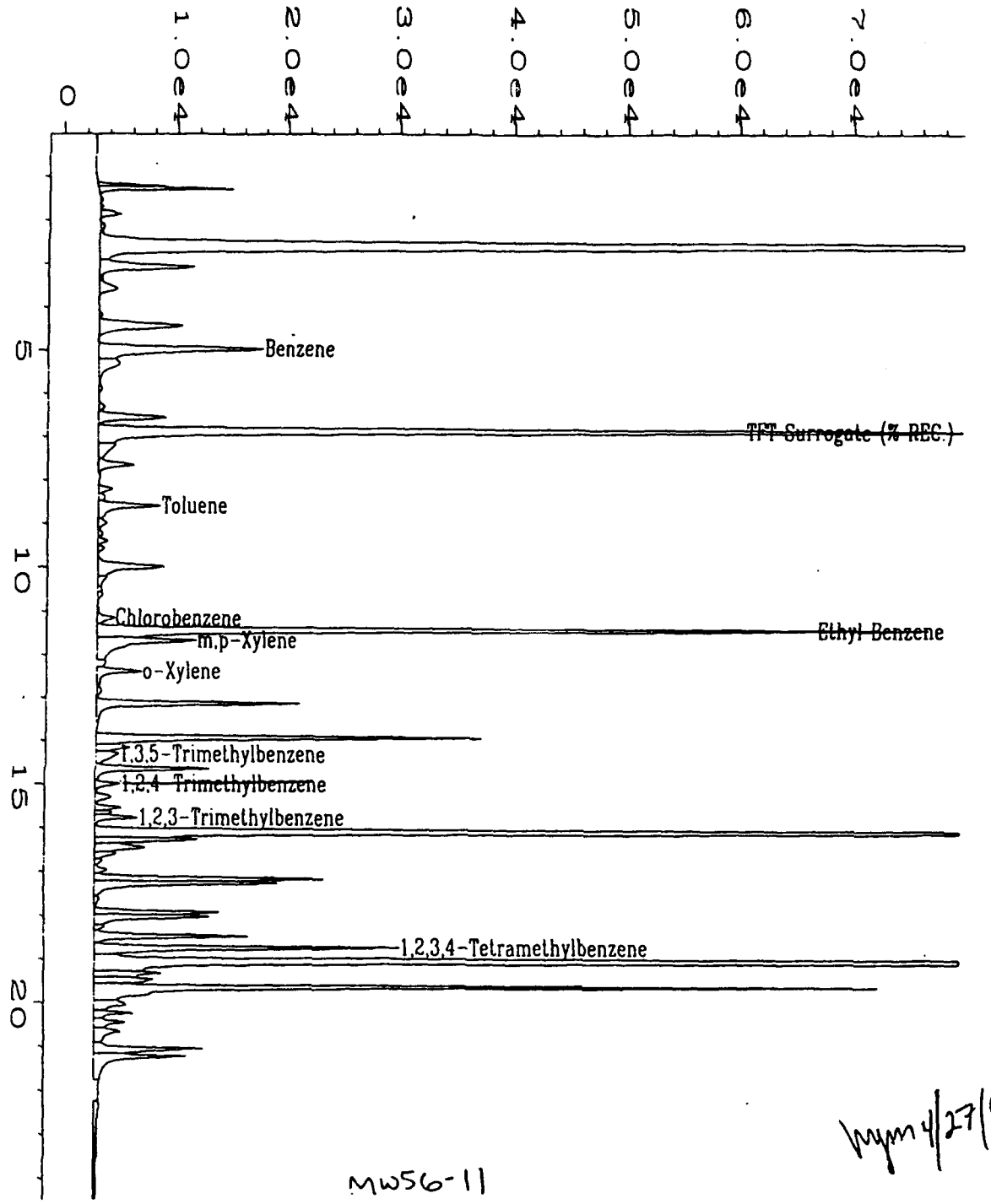
Compound Name	Cas Number	Sample Concentration ug/L		RL ug/L
Benzene	71-43-2	6.2		0.4
Toluene	108-88-3	1.7		0.4
Chlorobenzene	108-90-7	0.8		0.4
Ethyl Benzene	100-41-4	28		0.4
Total Xylenes (m, p & o)	108-38-3, 106-42-3 and 95-47-6	6.0		0.4
1,3,5-Trimethylbenzene	108-67-8	0.6		0.4
1,2,4-Trimethylbenzene	95-63-6		U	0.4
1,2,3-Trimethylbenzene	526-73-8	0.5		0.4
1,2,3,4-Tetramethylbenzene	488-23-3	11		0.4
Surrogate Recovery (α,α,α-Trifluorotoluene):		90%		70%-130% (QC limits)

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene RL is for a single peak.

QUALIFIERS:
E = Extrapolated value.
U = Compound analyzed for, but not detected.
B = Compound also found in the blank.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit (RL).
RL = Reporting Limit.
NA = Not Available/Not Applicable.

Analyst

K. Cone
Approved



mym 4/27/9

MW56-11

Data File Name	: C:\HPCHEM\2\DATA\BX20408\017R0901.D		
Operator	: S.W. Tyson	Page Number	: 1
Instrument	: BTEX2	Vial Number	: 17
Sample Name	: X04934DUP;1;5	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 9
Acquired on	: 08 Apr 95 09:31 PM	Instrument Method	: BX204C
Report Created on	: 09 Apr 95 02:30 PM	Analysis Method	: BX2040
Last Recalib on	: 09 Apr 95 02:21 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:

Evergreen Analytical, Inc.
4036 Youngfield, Wheat Ridge, CO 80033
(303) 425-6021

TOTAL VOLATILE HYDROCARBONS
TVH Matrix Spike/Matrix Spike Duplicate Data Report

Client Sample No.	: MW32-1	Client Project No.	: 722450.21020
Lab Sample No.	: X04941	Lab Project No.	: 95-1009
Date Sampled	: 3/28/95	EPA Method No.	: 5030/8015 Mod.
Date Received	: 3/29/95	Matrix	: Water
Date Prepared	: 4/11/95	Method Blank	: MB041195
Date Analyzed	: 4/12/95		

Compound	Spike Added (mg/L)	Sample Concentration (mg/L)	MS Concentration (mg/L)	MS %REC	QC Limits %REC
Gasoline	2.00	0.83	3.01	109%	60-140

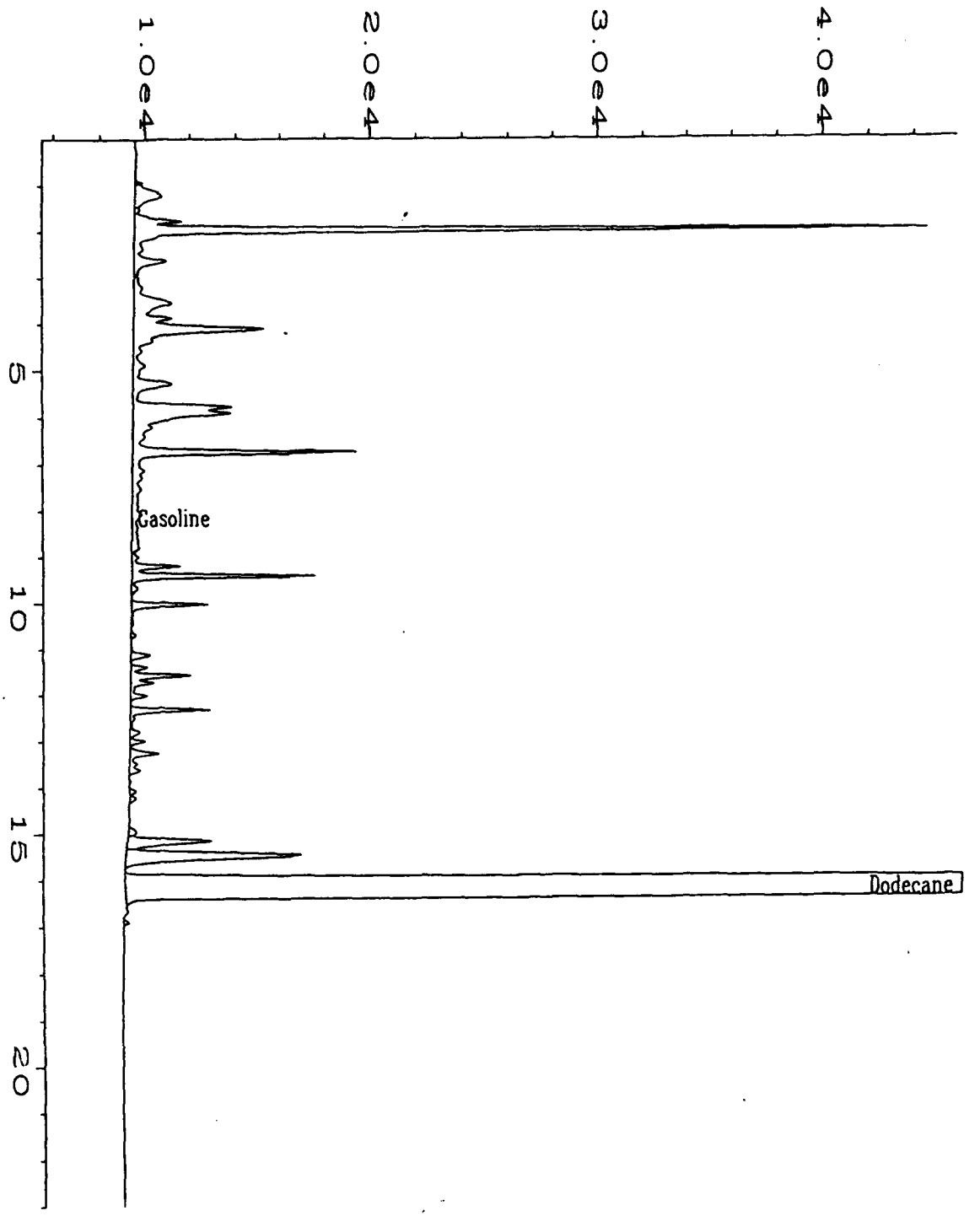
Compound	Spike Added (mg/L)	MSD Concentration (mg/L)	MSD %REC	RPD	QC Limits RPD	QC Limits %REC
Gasoline	2.00	3.26	122%	11	50	60-140

* = Values outside of QC limits.

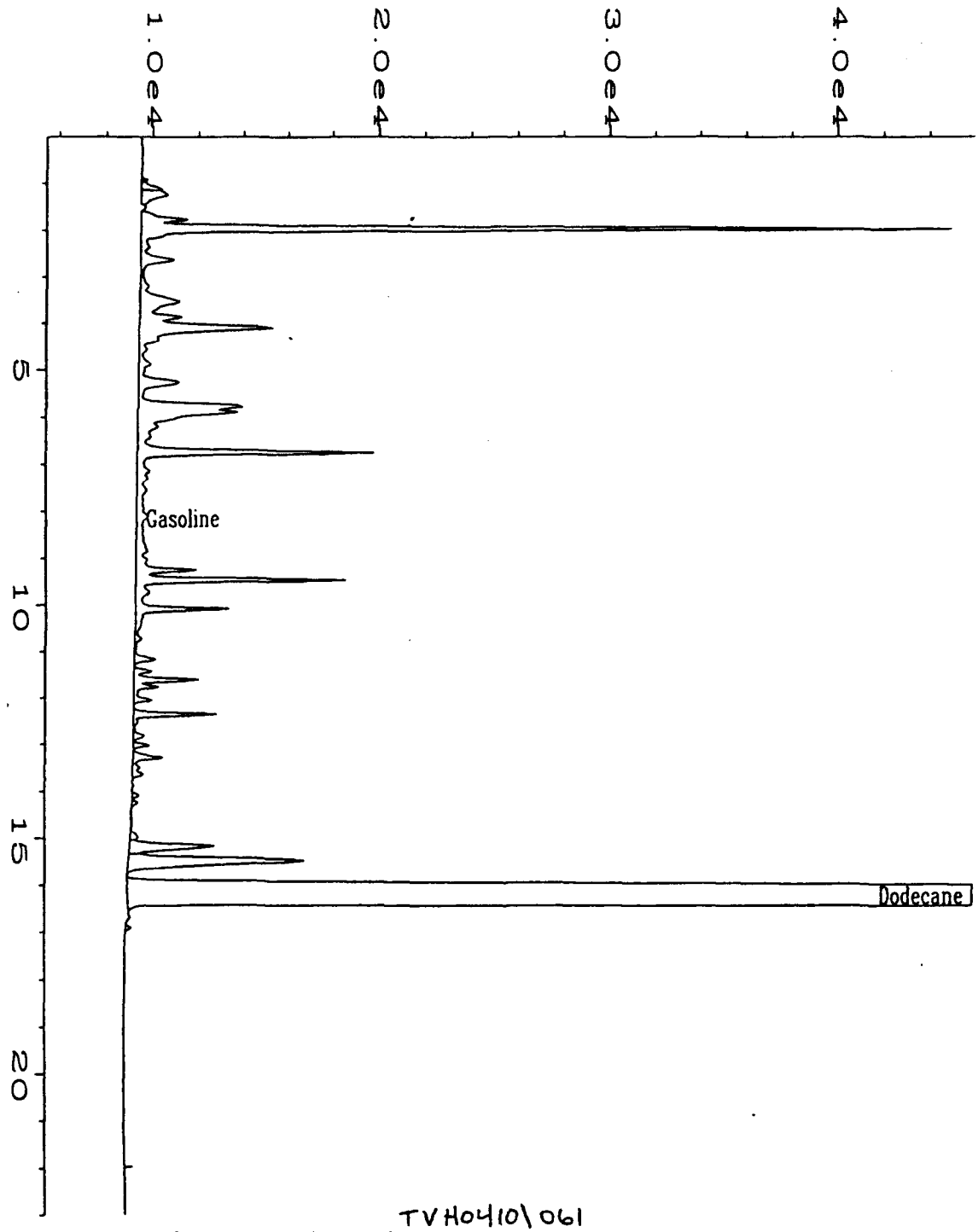
RPD: 0 out of (1) outside limits.

Spike Recovery: 0 out of (2) outside limits.

Comments: NA = Not analyzed/not applicable.



Data File Name	: C:\HPCHEM\1\DATA\TVH0410\060F0101.D		
Operator	: Dawn N. Guildner	Page Number	: 1
Instrument	: TVH	Vial Number	: 60
Sample Name	: X04941 MS	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 1
Acquired on	: 11 Apr 95 09:12 PM	Instrument Method	: TVH1.
Report Created on	: 11 Apr 95 10:23 PM	Analysis Method	: TVH04
Last Recalib on	: 10 APR 95 01:08 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:



TVH0410\061

Data File Name : C:\HPCHEM\1\DATA\~~NV-P0111.D~~

Operator :

Instrument : TVH

Sample Name : x04942 MSD

Run Time Bar Code:

Acquired on : 11 Apr 95 09:48 PM

Report Created on: 11 Apr 95 10:49 PM

Last Recalib on : 10 APR 95 01:08 PM

Multiplier : 1

Page Number : 1

Vial Number :

Injection Number :

Sequence Line :

Instrument Method: TVH1BASE.M

Analysis Method : TVH0410.MT

Sample Amount : 0

ISTD Amount :

Evergreen Analytical, Inc.
4036 Youngfield, Wheat Ridge, CO 80033
(303) 425-6021

BTEX Matrix Spike/Matrix Spike Duplicate Data Report

Client Sample No.	: MW56-11	Client Project No.	: 722450.21020/MacDill
Lab Sample No.	: X04934	Lab Project No.	: 95-1009
Date Sampled	: 3/28/95	EPA Method No.	: 602
Date Received	: 3/29/95	Matrix	: Water
Date Prepared	: 4/8/95	Lab File Number(s)	: BX2040818,19
Date Analyzed	: 4/8/95	Method Blank	: MB040895

Compound	Spike Added (ug/L)	Sample Concentration (ug/L)	MS Concentration (ug/L)	MS %REC	QC Limits %REC
Benzene	20.0	5.9	24.4	93	65-121
Toluene	20.0	0.0	17.1	86	69-117
Ethyl Benzene	20.0	29.2	47.1	90	68-118
m,p-Xylene	40.0	2.8	37.9	88	66-116
o-Xylene	20.0	1.1	18.1	85	73-117
Chlorobenzene	20.0	0.5	17.5	85	65-121
1,3,5-TMB	20.0	0.5	17.7	86	65-121
1,2,4-TMB	20.0	0.0	18.2	91	65-121
1,2,3-TMB	20.0	0.4	19.4	95	65-
1,2,3,4-TeMB	20.0	10.6	29.2	93	65-1

Compound	Spike Added (ug/L)	MSD Concentration (ug/L)	MSD %REC	RPD	QC Limits RPD	QC Limits %REC
Benzene	20.0	21.9	80	14.5	17.4	65-121
Toluene	20.0	16.3	82	4.8	15.8	69-117
Ethyl Benzene	20.0	46.1	85	5.7	11.9	68-118
m,p-Xylene	40.0	35.6	82	6.8	15.4	66-116
o-Xylene	20.0	17.1	80	6.1	13.2	73-117
Chlorobenzene	20.0	17.0	83	3.0	17.4	65-121
1,3,5-TMB	20.0	16.7	81	6.0	17.4	65-121
1,2,4-TMB	20.0	17.2	86	5.6	17.4	65-121
1,2,3-TMB	20.0	18.6	91	4.3	17.4	65-121
1,2,3,4-TeMB	20.0	28.8	91	2.2	17.4	65-121

* = Values outside of QC limits.

RPD: 0 out of (10) outside limits.

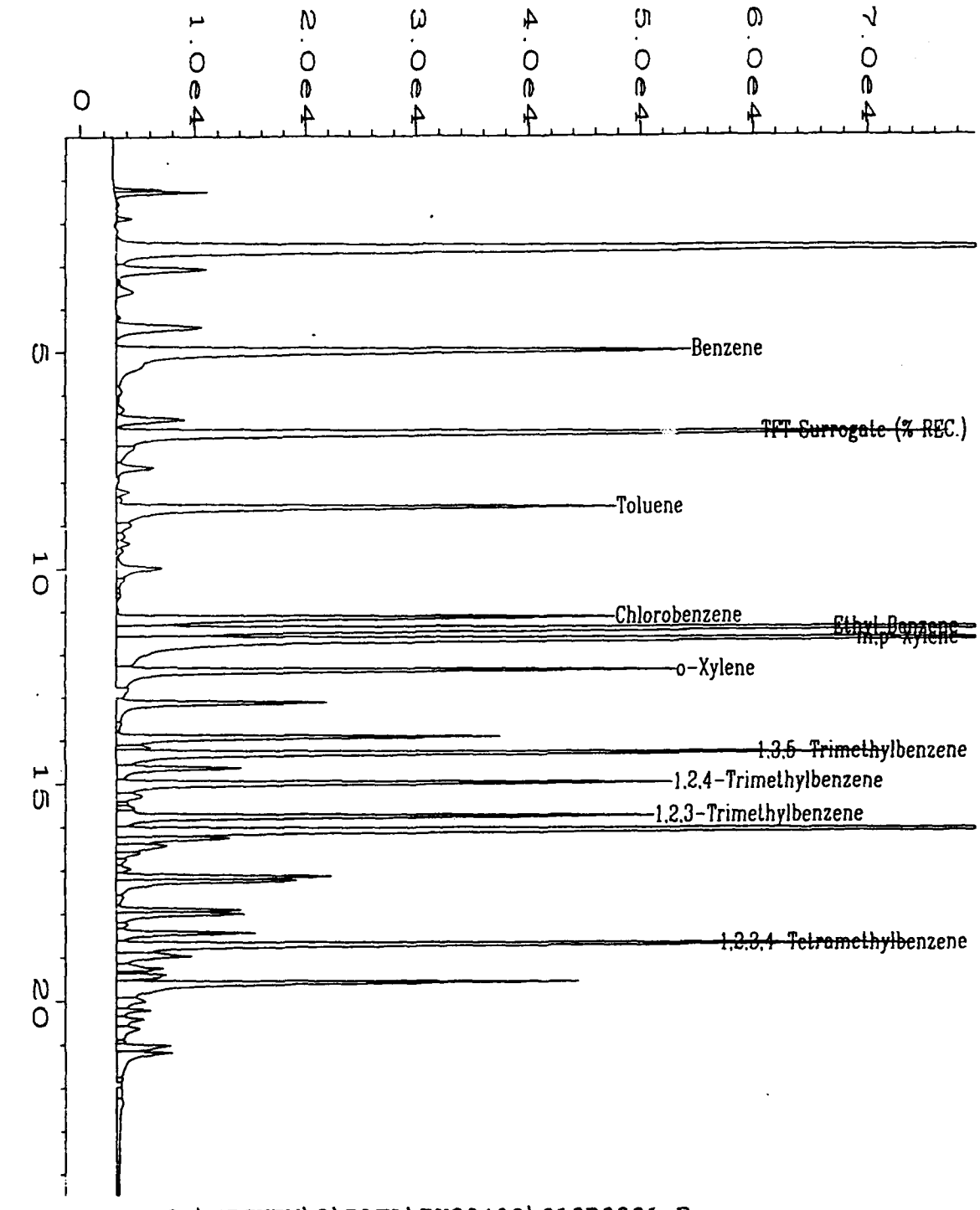
Spike Recovery: 0 out of (20) outside limits.

Comments:

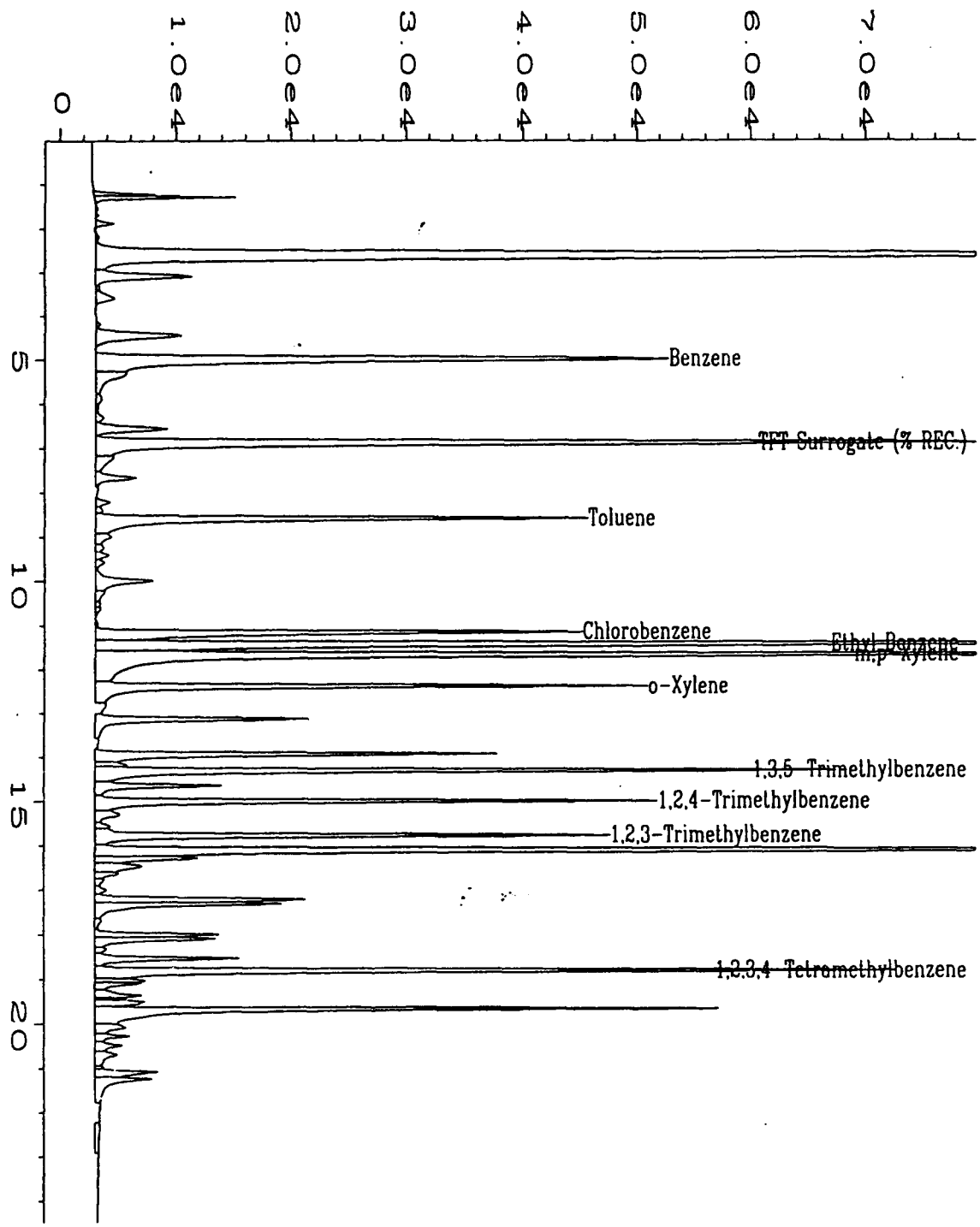
Analyst

K. Cone
Approved

MS1009A.XLS



Data File Name	: C:\HPCHEM\2\DATA\BX20408\018R0901.D		
Operator	: S.W. Tyson	Page Number	: 1
Instrument	: BTEX2	Vial Number	: 18
Sample Name	: X04934MS;1;5	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 9
Acquired on	: 08 Apr 95 10:16 PM	Instrument Method	: BX20408.MT
Report Created on	: 09 Apr 95 02:31 PM	Analysis Method	: BX20408.MT
Last Recalib on	: 09 Apr 95 02:21 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:



Data File Name	: C:\HPCHEM\2\DATA\BX20408\019R0901.D		
Operator	: S.W. Tyson	Page Number	: 1
Instrument	: BTEX2	Vial Number	: 19
Sample Name	: X04934MSD;1;5	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 9
Acquired on	: 08 Apr 95 11:02 PM	Instrument Method	: BX204(
Report Created on	: 09 Apr 95 02:32 PM	Analysis Method	: BX2040..
Last Recalib on	: 09 Apr 95 02:21 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:

EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303) 425-6021

Method 602 Data Report

Client Sample Number	: 56-Field Blank	Client Project No.	: 722450.21020/MacDil
Lab Sample Number	: X04943	Lab Project No.	: 95-1009
Date Sampled	: 3/28/95	Dilution Factor	: 1.00
Date Received	: 3/29/95	Method	: 602
Date Prepared	: 4/11/95	Matrix	: Water
Date Analyzed	: 4/11/95	Lab File No.	: BX1041046
		Method Blank No.	: MB041195

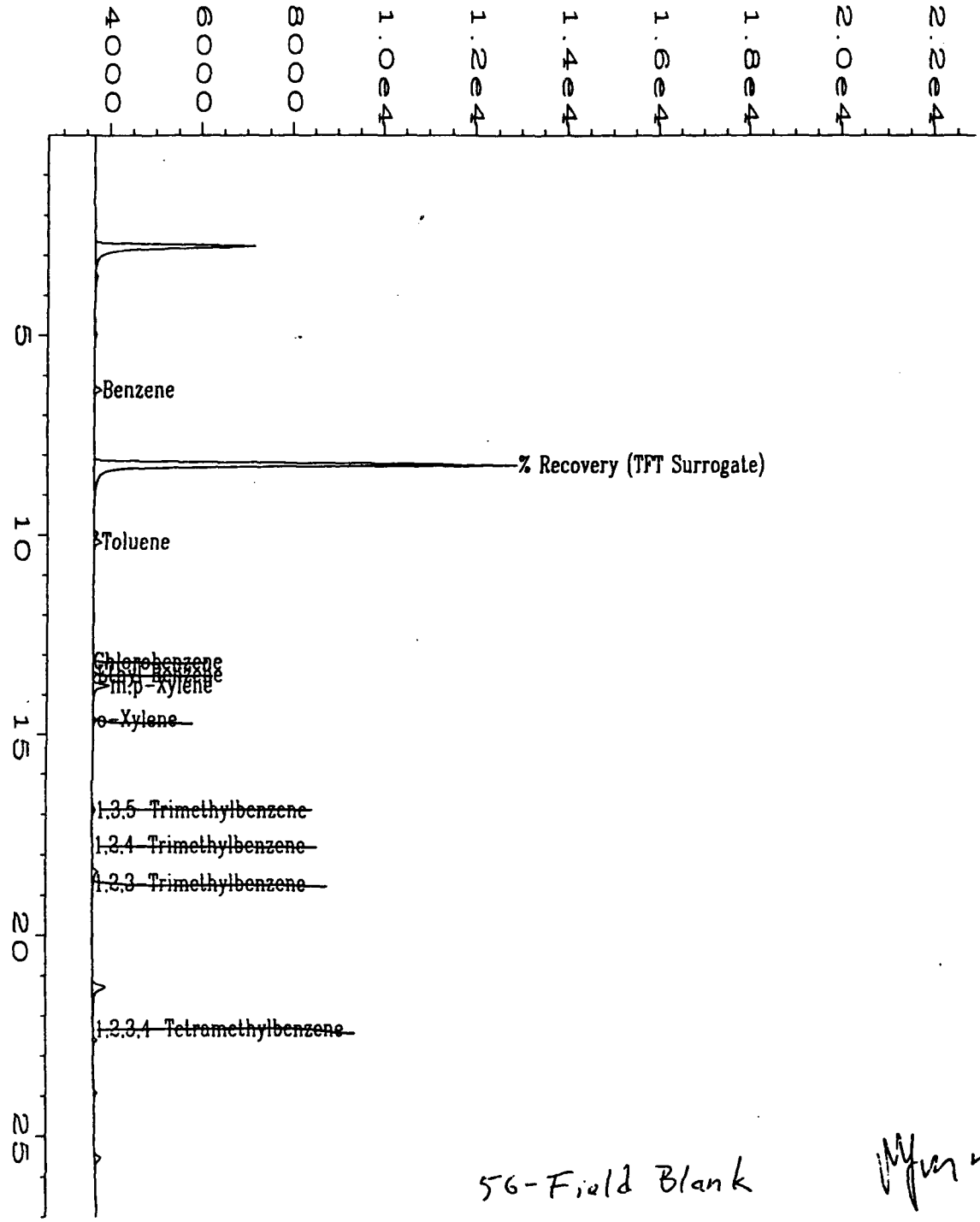
Compound Name	Cas Number	Sample Concentration ug/L		RL ug/L
Benzene	71-43-2	0.6		0.4
Toluene	108-88-3	0.8	B	0.4
Chlorobenzene	108-90-7		U	0.4
Ethyl Benzene	100-41-4		U	0.4
Total Xylenes (m, p & o)	108-38-3, 106-42-3 and 95-47-6	1.3		0.4
1,3,5-Trimethylbenzene	108-67-8		U	0.4
1,2,4-Trimethylbenzene	95-63-6		U	0.4
1,2,3-Trimethylbenzene	526-73-8		U	0.4
1,2,3,4-Tetramethylbenzene	488-23-3		U	0.4
Surrogate Recovery (α,α,α-Trifluorotoluene):		84%		70%-130% (QC limits)

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene RL is for a single peak.

QUALIFIERS:
E = Extrapolated value.
U = Compound analyzed for, but not detected.
B = Compound also found in the blank.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit (RL).
RL = Reporting Limit.
NA = Not Available/Not Applicable.

Analyst

Approved



56-Field Blank

4/2

Data File Name : C:\HPCHEM\1\DATA\BX10410\046F0101.D
Operator : Kaprie S. Cone
Instrument : BTEX1
Sample Name : X04943;1;5
Run Time Bar Code:
Acquired on : 11 Apr 95 05:36 PM
Report Created on: 17 Apr 95 01:26 AM
Last Recalib on : 11 APR 95 10:03 AM
Multiplier : 1

Page Number : 1
Vial Number : 46
Injection Number : 1
Sequence Line : 1
Instrument Method: BX1041
Analysis Method : BX1041...
Sample Amount : 0
ISTD Amount :

EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303) 425-6021

Method 602 Data Report

Client Sample Number	: Trip Blank	Client Project No.	: 722450.21020/MacDill
Lab Sample Number	: X04944	Lab Project No.	: 95-1009
Date Sampled	: 3/28/95	Dilution Factor	: 1.00
Date Received	: 3/29/95	Method	: 602
Date Prepared	: 4/11/95	Matrix	: Water
Date Analyzed	: 4/11/95	Lab File No.	: BX1041055
		Method Blank No.	: MB041195

Compound Name	Cas Number	Sample Concentration ug/L	RL ug/L
Benzene	71-43-2	U	0.4
Toluene	108-88-3	U	0.4
Chlorobenzene	108-90-7	U	0.4
Ethyl Benzene	100-41-4	U	0.4
Total Xylenes (m, p & o)	108-38-3, 106-42-3 and 95-47-6	U	0.4
1,3,5-Trimethylbenzene	108-67-8	U	0.4
1,2,4-Trimethylbenzene	95-63-6	U	0.4
1,2,3-Trimethylbenzene	526-73-8	U	0.4
1,2,3,4-Tetramethylbenzene	488-23-3	U	0.4

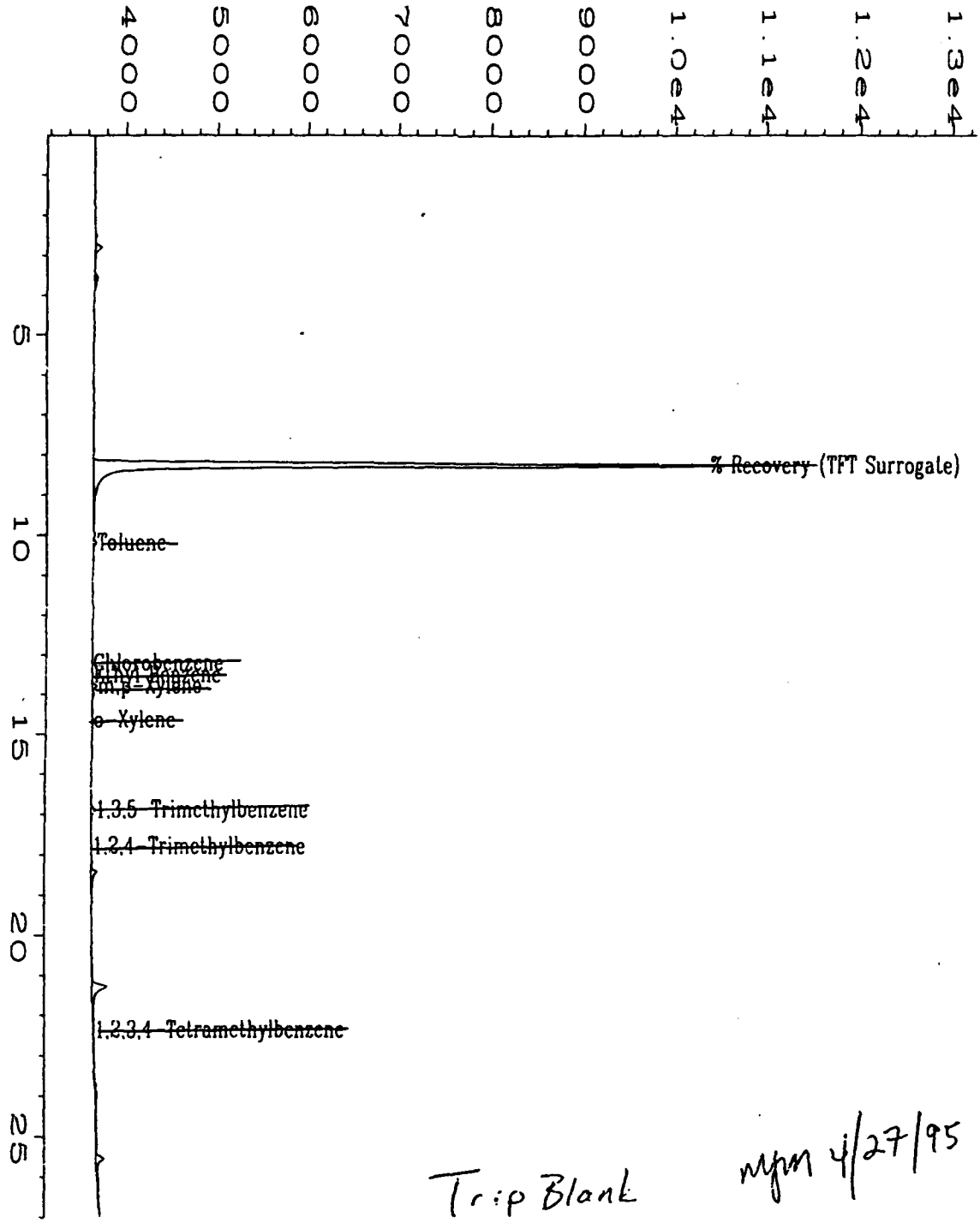
Surrogate Recovery (α,α,α-Trifluorotoluene):	72%	70%-130% (QC limits)

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene RL is for a single peak.

QUALIFIERS:
E = Extrapolated value.
U = Compound analyzed for, but not detected.
B = Compound also found in the blank.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit (RL).
RL = Reporting Limit.
NA = Not Available/Not Applicable.

Analyst

Approved



Trip Blank mjm 4/27/95

Data File Name	: C:\HPCHEM\1\DATA\BX10410\055F0101.D		
Operator	: Kaprie S. Cone	Page Number	: 1
Instrument	: BTEX1	Vial Number	: 55
Sample Name	: X04944;1;5	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 1
Acquired on	: 11 Apr 95 11:29 PM	Instrument Method	: BX1041
Report Created on	: 11 Apr 95 11:57 PM	Analysis Method	: BX1041
Last Recalib on	: 11 APR 95 10:03 AM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:
Sample Info	: Project # 95-1009 Client # Trip Blank Water		

EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303) 425-6021

Method 602 Data Report

Client Sample Number	: 56-Rinseate Blank	Client Project No.	: 722450.21020/MacD
Lab Sample Number	: X04945	Lab Project No.	: 95-1009
Date Sampled	: 3/28/95	Dilution Factor	: 1.00
Date Received	: 3/29/95	Method	: 602
Date Prepared	: 4/11/95	Matrix	: Water
Date Analyzed	: 4/11/95	Lab File No.	: BX1041050
		Method Blank No.	: MB041195

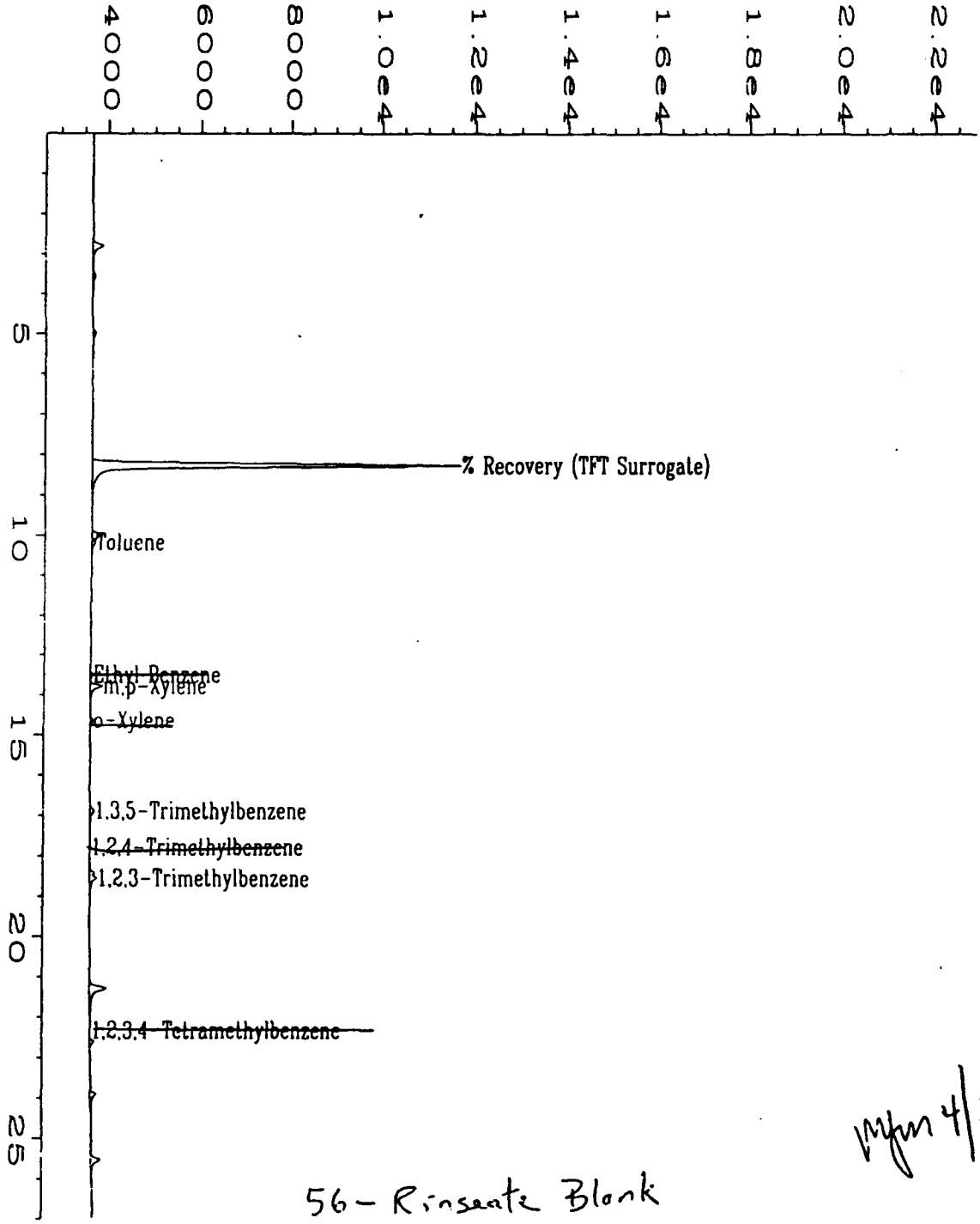
Compound Name	Cas Number	Sample Concentration ug/L		RL ug/L
Benzene	71-43-2		U	0.4
Toluene	108-88-3	0.5	B	0.4
Chlorobenzene	108-90-7		U	0.4
Ethyl Benzene	100-41-4		U	0.4
Total Xylenes (m, p & o)	108-38-3, 106-42-3 and 95-47-6	1.0		0.4
1,3,5-Trimethylbenzene	108-67-8	0.5		0.4
1,2,4-Trimethylbenzene	95-63-6		U	0.4
1,2,3-Trimethylbenzene	526-73-8	1.1		0.4
1,2,3,4-Tetramethylbenzene	488-23-3		U	0.4
Surrogate Recovery (α,α,α-Trifluorotoluene):		74%		70%-130% (QC limits

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene RL is for a single peak.

QUALIFIERS:
E = Extrapolated value.
B = Compound also found in the blank.
NA = Not Available/Not Applicable.

Analyst

Approved



mjm 4/27

56 - Rinseate Blank

Data File Name	: C:\HPCHEM\1\DATA\BX10410\050F0101.D		
Operator	: Kaprie S. Cone	Page Number	: 1
Instrument	: BTEX1	Vial Number	: 50
Sample Name	: X04945;1;5	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 1
Acquired on	: 11 Apr 95 08:17 PM	Instrument Method	: BX1041
Report Created on	: 11 Apr 95 08:44 PM	Analysis Method	: BX1041...
Last Recalib on	: 11 APR 95 10:03 AM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:
Sample Info	: Project#: 95-1009 Client#: Rinseate Blank Water		

EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303) 425-6021

Method 602 Data Report
Method Blank Report

Method Blank Number	: MB040895	Client Project No.	: 722450.21020/MacDill
Date Prepared	: 4/8/95	Lab Project No.	: 95-1009
Date Analyzed	: 4/8/95	Dilution Factor	: 1.00
		Method	: 602/8020
		Matrix	: Water
		Lab File No.	: BX1040810

Compound Name	Cas Number	Sample Concentration ug/L	RL ug/L
Benzene	71-43-2	U	0.4
Toluene	108-88-3	U	0.4
Chlorobenzene	108-90-7	U	0.4
Ethyl Benzene	100-41-4	U	0.4
Total Xylenes (m, p & o)	108-38-3, 106-42-3 and 95-47-6	U	0.4
1,3,5-Trimethylbenzene	108-67-8	U	0.4
1,2,4-Trimethylbenzene	95-63-6	U	0.4
1,2,3-Trimethylbenzene	526-73-8	U	0.4
1,2,3,4-Tetramethylbenzene	488-23-3	U	0.4

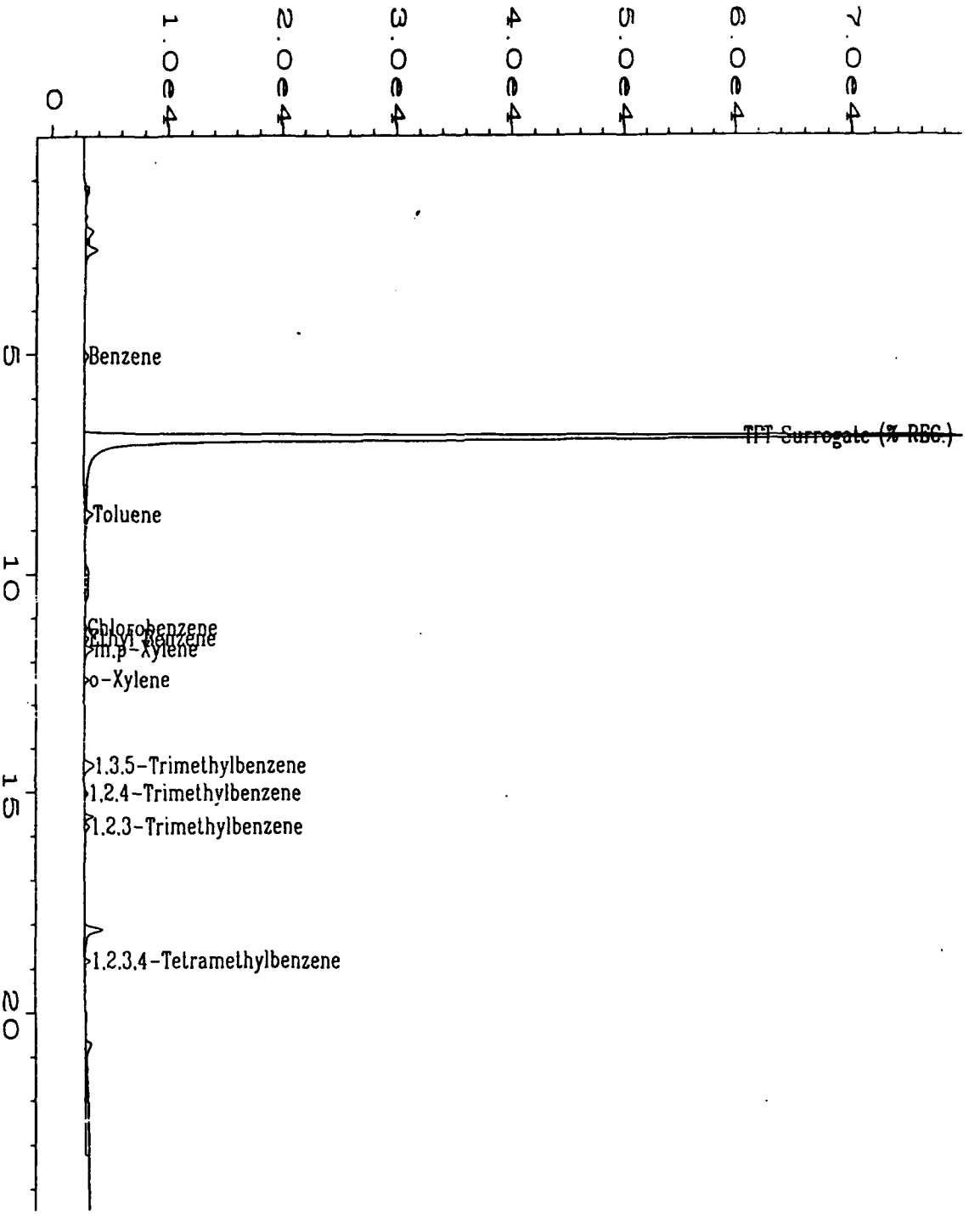
Surrogate Recovery (α,α,α-Trifluorotoluene):	104%	70%-130% (QC limits)

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene RL is for a single peak.

QUALIFIERS:
E = Extrapolated value.
U = Compound analyzed for, but not detected.
B = Compound also found in the blank.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit (RL).
RL = Reporting Limit.
NA = Not Available/Not Applicable.

Analyst

K. Cone
Approved



Data File Name : C:\HPCHEM\2\DATA\BX20408\010R0901.D
Operator : S.W. Tyson
Instrument : BTEX2
Sample Name : MB040895
Run Time Bar Code:
Acquired on : 08 Apr 95 04:07 PM
Report Created on: 09 Apr 95 02:24 PM
Last Recalib on : 09 Apr 95 02:21 PM
Multiplier : 1

Page Number : 1
Vial Number : 10
Injection Number : 1
Sequence Line : 9
Instrument Method: BX20408
Analysis Method : BX20408.MT
Sample Amount : 0
ISTD Amount :

EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303) 425-6021

Method 602 Data Report
Method Blank Report

Method Blank Number	: MB041195	Client Project No.	: 722450.21020/MacDil
Date Prepared	: 4/11/95	Lab Project No.	: 95-1009
Date Analyzed	: 4/11/95	Dilution Factor	: 1.00
		Method	: 602/8020
		Matrix	: Water
		Lab File No.	: BX1041035

Compound Name	Cas Number	Sample Concentration ug/L		RL ug/L
Benzene	71-43-2		U	0.4
Toluene	108-88-3	0.7		0.4
Chlorobenzene	108-90-7		U	0.4
Ethyl Benzene	100-41-4		U	0.4
Total Xylenes (m, p & o)	108-38-3, 106-42-3 and 95-47-6		U	0.4
1,3,5-Trimethylbenzene	108-67-8		U	0.4
1,2,4-Trimethylbenzene	95-63-6		U	0.4
1,2,3-Trimethylbenzene	526-73-8		U	0.4
1,2,3,4-Tetramethylbenzene	488-23-3		U	0.4

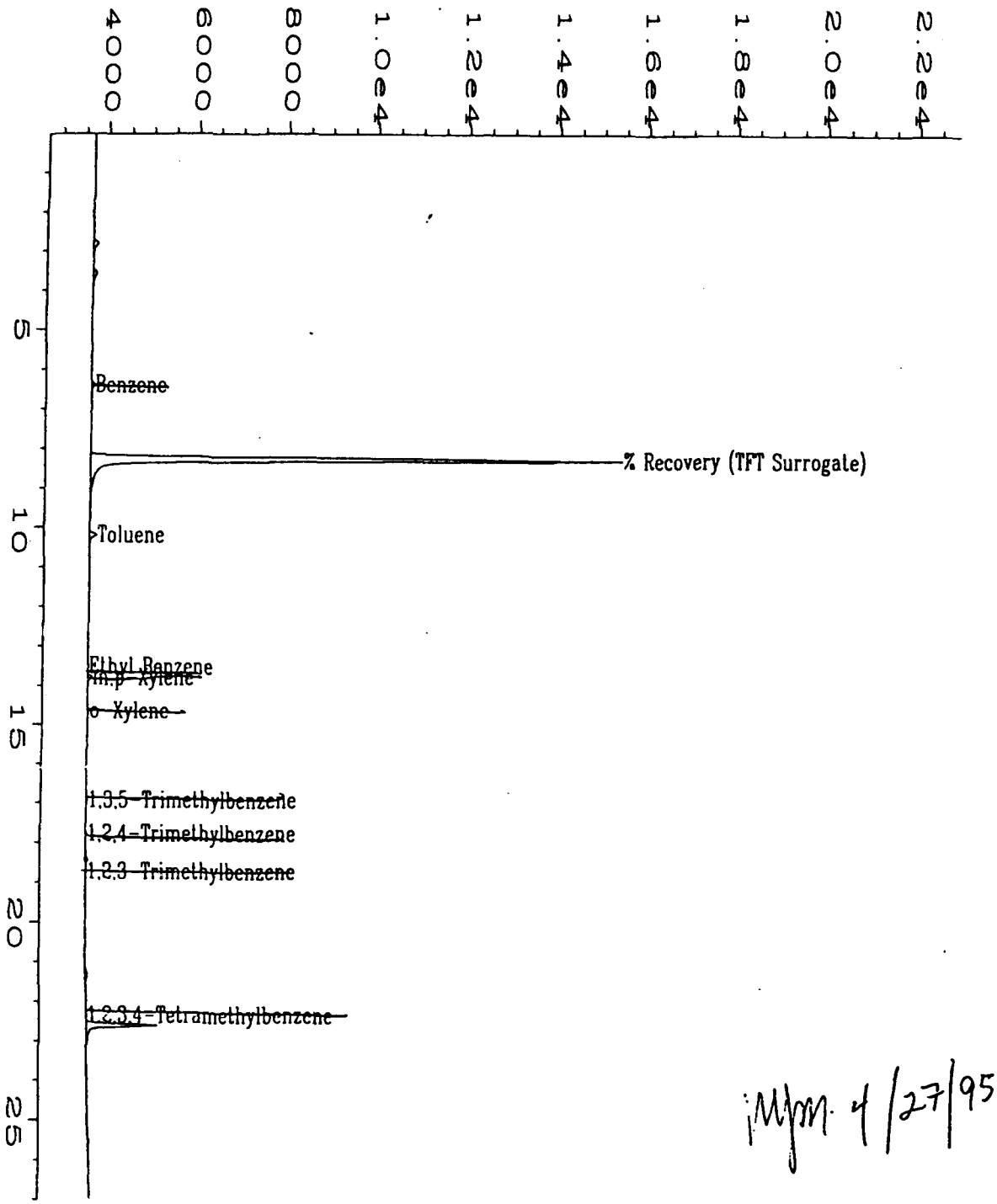
Surrogate Recovery (α,α,α-Trifluorotoluene):	107%	70%-130% (QC limits)

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene RL is for a single peak.

QUALIFIERS:
E = Extrapolated value.
U = Compound analyzed for, but not detected.
B = Compound also found in the blank.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit (RL).
RL = Reporting Limit.
NA = Not Available/Not Applicable.

Analyst

K. Cone
Approved



MJM 4/27/95

Data File Name : C:\HPCHEM\1\DATA\BX10410\035F0701.D
Operator : Kaprie S. Cone
Instrument : BTEX1
Sample Name : MB041195-WATER
Run Time Bar Code:
Acquired on : 11 Apr 95 09:41 AM
Report Created on: 17 Apr 95 01:37 AM
Last Recalib on : 11 APR 95 10:03 AM
Multiplier : 1

Page Number : 1
Vial Number : 35
Injection Number : 1
Sequence Line : 7
Instrument Method: BX10411.
Analysis Method : BX10411A.MT
Sample Amount : 0
ISTD Amount :

EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303) 425-6021

BTEX Data Report
Laboratory Control Sample (LCS)

LCS Number	: LCS040895	Dilution Factor	: 1.00
Date Extracted/Prepared	: 4/8/95	Method	: 602
Date Analyzed	: 4/8/95	Matrix	: Water
Spike Amount (ug/L)	: 20.0	Lab File No.	: BX2040811

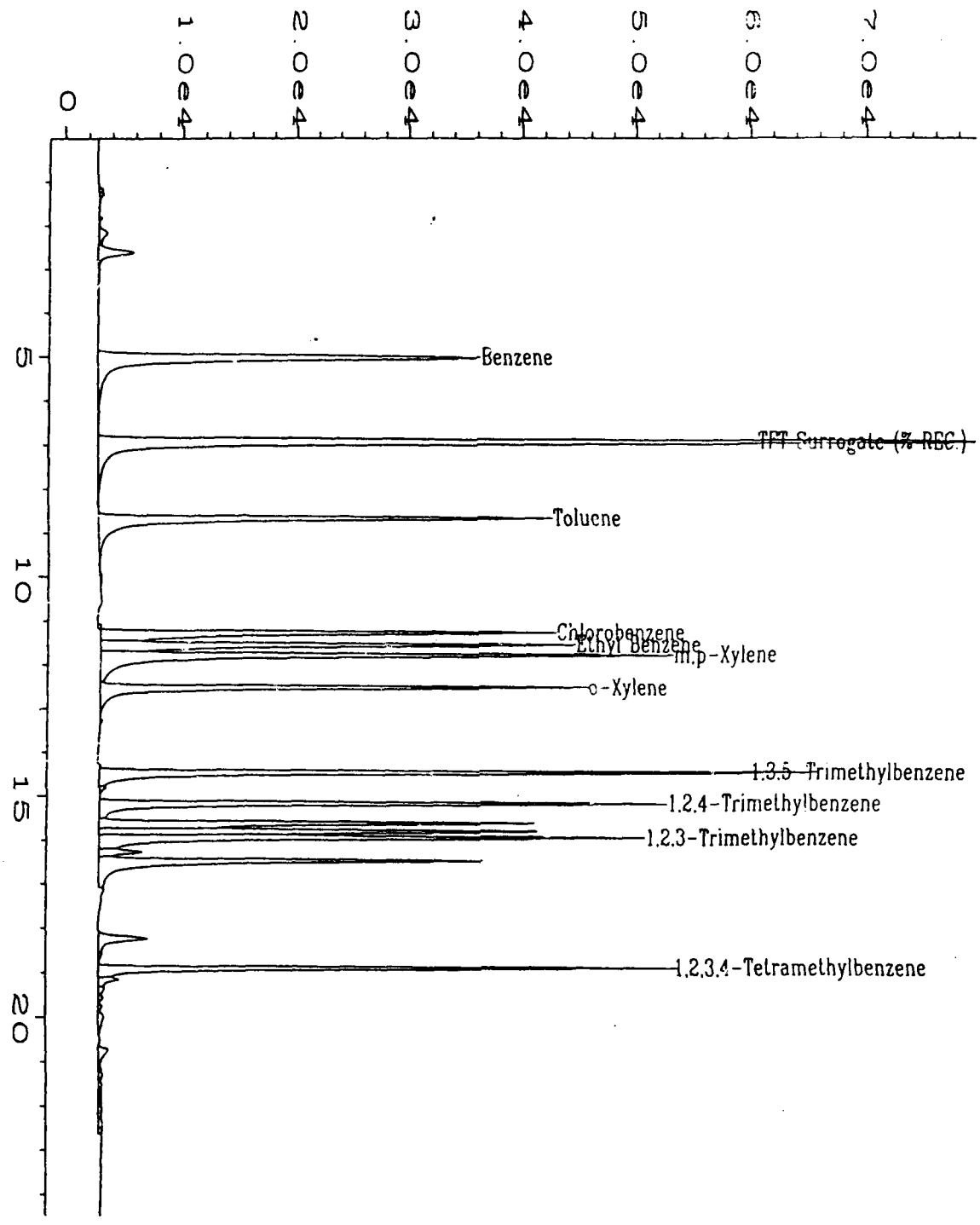
Compound Name	Cas Number	LCS Concentration ug/L	LCS % Recovery	QC Limit % Recovery
Benzene	71-43-2	15.9	79.5	71.0-119.0*
Toluene	108-88-3	16.4	82.0	73.0-111.0*
Chlorobenzene	108-90-7	15.9	79.5	64.0-119.0*
Ethyl Benzene	100-41-4	16.6	83.0	75.0-114.0*
m,p-Xylene	108-38-3	16.9	84.5	75.0-114.0*
o-Xylene	106-42-3 95-47-6	15.2	76.0	64.0-119.0*
1,3,5-Trimethylbenzene	108-67-8	16.2	81.0	50.0-150.0
1,2,4-Trimethylbenzene	95-63-6	17.9	89.5	50.0-150.0
1,2,3-Trimethylbenzene	526-73-8	21.7	108.5	50.0-150.0
1,2,3,4-Tetramethylbenzene	488-23-3	17 6	88.0	50.0-150.0
Surrogate Recovery (α,α,α-Trifluorotoluene):		98%	70%-130% (QC limits)	

* = Limits established 4/3/95 KSC

QUALIFIERS:
E = Extrapolated value
U = Compound analyzed for, but not detected.
B = Compound found in blank and sample. Compare blank and sample data.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit (RL).
NA = Not available/Not analyzed.

K. Cox
Analyst

Approved



Data File Name	: C:\HPCHEM\2\DATA\BX20408\011R0901.D		
Operator	: S.W. Tyson	Page Number	: 1
Instrument	: BTEX2	Vial Number	: 11
Sample Name	: LCS040895	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 9
Acquired on	: 08 Apr 95 04:54 PM	Instrument Method	: BX20408
Report Created on	: 09 Apr 95 02:25 PM	Analysis Method	: BX20408.MTH
Last Recalib on	: 09 Apr 95 02:21 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:

EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303) 425-6021

BTEX Data Report
Laboratory Control Sample (LCS)

LCS Number	: LCS041195	Dilution Factor	: 1.00
Date Extracted/Prepared	: 4/11/95	Method	: 602
Date Analyzed	: 4/11/95	Matrix	: Water
Spike Amount (ug/L)	: 20.0	Lab File No.	: BX2041036

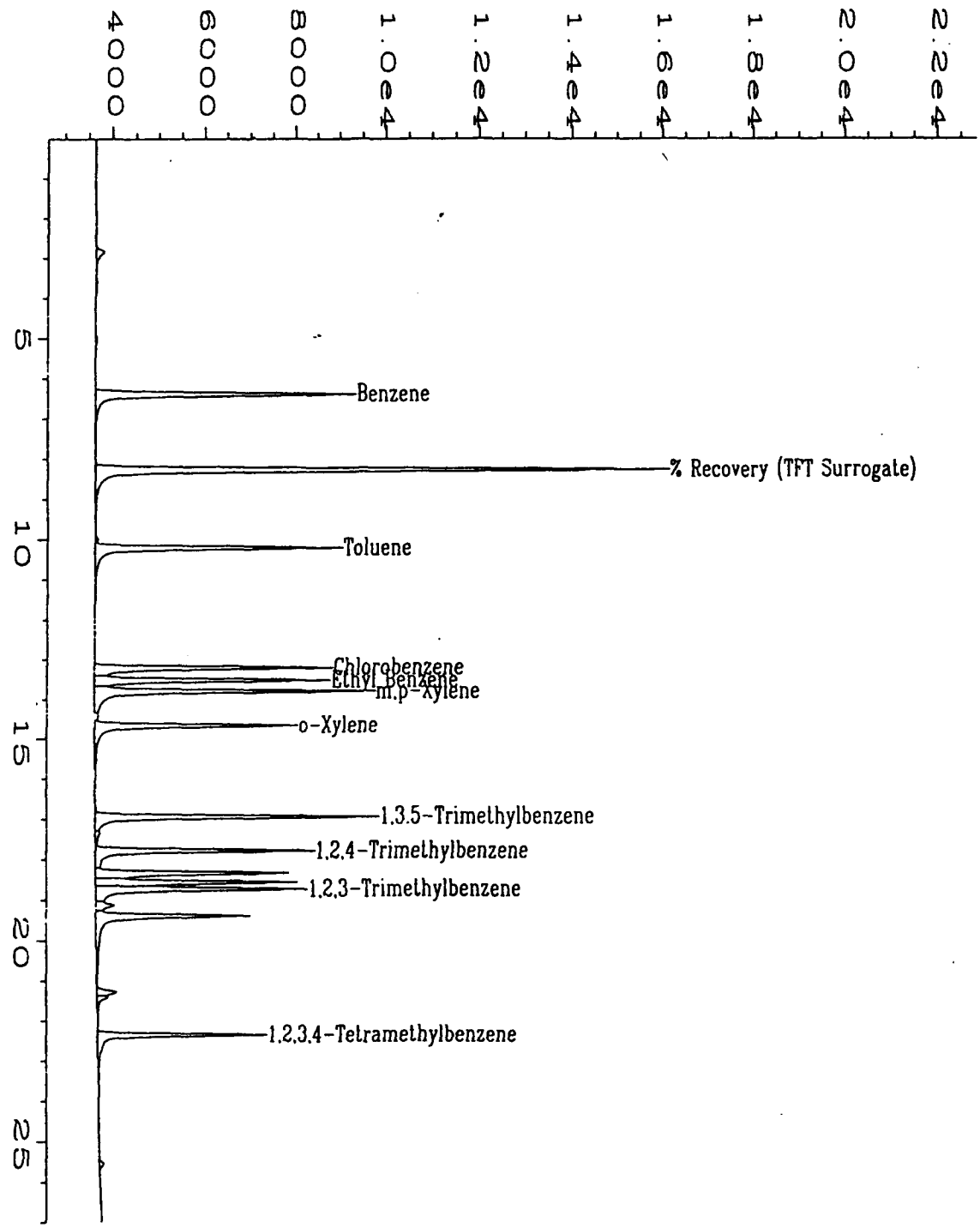
Compound Name	Cas Number	LCS Concentration ug/L	LCS % Recovery	QC Limit* % Recovery
Benzene	71-43-2	17.8	89.0%	71.0%-119.0%
Toluene	108-88-3	17.7	88.5%	73.0%-111.0%
Chlorobenzene	108-90-7	17.9	89.5%	64.0%-119.0%
Ethyl Benzene	100-41-4	17.6	88.0%	75.0%-114.0%
m,p-Xylene	108-38-3 106-42-3	17.7	88.5%	75.0%-114.0%
o-Xylene	95-47-6	16.0	80.0%	64.0%-119.0%
1,3,5-Trimethylbenzene	108-67-8	16.7	83.5%	68.0%-101.0%
1,2,4-Trimethylbenzene	95-63-6	17.2	86.0%	61.0%-88.0%
1,2,3-Trimethylbenzene	526-73-8	19.9	100%	63.0%-101.0%
1,2,3,4-Tetramethylbenzene	488-23-3	17.1	85.5%	58.0%-102.0%
Surrogate Recovery (α,α,α-Trifluorotoluene):		113%	70%-130% (QC limits)	

* = Limits established 4/3/95 KSC

QUALIFIERS:
E = Extrapolated value
U = Comp und analyzed for, but not detected.
B = Compound found in blank and sample. Compare blank and sample data.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit (RL).
NA = Not available/Not analyzed.

Analyst

Approved



Data File Name	: C:\HPCHEM\1\DATA\BX10410\036F0101.D		
Operator	: Kaprie S. Cone	Page Number	: 1
Instrument	: BTEX1	Vial Number	: 36
Sample Name	: LCS041195	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 1
Acquired on	: 11 Apr 95 10:46 AM	Instrument Method	: BX10411
Report Created on	: 11 Apr 95 06:11 PM	Analysis Method	: BX10411A.M
Last Recalib on	: 11 APR 95 10:03 AM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:
Sample Info	: 20 ppb spike, ref # 1649; mtbe = 20 ppb, ref # 1589		

EVERGREEN ANALYTICAL, INC.
4036 Youngfield, Wheat Ridge, CO 80033
(303) 425-6021

TOTAL VOLATILE HYDROCARBONS (TVH-GASOLINE)

Date Sampled	: 3/28/95	Client Project Number	: 722450.21020
Date Received	: 3/29/95	Lab Project Number	: 95-1009
Date Prepared	: 4/11/95	Matrix	: Water
Date Analyzed	: 4/11/95	Method Number	: 5030/Mod.8015

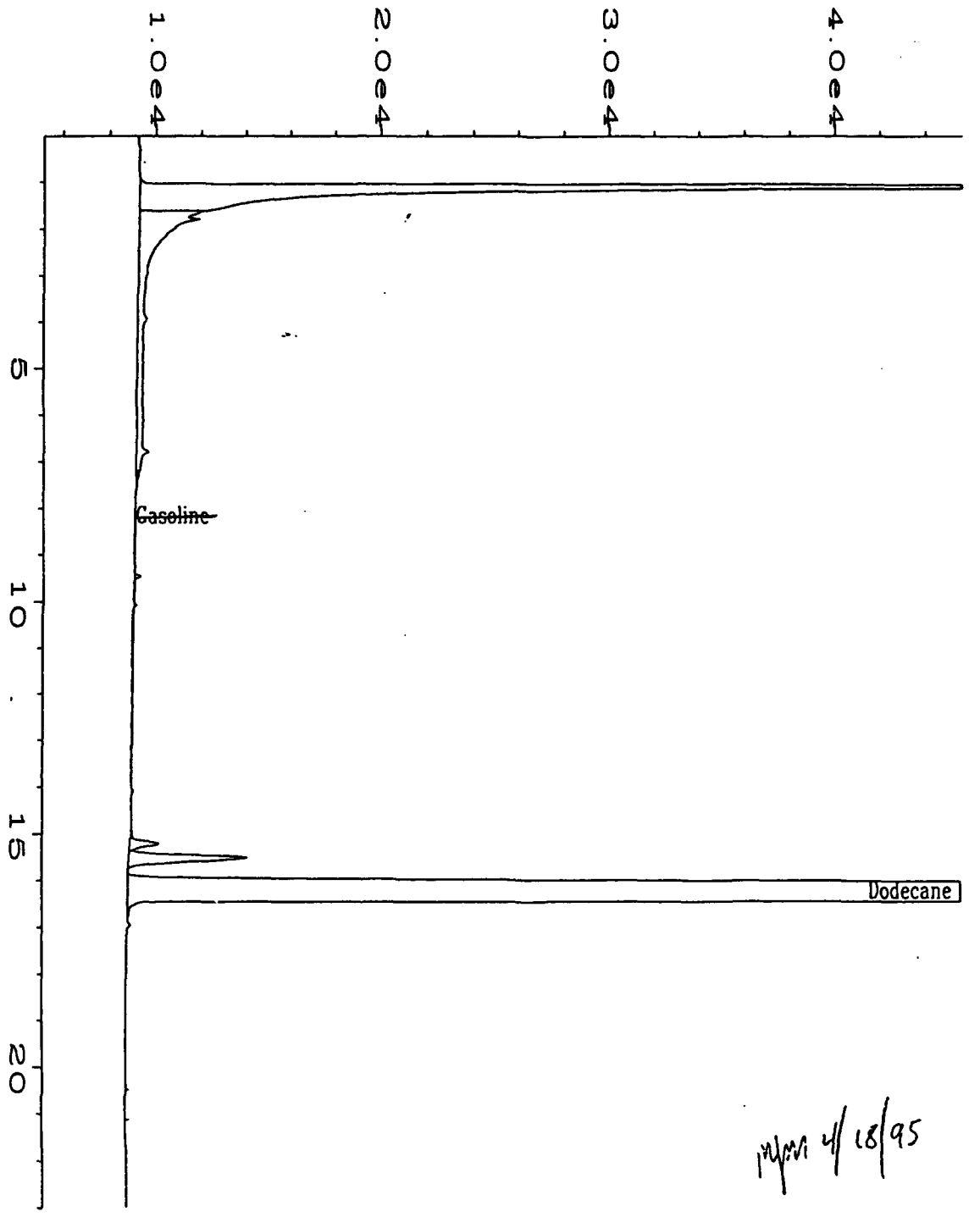
Evergreen Sample #	Client Sample #	Surrogate Recovery	TVH mg/L	RL mg/L
MB041195	METHOD BLANK	100%	U	0.1
MB041195B	METHOD BLANK	101%	U	0.1
X04934	MW56-11	102%	0.5	0.1
X04935	MW56-7	99%	2.1	0.1
X04936	56MP-3S	103%	U	0.1
X04937	56MP-3D	100%	U	0.1
X04938	56MP-1S	100%	U	0.1
X04939	MW56-5	101%	U	0.1
X04940	MD32-MW7	101%	0.1	0.1
X04941	MW32-1	100%	0.8	0.1
X04942	MW32-21	103%	1.0	0.1
X04942 DUP	MW32-21	107%	1.1	0.1

QUALIFIERS
U = TVH analyzed for but not detected.
B = TVH found in blank.
E = Extrapolated value.
RL = Reporting Limit.

K. Cone
Analyst

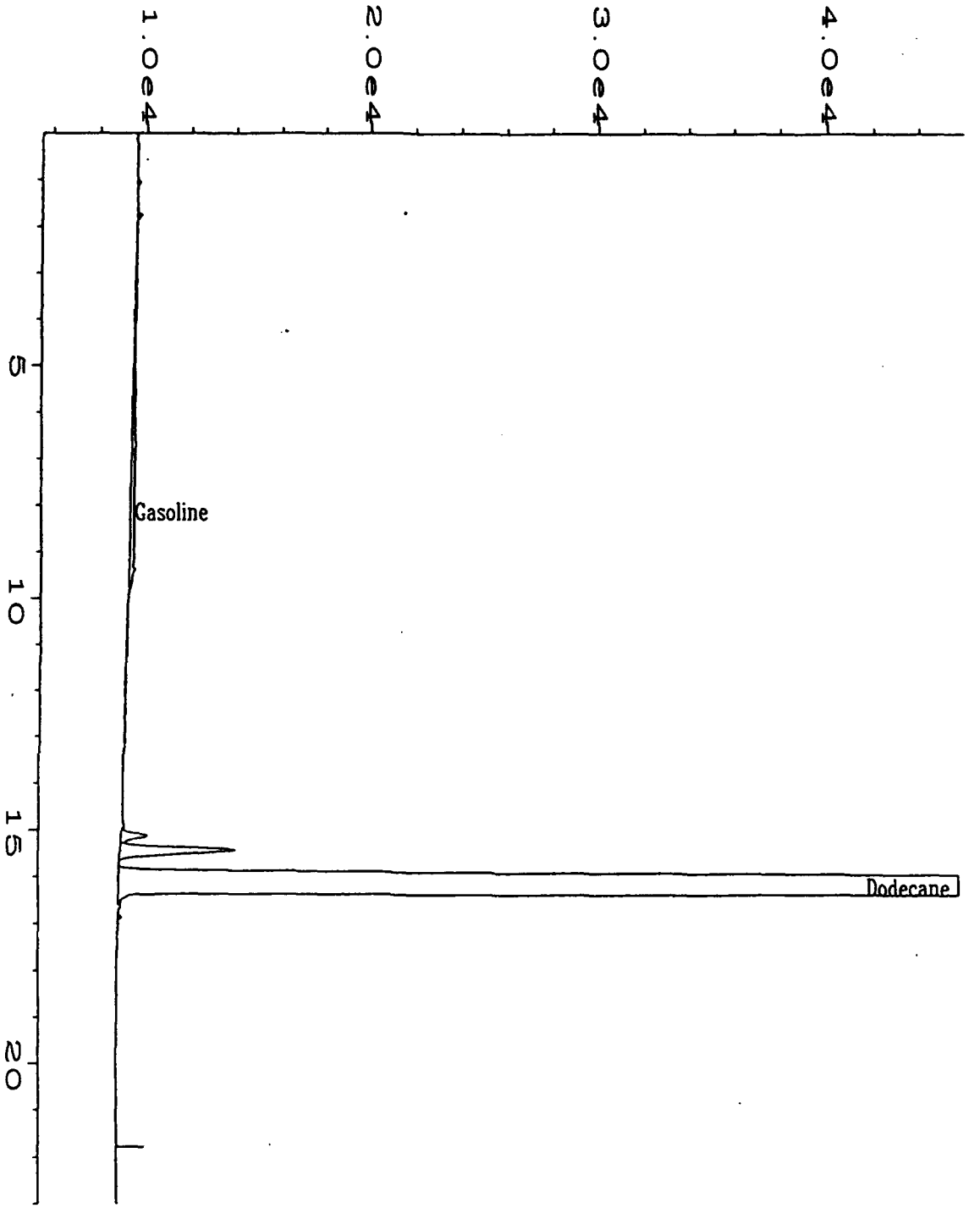
Approved

TVH1009.XLS

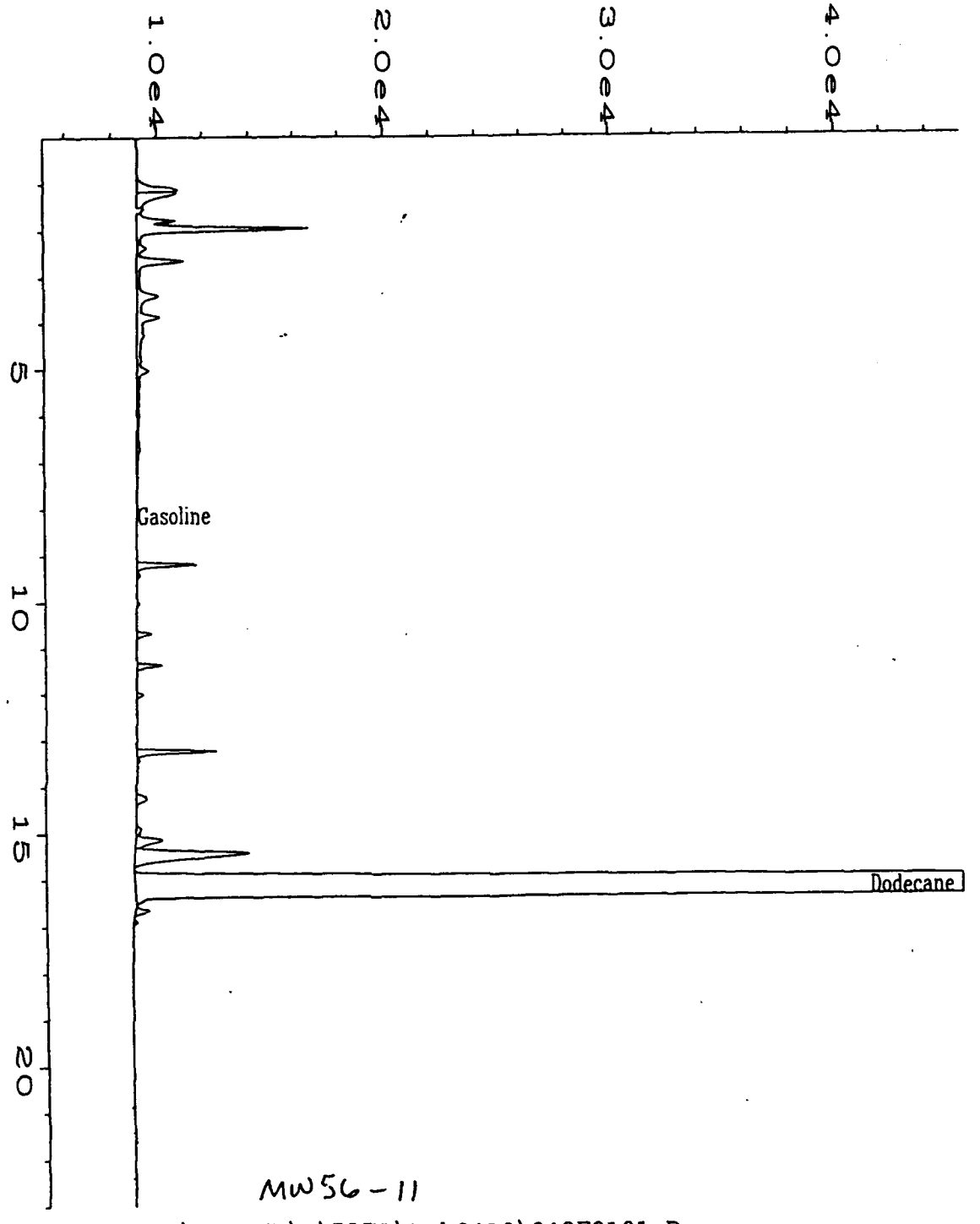


mpm 4/18/95

Data File Name	: C:\HPCHEM\1\DATA\TVH0410\030F0101.D		
Operator	: Dawn N. Guildner	Page Number	: 1
Instrument	: TVH	Vial Number	: 30
Sample Name	: MB041195	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 1
Acquired on	: 11 Apr 95 03:03 AM	Instrument Method	: TVH1B
Report Created on	: 11 Apr 95 09:30 PM	Analysis Method	: TVH0410.M
Last Recalib on	: 10 APR 95 01:08 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:

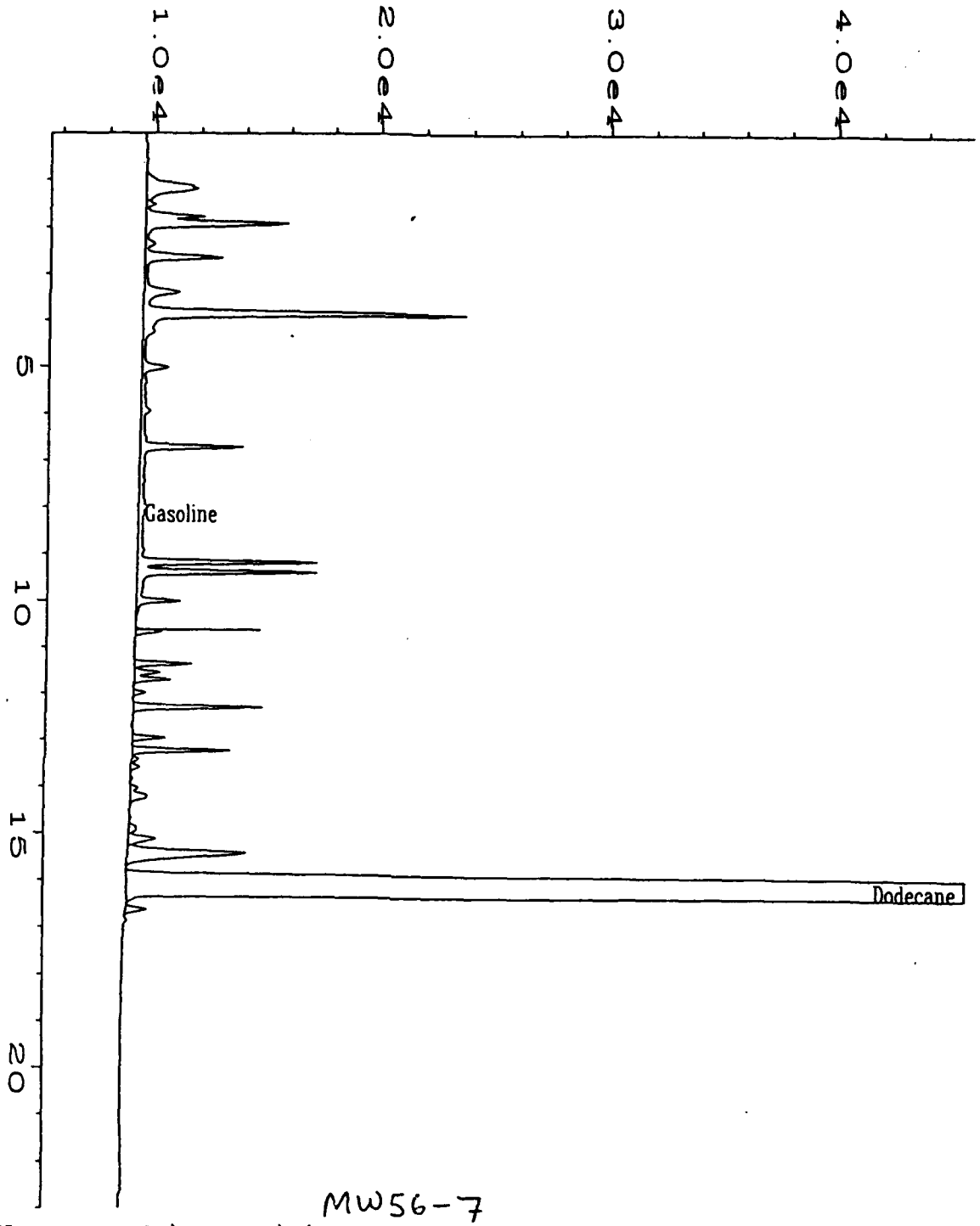


Data File Name	: C:\HPCHEM\1\DATA\tvh0410\052F0101.D		
Operator	: Dawn N. Guildner	Page Number	: 1
Instrument	: TVH	Vial Number	: 52
Sample Name	: MB041195B BC	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 1
Acquired on	: 11 Apr 95 04:25 PM	Instrument Method	: TVH1BASE.M
Report Created on	: 11 Apr 95 09:11 PM	Analysis Method	: TVH0410.MT
Last Recalib on	: 10 APR 95 01:08 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:



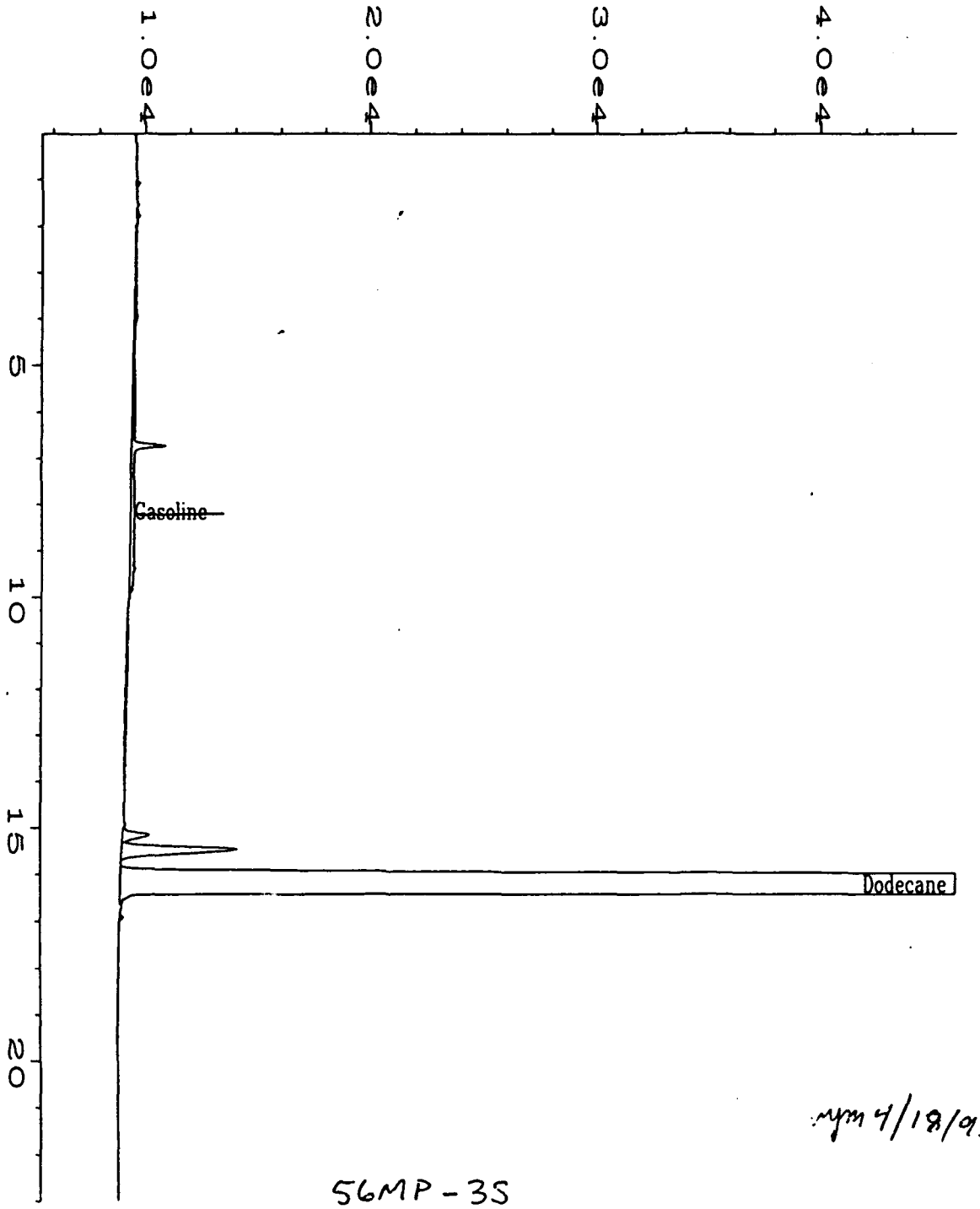
MW56-11

Data File Name	: C:\HPCHEM\1\DATA\tvh0410\049F0101.D		
Operator	: Dawn N. Guildner	Page Number	: 1
Instrument	: TVH	Vial Number	: 49
Sample Name	: X04934;1;5	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 1
Acquired on	: 11 Apr 95 02:37 PM	Instrument Method	: TVH1I
Report Created on	: 11 Apr 95 09:11 PM	Analysis Method	: TVH04
Last Recalib on	: 10 APR 95 01:08 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:



MW56-7

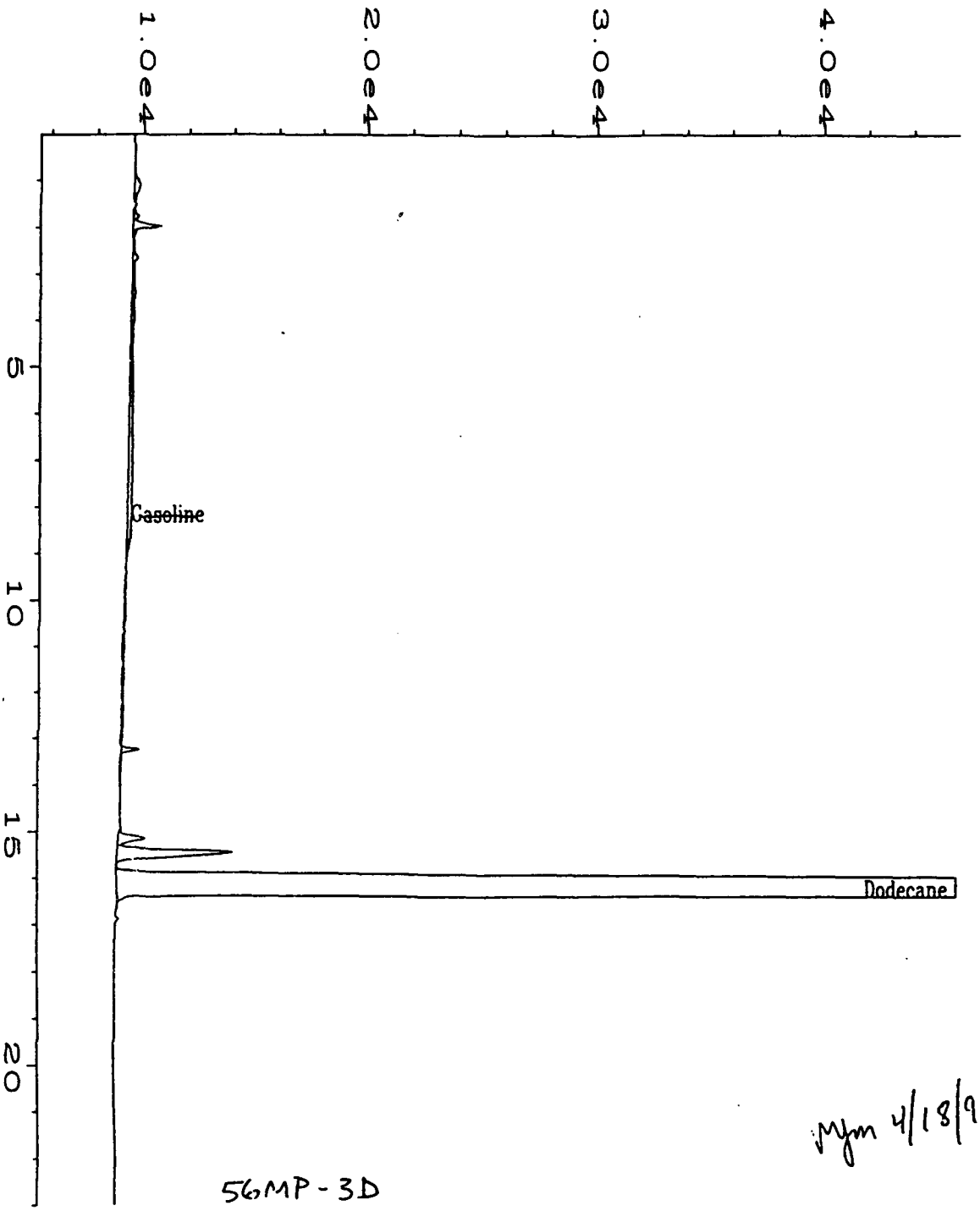
Data File Name	: C:\HPCHEM\1\DATA\tvh0410\050F0101.D		
Operator	: Dawn N. Guildner	Page Number	: 1
Instrument	: TVH	Vial Number	: 50
Sample Name	: X04935;1;5	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 1
Acquired on	: 11 Apr 95 03:13 PM	Instrument Method	: TVH1BASE.M
Report Created on	: 11 Apr 95 09:11 PM	Analysis Method	: TVH0410.MT
Last Recalib on	: 10 APR 95 01:08 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:



mm 4/18/95

56MP-35

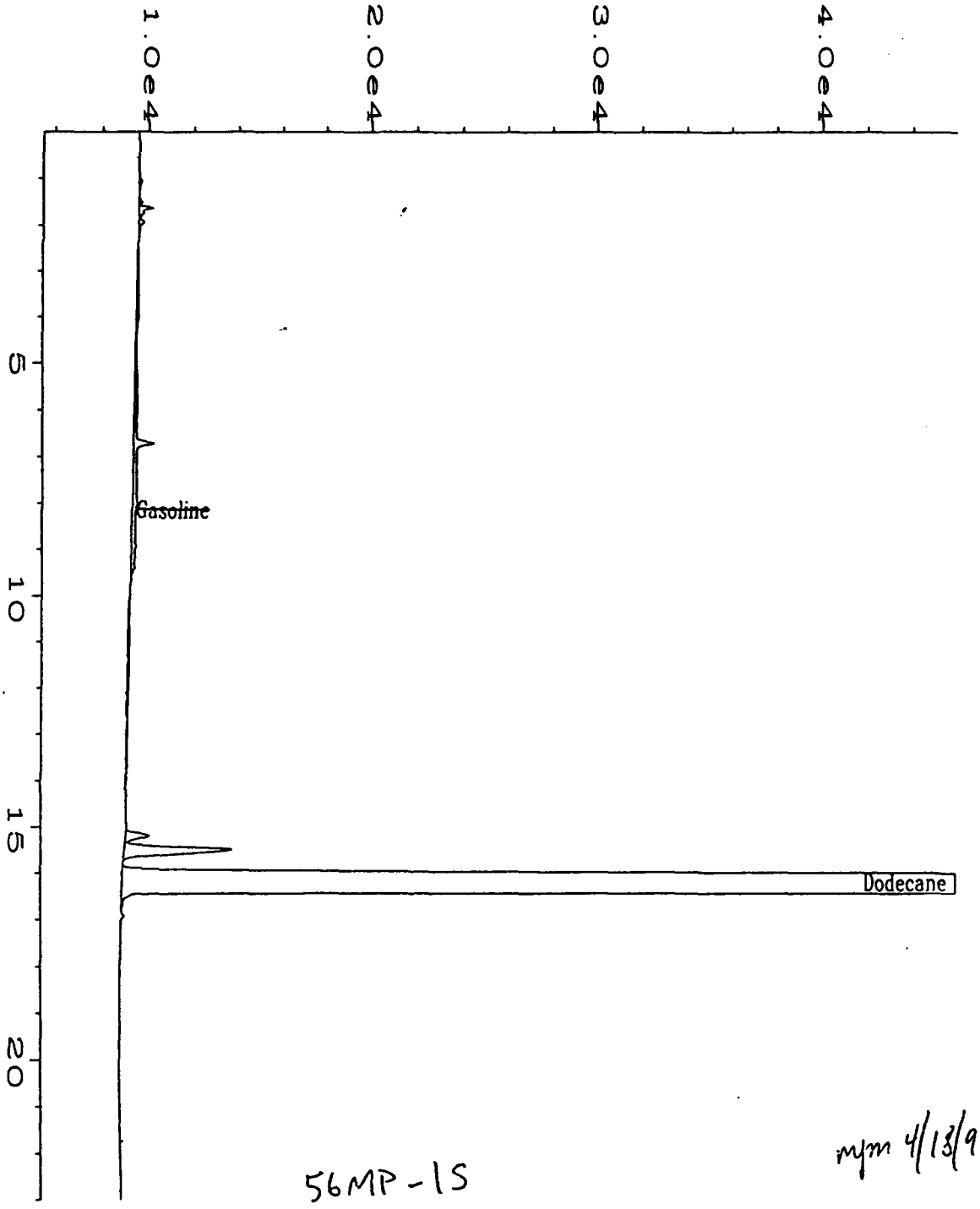
Data File Name	: C:\HPCHEM\1\DATA\tvh0410\053F0101.D		
Operator	: Dawn N. Guildner	Page Number	: 1
Instrument	: TVH	Vial Number	: 53
Sample Name	: X04936;1;5	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 1
Acquired on	: 11 Apr 95 05:00 PM	Instrument Method	: TVH1BA
Report Created on	: 11 Apr 95 09:12 PM	Analysis Method	: TVH0410.M
Last Recalib on	: 10 APR 95 01:08 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:



mjm 4/18/95

56MP-3D

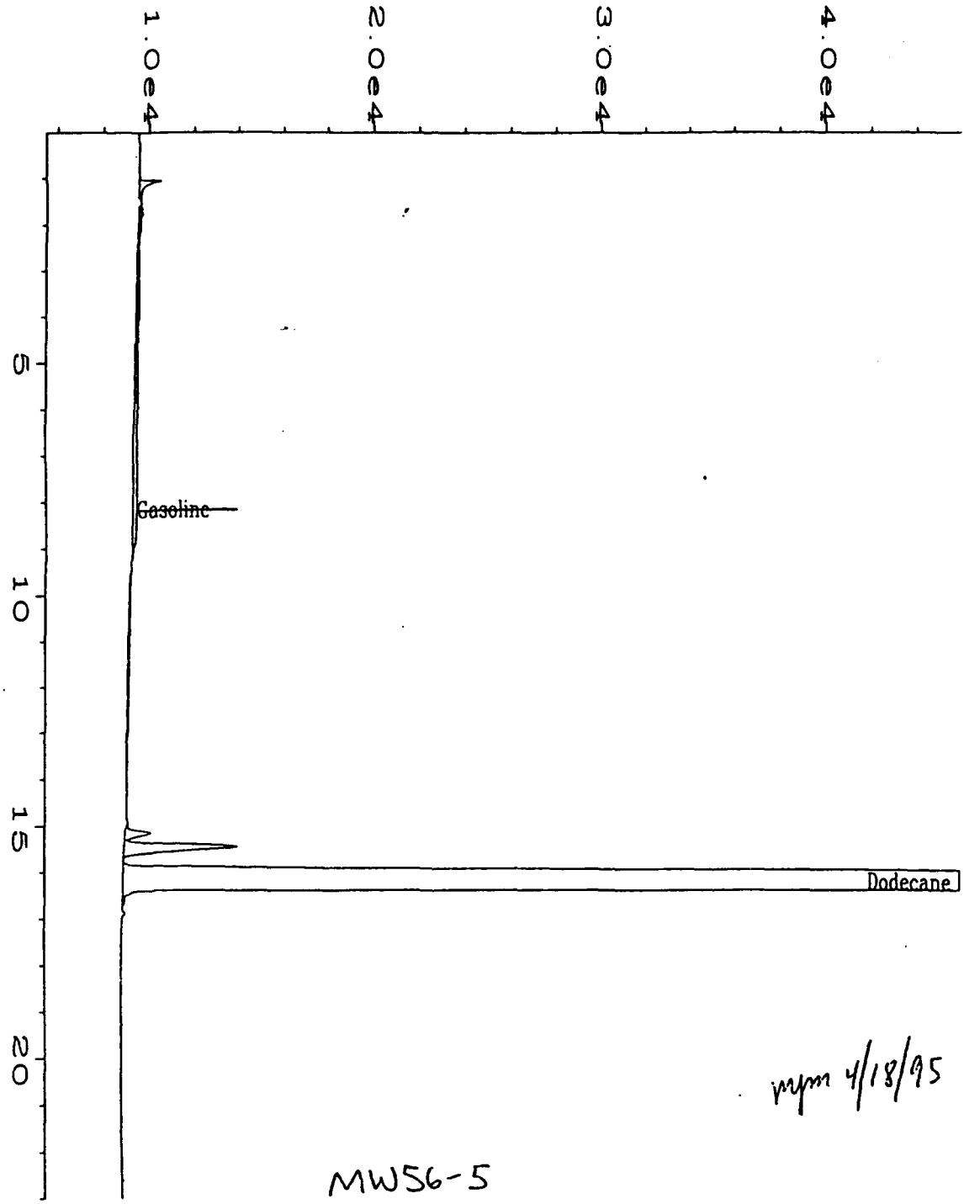
Data File Name	: C:\HPCHEM\1\DATA\tvh0410\054F0101.D		
Operator	: Dawn N. Guildner	Page Number	: 1
Instrument	: TVH	Vial Number	: 54
Sample Name	: X04937;1;5	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 1
Acquired on	: 11 Apr 95 05:36 PM	Instrument Method	: TVH1BASE.M
Report Created on	: 11 Apr 95 09:12 PM	Analysis Method	: TVH0410.MT
Last Recalib on	: 10 APR 95 01:08 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:



mjm 4/13/95

56MP-1S

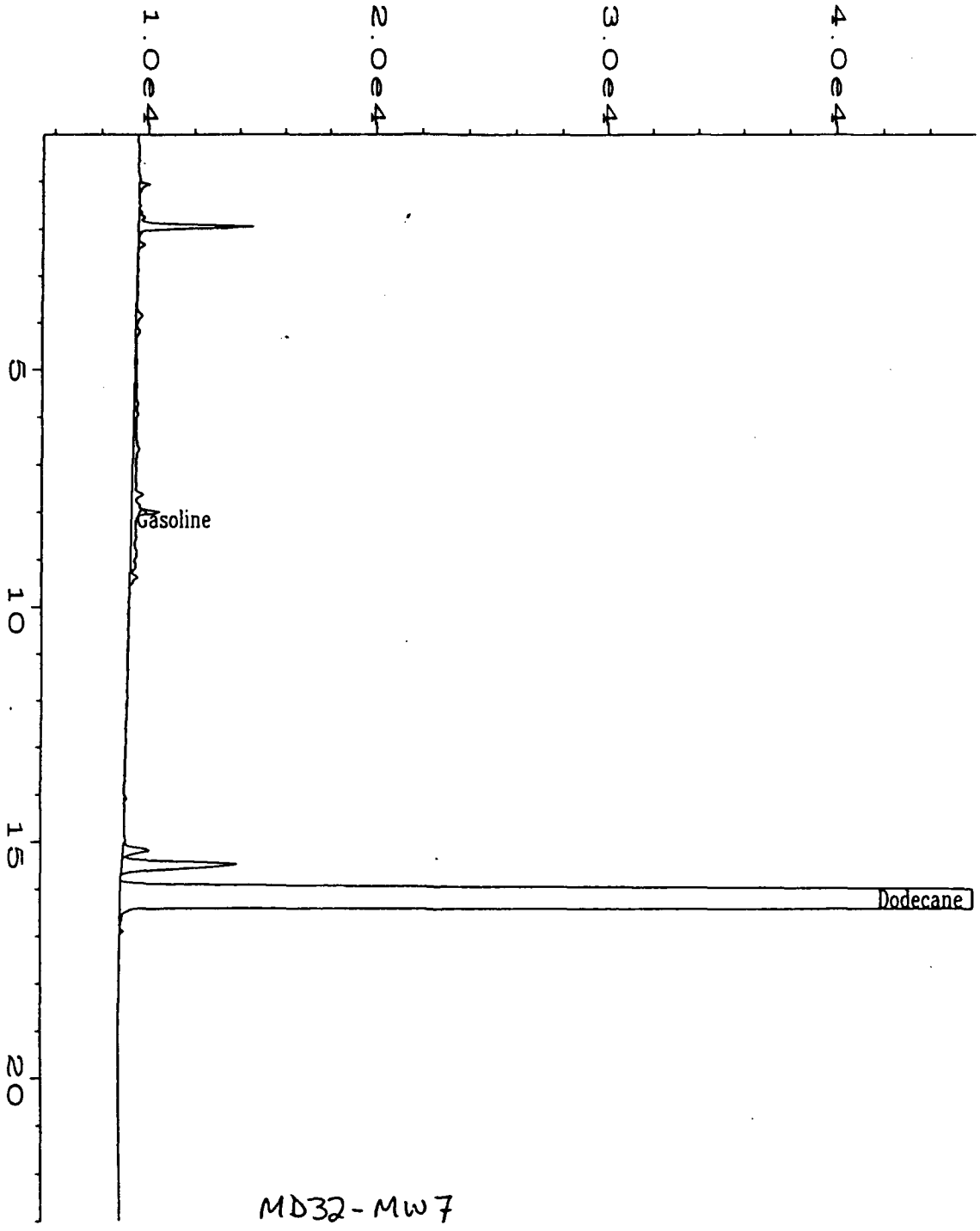
Data File Name	: C:\HPCHEM\1\DATA\tvh0410\055F0101.D		
Operator	: Dawn N. Guildner	Page Number	: 1
Instrument	: TVH	Vial Number	: 55
Sample Name	: X04938;1;5	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 1
Acquired on	: 11 Apr 95 06:12 PM	Instrument Method	: TVH1B
Report Created on	: 11 Apr 95 09:12 PM	Analysis Method	: TVH041U.
Last Recalib on	: 10 APR 95 01:08 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:



mym 4/18/95

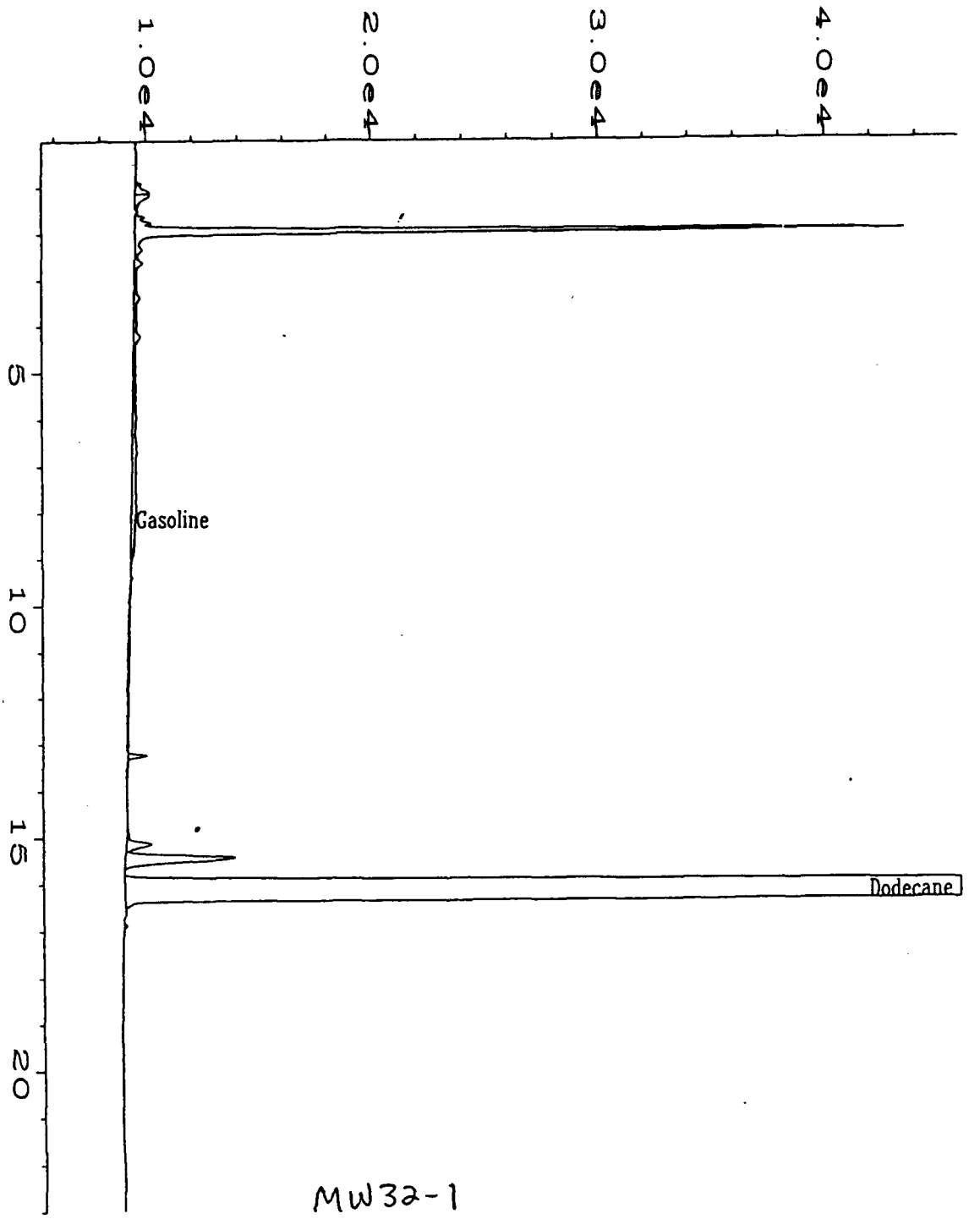
MW56-5

Data File Name	: C:\HPCHEM\1\DATA\tvh0410\056F0101.D		
Operator	: Dawn N. Guildner	Page Number	: 1
Instrument	: TVH	Vial Number	: 56
Sample Name	: X04939;1;5	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 1
Acquired on	: 11 Apr 95 06:48 PM	Instrument Method	: TVH1BASE.M
Report Created on	: 11 Apr 95 09:12 PM	Analysis Method	: TVH0410.M
Last Recalib on	: 10 APR 95 01:08 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:



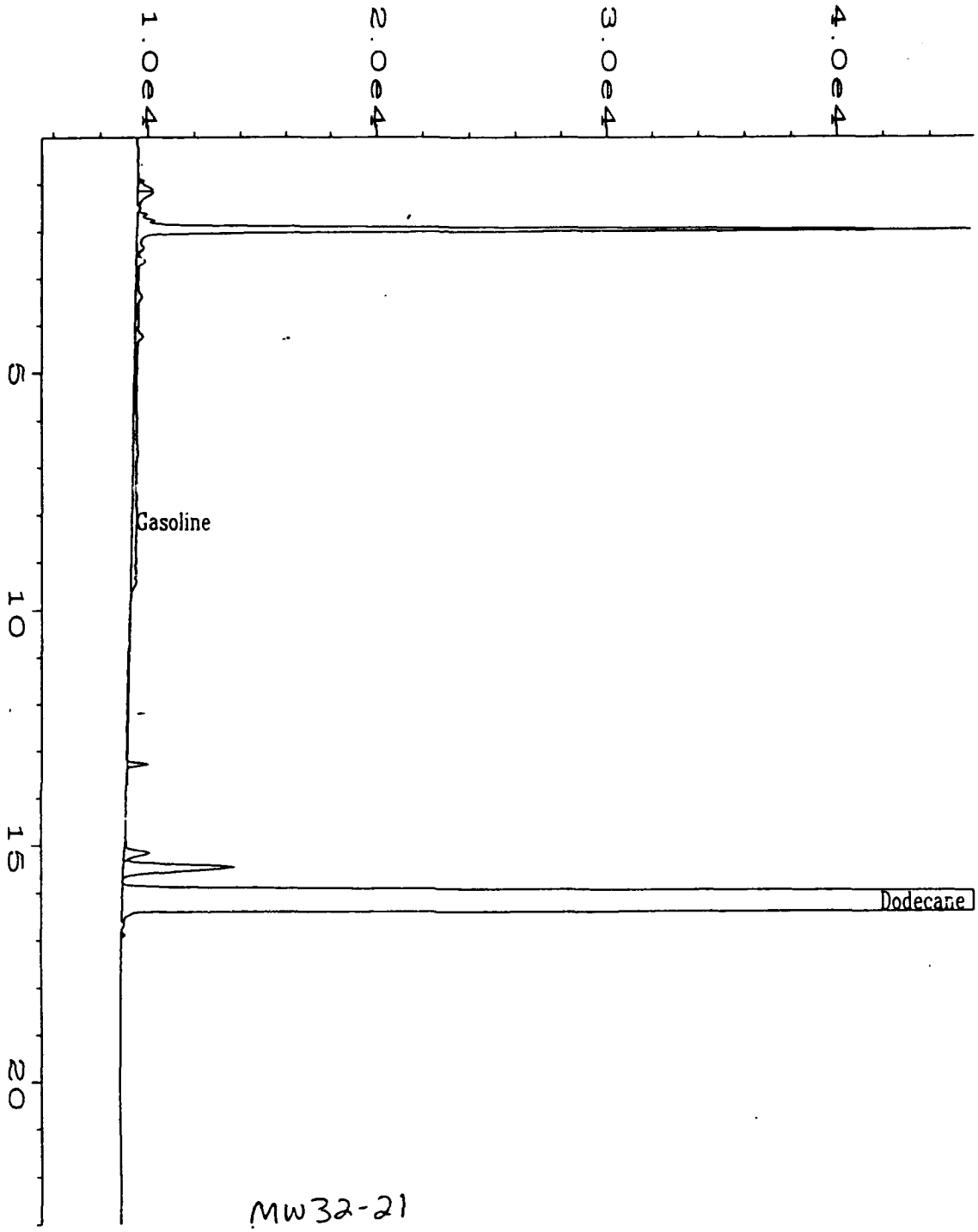
MD32-MW7

Data File Name	: C:\HPCHEM\1\DATA\tvh0410\057F0101.D		
Operator	: Dawn N. Guildner	Page Number	: 1
Instrument	: TVH	Vial Number	: 57
Sample Name	: X04940;1;5	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 1
Acquired on	: 11 Apr 95 07:24 PM	Instrument Method	: TVH1BA
Report Created on	: 11 Apr 95 09:12 PM	Analysis Method	: TVH0410
Last Recalib on	: 10 APR 95 01:08 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:



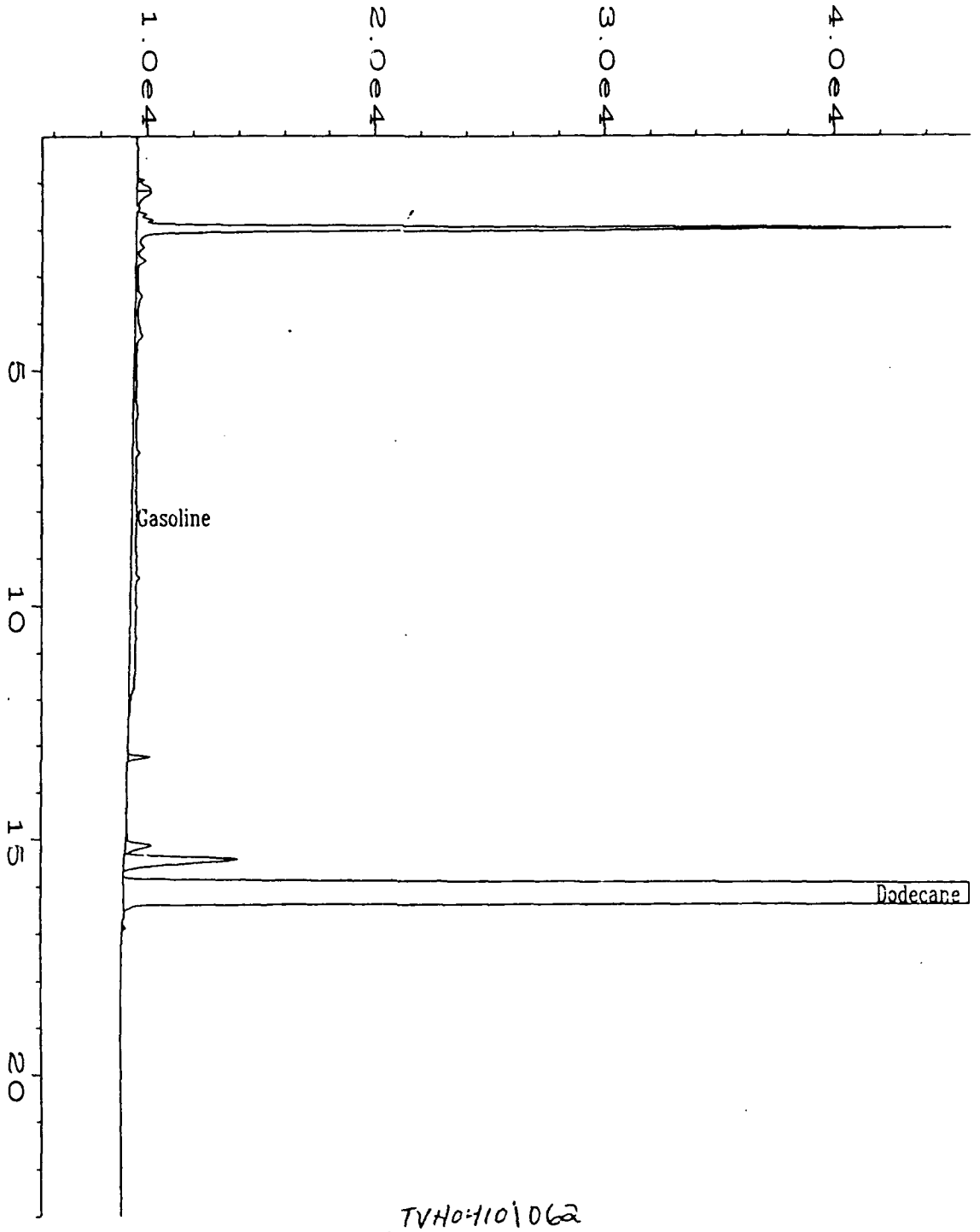
MW32-1

Data File Name	: C:\HPCHEM\1\DATA\tvh0410\058F0101.D		
Operator	: Dawn N. Guildner	Page Number	: 1
Instrument	: TVH	Vial Number	: 58
Sample Name	: X04941;1;5	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 1
Acquired on	: 11 Apr 95 08:00 PM	Instrument Method	: TVH1BASE.M
Report Created on	: 11 Apr 95 09:13 PM	Analysis Method	: TVH0410.MT
Last Recalib on	: 10 APR 95 01:08 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:



MW32-21

Data File Name	: C:\HPCHEM\1\DATA\TVH0410\059F0101.D		
Operator	: Dawn N. Guildner	Page Number	: 1
Instrument	: TVH	Vial Number	: 59
Sample Name	: X04942;1;5	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 1
Acquired on	: 11 Apr 95 08:36 PM	Instrument Method	: TVH1B
Report Created on	: 11 Apr 95 09:52 PM	Analysis Method	: TVH041
Last Recalib on	: 10 APR 95 01:08 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:



TVH0410\062

Data File Name : C:\HPCHEM\1\DATA\~~NV-F0112.D~~
Operator :
Instrument : TVH
Sample Name : X04942 Dup
Run Time Bar Code:
Acquired on : 11 Apr 95 10:24 PM
Report Created on: 11 Apr 95 11:44 PM
Last Recalib on : 10 APR 95 01:08 PM
Multiplier : 1

Page Number : 1
Vial Number :
Injection Number :
Sequence Line :
Instrument Method: TVH1BASE.I
Analysis Method : TVH0410.M
Sample Amount : 0
ISTD Amount :

EVERGREEN ANALYTICAL, INC.
4036 Youngfield, Wheat Ridge, CO 80033
(303) 425-6021

TOTAL VOLATILE HYDROCARBONS (TVH)
Laboratory Control Sample (LCS)

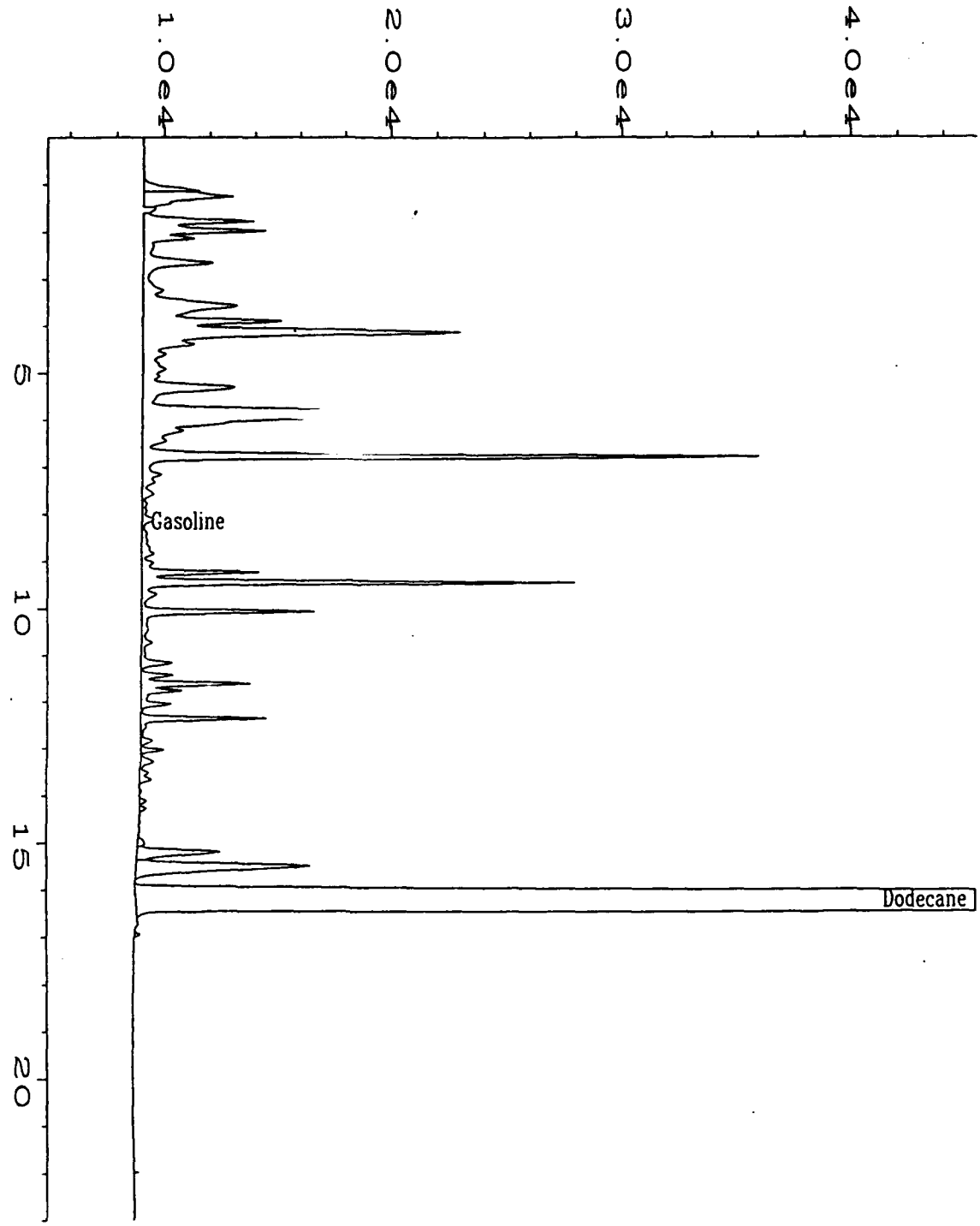
LCS Number	: LCS041095	Matrix	: WATER
Date Prepared	: 4/10/95	Method Number	: 5030/MOD.8015
Date Analyzed	: 4/10/95		
Sequence Number	: TVH7		

Compound Name	Theoretical Concentration mg/L	LCS Concentration mg/ L	LCS % Recovery	QC Limit % Recovery
Gasoline	5.00	4.97	99%	70%-130%

QUALIFIERS
U = TVH analyzed for but not detected.
B = TVH found in blank as well as sample (blank data should be compared).
E = Extrapolated value.
NA = Not Available.

Analyst

Approved



Data File Name	: C:\HPCHEM\1\DATA\tvh0410\007F0101.D		
Operator	: Dawn N. Guildner	Page Number	: 1
Instrument	: TVH	Vial Number	: 7
Sample Name	: LCS041095	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 1
Acquired on	: 10 Apr 95 01:17 PM	Instrument Method	: TVH1BASE.M
Report Created on	: 11 Apr 95 09:28 PM	Analysis Method	: TVH0410.MT
Last Recalib on	: 10 APR 95 01:08 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:

EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303)425-6021

Anions

Date Sampled	: 3/28/95	Client Project ID.	: 722450.21020/ MacDill AFB
Date Received	: 3/29/95	Lab Project No.	: 95-1009
Date Prepared	: 3/30/95	Method	: EPA 300.0
Date Analyzed	: 3/30/95	Detection Limit	: 0.250 mg/L
		Matrix	: Water

Evergreen Sample #	Client Sample ID	Chloride (mg/L)
X04934	MW56-11	37.8
X04935	MW56-7	25.7
X04936	56MP-3S	18.3
X04937	56MP-3D	30.5
X04938	56MP-1S	34.7
X04939	MW56-5	59.0
X04940	MD32-MW7	49.2
X04941	MW32-1	17.1
X04942	MW32-21	15.8
X04942 Dup	MW32-21 Dup	16.0
Method Blank 3-30-95		<0.250

Quality Assurance

		Spike Amount (mg/L)	Sample Result (mg/L)	Spike Result (mg/L)	% Recovery
X04942	MW32-21 Matrix Spike	10.0	15.8	26.7	109
X04942	MW32-21 Matrix Spike Dup	10.0	15.8	25.5	96.7
	MS/MSD RPD				12.1
X04942/X04942 Dup	RPD				0.9

Analyst

Approved

1009tm.25

EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303)425-6021

Anions

Date Sampled	: 3/28/95	Client Project ID.	: 722450.21020/ MacDill AFB
Date Received	: 3/29/95	Lab Project No.	: 95-1009
Date Prepared	: 3/30/95	Method	: EPA 300.0
Date Analyzed	: 3/30/95	Detection Limit	: 0.076 mg/L
		Matrix	: Water

Evergreen Sample #	Client Sample ID	Nitrite-N (mg/L)
X04934	MW56-11	<0.076
X04935	MW56-7	<0.076
X04936	56MP-3S	<0.076
X04937	56MP-3D	<0.076
X04938	56MP-1S	<0.076
X04939	MW56-5	<0.076
X04940	MD32-MW7	<0.076
X04941	MW32-1	<0.076
X04942	MW32-21	<0.076
X04942 Dup	MW32-21 Dup	<0.076
Method Blank 3-30-95		<0.076

Quality Assurance**

		Spike Amount (mg/L)	Sample Result (mg/L)	Spike Result (mg/L)	% Recovery
X04942	MW32-21 Matrix Spike	10.0	<0.250	9.39	93.9
X04942	MW32-21 Matrix Spike Dup	10.0	<0.250	9.32	93.2
	MS/MSD RPD				0.748
X04942/X04942 Dup	RPD				NC

** = Quality assurance reported as Nitrite (NO_2).
NC = Not calculated because sample and/or duplication results below detection limit.

Analyst

Approved

1009tm.25

EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303)425-6021

Anions

Date Sampled	: 3/28/95	Client Project ID.	: 722450.21020/ MacDill AFB
Date Received	: 3/29/95	Lab Project No.	: 95-1009
Date Prepared	: 3/30/95	Method	: EPA 300.0
Date Analyzed	: 3/30/95	Detection Limit	: 0.056 mg/L
		Matrix	: Water

Evergreen Sample #	Client Sample ID	Nitrate-N (mg/L)
X04934	MW56-11	<0.056
X04935	MW56-7	<0.056
X04936	56MP-3S	<0.056
X04937	56MP-3D	<0.056
X04938	56MP-1S	<0.056
X04939	MW56-5	1.32
X04940	MD32-MW7	<0.056
X04941	MW32-1	<0.056
X04942	MW32-21	<0.056
X04942 Dup	MW32-21 Dup	<0.056
Method Blank 3-30-95		<0.056

Quality Assurance**

		Spike Amount (mg/L)	Sample Result (mg/L)	Spike Result (mg/L)	% Recovery
X04942	MW32-21 Matrix Spike	10.0	<0.250	9.24	92.4
X04942	MW32-21 Matrix Spike Dup	10.0	<0.250	8.90	89.0
	MS/MSD RPD				3.75
X04942/X04942 Dup	RPD				NC

** = Quality assurance reported as Nitrate (NO_3).
NC = Not calculated because sample and/or duplication results below detection limit.

Analyst

Approved

1009tm.25

EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303)425-6021

Anions

Date Sampled	: 3/28/95	Client Project ID.	: 722450.21020/ MacDill AFB
Date Received	: 3/29/95	Lab Project No.	: 95-1009
Date Prepared	: 3/30/95	Method	: EPA 300.0
Date Analyzed	: 3/30/95	Detection Limit	: 0.250 mg/L
		Matrix	: Water

Evergreen Sample #	Client Sample ID	Sulfate (mg/L)
X04934	MW56-11	3.23
X04935	MW56-7	2.64
X04936	56MP-3S	31.6
X04937	56MP-3D	51.7
X04938	56MP-1S	395
X04939	MW56-5	194
X04940	MD32-MW7	8.10
X04941	MW32-1	14.4
X04942	MW32-21	15.3
X04942 Dup	MW32-21 Dup	15.3
Method Blank 3-30-95		<0.250

Quality Assurance

		Spike Amount (mg/L)	Sample Result (mg/L)	Spike Result (mg/L)	% Recovery
X04942	MW32-21 Matrix Spike	10.0	15.3	26.0	106
X04942	MW32-21 Matrix Spike Dup	10.0	15.3	25.4	101
	MS/MSD RPD				5.03
X04942/X04942 Dup	RPD				0.130

Analyst

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1009tm.25

EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303)425-6021

Miscellaneous Analyses

722450.21020

Date Sampled	: 3/28/95	Client Project ID.	: /MacDill AFB
Date Received	: 3/29/95	Lab Project No.	: 95-1009
Date Prepared	: 3/30/95	Detection Limit	: 5.00 mgCaCO$_3$/L
Date Analyzed	: 3/30/95	Method	: EPA 310.1

Evergreen Sample #	Client Sample ID	Matrix	Total Alkalinity (mgCaCO$_3$/L)
X04936	56MP-3S	Water	194
X04936 Dup	56MP-3S Dup	Water	196
Method Blank (3/30/95)			<5.00

Quality Assurance

	True Value (mgCaCO$_3$/L)	Result (mgCaCO$_3$/L)	% Recovery
APG Minerals Reference Lot 13862	11.8	10.5	89.0
X04936/X04936 Dup RPD			1.12

Analyst

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1009tm.4

EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303)425-6021

Total Organic Carbon

Date Sampled	: 3/28/95	Client Project ID.	: 722450.21020/ MacDill AFB
Date Received	: 3/29/95	Lab Project No.	: 95-1009
Date Prepared	: 3/31/95	Method	: EPA 415.1
Date Analyzed	: 3/31/95	Matrix	: Water
		Detection Limit	: 1.00 mg C/L

Evergreen Sample #	Client Sample ID	mg C/Liter
X04736	56MP-3S	10.2
X04736 Dup	56MP-3S Dup	10.2
Method blank (3/31/95)		<1.00

Quality Assurance

		Spike Amount (mg C/L)	Sample Result (mg C/L)	Spike Result (mg C/L)	% Recovery
X04936	Matrix Spike 56MP-3S	10.0	10.2	20.6	103
X04936	Matrix Spike Dup 56MP-3S	10.0	10.2	20.7	104
	MS/MSD RPD				1.15
X04936/X04936	RPD				0.098

Analyst

Approved

1009tm.10

Evergreen

CASE NARRATIVE

Evergreen Analytical Laboratory, (EAL) Project #: 95-0915

Parsons Engineering Science, Inc. (PES) Project: MacDill AFB (722450.21020)

Sample Receipt

On March 22, 1995, 13 water and 16 soil samples were received in good condition at Evergreen Analytical Laboratory. One trip blank was received with instructions to analyze for BTEX, TVH, Anions and Alkalinity. EAL was instructed by Leigh Benson of PES to analyze all trip blanks for BTEX only by telephone on March 22, 1995. Matrix spike (MS) samples were submitted for analysis with no associated sample. Upon questioning, John Hicks of PES was unable to determine which samples the MSs were associated with, therefore, they were handled as normal samples.

BTEX, Soil Matrix, Method SW8020

The soil samples were analyzed for BTEX within holding times. Samples 56MP-1(8-10), 56MP-2(13-15), 56SS-1(8-10) and Matrix Spike were analyzed at a dilution factor of 5 and 56MP-5(406) at DF = 1250 and 12500 due to levels of contamination. The reporting limits were adjusted accordingly.

Sample 56MP-6(4-6) exhibited low surrogate recovery. The sample was re-run for low surrogate confirmation with similar results. Method Blank MB032895 also exhibited low surrogate recovery, therefore, please refer to the Methanol Extraction Blank MEB032895.

BTEX, Water Matrix, Method 602

The water samples were analyzed within holding times at normal concentrations. No adjustment in reporting limits was necessary.

BTEX QC SAMPLES

The following Method Blanks exhibited total xylene contamination at or around the detection limit; MB032695, MEB032895, MEB032995 and MB032995. MEB033095 was contaminated with 1,2,3-trimethylbenzene. All samples associated with contaminated blanks are flagged "B".

Six Laboratory Control Samples (LCS) were associated with this project. All spikes and surrogates are within EAL control limits.

All duplicate sets of sample RPDs were within control limits.

Total Volatile Hydrocarbons, Soil and Water Matrix, Method 8015M
All samples were analyzed for TVH within holding times. Sample 56MP-16(4-6) exhibited low surrogate recovery due to matrix interference. This was confirmed by a second analysis.

There were no other quality control anomalies to report.

Total Extractable Hydrocarbons, Soil Matrix, Method 8015M
There were no quality control anomalies to report.

General Chemistry
There were no quality control anomalies to report.

Total Organic Carbon (TOC) in Soil
TOC was analyzed by Huffman Laboratories in Golden, Colorado by analyzing for total carbon (TC) and inorganic (carbonate) carbon (CC). The difference is then calculated and reported as TOC. The reports from Huffman are included.

P.McClellan

Patricia A. McClellan, Project Manager

Evergreen Analytical Sample Log Sheet

Project # 95-0915

Date(s) Sampled: 03/17,20,21/95 COC

Date Due: 03/27/95-UST
04/05/95-OTHERS

Date Received: 03/22/95 1015

Holding Time(s): 3/22,23-NO_2,NO_3, 3/31,4/3,4-BTEX,TVH,TEH,4/3,4-ALK

Client Project I.D. 722450.21020/MAC DILL AFB

Rush STANDARD

Client: Parsons Engineering Science, Inc.

Address: 1700 Broadway Suite 900
Denver, CO 80290

Contact: TODD WIEDEMEIR

Client P.O. 722450.21020

Phone #831-8100 Fax #831-8208

Shipping Charges N/A

E.A. Cooler # 422,412

Airbill # FEDEX 3518630791

Custody Seal Intact? Y
Cooler X Bottles ___
COC Present Y
Sample Tags Present? Y
Sample Tags Listed? Y
Sample(s) Sealed? Y

Special Instructions $PLUS CHLOROBENZENE, TEMB & TMB. REPORT ALL SOILS ON A DRY WEIGHT BASIS. ANALYZE AN MS/MSD AND LAB DUPLICATE FOR THIS CLIENT.

Lab ID #	Client ID#	Analysis	Mtx	Btl	Loc
X04546A/B	24MP-5S	$BTEX 602	W	40V	2
X04547A/B	24MP-3S	$BTEX 602	W	40V	2
X04548A/B	24MP-3D	$BTEX 602	W	40V	2
X04549A/B	24MP-8D	$BTEX 602	W	40V	2
X04550A/B	24MP-8S	$BTEX 602	W	40V	2
X04551A/B	MD24-9	$BTEX 602	W	40V	2
X04552A/B	MD24-10A	$BTEX 602	W	40V	2
X04553A/B	MD24-10	$BTEX 602	W	40V	2
X04554A/B	MD24-7	$BTEX 602	W	40V	2
X04555A/B	MD24-7(DUP)	$BTEX 602	W	40V	2
X04559	RINSEATE BLANK	$BTEX 602	W	40V	2
X04565	MATRIX SPIKE	$BTEX 8020 (% MOISTURE)	S	4WM	2
X04557	56MP-1(4-6)	$BTEX 8020,TVH	S	4WM	2
X04558	56MP-1(8-10)	$BTEX 8020,TVH	S	4WM	2
X04560	56MP-2(6-8)	$BTEX 8020,TVH	S	4WM	2
X04561	56MP-2(13-15)	$BTEX 8020,TVH	S	4WM	2
X04562	56MP-3(4-6)	$BTEX 8020,TVH	S	4WM	2
X04563	56MP-3(11-13)	$BTEX 8020,TVH	S	4WM	2
X04564	56SS-1(8-10)	$BTEX 8020,TVH(% MOISTURE)	S	TUBE	2

R=Sample to be returned

Route To: GC/MS ___ GC 4 Metals ___ Wet Chem 1 SxPrep 1 Acctg 1
SxRec C QA/QC C Sales C File Orig

Custodian/Date: 3/24/95

Lab ID #	Client ID#	Analysis	Mtx	Btl	Loc
X04566	56MP-5(4-6)	$BTEX 8020,TVH	S	4WM	2
X04567	56MP-5(8-11)	$BTEX 8020,TVH(% MOISTURE)	S	2WM	2
X04568	56MP-6(4-6)	$BTEX 8020,TVH	S	4WM	2
X04569	56MP-6(10-11)	$BTEX 8020,TVH(% MOISTURE)	S	TUBE	2
X04571	MATRIX SPIKE	$BTEX 8020,TVH	S	2WM	2
X04572	56MP-16(4-6)	$BTEX 8020,TVH	S	4WM	2
X04556A/B	TRIP BLANK	$BTEX 602	W	40V	2
X04573A	TRIP BLANK	$BTEX 602	W	40V	2
X04546C/D	24MP-5S	TVH	W	40V	2
X04547C/D	24MP-3S	TVH	W	40V	2
X04548C/D	24MP-3D	TVH	W	40V	2
X04549C/D	24MP-8D	TVH	W	40V	2
X04550C/D	24MP-8S	TVH	W	40V	2
X04551C/D	MD24-9	TVH	W	40V	2
X04552C/D	MD24-10A	TVH	W	40V	2
X04553C/D	MD24-10	TVH	W	40V	2
X04554C/D	MD24-7	TVH	W	40V	2
X04555C/D	MD24-7(DUP)	TVH	W	40V	2
X04557	56MP-1(4-6)	TEH	S	2WM	CL3
X04558	56MP-1(8-10)	TEH	S	2WM	CL3
X04560	56MP-2(6-8)	TEH	S	2WM	CL3
X04561	56MP-2(13-15)	TEH	S	2WM	CL3
X04562	56MP-3(4-6)	TEH	S	2WM	CL3
X04566	56MP-5(4-6)	TEH	S	2WM	CL3
X04568	56MP-6(4-6)	TEH	S	2WM	CL3
X04571	MATRIX SPIKE	TEH	S	2WM	CL3
X04572	56MP-16(4-6)	TEH	S	2WM	CL3
X04557	56MP-1(4-6)	% MOISTURE	S	2WM	CL3
X04558	56MP-1(8-10)	% MOISTURE	S	2WM	CL3
X04560	56MP-2(6-8)	% MOISTURE	S	2WM	CL3
X04561	56MP-2(13-15)	% MOISTURE	S	2WM	CL3
X04562	56MP-3(4-6)	% MOISTURE	S	2WM	CL3
X04563	56MP-3(11-13)	% MOISTURE	S	2WM	CL3
X04566	56MP-5(4-6)	% MOISTURE	S	2WM	CL3
X04568	56MP-6(4-6)	% MOISTURE	S	2WM	CL3
X04571	MATRIX SPIKE	% MOISTURE	S	2WM	CL3
X04572	56MP-16(4-6)	% MOISTURE	S	2WM	CL3

R=Sample to be returned

Lab ID #	Client ID#	Analysis	Mtx	Btl	Loc
X04546E	24MP-5S	ALKALINITY	W	250P	CL3
X04547E	24MP-3S	ALKALINITY	W	250P	CL3
X04548E	24MP-3D	ALKALINITY	W	250P	CL3
04549E	24MP-8D	ALKALINITY	W	250P	CL3
04550E	24MP-8S	ALKALINITY	W	250P	CL3
04552E	MD24-10A	ALKALINITY	W	250P	CL3
04553E	MD24-10	ALKALINITY	W	250P	CL3
04546F	24MP-5S	Cl^-, SO_4, NO_2, NO_3	W	125P	CL3
04547F	24MP-3S	Cl^-, SO_4, NO_2, NO_3	W	125P	CL3
04548F	24MP-3D	Cl^-, SO_4, NO_2, NO_3	W	125P	CL3
04549F	24MP-8D	Cl^-, SO_4, NO_2, NO_3	W	125P	CL3
04550F	24MP-8S	Cl^-, SO_4, NO_2, NO_3	W	125P	CL3
04551E	24MP-9	Cl^-, SO_4, NO_2, NO_3	W	125P	CL3
04552F	MD24-10A	Cl^-, SO_4, NO_2, NO_3	W	125P	CL3
04553F	MD24-10	Cl^-, SO_4, NO_2, NO_3	W	125P	CL3
04554E	MD24-7	Cl^-, SO_4, NO_2, NO_3	W	125P	CL3
04555E	MD24-7(DUP)	Cl^-, SO_4, NO_2, NO_3	W	125P	CL3
04562	56MP-3(4-6)	TOC	S	2WM	OUT
04568	56MP-6(4-6)	TOC	S	2WM	OUT
04570	56SS-2(4-6)	TOC (% MOISTURE)	S	2WM	OUT
04574	56SS-12(4-6)	TOC (% MOISTURE)	S	2WM	OUT

Project # 95-0915

R=Sample to be returned

Evergreen Analytical Inc.

4036 Youngfield St.
Wheat Ridge, Colorado 80033
(303) 425-6021
FAX (303) 425-6854
(800) 845-7400

COMPANY: PA ENGINEERING SCIENCE
ADDRESS: 1700 BROADWAY, SUITE 900
CITY: DENVER STATE: CO ZIP: 80290
PHONE#: 303-831-8100 FAX #: 303-831-8208 FAX RESULTS Y / (N)

CLIENT CONTACT (print): Todd Wiedemeier
PROJECT I.D.: Mac Dill AFB
EAL. QUOTE #: 722450 21020 P.O.#:
TURNAROUND REQUIRED*: 30 DAYS
*expedited turnaround subject to additional fee

Sampler Name:
(signature): Mark Vessely
(print): MARK VESSELY

Evergreen Analytical Cooler No.: 422
Cooler Received:

Please **PRINT** all information:

CLIENT SAMPLE IDENTIFICATION	DATE SAMPLED	TIME	No. of Containers	MATRIX: Water-Drinking/Discharge/Ground (circle)	MATRIX: Soil / Solid	MATRIX: Oil / Sludge	TCLP VOA/BNA/Pest/Herb/Metals (circle)	VOA 8260/624/524.2 (circle)	BNA 8270/625 (circle)	Pesticides 8080/608 (circle)	Pest/PCBs 8080/608/508 (circle)	Herbicides 8150/515 (circle)	PCB Screen	BTEX 8020/602 (circle)/MTBE (circle)	TRPH 418.1/Oil & Grease 413.1 (circle)	TVPH 8015mod. (Gasoline)	TEPH 8015mod. (Diesel)	Total Metals-DW / NPDES / SW846 (circle & list metals below)	Dissolved Metals - DW / SW846 (circle & list metals below)	Alkalinity	Cl⁻, SO₄⁻², NO₂⁻, NO₃⁻	125P	EAL Sample No.
24MP-5S	3/20/95	08:50	6	X										X		X				X	X		X04546
24MP-3S	3/20/95	11:25	6	X										X		X				X	X		47
24MP-3D	3/20/95	12:20	6	X										X		X				X	X		48
24MP-8D	3/20/95	13:55	6	X										X		X				X	X		49
24MP-8S	3/20/95	15:10	6	X										X		X				X	X		50
MO24-9	3/20/95	10:05	5	X										X		X					X		51
MO24-10A	3/21/95	10:00	6	X										X		X				X	X		52
MO24-10	3/21/95	10:45	6	X										X		X				X	X		53
MO24-7	3/21/95	11:45	5	X										X		X					X		54
MO24-7 (DUP)	3/21/95	11:45	5	X										X		X					X		55
HT:																							
DD:																							

EAL use only
Do not write in shaded area

EAL Project #: 0915
Custodian:

Location: 2, CL1
Container Size:

Instructions: All samples placed in ice
Please analyze filtered blank for dissolved, alkalinity, anions

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time	Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time
Mark Vessely	3/21/95	FED EX		FED EX		[illegible]	3/22/95

Evergreen Analytical Inc.

4036 Youngfield St.
Wheat Ridge, Colorado 80033
(303) 425-6021
FAX (303) 425-6854
(800) 845-7400

Page 2 of —

COMPANY Parsons Engineering Science
ADDRESS 1700 Broadway, Suite 900
CITY Denver STATE CO ZIP 80290
PHONE# 303-831-8100 FAX # 303-831-8208 FAX RESULTS Y / (N)

CLIENT CONTACT (print) Todd Wiedemeier
PROJECT I.D. Mac Dill AFB
EAL. QUOTE # 72450-21020 P.O.#
TURNAROUND REQUIRED* 30 days
*expedited turnaround subject to additional fee

Sampler Name:
(signature) Mark Vessely
(print) Mark Vessely
Evergreen Analytical Cooler No. 422
Cooler Received

Please **PRINT** all information:

CLIENT SAMPLE IDENTIFICATION	DATE SAMPLED	TIME	No. of Containers	MATRIX: Water-Drinking/Discharge/Ground (circle)	MATRIX: Soil / Solid	MATRIX: Oil / Sludge	ANALYSIS REQUESTED: TCLP VOA/BNA/Pest/Herb/Metals (circle)	VOA 8260/624/524.2 (circle)	BNA 8270/625 (circle)	Pesticides 8080/608 (circle)	Pest/PCBs 8080/608/508 (circle)	Herbicides 8150/515 (circle)	PCB Screen	BTEX 8020/602 (circle)/MTBE (circle) and Trip & Trip Blk	TRPH 418.1/Oil & Grease 413.1 (circle)	TVPH 8015mod. (Gasoline)	TEPH 8015mod. (Diesel)	Total Metals-DW / NPDES / SW846 (circle & list metals below)	Dissolved Metals - DW / SW846 (circle & list metals below)	Alkalinity	Cl⁻, SO₄²⁻, NO₂⁻, NO₃⁻	EAL Sample No.
Trip Blank	3-7-96	0915	1	X										X		X				X	X	X048556
HT:																						Location 2, CL1
DD:																						Container Size

EAL use only
Do not write in shaded area

EAL Project # 0915
Custodian

Instructions: Please See Page 1 Trip Blank for BTEX only / Leigh Berson

Relinquished by (Signature)	Date/Time	Received by: (Signature)	Date/Time	Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time

Evergreen Analytical Inc.
40. ingfield St.
Wheat Ridge, Colorado 80033
(303) 425-6021
FAX (303) 425-6854
(800) 845-7400
FAX RESULTS Y / N

COMPANY Pa. ns ES
ADDRESS 1700 Broadway
CITY Denver STATE CO ZIP 80290
PHONE# 323 831 8100 FAX #
Sampler Name:
(signature)
(print) Kyle L. Cannon
Evergreen Analytical Cooler No. 412
Cooler Received

CLIENT CONTACT (print) John H
PROJECT I.D. MacDill
EAL QUOTE # P.O.# 772450.2102
TURNAROUND REQUIRED*
*expedited turnaround subject to additional fee

Please **PRINT** all information:

CLIENT SAMPLE IDENTIFICATION	DATE SAMPLED	TIME	No. of Containers	MATRIX: Water-Drinking/Discharge/Ground (circle)	MATRIX: Soil / Solid	MATRIX: Oil / Sludge	TCLP VOA/BNA/Pest/Herb/Metals (circle)	VOA 8260/624/524.2 (circle)	BNA 8270/625 (circle)	Pesticides 8080/608 (circle)	Pest/PCBs 8080/608/508 (circle)	Herbicides 8150/515 (circle)	PCB Screen	BTEX 8020/602 (circle)/MTBE	TRPH 418.1/Oil & Grease 413.1 (circle)	TVPH 8015mod. (Gasoline)	TEPH 8015mod. (Diesel)	Total Metals-DW / NPDES / SW846 (circle & list metals below)	Dissolved Metals - DW / SW846 (circle & list metals below)	TOC	Moisture	EAL Sample No.
56MP-1(4-6)	3-17-95	0915	3		X									X		X	X				X	X04557
56MP-1(8-10)	3-17-95		3		X									X		X	X				X	58
Rinsate Blank	3-17-95	0930	1	X										X								59 40V
56MP-2(6-8)	3-17-95	1110	3		X									X		X	X				X	60
56MP-2(13-15)	3-17-95	1145	3		X									X		X	X				X	61
56MP-3(4-6)	3-17-95	1415	4		X									X		X	X			X	X	62
56MP-3(11-13)	3-17-95	1600	3		X									X		X					X	63
5655-1(8-10)	3-20-95	0822	61		X									X		X						64 T
[illegible]																						
Matrix Spike	3-17-95		1		X									X								65
HT:																						Location 2, CL3
DD:																						Container Size-tubes

EAL use only
Do not write in shaded area
EAL Project # 0915
Custodian

Instructions: 2WM, 4WM

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time	Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time
	3/24/95	Lee Connor	3/22/95				

Evergreen Analytical Inc.

4036 Youngfield St.
Wheat Ridge, Colorado 80033
(303) 425-6021
FAX (303) 425-6854
(800) 845-7400

COMPANY Parsons ES
ADDRESS 1700 Broadway
CITY Denver STATE CO ZIP 80290
PHONE# 831-8100 FAX # FAX RESULTS Y / N

CLIENT CONTACT (print) John Hicks
PROJECT I.D. MacDill AFB
EAL. QUOTE # P.O.# 7221 50.21.21
TURNAROUND REQUIRED*
*expedited turnaround subject to additional fee

Sampler Name:
(signature)
(print) Kyle L. Camm
Evergreen Analytical Cooler No. 412
Cooler Received

Please **PRINT** all information:

CLIENT SAMPLE IDENTIFICATION	DATE SAMPLED	TIME	No. of Containers	MATRIX: Water-Drinking/Discharge/Ground (circle)	MATRIX: Soil / Solid	MATRIX: Oil / Sludge	TCLP VOA/BNA/Pest/Herb/Metals (circle)	VOA 8260/624/524.2 (circle)	BNA 8270/625 (circle)	Pesticides 8080/608 (circle)	Pest/PCBs 8080/608/508 (circle)	Herbicides 8150/515 (circle)	PCB Screen	BTEX 8020/602 (circle)/MTBE (circle)	TRPH 418.1/Oil & Grease 413.1 (circle)	TVPH 8015mod. (Gasoline)	TEPH 8015mod. (Diesel)	Total Metals-DW / NPDES / SW846 (circle & list metals below)	Dissolved Metals - DW / SW846 (circle & list metals below)	TOC	Waste Store	EAL Sample No.
56MP5(4-6)	3-20-95	1130	3		X									X	X	X	X				X	X045 60
56 MP-5 (9-11)	3-20-95	1200	2		X									X	X	X	X				✓	62
56 MP-6 (4-6)	3-20-95	1230	4		X									X		X	X			X	X	68
56 MP-6 (10-11)	3-20-95	1400	1		X									X		X					✓	69
56 SS-2 (4-6)	3-20-95	1500	1		X															X	✓	70
Matrix Spike	3-20-95		1		X									X		X	X				X	71
56MP-16 (4-6)	3-20-95	1830	3		X									X		X	X				X	72
Trip Blank			1	X										X							DI	73
[redacted]																						
56 SS-12 (4-6)	3-20-95	1900	1			X														X	✓	74
HT:																						Location 2, 3
DD:																						Container Size 2oz, 4oz, 8oz

Instructions: Sample 56MP-5 (9-11) had poor recovery. If the container for BTEX is not sufficient, use the TVH vial to analyze for BTEX. Same w/ 56MP-6 (10-11). ALL TOC Samples Composited.

Relinquished by:	Date/Time	Received by: (Signature)	Date/Time	Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time
	3/21/95		3/21/95				

Evergreen Analytical Sample Receipt/Check-in Record

Date & Time Rec'd: 3/22/95 10.15 Shipped Via: Fed Ex
(Airbill # if applicable)

Client : Parsons Engineering

Client Project ID(s): 722450.21020

EAL Project #(s): 95-0915 EAL Cooler(s): (Y) N

Cooler#	422								
Ice packs	(Y)	N	Y	N	Y	N	Y	N	Y	N
Temperature °C	cold								

	Y	N	N/A
1. Custody seal(s) present:	✓		
Seals on cooler intact	✓		✓
Seals on bottle intact			
2. Chain of Custody present:	✓		
3. Containers broken or leaking: (Comment on COC if Y)		✓	
4. Containers labeled:	✓		
5. COC agrees w/ bottles received: (Comment on COC if N)	✓		
6. COC agrees w/ labels: (Comment on COC if N)	✓		
7. Headspace in VOA vials-waters only (comment on COC if Y)		✓	
8. VOA samples preserved:	✓		
9. pH measured on metals, cyanide or phenolics*:			✓
List discrepancies			
*Non-EAL provided containers only, water samples only.			
10. Metal samples present:			✓
Total _____ , Dissolved _____			
D or PD to be filtered:			
T,TR,D,PD to be Preserved:			
11. Short holding times:			
Specify parameters			
12. Multi-phase sample(s) present:		✓	
13. COC signed w/ date/time:	✓		

Comments: _____

(Additional comments on back)
Custodian Signature/Date: Lee Connor 3/22/95

Evergreen Analytical Sample Receipt/Check-in Record

Date & Time Rec'd: 3/22/95 10:15 Shipped Via: HD
(Airbill # if applicable)

Client : Parsons ES.

Client Project ID(s): ~~[illegible]~~ 722450.21020

EAL Project #(s): 95- 0915 EAL Cooler(s): (Y) N

Cooler#	412								
Ice packs	(Y)	N	Y	N	Y	N	Y	N	Y	N
Temperature °C	cold								

	Y	N	N/A
1. Custody seal(s) present:	✓		
Seals on cooler intact	✓		
Seals on bottle intact			✓
2. Chain of Custody present:	✓		
3. Containers broken or leaking: (Comment on COC if Y)		✓	
4. Containers labeled:	✓		
5. COC agrees w/ bottles received: (Comment on COC if N)	✓		
6. COC agrees w/ labels: (Comment on COC if N)		✓	
7. Headspace in VOA vials-waters only (comment on COC if Y)		✓	
8. VOA samples preserved:		✓	
9. pH measured on metals, cyanide or phenolics*:			✓
List discrepancies			
*Non-EAL provided containers only, water samples only.			
10. Metal samples present:			✓
Total _____ , Dissolved _____			
D or PD to be filtered:			
T,TR,D,PD to be Preserved:			
11. Short holding times:		✓	
Specify parameters			
12. Multi-phase sample(s) present:		✓	
13. COC signed w/ date/time:	✓		

Comments: _____

(Additional comments on back)

Custodian Signature/Date: Lee Connor

CHAIN OF CUSTODY RECORD / ANALYTICAL SERVICES REQUEST

Evergreen Analytical Inc.
4036 Youngfield St.
Wheat Ridge, Colorado 80033
(303) 425-6021
FAX (303) 425-6854
(800) 845-7400

COMPANY Parsons Engineering Science
ADDRESS 1700 S. Broadway, Suite 900
CITY Denver STATE CO ZIP 80290
PHONE# 303-831-8100 FAX # 303-831-8208 FAX RESULTS Y / (N)

CLIENT CONTACT (print) Todd Wiedemeier
PROJECT I.D. Mac Dill AFB
EAL. QUOTE # 722450.21020 P.O.#
TURNAROUND REQUIRED* 30 days
*expedited turnaround subject to additional fee

Sampler Name:
(signature)
(print) Mark Jessely

Evergreen Analytical Cooler No. 422
Cooler Received

Please **PRINT** all information:

CLIENT SAMPLE IDENTIFICATION	DATE SAMPLED	TIME	No. of Containers	MATRIX: Water-Drinking/Discharge/Ground (circle)	MATRIX: Soil / Solid	MATRIX: Oil / Sludge	TCLP VOA/BNA/Pest/Herb/Metals (circle)	VOA 8260/624/524.2 (circle)	BNA 8270/625 (circle)	Pesticides 8080/608 (circle)	Pest/PCBs 8080/608/508 (circle)	Herbicides 8150/515 (circle)	PCB Screen	BTEX 8020/602 (circle)/MTBE (circle)	TRPH 418.1/Oil & Grease 413.1 (circle)	TVPH 8015mod. (Gasoline)	TEPH 8015mod. (Diesel)	Total Metals-DW / NPDES / SW846 (circle & list metals below)	Dissolved Metals - DW / SW846 (circle & list metals below)	Alkalinity	Cl^-, SO_4^{-2}, NO_2, NO_3^-					EAL Sample No.
24MP-5S	3/20/95	08:50	6	X										X		X				X	X					
24MP-3S	3/20/95	11:25	6	X										X		X				X	X					
24MP-3D	3/20/95	12:20	6	X										X		X				X	X					
24MP-8D	3/20/95	13:55	6	X										X		X				X	X					
24MP-8S	3/20/95	15:10	6	X										X		X				X	X					
MO24-9	3/20/95	10:05	5	X										X		X					X					
MO24-10A	3/21/95	10:00	6	X										X		X				X	X					
MO24-10	3/21/95	10:45	6	X										X		X				X	X					
MO24-7	3/21/95	11:45	5	X										X		X					X					
MO24-7 (DUP)	3/21/95	11:45	5	X										X		X					X					
HT:																										Location
DD:																										Container Size

EAL use only
Do not write in shaded area

EAL
Project #
Custodian

Instructions: All samples placed in ice
Please analyze trip blank for BTEX, TVH, Alkalinity, Anions

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time	Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time
Mark Vessely	3/21/95 17:00	FED EX		FED EX		Lee Connor	1015

Evergreen Analytical Inc.

4036 Youngfield St.
Wheat Ridge, Colorado 80033
(303) 425-6021
FAX (303) 425-6854
(800) 845-7400

COMPANY Parsons Engineering Science
ADDRESS 1700 Broadway, Suite 900
CITY Denver STATE CO ZIP 80290
PHONE# 303-831-8100 FAX # 303-831-8208 FAX RESULTS Y / (N)

CLIENT CONTACT (print) Todd Wiedemeier
PROJECT I.D. Mac Dill AFB
EAL. QUOTE # 22450-21020 P.O.#
TURNAROUND REQUIRED* 30 days
*expedited turnaround subject to additional fee

Sampler Name:
(signature) Mark Vessely
(print) Mark Vessely

Evergreen Analytical Cooler No. 421
Cooler Received

Please **PRINT** all information:

CLIENT SAMPLE IDENTIFICATION	DATE SAMPLED	TIME	No. of Containers	MATRIX: Water-Drinking/Discharge/Ground (circle)	MATRIX: Soil / Solid	MATRIX: Oil / Sludge	TCLP VOA/BNA/Pest/Herb/Metals (circle)	VOA 8260/624/524.2 (circle)	BNA 8270/625 (circle)	Pesticides 8080/608 (circle)	Pest/PCBs 8080/608/508 (circle)	Herbicides 8150/515 (circle)	PCB Screen	BTEX 8020/602 (circle)/MTBE (circle) and TMB & TAME 8260	TRPH 418.1/Oil & Grease 413.1 (circle)	TVPH 8015mod. (Gasoline)	TEPH 8015mod. (Diesel)	Total Metals-DW / NPDES / SW846 (circle & list metals below)	Dissolved Metals - DW / SW846 (circle & list metals below)	Alkalinity	Cl⁻, SO₄²⁻, NO₂⁻, NO₃⁻	EAL Sample No.
Trip Blank	[illegible]	[illegible]	1	✓										X	X							
HT:																						Location
DD:																						Container Size

EAL use only
Do not write in shaded area

EAL
Project #
Custodian

Instructions: Please See Page 1 Analyze trip blank for BTEX only per Leigh Benson 3/22/95 pm.

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time	Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time
Mark Vess.	3/2/95	Fed Ex		Fed Ex		[illegible]	

Evergreen Analytical Inc.
4036 Youngfield St.
Wheat Ridge, Colorado 80033
(303) 425-6021
FAX (303) 425-6854
(800) 845-7400

COMPANY Jurons ES
ADDRESS 1700 Broadway
CITY Denver STATE CO ZIP 80290
PHONE# 323 831 8100 FAX #
FAX RESULTS? Y / N

CLIENT CONTACT (print) Julie Jones
PROJECT I.D. MacDill
EAL. QUOTE # P.O.# 772450.2102
TURNAROUND REQUIRED*
*expedited turnaround subject to additional fee

Sampler Name:
(signature)
(print) Kyle L. Cannon
Evergreen Analytical Cooler No. 412
Cooler Received

Please **PRINT** all information:

CLIENT SAMPLE IDENTIFICATION	DATE SAMPLED	TIME	No. of Containers	MATRIX: Water-Drinking/Discharge/Ground (circle)	MATRIX: Soil / Solid	MATRIX: Oil / Sludge	TCLP VOA/BNA/Pest/Herb/Metals (circle)	VOA 8260/624/524.2 (circle)	BNA 8270/625 (circle)	Pesticides 8080/608 (circle)	Pest/PCBs 8080/608/508 (circle)	Herbicides 8150/515 (circle)	PCB Screen	BTEX 8020/602 (circle)/MTBE (circle)	TRPH 418.1/Oil & Grease 413.1 (circle)	TVPH 8015mod. (Gasoline)	TEPH 8015mod. (Diesel)	Total Metals-DW / NPDES / SW846 (circle & list metals below)	Dissolved Metals - DW / SW846 (circle & list metals below)	TOC	Moisture	EAL Sample No.
56MP-1(4-6)	3-17-95	0815	3		X									X		X	X				X	
56MP-1(8-10)	3-17-95		3		X									X		X	X				X	
Rinsate Blank	3-17-95	0930	1	X										X								
56MP-2(6-8)	3-17-95	1110	3		X									X		X	X				X	
56MP-2(13-15)	3-17-95	1145	3		X									X		X	X				X	
56MP-3(4-6)	3-17-95	1415	84		X									X		X	X			X	X	
56MP-3(11-13)	3-17-95	1600	3		X									X		X					X	
56SS-1(8-10)	3-20-95	0830	81		X									X		X						
~~56MP-4(13-15)~~	~~3-20-95~~	~~1015~~																				
Matrix Spike	3-17-95		1		X									X								
HT:																						Location
DD:																						Container Size

EAL use only
Do not write in shaded area

EAL
Project #
Custodian

Instructions:

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time	Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time
	3/24/95 1402	Lee Cornum	3/22/95 10:15				

Evergreen Analytical Inc.

4036 Youngfield St.
Wheat Ridge, Colorado 80033
(303) 425-6021
FAX (303) 425-6854
(800) 845-7400

COMPANY Parsons ES
ADDRESS 1700 Broadway
CITY Denver STATE CO ZIP 80290
PHONE# 831-8100 FAX # _____ FAX RESULTS Y / N

CLIENT CONTACT (print) John Hicks
PROJECT I.D. MacDill AFB
EAL. QUOTE # _____ P.O.# 7221 TO. 21622
TURNAROUND REQUIRED* _____
*expedited turnaround subject to additional fee

Sampler Name:
(signature) _____
(print) Kyle L. Cavin
Evergreen Analytical Cooler No. 412
Cooler Received _____

Please **PRINT** all information:

CLIENT SAMPLE IDENTIFICATION	DATE SAMPLED	TIME	No. of Containers	MATRIX: Water-Drinking/Discharge/Ground (circle)	MATRIX: Soil / Solid	MATRIX: Oil / Sludge	TCLP VOA/BNA/Pest/Herb/Metals (circle)	VOA 8260/624/524.2 (circle)	BNA 8270/625 (circle)	Pesticides 8080/608 (circle)	Pest/PCBs 8080/608/508 (circle)	Herbicides 8150/515 (circle)	PCB Screen	BTEX 8020/602 (circle)/MTBE	TRPH 418.1/Oil & Grease 413.1 (circle)	TVPH 8015mod. (Gasoline)	TEPH 8015mod. (Diesel)	Total Metals-DW / NPDES / SW846 (circle & list metals below)	Dissolved Metals - DW / SW846 (circle & list metals below)	TOC	Moisture						EAL Sample No.
SGMP5(4-6)	3-20-95	1130	3		X									X	X	X	X				X					
SG MP-5 (9-11)	3-20-95	1200	2		X									X	X	X										
SG MP-6 (4-6)	3-20-95	1230	4		X									X		X	X			X	X					
SG MP-6 (10-11)	3-20-95	1400	1		X									X		X										
SG SS-2 (4-6)	3-20-95	1500	1		X															X						
Matrix Spike	3-20-95		1		X									X												
SG MP-10 (4-6)	3-20-95	1830	3		X									X		X	X				X					
Trip Blank			1	X										X												
[redacted]																										
SG SS-12 (4-6)	3-20-95	1900	1			X														X						
HT:																									Location	
DD:																									Container Size	

EAL use only
Do not write in shaded area

EAL
Project # _____
Custodian _____

Instructions: Sample SGMP-5 (9-11) had [illegible] If the container for BTEX is not sufficient, use the TVH for to analyze for BTEX. Same w/ SGMP-6 (10-11). ALL TOC Samples Completed.

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time	Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time
[signature]	3/21/95	[signature]	2/22/95				

EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303) 425-6021

BTEX Data Report

Client Sample Number	: 56MP-1(4-6)	Client Project No.	: 722450.21020 MacDill AFB
Lab Sample Number	: X04557	Lab Project No.	: 95-0915
Date Sampled	: 3/17/95	Dilution Factor	: 1.00
Date Received	: 3/22/95	Method	: 8020
Date Extracted/Prepared	: 3/27/95	Matrix	: Soil
Date Analyzed	: 3/27/95	Lab File No.	: BX2032714
Methanol Extract?	: No	Method Blank No.	: MB032795
% Moisture	: 14.25%		

Compound Name	Cas Number	Sample Concentration* ug/kg		PQL* ug/kg
Benzene	71-43-2		U	4.7
Toluene	108-88-3	0.8	J	4.7
Ethyl Benzene	100-41-4		U	4.7
Total Xylenes	1330-20-7	2.5	J	4.7
Chlorobenzene	108-90-7		U	4.7
1,3,5-trimethylbenzene	108-67-8		U	4.7
1,2,4-trimethylbenzene	95-63-6	1.0	J	4.7
1,2,3-trimethylbenzene	526-73-8		U	4.7
1,2,3,4-tetramethylbenzene	488-23-3		U	4.7

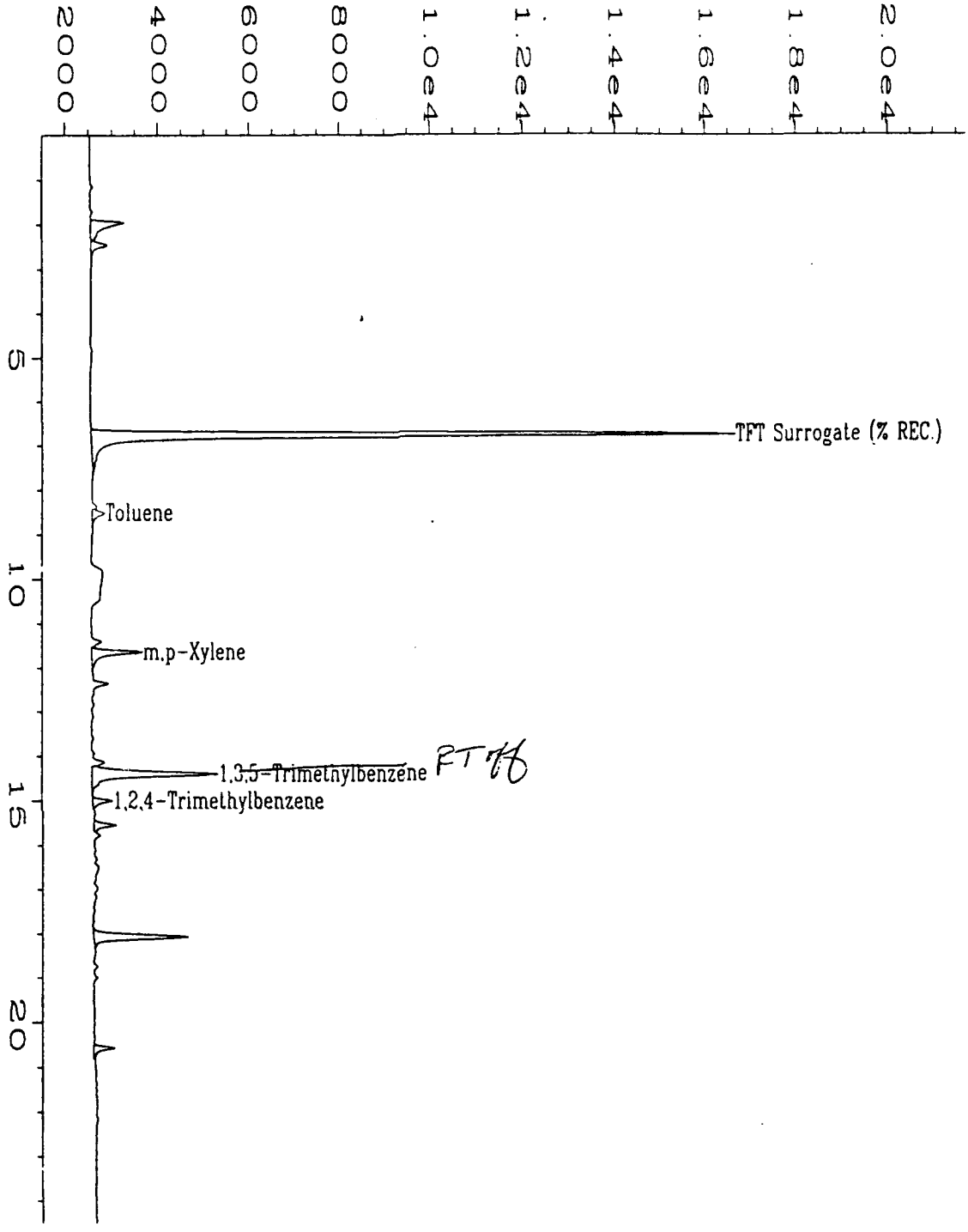
Surrogate Recovery (α,α,α-Trifluorotoluene):	85%	64%-130% (QC limits)

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene PQL is for a single peak.
* = Dry Weight Basis.

QUALIFIERS:
E = Extrapolated value
U = Compound analyzed for, but not detected.
B = Compound found in blank and sample. Compare blank and sample data.
J = Indicates an estimated value when the compound is detected, but is below the Practical Quantitation Limit (PQL).
PQL = Practical Quantitation Limit. The PQL is equal to the dilution factor multiplied by ten times the Method Detection Limit as determined by EPA SW846, Vol. 1B, Part II, pa. 8000-14.
NA = Not available.

Analyst

Approved



FT 11

Data File Name	: C:\HPCHEM\2\DATA\BX20327\014R0601.D		
Operator	: C.J. Cook	Page Number	: 1
Instrument	: BTEX2	Vial Number	: 14
Sample Name	: X04557;1;5	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 6
Acquired on	: 27 Mar 95 08:16 PM	Instrument Method	: BX20327.*
Report Created on	: 17 Apr 95 12:36 PM	Analysis Method	: BX20327A
Last Recalib on	: 14 APR 95 00:39 AM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:
Sample Info	: Project#: 95-0915 Client#: 56MP-1(4-6) Soil		

EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303) 425-6021

BTEX Data Report

		Client Project No.	: 722450.21020 MacDill AFB
Client Sample Number	: 56MP-1(8-10)		
Lab Sample Number	: X04558	Lab Project No.	: 95-0915
Date Sampled	: 3/17/95	Dilution Factor	: 5.00
Date Received	: 3/22/95	Method	: 8020
Date Extracted/Prepared	: 3/27/95	Matrix	: Soil
Date Analyzed	: 3/27/95,	Lab File No.	: BX2032717
Methanol Extract?	: No	Method Blank No.	: MB032795
% Moisture	: 20.19%		

Compound Name	Cas Number	Sample Concentration* ug/kg		PQL* ug/kg
Benzene	71-43-2		U	25
Toluene	108-88-3	3.8	J	25
Ethyl Benzene	100-41-4		U	25
Total Xylenes	1330-20-7	5.0	J	25
Chlorobenzene	108-90-7		U	25
1,3,5-trimethylbenzene	108-67-8		U	25
1,2,4-trimethylbenzene	95-63-6		U	25
1,2,3-trimethylbenzene	526-73-8		U	25
1,2,3,4-tetramethylbenzene	488-23-3		U	25

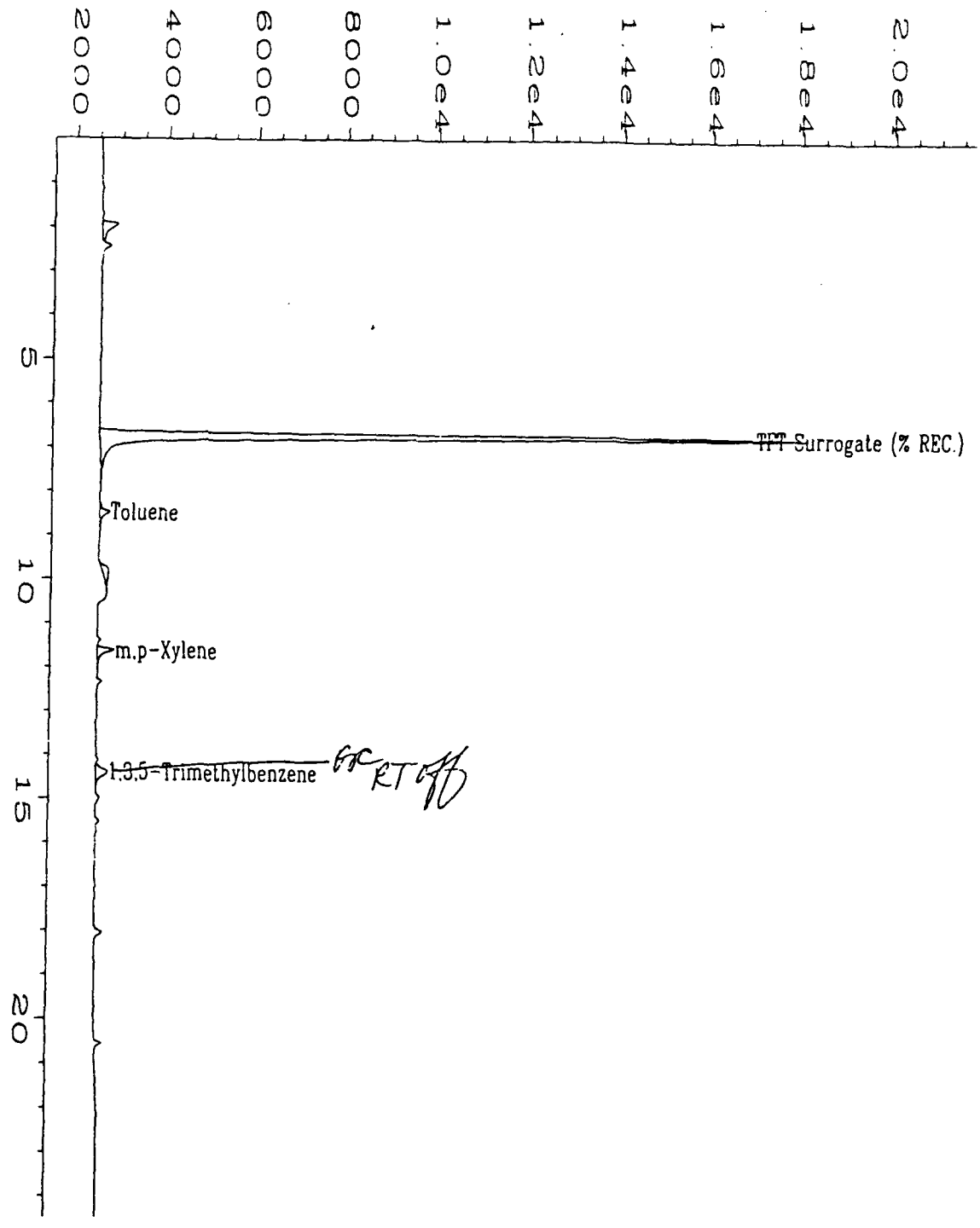
Surrogate Recovery (α,α,α-Trifluorotoluene):	94%	64%-130% (QC limits)

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene PQL is for a single peak.
* = Dry Weight Basis.

QUALIFIERS:
E = Extrapolated value
U = Compound analyzed for, but not detected.
B = Compound found in blank and sample. Compare blank and sample data.
J = Indicates an estimated value when the compound is detected, but is below the Practical Quantitation Limit (PQL).
PQL = Practical Quantitation Limit. The PQL is equal to the dilution factor multiplied by ten times the Method Detection Limit as determined by EPA SW846, Vol. 1B, Part II, pa. 8000-14.
NA = Not available.

Analyst

Approved



Data File Name	: C:\HPCHEM\2\DATA\BX20327\017R0601.D		
Operator	: C.J. Cook	Page Number	: 1
Instrument	: BTEX2	Vial Number	: 17
Sample Name	: X04558;5;1	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 6
Acquired on	: 27 Mar 95 10:28 PM	Instrument Method	: BX20327.MT
Report Created on	: 17 Apr 95 12:38 PM	Analysis Method	: BX20327
Last Recalib on	: 14 APR 95 00:39 AM	Sample Amount	: 0
Multiplier	: 5	ISTD Amount	:
Sample Info	: Project#: 95-0915 Client#: 56MP-1(8-10) Soil		

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BTEX Data Report

Client Sample Number	: 56MP-2(6-8)	Client Project No.	: 722450.21020 MacDill AFB
Lab Sample Number	: X04560	Lab Project No.	: 95-0915
Date Sampled	: 3/17/95	Dilution Factor	: 1.00
Date Received	: 3/22/95	Method	: 8020
Date Extracted/Prepared	: 3/27/95	Matrix	: Soil
Date Analyzed	: 3/27/95,	Lab File No.	: BX2032718
Methanol Extract?	: No	Method Blank No.	: MB032795
% Moisture	: 18.68%		

Compound Name	Cas Number	Sample Concentration* ug/kg		PQL* ug/kg
Benzene	71-43-2		U	4.9
Toluene	108-88-3		U	4.9
Ethyl Benzene	100-41-4		U	4.9
Total Xylenes	1330-20-7	1.2	J	4.9
Chlorobenzene	108-90-7		U	4.9
1,3,5-trimethylbenzene	108-67-8		U	4.9
1,2,4-trimethylbenzene	95-63-6		U	4.9
1,2,3-trimethylbenzene	526-73-8		U	4.9
1,2,3,4-tetramethylbenzene	488-23-3		U	4.9

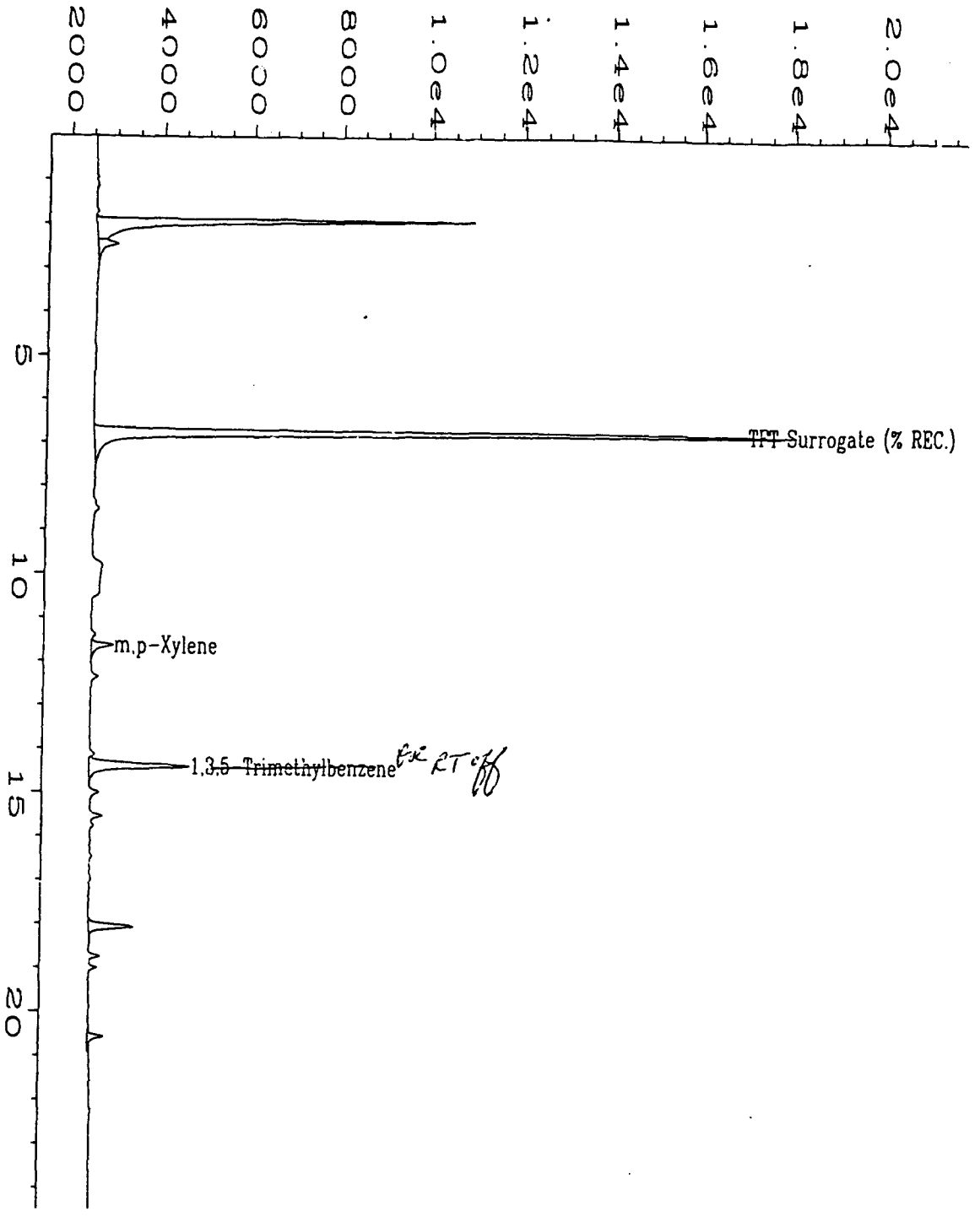
Surrogate Recovery (α,α,α-Trifluorotoluene):	94%	64%-130% (QC limits)

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene PQL is for a single peak.
* = Dry Weight Basis.

QUALIFIERS:
E = Extrapolated value
U = Compound analyzed for, but not detected.
B = Compound found in blank and sample. Compare blank and sample data.
J = Indicates an estimated value when the compound is detected, but is below the Practical Quantitation Limit (PQL).
PQL = Practical Quantitation Limit. The PQL is equal to the dilution factor multiplied by ten times the Method Detection Limit as determined by EPA SW846, Vol. 1B, Part II, pa. 8000-14.
NA = Not available.

Analyst

Approved



Data File Name	: C:\HPCHEM\2\DATA\BX20327\018R0601.D		
Operator	: C.J. Cook	Page Number	: 1
Instrument	: BTEX2	Vial Number	: 18
Sample Name	: X04560;1;5	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 6
Acquired on	: 27 Mar 95 11:12 PM	Instrument Method	: BX20327.\
Report Created on	: 17 Apr 95 12:39 PM	Analysis Method	: BX20327A.
Last Recalib on	: 14 APR 95 00:39 AM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:
Sample Info	: Project#: 95-0915 Client#: 56MP-2(6-8) Soil		

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BTEX Data Report

		Client Project No.	: 722450.21020 MacDill AFB
Client Sample Number	: 56MP-2(13-15)		
Lab Sample Number	: X04561	Lab Project No.	: 95-0915
Date Sampled	: 3/17/95	Dilution Factor	: 5.00
Date Received	: 3/22/95	Method	: 8020
Date Extracted/Prepared	: 3/29/95	Matrix	: Soil
Date Analyzed	: 3/29/95,	Lab File No.	: BX2032911
Methanol Extract?	: No	Method Blank No.	: MB032995
% Moisture	: 20.67%		

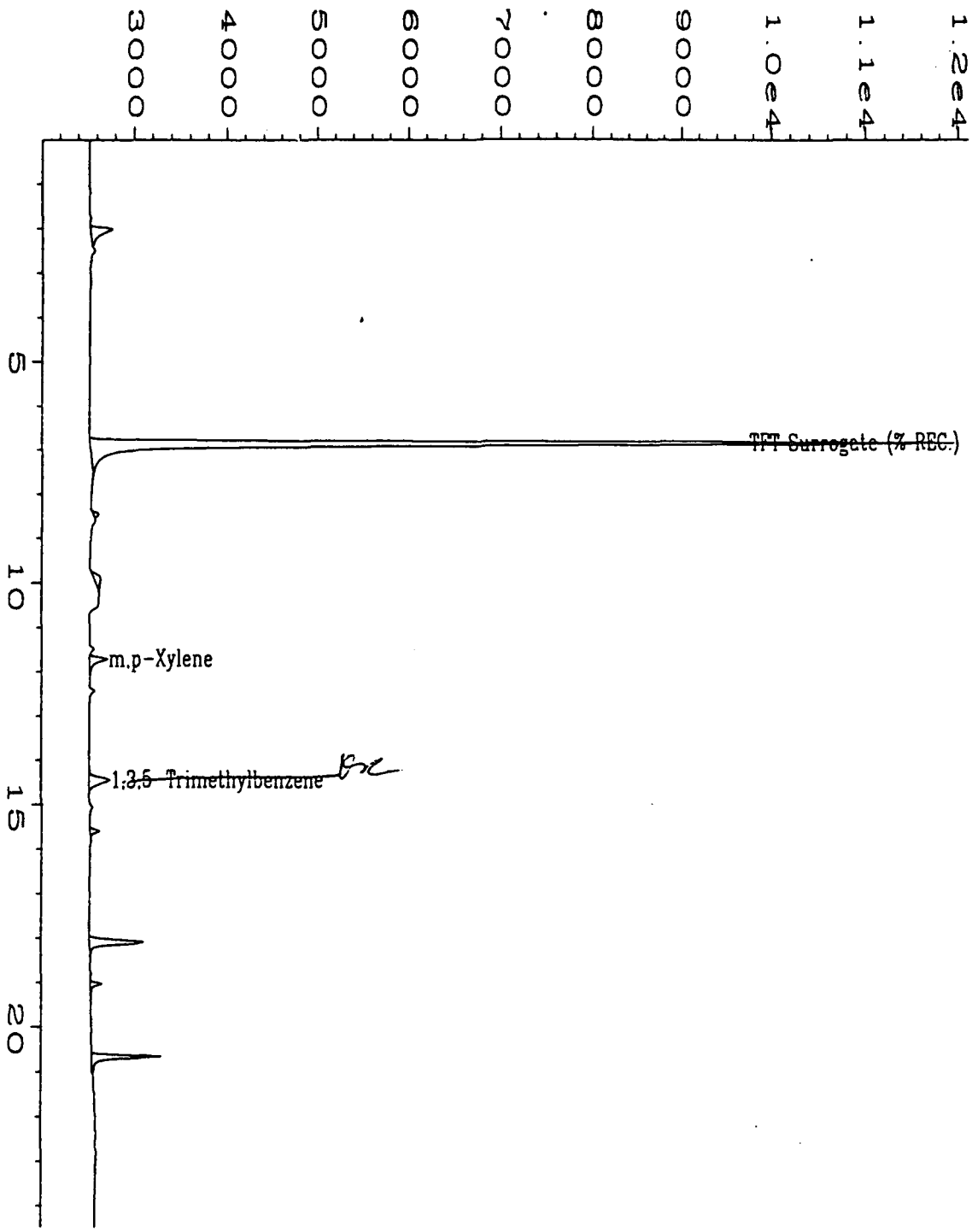
Compound Name	Cas Number	Sample Concentration* ug/kg		PQL* ug/kg
Benzene	71-43-2		U	25.2
Toluene	108-88-3		U	25.2
Ethyl Benzene	100-41-4		U	25.2
Total Xylenes	1330-20-7	4.9	JB	25.2
Chlorobenzene	108-90-7		U	25.2
1,3,5-trimethylbenzene	108-67-8		U	25.2
1,2,4-trimethylbenzene	95-63-6		U	25.2
1,2,3-trimethylbenzene	526-73-8		U	25.2
1,2,3,4-tetramethylbenzene	488-23-3		U	25.2
Surrogate Recovery (α,α,α-Trifluorotoluene):		101%		64%-130% (QC limits)

Notes: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene PQL is for a single peak.
The sample did not purge at DF = 1 at BX20328011.
* = Dry Weight Basis.

QUALIFIERS:
E = Extrapolated value
U = Compound analyzed for, but not detected.
B = Compound found in blank and sample. Compare blank and sample data.
J = Indicates an estimated value when the compound is detected, but is below the Practical Quantitation Limit (PQL).
PQL = Practical Quantitation Limit. The PQL is equal to the dilution factor multiplied by ten times the Method Detection Limit as determined by EPA SW846, Vol. 1B, Part II, pa. 8000-14.
NA = Not available.

K. Cone
Analyst

P.M. McClellan
Approved



Data File Name	: C:\HPCHEM\2\DATA\BX20329\011R0101.D		
Operator	: C.J. Cook	Page Number	: 1
Instrument	: BTEX2	Vial Number	: 11
Sample Name	: X04561;5;1	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 1
Acquired on	: 29 Mar 95 06:46 PM	Instrument Method	: BX20329.
Report Created on	: 17 Apr 95 09:41 PM	Analysis Method	: BX20329B.
Last Recalib on	: 14 APR 95 00:39 AM	Sample Amount	: 0
Multiplier	: 5	ISTD Amount	:
Sample Info	: Project#: 95-0915 Client#: 56MP-2(13-15) Soil		

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BTEX Data Report

Client Sample Number	: 56MP-3(4-6)	Client Project No.	: 722450.21020 MacDill AFB
Lab Sample Number	: X04562	Lab Project No.	: 95-0915
Date Sampled	: 3/17/95	Dilution Factor	: 1.00
Date Received	: 3/22/95	Method	: 8020
Date Extracted/Prepared	: 3/28/95	Matrix	: Soil
Date Analyzed	: 3/28/95	Lab File No.	: BX2032813
Methanol Extract?	: No	Method Blank No.	: MB032895
% Moisture	: 17.66%		

Compound Name	Cas Number	Sample Concentration* ug/kg		PQL* ug/kg
Benzene	71-43-2		U	4.9
Toluene	108-88-3		U	4.9
Ethyl Benzene	100-41-4		U	4.9
Total Xylenes	1330-20-7		U	4.9
Chlorobenzene	108-90-7		U	4.9
1,3,5-trimethylbenzene	108-67-8		U	4.9
1,2,4-trimethylbenzene	95-63-6		U	4.9
1,2,3-trimethylbenzene	526-73-8	0.6	J	4.9
1,2,3,4-tetramethylbenzene	488-23-3		U	4.9

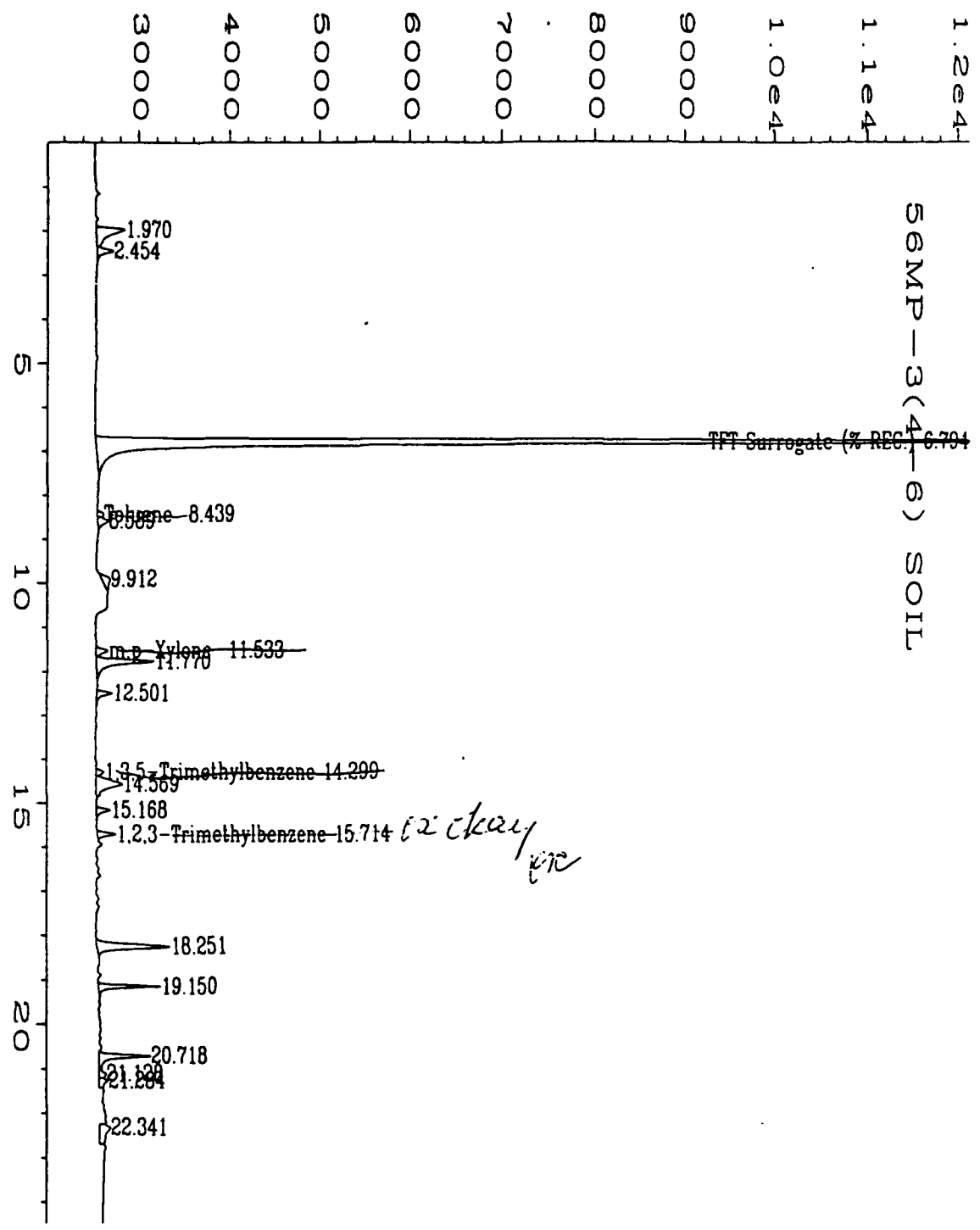
Surrogate Recovery (α,α,α-Trifluorotoluene):	112%	64%-130% (QC limits)

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene PQL is for a single peak.
* = Dry Weight Basis.

QUALIFIERS:
E = Extrapolated value
U = Compound analyzed for, but not detected.
B = Compound found in blank and sample. Compare blank and sample data.
J = Indicates an estimated value when the compound is detected, but is below the Practical Quantitation Limit (PQL).
PQL = Practical Quantitation Limit. The PQL is equal to the dilution factor multiplied by ten times the Method Detection Limit as determined by EPA SW846, Vol. 1B, Part II, pa. 8000-14.
NA = Not available.

K. Cone
Analyst

Approved



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Data File Name	: C:\HPCHEM\2\DATA\BX20328\013R0801.D		
Operator	: C.J. Cook	Page Number	: 1
Instrument	: BTEX2	Vial Number	: 13
Sample Name	: X04562;1;5	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 8
Acquired on	: 28 Mar 95 07:35 PM	Instrument Method	: BX20328.
Report Created on	: 18 Apr 95 01:09 AM	Analysis Method	: BX20328B.
Last Recalib on	: 14 APR 95 00:39 AM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:

Dm 4/26/95

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BTEX Data Report

		Client Project No.	: 722450.21020 MacDill AFB
Client Sample Number	: 56MP-3(11-13)		
Lab Sample Number	: X04563	Lab Project No.	: 95-0915
Date Sampled	: 3/17/95	Dilution Factor	: 1.00
Date Received	: 3/22/95	Method	: 8020
Date Extracted/Prepared	: 3/29/95	Matrix	: Soil
Date Analyzed	: 3/29/95	Lab File No.	: BX2032913
Methanol Extract?	: No	Method Blank No.	: MB032995
% Moisture	: 17.30%		

Compound Name	Cas Number	Sample Concentration* ug/kg		PQL* ug/kg
Benzene	71-43-2		U	4.8
Toluene	108-88-3	0.6	J	4.8
Ethyl Benzene	100-41-4		U	4.8
Total Xylenes	1330-20-7	1.2	JB	4.8
Chlorobenzene	108-90-7		U	4.8
1,3,5-trimethylbenzene	108-67-8		U	4.8
1,2,4-trimethylbenzene	95-63-6		U	4.8
1,2,3-trimethylbenzene	526-73-8		U	4.8
1,2,3,4-tetramethylbenzene	488-23-3		U	4.8

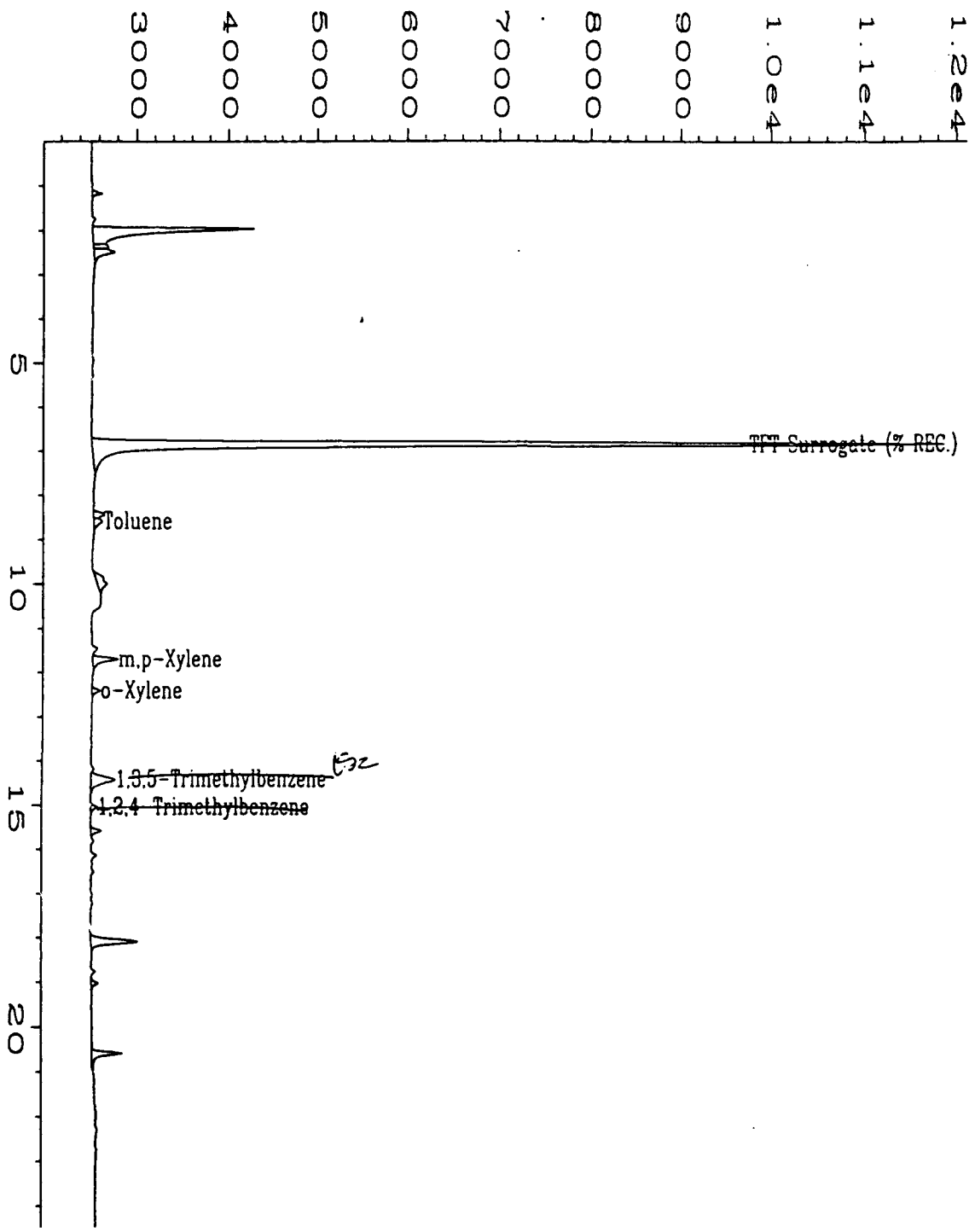
Surrogate Recovery (α,α,α-Trifluorotoluene):	100%	64%-130% (QC limits)

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene PQL is for a single peak.
* = Dry Weight Basis.

QUALIFIERS:
E = Extrapolated value
U = Compound analyzed for, but not detected.
B = Compound found in blank and sample. *Compare blank and sample data.*
J = Indicates an estimated value when the compound is detected, but is below the Practical Quantitation Limit (PQL).
PQL = Practical Quantitation Limit. The PQL is equal to the dilution factor multiplied by ten times the Method Detection Limit as determined by EPA SW846, Vol. 1B, Part II, pa. 8000-14.
NA = Not available.

Analyst

K. Cone
Approved



Data File Name : C:\HPCHEM\2\DATA\BX20329\013R0101.D
Operator : C.J. Cook
Instrument : BTEX2
Sample Name : X04563;1;5
Run Time Bar Code:
Acquired on : 29 Mar 95 08:25 PM
Report Created on: 17 Apr 95 09:43 PM
Last Recalib on : 14 APR 95 00:39 AM
Multiplier : 1
Sample Info : Project#: 95-0915 Client#: 56MP-3(11-13) Soil

Page Number : 1
Vial Number : 13
Injection Number : 1
Sequence Line : 1
Instrument Method: BX20329.
Analysis Method : BX20329B.
Sample Amount : 0
ISTD Amount :

pm 4/19/95

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BTEX Data Report

		Client Project No.	: 722450.21020
Client Sample Number	: 56MP-5(4-6)		MacDill AFB
Lab Sample Number	: X04566	Lab Project No.	: 95-0915
Date Sampled	: 3/20/95	Dilution Factor	: 12500.00
Date Received	: 3/22/95	Method	: 8020
Date Extracted/Prepared	: 3/30/95	Matrix	: Soil
Date Analyzed	: 3/31/95	Lab File No.	: BX2033024
Methanol Extract?	: Yes	Method Blank No.	: MEB033095
% Moisture	: 20.69%		

Compound Name	Cas Number	Sample Concentration* ug/kg		PQL* ug/kg
Benzene	71-43-2	**		**
Toluene	108-88-3	**		**
Ethyl Benzene	100-41-4	**		**
Total Xylenes	1330-20-7	**		**
Chlorobenzene	108-90-7	**		**
1,3,5-trimethylbenzene	108-67-8	380000		63000
1,2,4-trimethylbenzene	95-63-6	520000		63000
1,2,3-trimethylbenzene	526-73-8	260000	B	63000
1,2,3,4-tetramethylbenzene	488-23-3	350000		63000

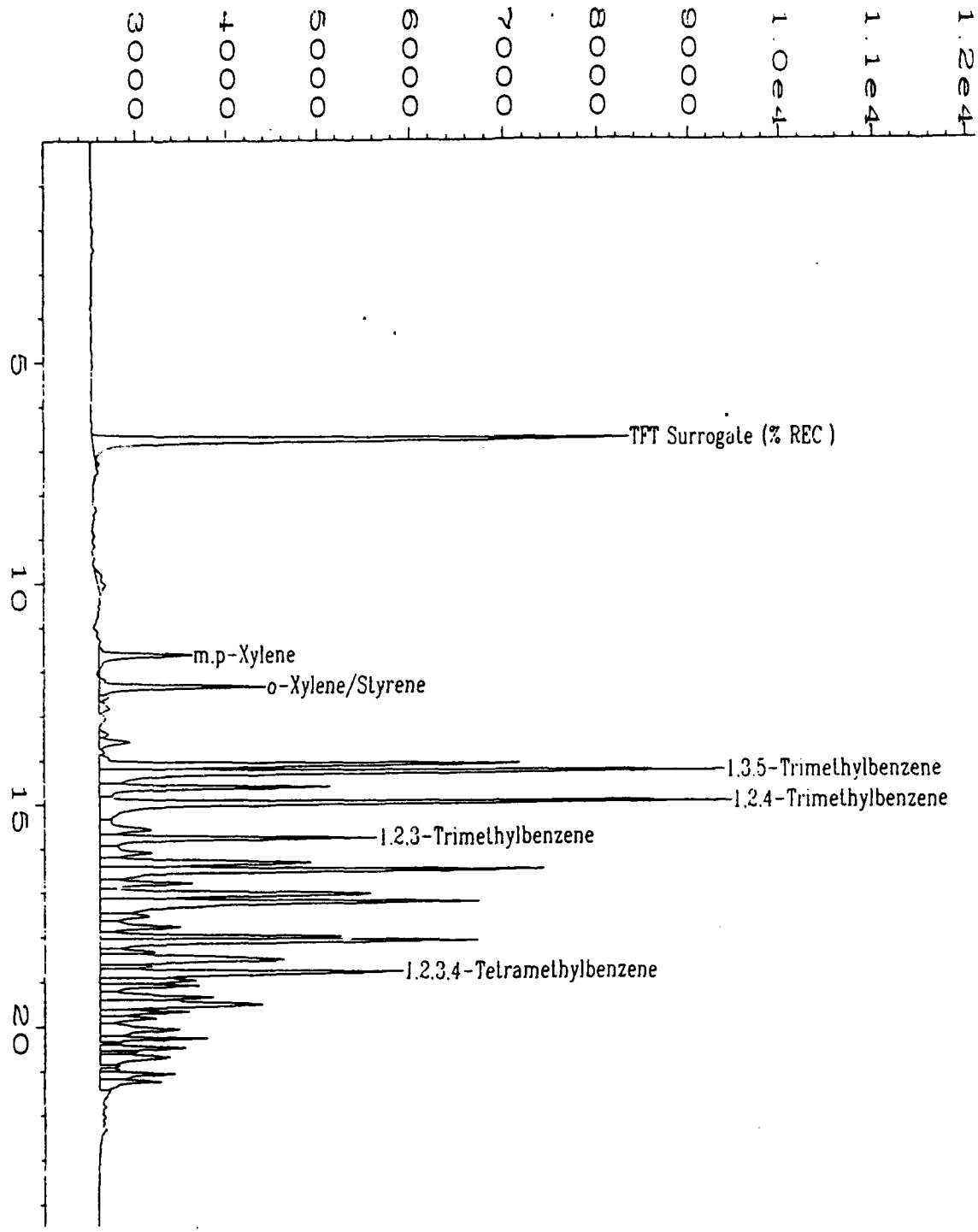
Surrogate Recovery (α,α,α-Trifluorotoluene):	80%	64%-130% (QC limits)

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene PQL is for a single peak.
* = Dry Weight Basis.
** = See BX2033023 for noted values, df=1250, 3/31/95.

QUALIFIERS:
E = Extrapolated value
U = Compound analyzed for, but not detected.
B = Compound found in blank and sample. Compare blank and sample data.
J = Indicates an estimated value when the compound is detected, but is below the Practical Quantitation Limit (PQL).
PQL = Practical Quantitation Limit. The PQL is equal to the dilution factor multiplied by ten times the Method Detection Limit as determined by EPA SW846, Vol. 1B, Part II, pa. 8000-14.
NA = Not available.

Analyst

K. Cone
Approved



Data File Name	: C:\HPCHEM\2\DATA\BX20330\024R0101.D		
Operator	: C.J. Cook	Page Number	: 1
Instrument	: BTEX2	Vial Number	: 24
Sample Name	: X04566;12500;4	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 1
Acquired on	: 31 Mar 95 04:22 AM	Instrument Method	: BX2033C
Report Created on	: 31 Mar 95 08:48 AM	Analysis Method	: BX20330
Last Recalib on	: 31 MAR 95 08:24 AM	Sample Amount	: 0
Multiplier	: 1.25e+004	ISTD Amount	:
Sample Info	: Project#: 95-0915 Client#: 56MP-5(4-6) Soil		

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BTEX Data Report

Client Sample Number	: 56MP-5(9-11)	Client Project No.	: 722450.21020 MacDill AFB
Lab Sample Number	: X04567	Lab Project No.	: 95-0915
Date Sampled	: 3/20/95	Dilution Factor	: 1.00
Date Received	: 3/22/95	Method	: 8020
Date Extracted/Prepared	: 3/29/95	Matrix	: Soil
Date Analyzed	: 3/29/95	Lab File No.	: BX2032915
Methanol Extract?	: No	Method Blank No.	: MB032995
% Moisture	: 18.81%		

Compound Name	Cas Number	Sample Concentration* ug/kg		PQL* ug/kg
Benzene	71-43-2		U	4.9
Toluene	108-88-3	0.6	J	4.9
Ethyl Benzene	100-41-4		U	4.9
Total Xylenes	1330-20-7	3.1	JB	4.9
Chlorobenzene	108-90-7		U	4.9
1,3,5-trimethylbenzene	108-67-8	2.0	J	4.9
1,2,4-trimethylbenzene	95-63-6	1.7	J	4.9
1,2,3-trimethylbenzene	526-73-8	0.6	J	4.9
1,2,3,4-tetramethylbenzene	488-23-3	4.8	J	4.9

Surrogate Recovery (α,α,α-Trifluorotoluene):	95%	64%-130% (QC limits)

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene PQL is for a single peak.
* = Dry Weight Basis.

QUALIFIERS:
E = Extrapolated value
U = Compound analyzed for, but not detected.
B = Compound found in blank and sample. Compare blank and sample data.
J = Indicates an estimated value when the compound is detected, but is below the Practical Quantitation Limit (PQL).
PQL = Practical Quantitation Limit. The PQL is equal to the dilution factor multiplied by ten times the Method Detection Limit as determined by EPA SW846, Vol. 1B, Part II, pa. 8000-14.
NA = Not available.

Analyst

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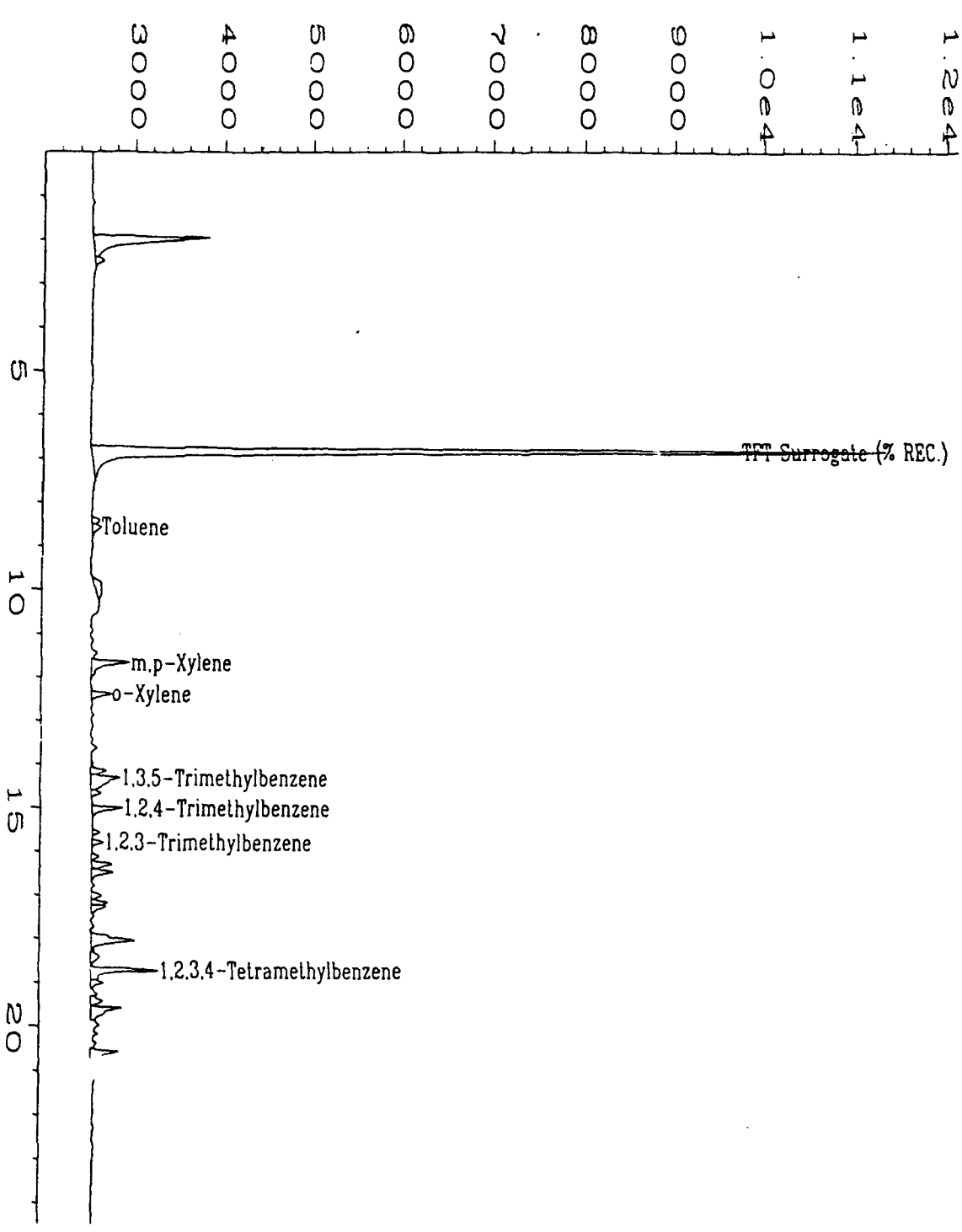

Data File Name	: C:\HPCHEM\2\DATA\BX20329\015R0101.D		
Operator	: C.J. Cook	Page Number	: 1
Instrument	: BTEX2	Vial Number	: 15
Sample Name	: X04567;1;5	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 1
Acquired on	: 29 Mar 95 10:05 PM	Instrument Method	: BX20329.
Report Created on	: 17 Apr 95 09:43 PM	Analysis Method	: BX20329B.
Last Recalib on	: 14 APR 95 00:39 AM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:
Sample Info	: Project#: 95-0915 Client#: 56MP-5(9-11) Soil		

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BTEX Data Report

Client Sample Number	: 56MP-6(4-6)	Client Project No.	: 722450.21020 MacDill AFB
Lab Sample Number	: X04568	Lab Project No.	: 95-0915
Date Sampled	: 3/20/95	Dilution Factor	: 1.00
Date Received	: 3/22/95	Method	: 8020
Date Extracted/Prepared	: 3/30/95	Matrix	: Soil
Date Analyzed	: 3/30/95	Lab File No.	: BX2033013
Methanol Extract?	: No	Method Blank No.	: MB033095
% Moisture	: 17.33%		

Compound Name	Cas Number	Sample Concentration* ug/kg		PQL* ug/kg
Benzene	71-43-2		U	4.8
Toluene	108-88-3	3.8	J	4.8
Ethyl Benzene	100-41-4	2.2	J	4.8
Total Xylenes	1330-20-7	4.0	J	4.8
Chlorobenzene	108-90-7		U	4.8
1,3,5-trimethylbenzene	108-67-8	2.4	J	4.8
1,2,4-trimethylbenzene	95-63-6	3.0	J	4.8
1,2,3-trimethylbenzene	526-73-8		U	4.8
1,2,3,4-tetramethylbenzene	488-23-3		U	4.8

Surrogate Recovery (α,α,α-Trifluorotoluene): 62% X 64%-130% (QC limits)

X Note: See BX2033014 for low surrogate confirmation (51%), df=1, 03/30/95.

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene PQL is for a single peak.

* = Dry Weight Basis.

QUALIFIERS:

E = Extrapolated value

U = Compound analyzed for, but not detected.

B = Compound found in blank and sample. Compare blank and sample data.

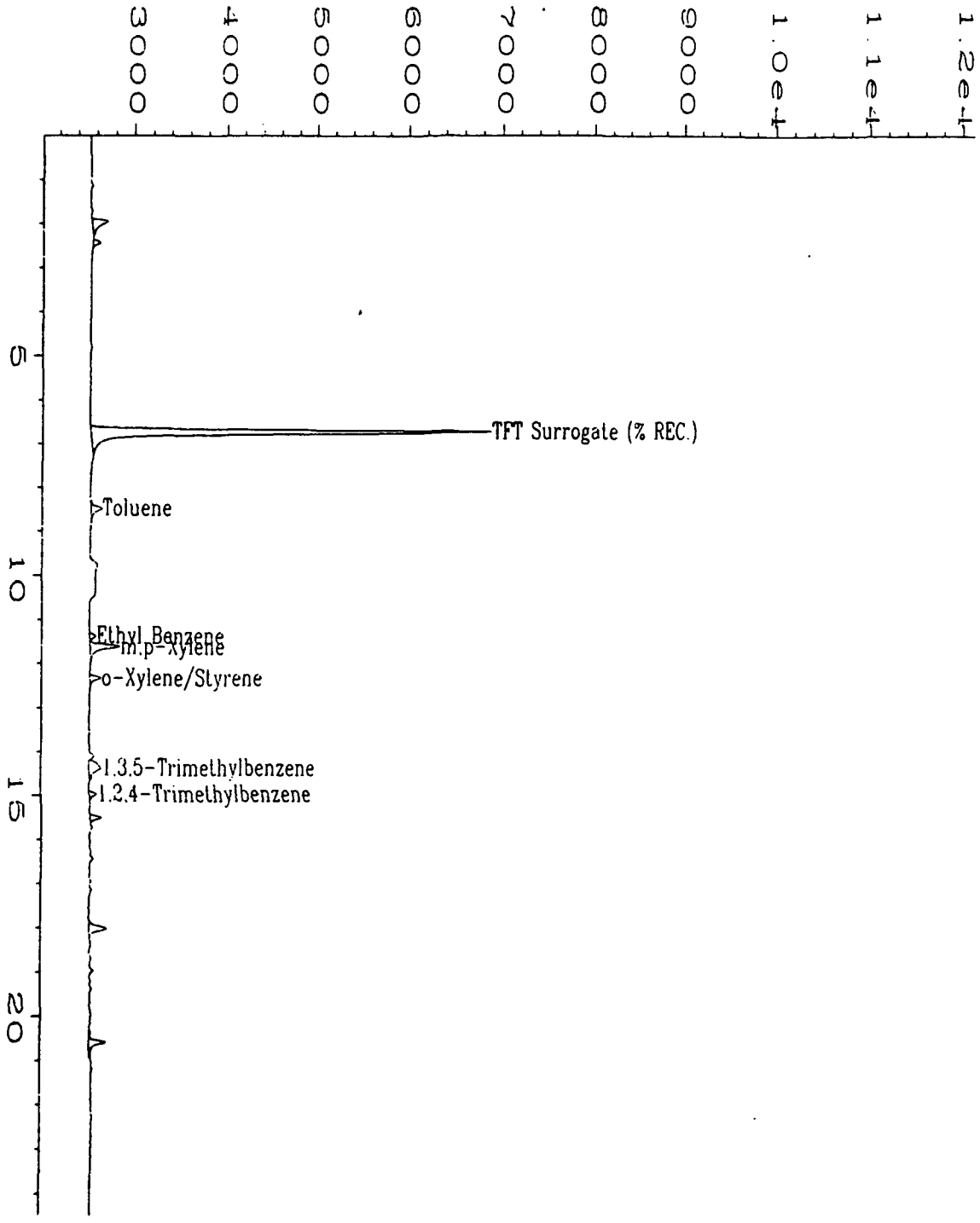
J = Indicates an estimated value when the compound is detected, but is below the Practical Quantitation Limit (PQL).

PQL = Practical Quantitation Limit. The PQL is equal to the dilution factor multiplied by ten times the Method Detection Limit as determined by EPA SW846, Vol. 1B, Part II, pa. 8000-14.

NA = Not available.

Analyst

Approved



Data File Name	: C:\HPCHEM\2\DATA\BX20330\013R0101.D		
Operator	: C.J. Cook	Page Number	: 1
Instrument	: BTEX2	Vial Number	: 13
Sample Name	: X04568;1;5	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 1
Acquired on	: 30 Mar 95 08:13 PM	Instrument Method	: BX20330
Report Created on	: 31 Mar 95 08:45 AM	Analysis Method	: BX20330
Last Recalib on	: 31 MAR 95 08:24 AM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:
Sample Info	: Project#: 95-0915 Client#: 56MP-6(4-6) Soil		

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BTEX Data Report

Client Sample Number	: 56MP-6(10-11)	Client Project No.	: 722450.21020 MacDill AFB
Lab Sample Number	: X04569	Lab Project No.	: 95-0915
Date Sampled	: 3/20/95	Dilution Factor	: 1.00
Date Received	: 3/22/95	Method	: 8020
Date Extracted/Prepared	: 3/30/95	Matrix	: Soil
Date Analyzed	: 3/30/95	Lab File No.	: BX2033011
Methanol Extract?	: No	Method Blank No.	: MB033095
% Moisture	: 17.41%		

Compound Name	Cas Number	Sample Concentration* ug/kg		PQL* ug/kg
Benzene	71-43-2		U	4.8
Toluene	108-88-3		U	4.8
Ethyl Benzene	100-41-4		U	4.8
Total Xylenes	1330-20-7		U	4.8
Chlorobenzene	108-90-7		U	4.8
1,3,5-trimethylbenzene	108-67-8	1.7	J	4.8
1,2,4-trimethylbenzene	95-63-6	4.0	J	4.8
1,2,3-trimethylbenzene	526-73-8	2.6	J	4.8
1,2,3,4-tetramethylbenzene	488-23-3		U	4.8

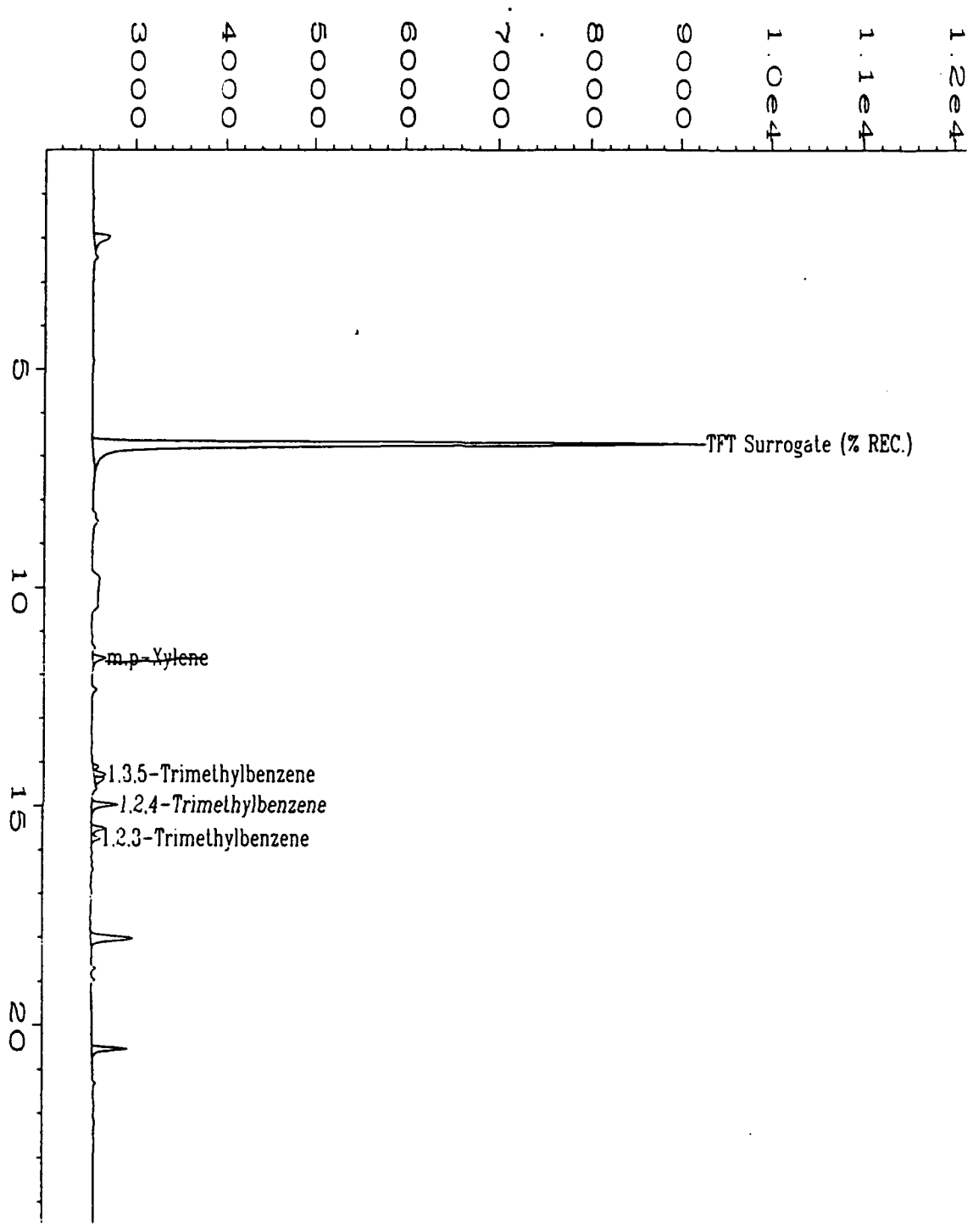
Surrogate Recovery (α,α,α-Trifluorotoluene):	96%	64%-130% (QC limits)

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene PQL is for a single peak.
* = Dry Weight Basis.

QUALIFIERS:
E = Extrapolated value
U = Compound analyzed for, but not detected.
B = Compound found in blank and sample. Compare blank and sample data.
J = Indicates an estimated value when the compound is detected, but is below the Practical Quantitation Limit (PQL).
PQL = Practical Quantitation Limit. The PQL is equal to the dilution factor multiplied by ten times the Method Detection Limit as determined by EPA SW846, Vol. 1B, Part II, pa. 8000-14.
NA = Not available.

Analyst

Approved



Data File Name	: C:\HPCHEM\2\DATA\BX20330\011R0101.D		
Operator	: C.J. Cook	Page Number	: 1
Instrument	: BTEX2	Vial Number	: 11
Sample Name	: X04569;1;5	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 1
Acquired on	: 30 Mar 95 06:46 PM	Instrument Method	: BX20330
Report Created on	: 31 Mar 95 08:44 AM	Analysis Method	: BX20330.
Last Recalib on	: 31 MAR 95 08:24 AM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:
Sample Info	: Project#: 95-0915 Client#: 56MP-6(10-11) Soil		

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4036 Youngfield St. Wheat Ridge, CO 80033
(303) 425-6021

BTEX Data Report

Client Sample Number	: 56MP-16(4-6)	Client Project No.	: 722450.21020 MacDill AFB
Lab Sample Number	: X04572	Lab Project No.	: 95-0915
Date Sampled	: 3/20/95	Dilution Factor	: 1.00
Date Received	: 3/22/95	Method	: 8020
Date Extracted/Prepared	: 3/30/95	Matrix	: Soil
Date Analyzed	: 3/30/95,	Lab File No.	: BX2032918
Methanol Extract?	: No	Method Blank No.	: MB032995
% Moisture	: 21.77%		

Compound Name	Cas Number	Sample Concentration* ug/kg		PQL* ug/kg
Benzene	71-43-2		U	5.1
Toluene	108-88-3	0.9	J	5.1
Ethyl Benzene	100-41-4		U	5.1
Total Xylenes	1330-20-7	1.0	JB	5.1
Chlorobenzene	108-90-7		U	5.1
1,3,5-trimethylbenzene	108-67-8		U	5.1
1,2,4-trimethylbenzene	95-63-6		U	5.1
1,2,3-trimethylbenzene	526-73-8		U	5.1
1,2,3,4-tetramethylbenzene	488-23-3	0.5	J	5.1

Surrogate Recovery (α,α,α-Trifluorotoluene): 64% 64%-130% (QC limits)

Note: See BX2032917 for low surrogate confirmation (55%), df=1, 03/29/95.

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene PQL is for a single peak.

* = Dry Weight Basis.

QUALIFIERS:

E = Extrapolated value

U = Compound analyzed for, but not detected.

B = Compound found in blank and sample. Compare blank and sample data.

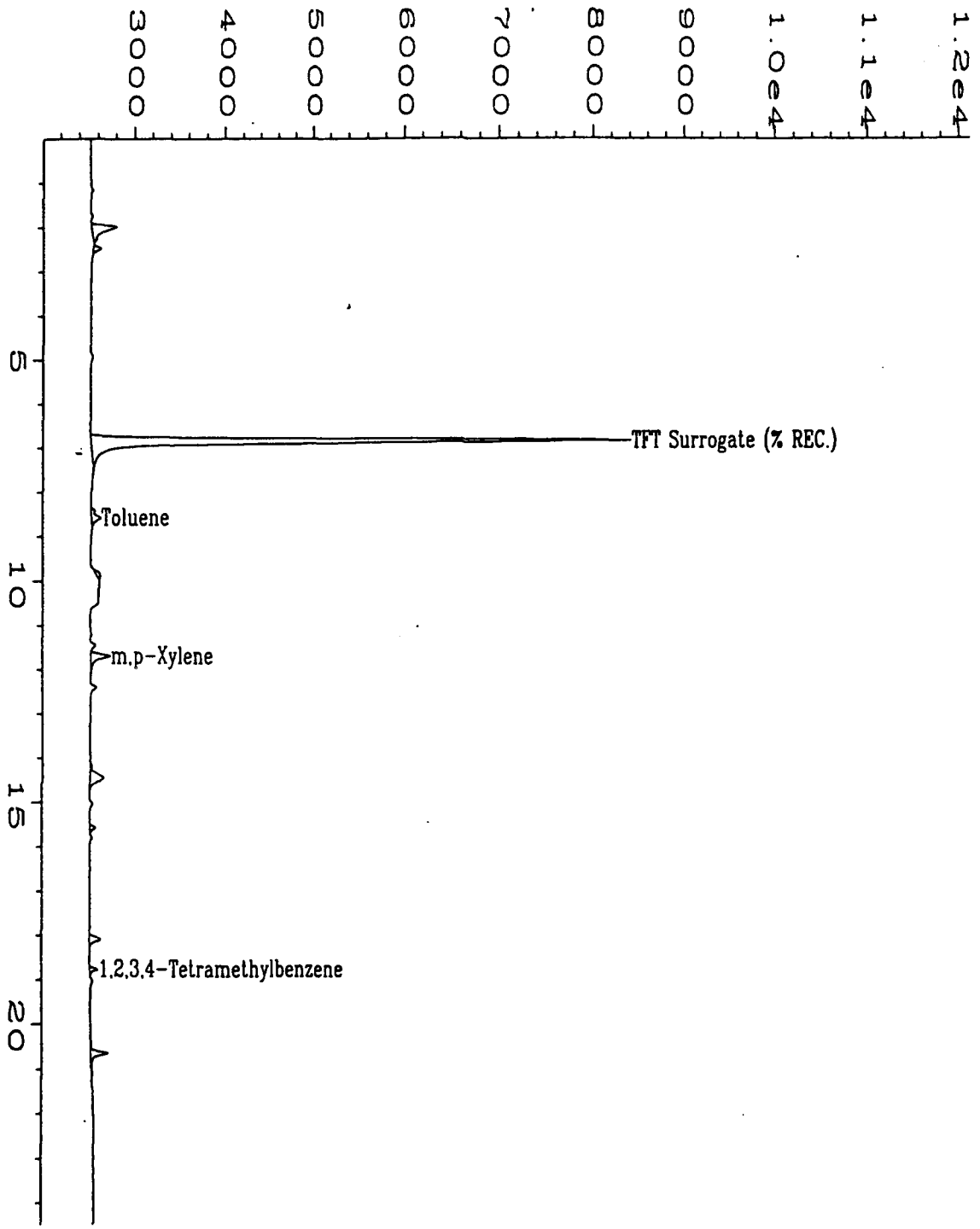
J = Indicates an estimated value when the compound is detected, but is below the Practical Quantitation Limit (PQL).

PQL = Practical Quantitation Limit. The PQL is equal to the dilution factor multiplied by ten times the Method Detection Limit as determined by EPA SW846, Vol. 1B, Part II, pa. 8000-14.

NA = Not available.

K. Cone
Analyst

Approved



Data File Name	: C:\HPCHEM\2\DATA\BX20329\018R0101.D		
Operator	: C.J. Cook	Page Number	: 1
Instrument	: BTEX2	Vial Number	: 18
Sample Name	: X04572 1;5	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 1
Acquired on	: 30 Mar 95 00:31 AM	Instrument Method	: BX20329
Report Created on	: 17 Apr 95 09:45 PM	Analysis Method	: BX20329
Last Recalib on	: 14 APR 95 00:39 AM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:
Sample Info	: Project#: 95-0915 Client#: 56MP-16(4-6) Soil		

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BTEX Data Report

Client Sample Number	: 56MP-5(4-6)	Client Project No.	: 722450.21020 MacDill AFB
Lab Sample Number	: X04566	Lab Project No.	: 95-0915
Date Sampled	: 3/20/95	Dilution Factor	: 1250.00
Date Received	: 3/22/95	Method	: 8020
Date Extracted/Prepared	: 3/30/95	Matrix	: Soil
Date Analyzed	: 3/31/95	Lab File No.	: BX2033023
Methanol Extract?	: Yes	Method Blank No.	: MEB033095
% Moisture	: 20.69%		

Compound Name	Cas Number	Sample Concentration* ug/kg	PQL* ug/kg
Benzene	71-43-2	U	6300
Toluene	108-88-3	U	6300
Ethyl Benzene	100-41-4	15000	6300
Total Xylenes	1330-20-7	260000	6300
Chlorobenzene	108-90-7	11000	6300
1,3,5-trimethylbenzene	108-67-8	**	**
1,2,4-trimethylbenzene	95-63-6	**	**
1,2,3-trimethylbenzene	526-73-8	**	**
1,2,3,4-tetramethylbenzene	488-23-3	**	**

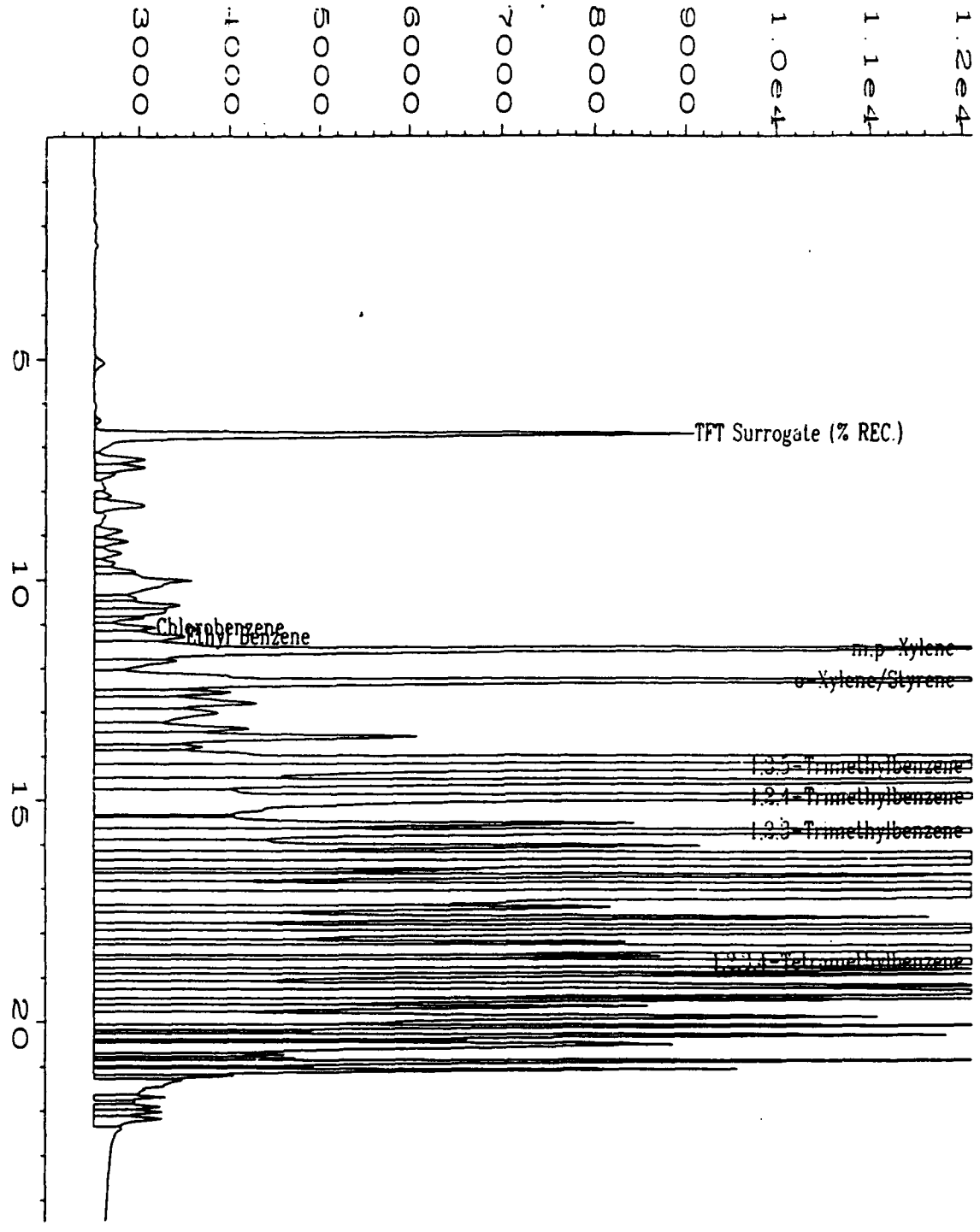
Surrogate Recovery (α,α,α-Trifluorotoluene):	92%	64%-130% (QC limits)

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene PQL is for a single peak.
* = Dry Weight Basis.
** = See BX2033024 for noted values, df = 12500, 3/31/95.

QUALIFIERS:
E = Extrapolated value
U = Compound analyzed for, but not detected.
B = *Compound found in blank and sample. Compare blank and sample data.*
J = Indicates an estimated value when the compound is detected, but is below the Practical Quantitation Limit (PQL).
PQL = Practical Quantitation Limit. The PQL is equal to the dilution factor multiplied by ten times the Method Detection Limit as determined by EPA SW846, Vol. 1B, Part II, pa. 8000-14.
NA = Not available.

Analyst

Approved



Data File Name : C:\HPCHEM\2\DATA\BX20330\023R0101.D
Operator : C.J. Cook
Instrument : BTEX2
Sample Name : X04566;1250;4
Run Time Bar Code:
Acquired on : 31 Mar 95 03:37 AM
Report Created on: 31 Mar 95 08:48 AM
Last Recalib on : 31 MAR 95 08:24 AM
Multiplier : 1250
Sample Info : Project#: 95-0915 Client#: 56MP-5(4-6) Soil

Page Number : 1
Vial Number : 23
Injection Number : 1
Sequence Line : 1
Instrument Method: BX20330.
Analysis Method : BX20330.M...
Sample Amount : 0
ISTD Amount :

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BTEX Data Report

Client Sample Number	: 56SS-1(8-10)	Client Project No.	: 722450.21020 MacDill AFB
Lab Sample Number	: X04564	Lab Project No.	: 95-0915
Date Sampled	: 3/20/95	Dilution Factor	: 5.00
Date Received	: 3/22/95	Method	: 8020
Date Extracted/Prepared	: 3/29/95	Matrix	: Soil
Date Analyzed	: 3/29/95,	Lab File No.	: BX2032914
Methanol Extract?	: No	Method Blank No.	: MB032995
% Moisture	: 19.66%		

Compound Name	Cas Number	Sample Concentration* ug/kg		PQL* ug/kg
Benzene	71-43-2	10	J	25
Toluene	108-88-3	4.9	J	25
Ethyl Benzene	100-41-4	37		25
Total Xylenes	1330-20-7	100	B	25
Chlorobenzene	108-90-7		U	25
1,3,5-trimethylbenzene	108-67-8	42.0		25
1,2,4-trimethylbenzene	95-63-6	140		25
1,2,3-trimethylbenzene	526-73-8	15	J	25
1,2,3,4-tetramethylbenzene	488-23-3	23	J	25

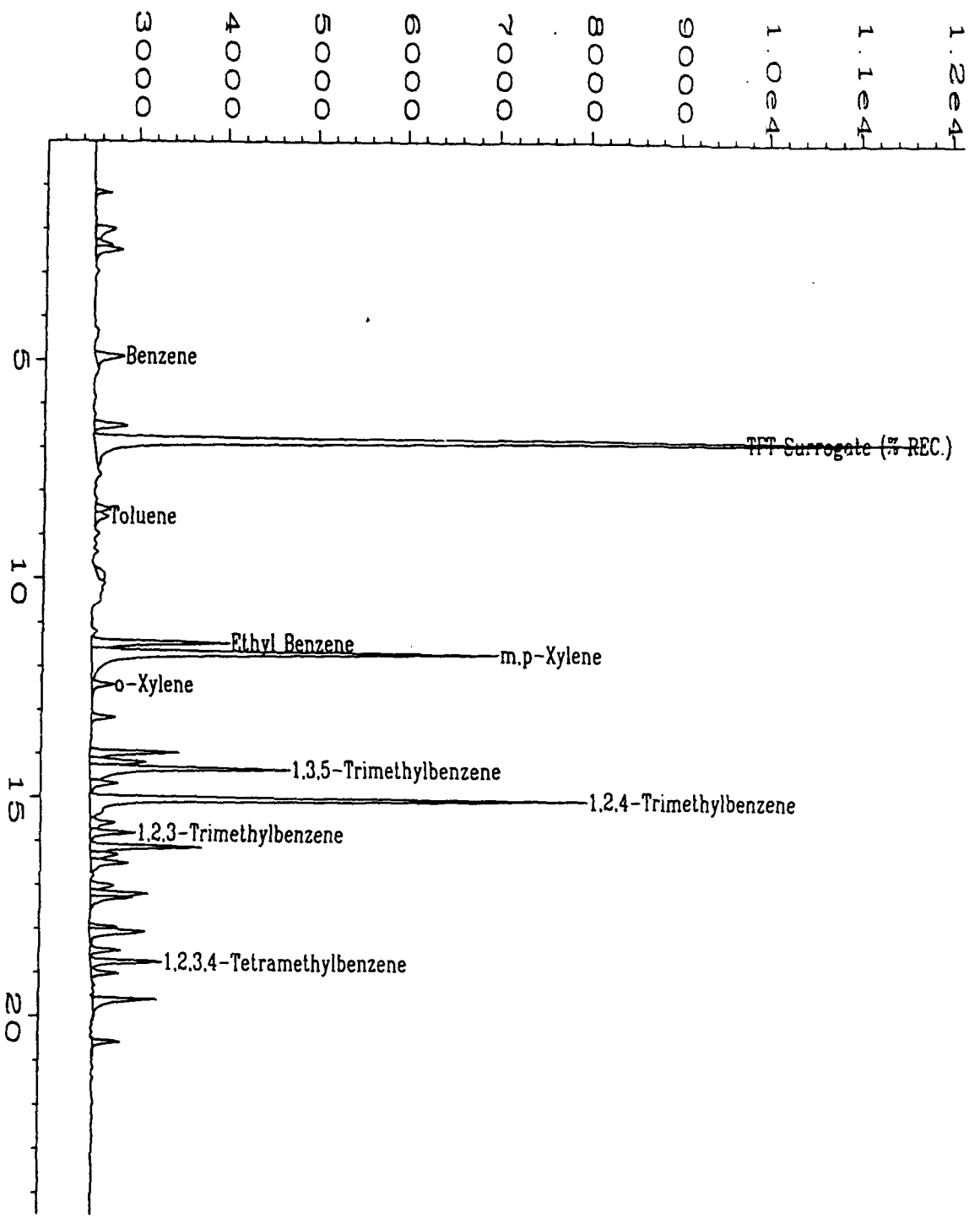
Surrogate Recovery (α,α,α-Trifluorotoluene):	97%	64%-130% (QC limits)

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene PQL is for a single peak.
* = Dry Weight Basis.

QUALIFIERS:
E = Extrapolated value
U = Compound analyzed for, but not detected.
B = Compound found in blank and sample. Compare blank and sample data.
J = Indicates an estimated value when the compound is detected, but is below the Practical Quantitation Limit (PQL).
PQL = Practical Quantitation Limit. The PQL is equal to the dilution factor multiplied by ten times the Method Detection Limit as determined by EPA SW846, Vol. 1B, Part II, pa. 8000-14.
NA = Not available.

Analyst

Approved



Data File Name : C:\HPCHEM\2\DATA\BX20329\014R0101.D
Operator : C.J. Cook
Instrument : BTEX2
Sample Name : X04564;5;1
Run Time Bar Code:
Acquired on : 29 Mar 95 09:15 PM
Report Created on: 17 Apr 95 09:43 PM
Last Recalib on : 14 APR 95 00:39 AM
Multiplier : 5
Sample Info : Project#: 95-0915 Client#: 56SS-1(8-10) Soil

Page Number : 1
Vial Number : 14
Injection Number : 1
Sequence Line : 1
Instrument Method: BX20329
Analysis Method : BX20329
Sample Amount : 0
ISTD Amount :

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(303) 425-6021

TOTAL VOLATILE HYDROCARBONS
TVH Matrix Spike/Matrix Spike Duplicate Data Report

Client Sample No.	: 56MP-1(4-6)	**Client Project No.**	: 722450.21020/MAC
Lab Sample No.	: X04557	**Lab Project No.**	: 95-0915
Date Sampled	: 3/17/95	**EPA Method No.**	: 5030/8015 Mod.
Date Received	: 3/22/95	**Matrix**	: SOIL
Date Prepared	: 3/30/95	**Method Blank**	: MB033095
Date Analyzed	: 3/30/95		

Compound	Spike Added (mg/kg)	Sample Concentration (mg/kg)	MS Concentration (mg/kg)	MS %REC	QC Limits %REC
Gasoline	1.00	0.00	0.93	93%	60-140

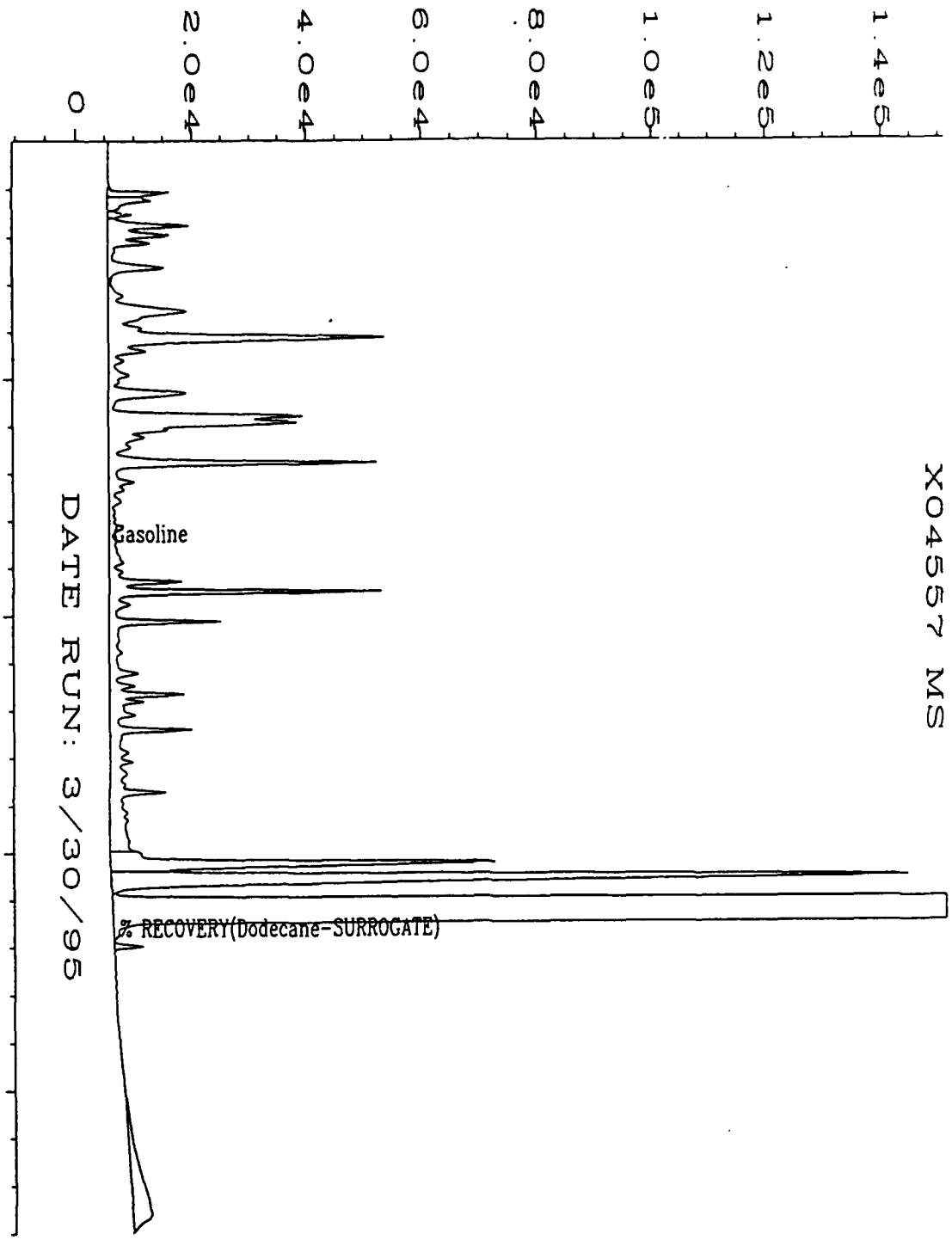
Compound	Spike Added (mg/kg)	MSD Concentration (mg/kg)	MS %REC	RPD	QC Limits RPD	QC Limits %REC
Gasoline	1.00	0.91	91%	2	50	60-140

* = Values outside of QC limits.

RPD: 0 out of (1) outside limits.

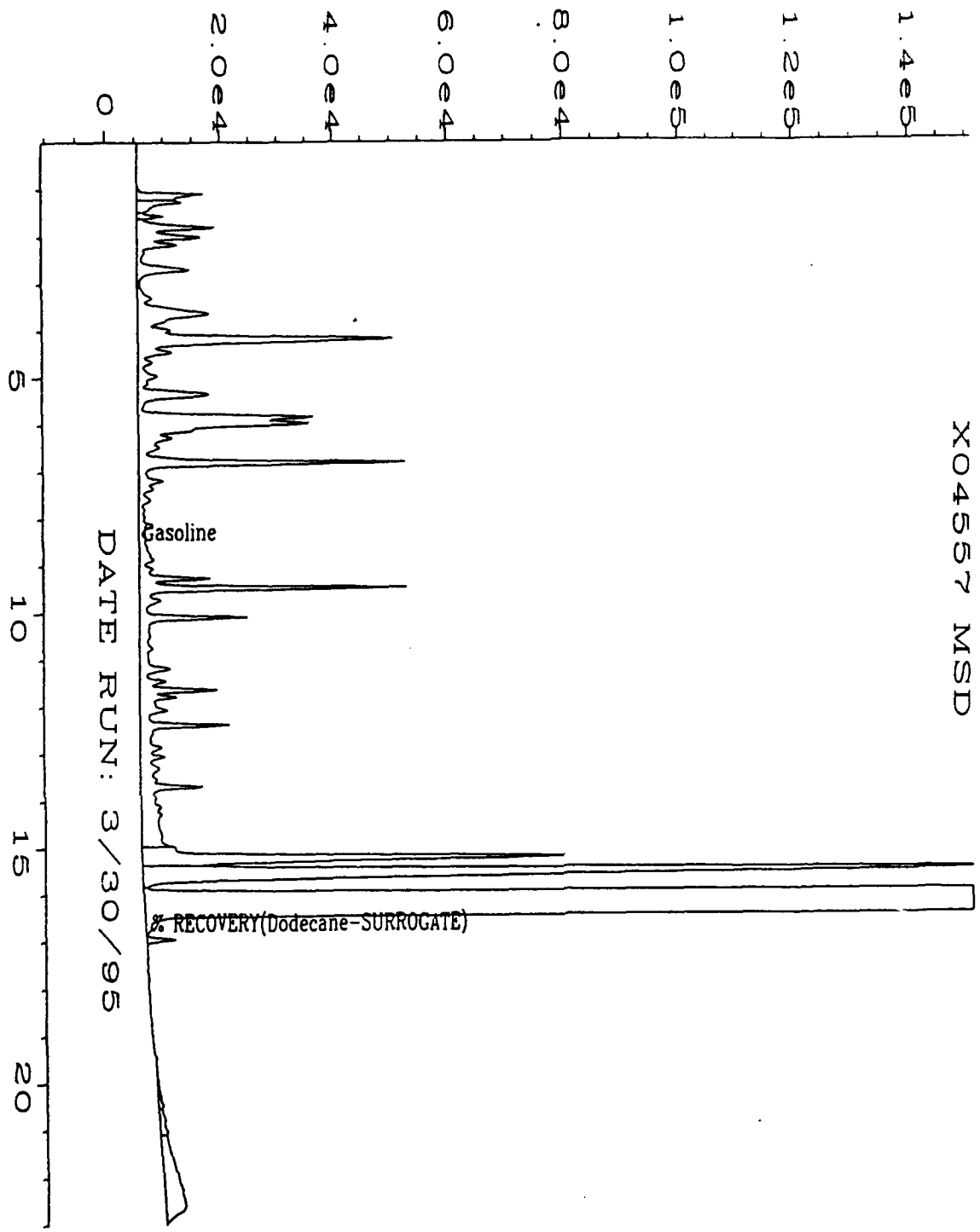
Spike Recovery: 0 out of (2) outside limits.

Comments: NA = Not analyzed/not applicable.



Data File Name	: C:\HPCHEM\1\DATA\TVH0330\004F0201.D		
Operator	: Dawn N. Guildner	Page Number	: 1
Instrument	: TVH	Vial Number	: 4
Sample Name	: X04557 MS	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 2
Acquired on	: 30 Mar 95 07:36 PM	Instrument Method	: TVH0323
Report Created on	: 31 Mar 95 09:45 AM	Analysis Method	: TVH0330
Last Recalib on	: 29 MAR 95 08:06 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:

Client # 56MP-1(4-6)



ata File Name : C:\HPCHEM\1\DATA\TVH0330\005F0201.D
perator : Dawn N. Guildner
nstrument : TVH
ample Name : X04557 MSD
un Time Bar Code:
quired on : 30 Mar 95 08:10 PM
port Created on: 31 Mar 95 09:46 AM
ast Recalib on : 29 MAR 95 08:06 PM
ultiplier : 1

Page Number : 1
Vial Number : 5
Injection Number : 1
Sequence Line : 2
Instrument Method: TVH0323.MTH
Analysis Method : TVH0330.MTH
Sample Amount : 0
ISTD Amount :

Client # 56MP-1(4-6)

Evergreen Analytical, Inc.
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(303) 425-6021

BTEX Matrix Spike/Matrix Spike Duplicate Data Report

		Client Project No.	: 722450.21020
Client Sample No.	: 24MP-5S		MacDill AFB
Lab Sample No.	: X04546	Lab Project No.	: 95-0915
Date Sampled	: 3/20/95	EPA Method No.	: 602
Date Received	: 3/22/95	Matrix	: Water
Date Prepared	: 3/25/95	Lab File Number(s)	: BX2032515,16
Date Analyzed	: 3/25,26/1995	Method Blank	: MB032595

Compound	Spike Added (ug/L)	Sample Concentration (ug/L)	MS Concentration (ug/L)	MS %REC	QC Limits %REC
Benzene	20.0	0.0	16.7	84	50-150
Toluene	20.0	9.3	26.1	84	50-148
Ethyl Benzene	20.0	0.0	16.5	83	50-150
m,p-Xylene	40.0	0.0	32.2	81	50-150
o-Xylene	20.0	0.0	15.9	80	50-150
Chlorobenzene	20.0	0.0	16.9	85	55-135
1,3,5-TMB	20.0	0.0	16.4	82	50-150
1,2,4-TMB	20.0	0.0	16.4	82	50-150
1,2,3-TMB	20.0	0.0	16.3	82	50-150
1,2,3,4-TeMB	20.0	0.0	15.9	80	50-15

Compound	Spike Added (ug/L)	MSD Concentration (ug/L)	MSD %REC	RPD	QC Limits RPD	QC Limits %REC
Benzene	20.0	15.9	80	4.9	25	50-150
Toluene	20.0	24.9	78	7.4	25	50-148
Ethyl Benzene	20.0	15.5	78	6.3	25	50-150
m,p-Xylene	40.0	29.7	74	8.1	25	50-150
o-Xylene	20.0	14.8	74	7.2	25	50-150
Chlorobenzene	20.0	16.2	81	4.2	25	55-135
1,3,5-TMB	20.0	14.3	72	13.7	25	50-150
1,2,4-TMB	20.0	14.3	72	13.7	25	50-150
1,2,3-TMB	20.0	14.7	74	10.3	25	50-150
1,2,3,4-TeMB	20.0	13.6	68	15.6	25	50-150

* = Values outside of QC limits.

RPD: 0 out of (10) outside limits.

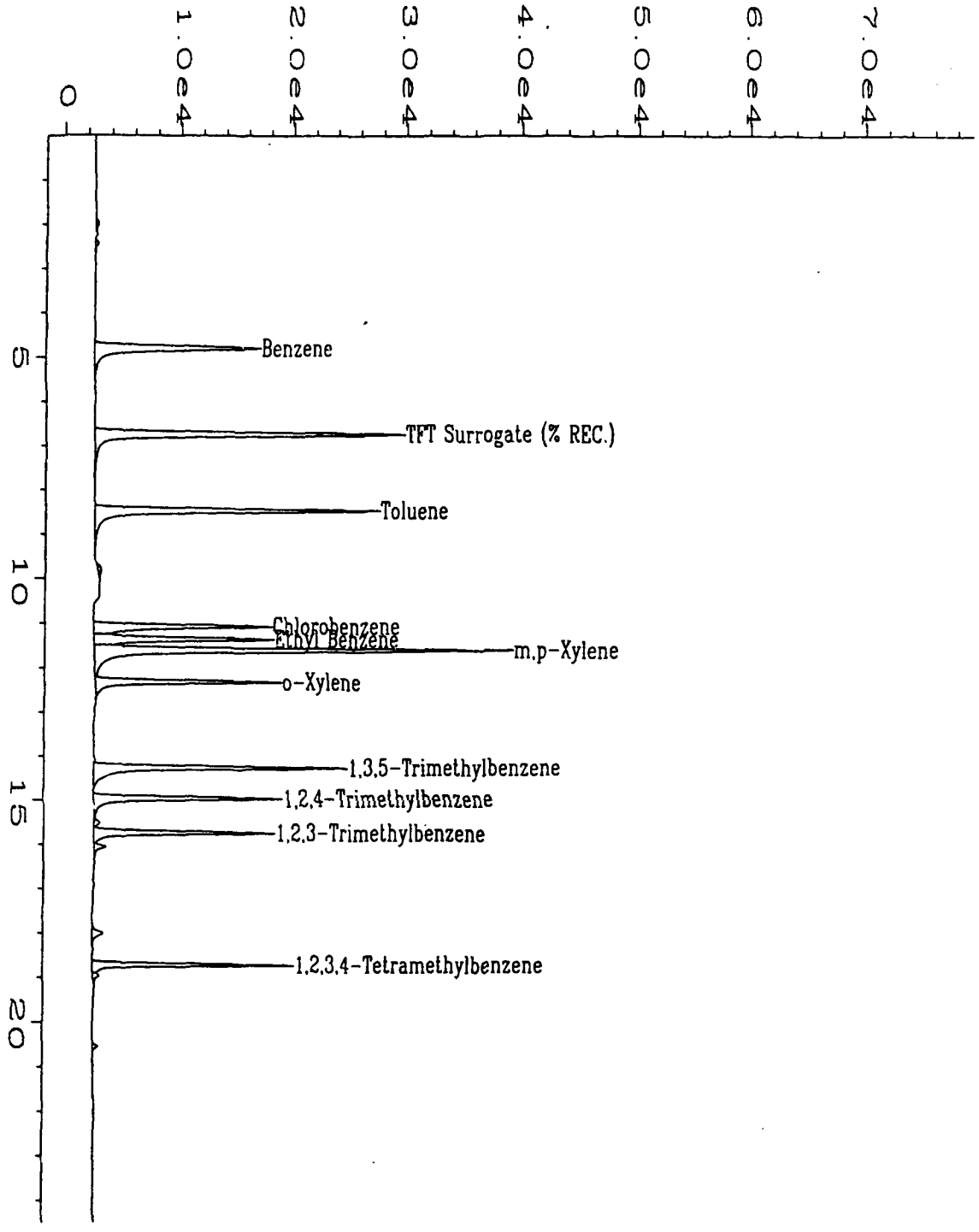
Spike Recovery: 0 out of (20) outside limits.

Comments:

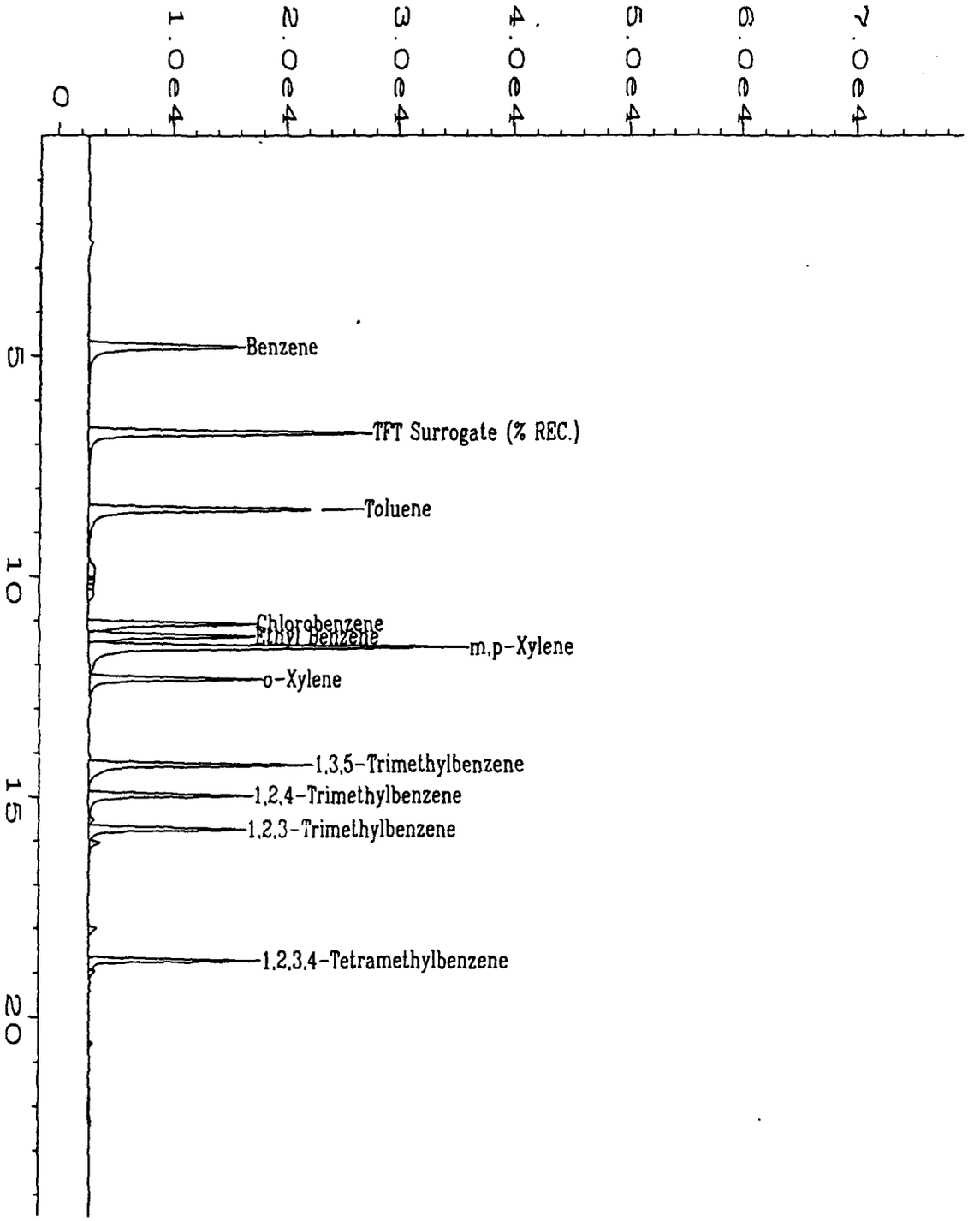
K. Cone
Analyst

P McClellan
Approved

MS0915A.XLS



Data File Name	: C:\HPCHEM\2\DATA\BX20325\015R0801.D		
Operator	: T.L. Lockwood	Page Number	: 1
Instrument	: BTEX2	Vial Number	: 15
Sample Name	: X04546MS;1;5	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 8
Acquired on	: 25 Mar 95 11:51 PM	Instrument Method	: BX20325.MTH
Report Created on	: 17 Apr 95 01:04 PM	Analysis Method	: BX20325A.MTH
Last Recalib on	: 14 APR 95 00:39 AM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:
Sample Info	: Project#: 95-0915	Client#: 24MP-5S	Water



Data File Name	: C:\HPCHEM\2\DATA\BX20325\016R0801.D		
Operator	: T.L. Lockwood	Page Number	: 1
Instrument	: BTEX2	Vial Number	: 16
Sample Name	: X04546MSD;1;5	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 8
Acquired on	: 26 Mar 95 00:36 AM	Instrument Method	: BX20325.
Report Created on	: 17 Apr 95 01:05 PM	Analysis Method	: BX20325A.
Last Recalib on	: 14 APR 95 00:39 AM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:
Sample Info	: Project#: 95-0915	Client#: 24MP-5S	Water

Evergreen Analytical, Inc.
4036 Youngfield, Wheat Ridge, CO 80033
(303) 425-6021

BTEX Matrix Spike/Matrix Spike Duplicate Data Report

		Client Project No.	: 722450.21020 MacDill AFB
Client Sample No.	: MD24-9		
Lab Sample No.	: X04551	Lab Project No.	: 95-0915
Date Sampled	: 3/20/95	EPA Method No.	: 602
Date Received	: 3/22/95	Matrix	: Water
Date Prepared	: 3/26/95	Lab File Number(s)	: BX2032614,15
Date Analyzed	: 3/26/95	Method Blank	: MB032695

Compound	Spike Added (ug/L)	Sample Concentration (ug/L)	MS Concentration (ug/L)	MS %REC	QC Limits %REC
Benzene	20.0	0.0	17.3	87	65-121
Toluene	20.0	0.0	17.1	86	69-117
Ethyl Benzene	20.0	0.0	17.3	87	68-118
m,p-Xylene	40.0	0.5	34.6	85	66-116
o-Xylene	20.0	0.0	17.3	87	73-117
Chlorobenzene	20.0	0.0	17.3	87	65-121
1,3,5-TMB	20.0	0.0	16.8	84	65-121
1,2,4-TMB	20.0	0.0	17.1	86	65-121
1,2,3-TMB	20.0	0.0	17.2	86	65-121
1,2,3,4-TeMB	20.0	0.0	16.7	84	65-121

Compound	Spike Added (ug/L)	MSD Concentration (ug/L)	MSD %REC	RPD	QC Limits RPD	QC Limits %REC
Benzene	20.0	17.7	89	2.3	17.4	65-121
Toluene	20.0	17.5	88	2.3	15.8	69-117
Ethyl Benzene	20.0	17.7	89	2.3	11.9	68-118
m,p-Xylene	40.0	35.3	87	2.0	15.4	66-116
o-Xylene	20.0	17.8	89	2.8	13.2	73-117
Chlorobenzene	20.0	17.8	89	2.8	17.4	65-121
1,3,5-TMB	20.0	17.2	86	2.4	17.4	65-121
1,2,4-TMB	20.0	17.8	89	4.0	17.4	65-121
1,2,3-TMB	20.0	17.9	90	4.0	17.4	65-121
1,2,3,4-TeMB	20.0	17.8	89	6.4	17.4	65-121

* = Values outside of QC limits.

RPD: 0 out of (10) outside limits.

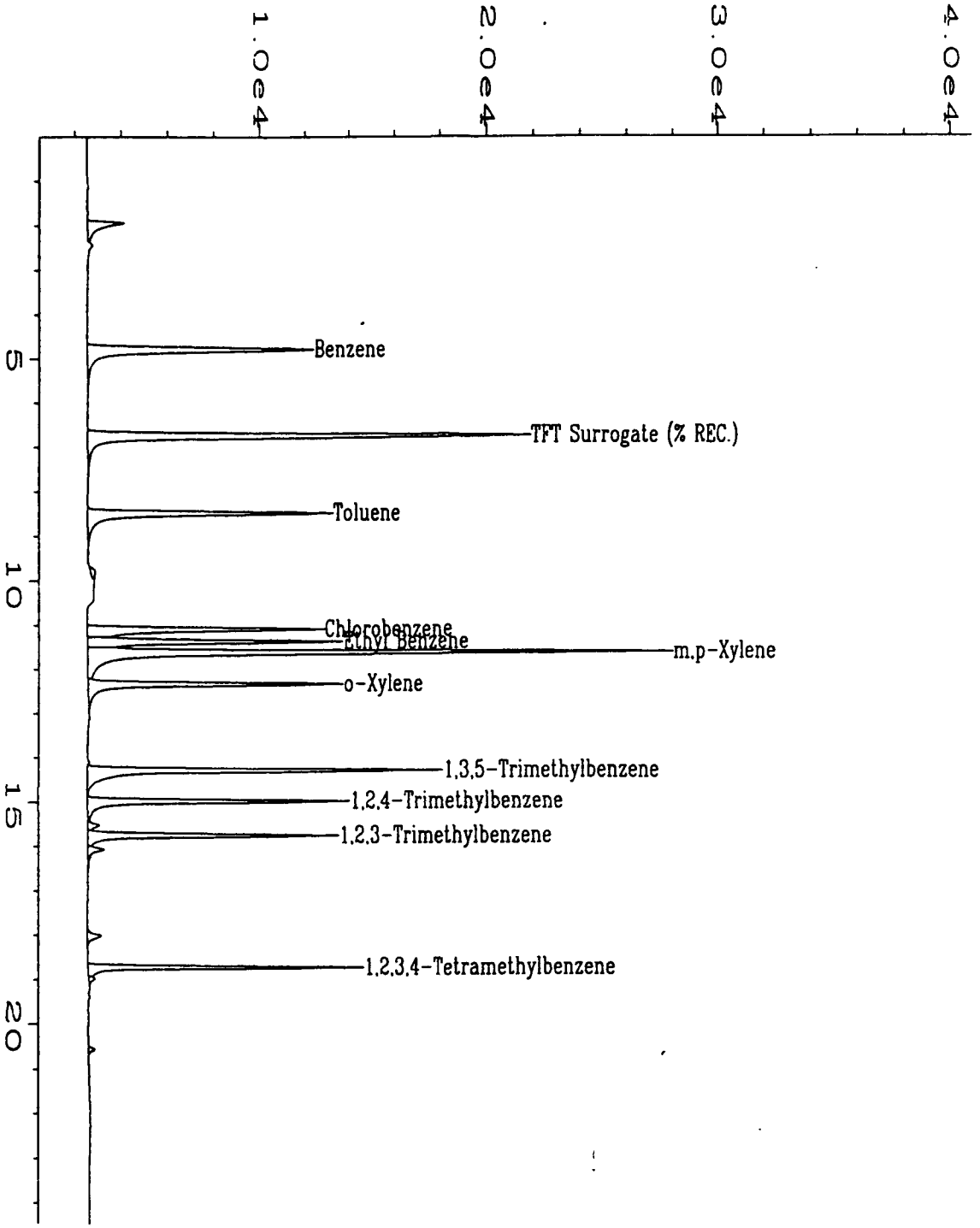
Spike Recovery: 0 out of (20) outside limits.

Comments:

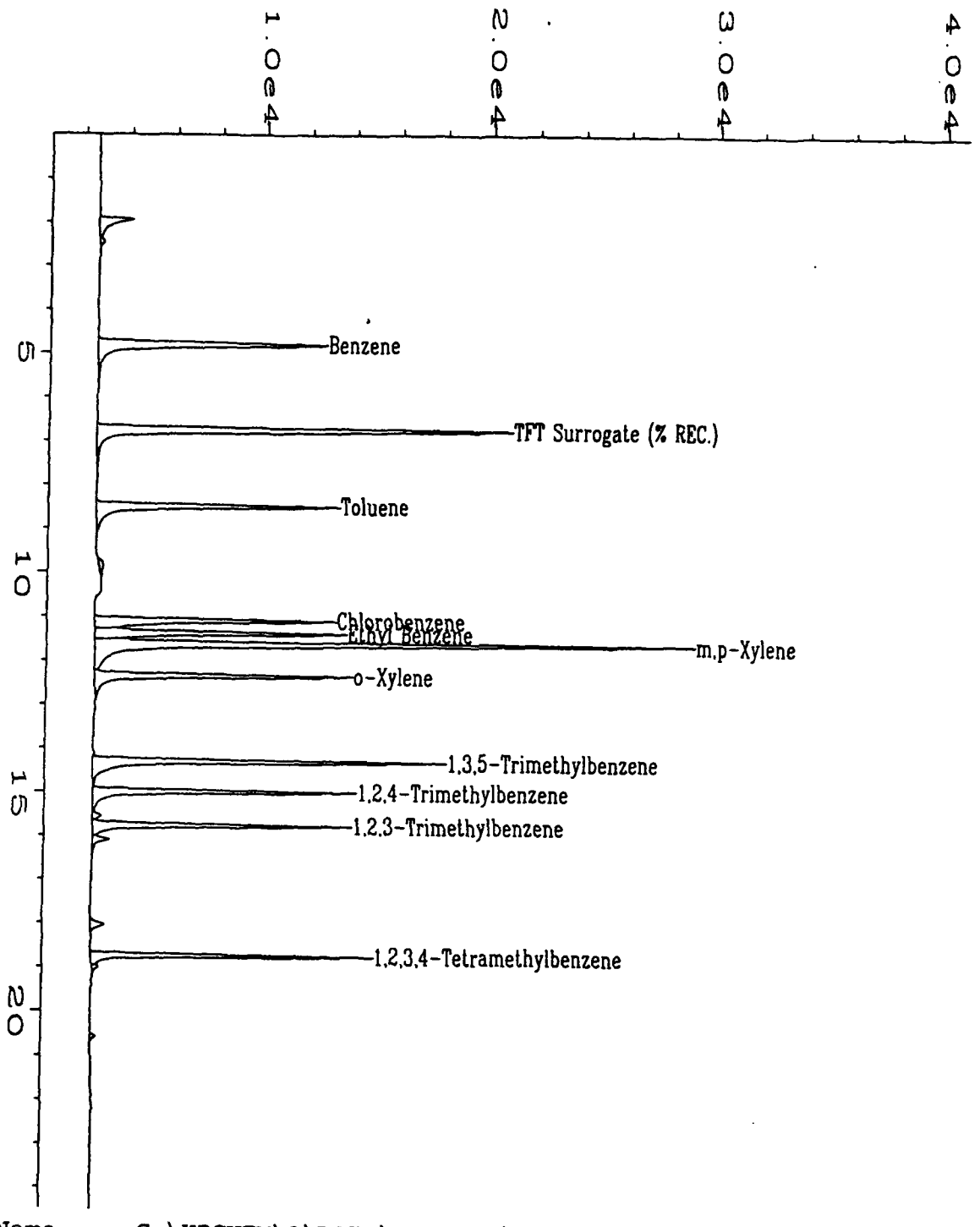
Analyst

Approved

MS0915B.XLS



Data File Name	: C:\HPCHEM\2\DATA\BX20326\014R0801.D		
Operator	: T.L. Lockwood	Page Number	: 1
Instrument	: BTEX2	Vial Number	: 14
Sample Name	: X04551MS;1;5	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 8
Acquired on	: 26 Mar 95 09:43 PM	Instrument Method	: BX20326
Report Created on	: 17 Apr 95 02:10 PM	Analysis Method	: BX20326
Last Recalib on	: 14 APR 95 00:39 AM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:



Data File Name : C:\HPCHEM\2\DATA\BX20326\015R0801.D
Operator : T.L. Lockwood
Instrument : BTEX2
Sample Name : X04551MSD;1;5
Run Time Bar Code:
Acquired on : 26 Mar 95 10:27 PM
Report Created on: 17 Apr 95 02:10 PM
Last Recalib on : 14 APR 95 00:39 AM
Multiplier : 1

Page Number : 1
Vial Number : 15
Injection Number : 1
Sequence Line : 8
Instrument Method: BX20326.MTH
Analysis Method : BX20326A.MTH
Sample Amount : 0
ISTD Amount :

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(303) 425-6021

BTEX Matrix Spike/Matrix Spike Duplicate Data Report

Client Sample No.	: Matrix Spike 3/20	Client Project No.	: 722450.21020 MacDill AFB
Lab Sample No.	: X04571	Lab Project No.	: 95-0915
Date Sampled	: 3/20/95	EPA Method No.	: 8020
Date Received	: 3/22/95	Matrix	: SOIL
Date Prepared	: 3/29/95	Lab File Number(s)	: BX2032926,27
Date Analyzed	: 3/30/95	Method Blank	: MB032995

Compound	Spike Added (ug/L)	Sample Concentration (ug/L)	MS Concentration (ug/L)	MS %REC	QC Limits %REC
Benzene	40.0	0.0	35.3	88	50-150
Toluene	40.0	0.0	32.6	82	50-148
Ethyl Benzene	40.0	0.0	28.4	71	50-150
m,p-Xylene	80.0	0.0	54.3 B	68	50-150
o-Xylene	40.0	0.0	30.6	77	50-150
Chlorobenzene	40.0	0.0	32.8	82	55-135
1,3,5-TMB	40.0	0.0	24.4	61	50-150
1,2,4-TMB	40.0	0.0	26.9	67	50-150
1,2,3-TMB	40.0	0.0	27.1	68	50-150
1,2,3,4-TeMB	40.0	0.0	22.0	55	50-15

Compound	Spike Added (ug/L)	MSD Concentration (ug/L)	MSD %REC	RPD	QC Limits RPD	QC Limits %REC
Benzene	40.0	32.5	81	8.3	25	50-150
Toluene	40.0	31.7	79	2.8	25	50-148
Ethyl Benzene	40.0	28.0	70	1.4	25	50-150
m,p-Xylene	80.0	53.4 B	67	1.7	25	50-150
o-Xylene	40.0	30.3	76	1.0	25	50-150
Chlorobenzene	40.0	32.2	81	1.8	25	55-135
1,3,5-TMB	40.0	24.1	60	1.2	25	50-150
1,2,4-TMB	40.0	26.7	67	0.7	25	50-150
1,2,3-TMB	40.0	27.2	68	0.4	25	50-150
1,2,3,4-TeMB	40.0	21.5	54	2.3	25	50-150

* = Values outside of QC limits.

RPD: 0 out of (10) outside limits.

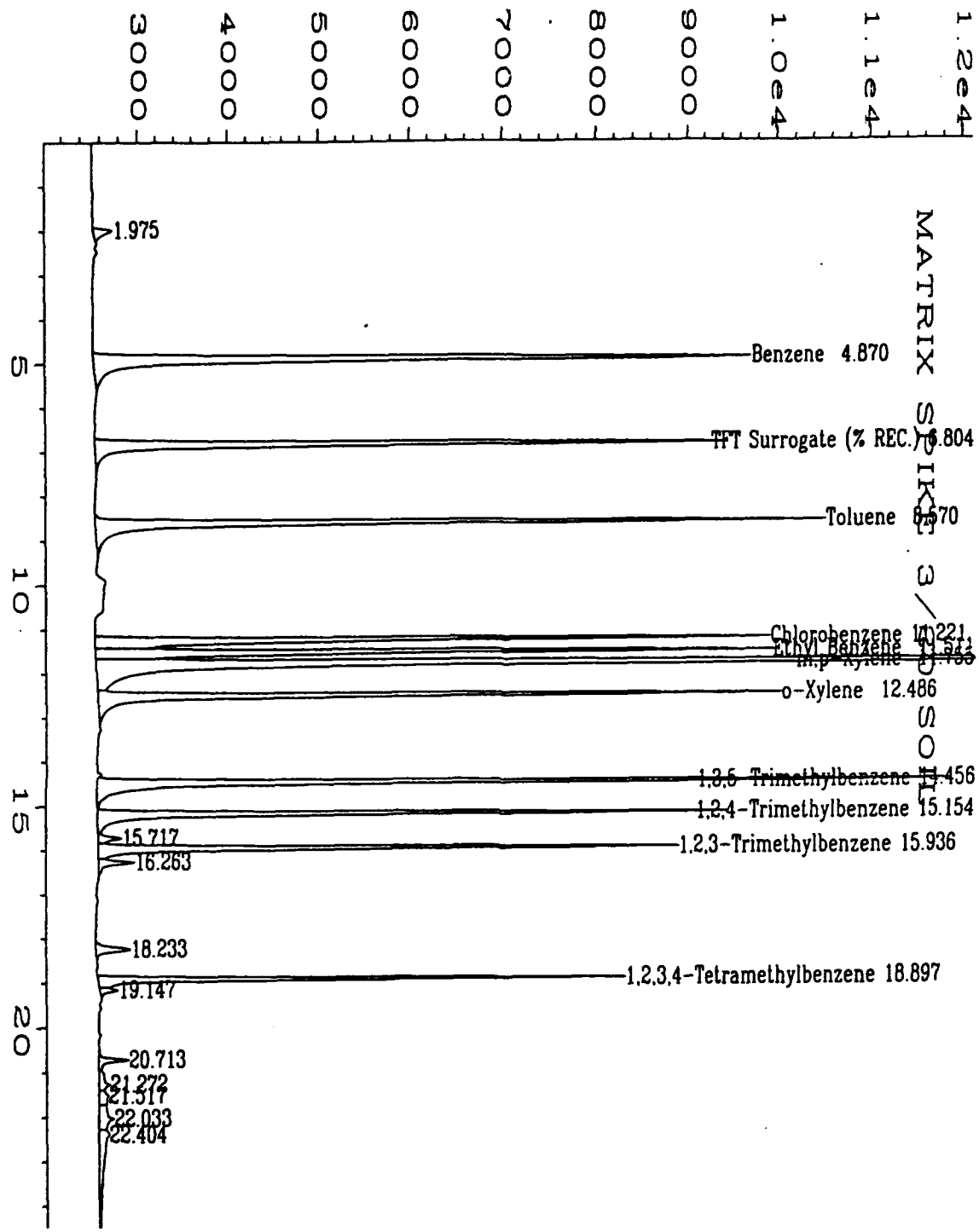
Spike Recovery: 0 out of (20) outside limits.

Comments:

K. Cone
Analyst

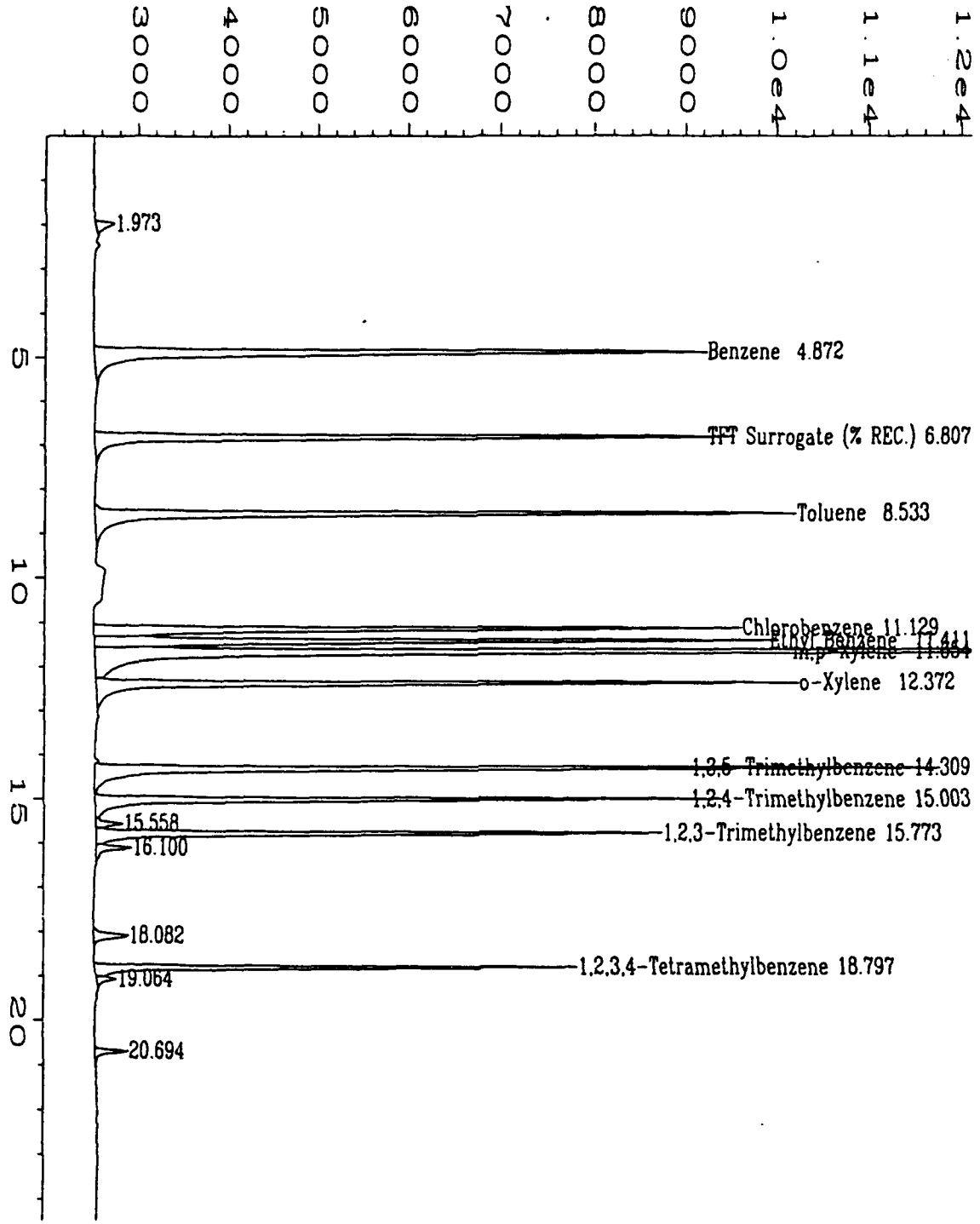
Approved

MS0915E.XLS



Data File Name : C:\HPCHEM\2\DATA\BX20329\026R0101.D
Operator : C.J. Cook
Instrument : BTEX2
Sample Name : X04571MS;5;1
Run Time Bar Code:
Acquired on : 30 Mar 95 06:53 AM
Report Created on: 18 Apr 95 00:15 AM
Last Recalib on : 14 APR 95 00:39 AM
Multiplier : 1

Page Number : 1
Vial Number : 26
Injection Number : 1
Sequence Line : 1
Instrument Method: BX20329.MTH
Analysis Method : BX20329B.MTH
Sample Amount : 0
ISTD Amount :



Data File Name	: C:\HPCHEM\2\DATA\BX20329\027R0101.D		
Operator	: C.J. Cook	Page Number	: 1
Instrument	: BTEX2	Vial Number	: 27
Sample Name	: X04571MSD;5;1	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 1
Acquired on	: 30 Mar 95 07:41 AM	Instrument Method	: BX20329
Report Created on	: 18 Apr 95 00:18 AM	Analysis Method	: BX20329.
Last Recalib on	: 14 APR 95 00:39 AM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:

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BTEX Data Report

Client Sample Number	: Trip Blank	Client Project No.	: 722450.21020 MacDill AFB
Lab Sample Number	: X04573	Lab Project No.	: 95-0915
Date Sampled	: NA	Dilution Factor	: 1.00
Date Received	: 3/22/95	Method	: 602
Date Extracted/Prepared	: 3/29/95	Matrix	: Water
Date Analyzed	: 3/30/95	Lab File No.	: BX2032922
Methanol Extract?	: No	Method Blank No.	: MB032995
% Moisture	: NA		

Compound Name	Cas Number	Sample Concentration ug/L	PQL ug/L
Benzene	71-43-2	U	4.0
Toluene	108-88-3	U	4.0
Ethyl Benzene	100-41-4	U	4.0
Total Xylenes	1330-20-7	U	4.0
Chlorobenzene	108-90-7	U	4.0
1,3,5-trimethylbenzene	108-67-8	U	4.0
1,2,4-trimethylbenzene	95-63-6	U	4.0
1,2,3-trimethylbenzene	526-73-8	U	4.0
1,2,3,4-tetramethylbenzene	488-23-3	U	4.0

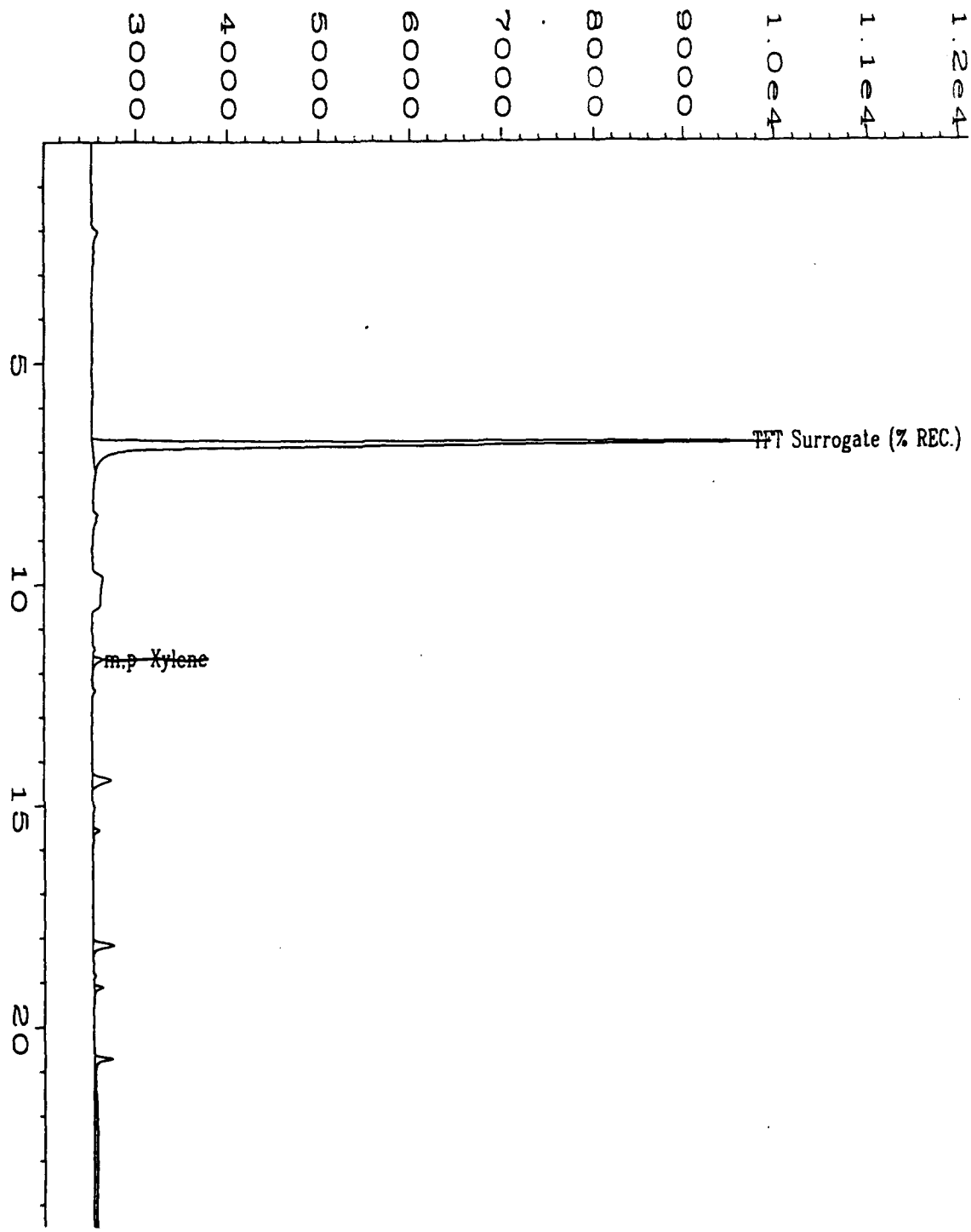
Surrogate Recovery (α,α,α-Trifluorotoluene):	82%	70%-130% (QC limits)

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene PQL is for a single peak.

QUALIFIERS:
E = Extrapolated value
U = Compound analyzed for, but not detected.
B = Compound found in blank and sample. Compare blank and sample data.
J = Indicates an estimated value when the compound is detected, but is below the Practical Quantitation Limit (PQL).
PQL = Practical Quantitation Limit. The PQL is equal to the dilution factor multiplied by ten times the Method Detection Limit as determined by EPA SW846, Vol. 1B, Part II, pa. 8000-14.
NA = Not available/Not Applicable.

K. Cline
Analyst

Approved



Data File Name : C:\HPCHEM\2\DATA\BX20329\022R0101.D
Operator : C.J. Cook
Instrument : BTEX2
Sample Name : X04573;1;5
Run Time Bar Code:
Acquired on : 30 Mar 95 03:43 AM
Report Created on: 17 Apr 95 09:48 PM
Last Recalib on : 14 APR 95 00:39 AM
Multiplier : 1
Sample Info : Project#: 95-0915 Client#: Trip Blank Water

Page Number : 1
Vial Number : 22
Injection Number : 1
Sequence Line : 1
Instrument Method: BX20329
Analysis Method : BX20329L
Sample Amount : 0
ISTD Amount :

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BTEX Data Report

		Client Project No.	: 722450.21020 MacDill AFB
Client Sample Number	: Matrix Spike 3/20		
Lab Sample Number	: X04571	Lab Project No.	: 95-0915
Date Sampled	: 3/20/95	Dilution Factor	: 5.00
Date Received	: 3/22/95	Method	: 8020
Date Extracted/Prepared	: 3/30/95	Matrix	: Soil
Date Analyzed	: 3/31/95	Lab File No.	: BX2033019
Methanol Extract?	: No	Method Blank No.	: MB033095
% Moisture	: 23.58%		

Compound Name	Cas Number	Sample Concentration* ug/kg	PQL* ug/kg
Benzene	71-43-2	U	26
Toluene	108-88-3	U	26
Ethyl Benzene	100-41-4	U	26
Total Xylenes	1330-20-7	U	26
Chlorobenzene	108-90-7	U	26
1,3,5-trimethylbenzene	108-67-8	U	26
1,2,4-trimethylbenzene	95-63-6	U	26
1,2,3-trimethylbenzene	526-73-8	U	26
1,2,3,4-tetramethylbenzene	488-23-3	U	26

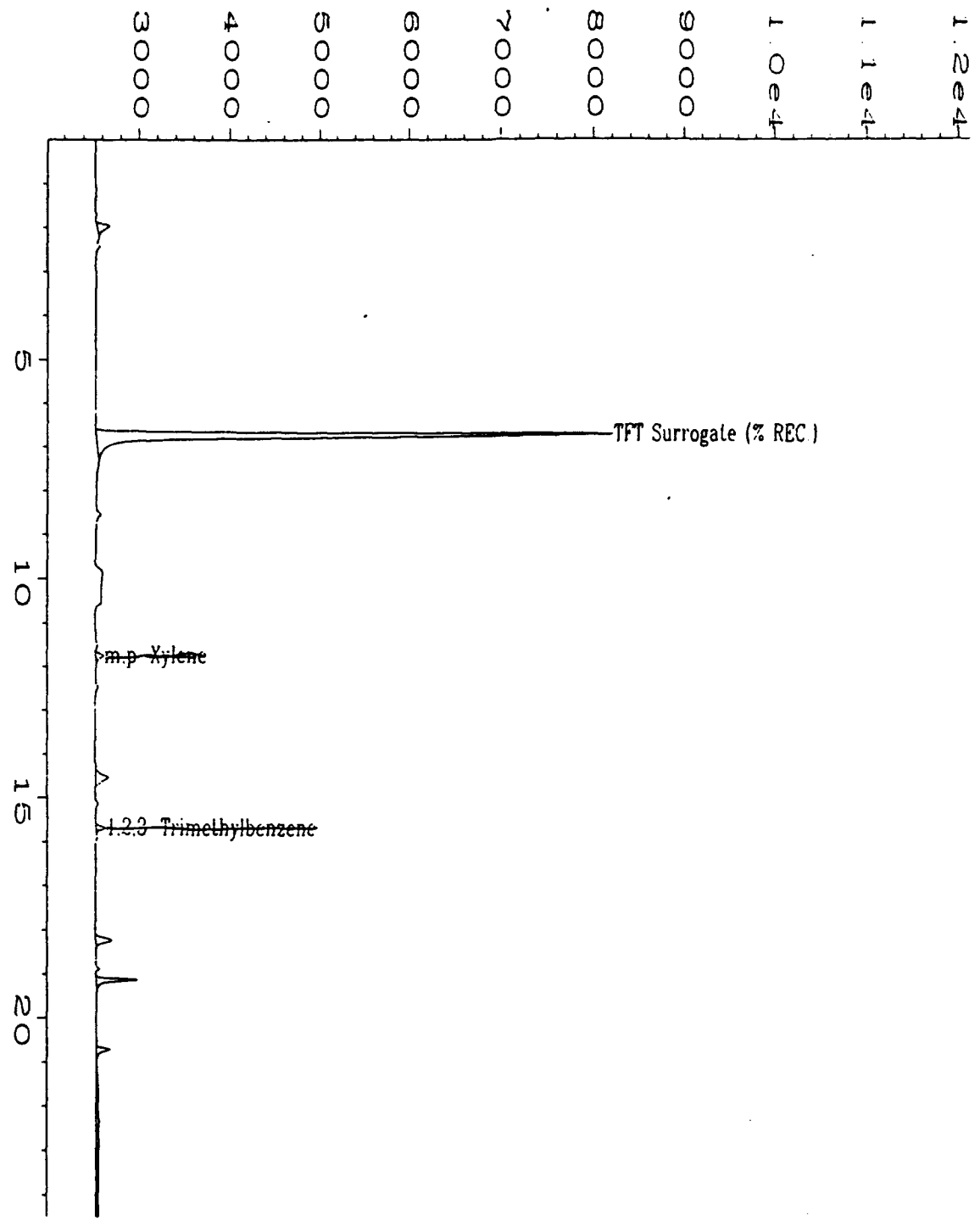
Surrogate Recovery (α,α,α-Trifluorotoluene):	82%	64%-130% (QC limits)

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene PQL is for a single peak.
* = Dry Weight Basis.

QUALIFIERS:
E = Extrapolated value
U = Compound analyzed for, but not detected.
B = Compound found in blank and sample. Compare blank and sample data.
J = Indicates an estimated value when the compound is detected, but is below the Practical Quantitation Limit (PQL).
PQL = Practical Quantitation Limit. The PQL is equal to the dilution factor multiplied by ten times the Method Detection Limit as determined by EPA SW846, Vol. 1B, Part II, pa. 8000-14.
NA = Not available.

Analyst

Approved



Data File Name : C:\HPCHEM\2\DATA\BX20330\019R0101.D

Operator	: C.J. Cook	Page Number	: 1
Instrument	: BTEX2	Vial Number	: 19
Sample Name	: X04571;5;1	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 1
Acquired on	: 31 Mar 95 00:39 AM	Instrument Method	: BX2033(
Report Created on	: 31 Mar 95 08:47 AM	Analysis Method	: BX2033(
Last Recalib on	: 31 MAR 95 08:24 AM	Sample Amount	: 0
Multiplier	: 5	ISTD Amount	:

Sample Info : Project#: 95-0915 Client#: Matrix Spike 3/20 Soil

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BTEX Data Report

		Client Project No.	: 722450.21020 MacDill AFB
Client Sample Number	: Matrix Spike 3/20		
Lab Sample Number	: X04571DUP	Lab Project No.	: 95-0915
Date Sampled	: 3/20/95	Dilution Factor	: 5.00
Date Received	: 3/22/95	Method	: 8020
Date Extracted/Prepared	: 3/30/95	Matrix	: Soil
Date Analyzed	: 3/31/95,	Lab File No.	: BX2033020
Methanol Extract?	: No	Method Blank No.	: MB033095
% Moisture	: 23.58%		

Compound Name	Cas Number	Sample Concentration* ug/kg	PQL* ug/kg
Benzene	71-43-2	U	26
Toluene	108-88-3	U	26
Ethyl Benzene	100-41-4	U	26
Total Xylenes	1330-20-7	U	26
Chlorobenzene	108-90-7	U	26
1,3,5-trimethylbenzene	108-67-8	U	26
1,2,4-trimethylbenzene	95-63-6	U	26
1,2,3-trimethylbenzene	526-73-8	U	26
1,2,3,4-tetramethylbenzene	488-23-3	U	26

Surrogate Recovery (α,α,α-Trifluorotoluene):	80%	64%-130% (QC limits)

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene PQL is for a single peak.
* = Dry Weight Basis.

QUALIFIERS:
E = Extrapolated value
U = Compound analyzed for, but not detected.
B = Compound found in blank and sample. Compare blank and sample data.
J = Indicates an estimated value when the compound is detected, but is below the Practical Quantitation Limit (PQL).
PQL = Practical Quantitation Limit. The PQL is equal to the dilution factor multiplied by ten times the Method Detection Limit as determined by EPA SW846, Vol. 1B, Part II, pa. 8000-14.
NA = Not available.

Analyst

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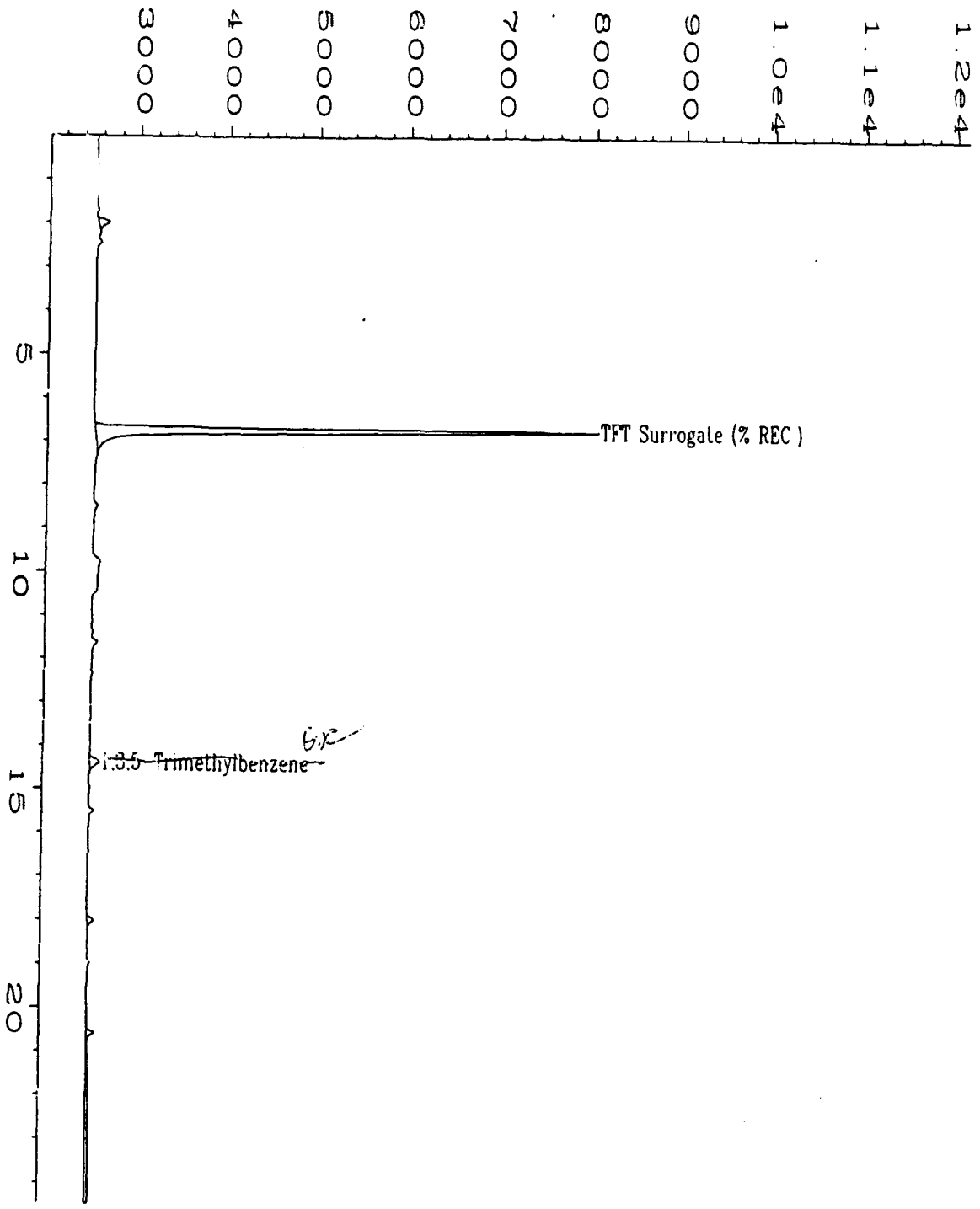

Data File Name	: C:\HPCHEM\2\DATA\BX20330\020R0101.D		
Operator	: C.J. Cook	Page Number	: 1
Instrument	: BTEX2	Vial Number	: 20
Sample Name	: X04571DUP;5;1	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 1
Acquired on	: 31 Mar 95 01:23 AM	Instrument Method	: BX20330
Report Created on	: 31 Mar 95 08:47 AM	Analysis Method	: BX20330
Last Recalib on	: 31 MAR 95 08:24 AM	Sample Amount	: 0
Multiplier	: 5	ISTD Amount	:
Sample Info	: Project#: 95-0915 Client#: Matrix Spike 3/20 Soil		

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BTEX Data Report

Client Sample Number	: Matrix Spike 3/17	Client Project No.	: 722450.21020 MacDill AFB
Lab Sample Number	: X04565	Lab Project No.	: 95-0915
Date Sampled	: 3/17/95	Dilution Factor	: 1.00
Date Received	: 3/22/95	Method	: 8020
Date Extracted/Prepared	: 3/28/95	Matrix	: Soil
Date Analyzed	: 3/28/95,	Lab File No.	: BX2032816
Methanol Extract?	: No	Method Blank No.	: MEB032895
% Moisture	: 17.63%		

Compound Name	Cas Number	Sample Concentration* ug/kg	PQL* ug/kg
Benzene	71-43-2	U	4.9
Toluene	108-88-3	U	4.9
Ethyl Benzene	100-41-4	U	4.9
Total Xylenes	1330-20-7	U	4.9
Chlorobenzene	108-90-7	U	4.9
1,3,5-trimethylbenzene	108-67-8	U	4.9
1,2,4-trimethylbenzene	95-63-6	U	4.9
1,2,3-trimethylbenzene	526-73-8	U	4.9
1,2,3,4-tetramethylbenzene	488-23-3	U	4.9

Surrogate Recovery (α,α,α-Trifluorotoluene):	103%	64%-130% (QC limits)

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene PQL is for a single peak.
* = Dry Weight Basis.

QUALIFIERS:
E = Extrapolated value
U = Compound analyzed for, but not detected.
B = Compound found in blank and sample. Compare blank and sample data.
J = Indicates an estimated value when the compound is detected, but is below the Practical Quantitation Limit (PQL).
PQL = Practical Quantitation Limit. The PQL is equal to the dilution factor multiplied by ten times the Method Detection Limit as determined by EPA SW846, Vol. 1B, Part II, pa. 8000-14.
NA = Not available.

Analyst

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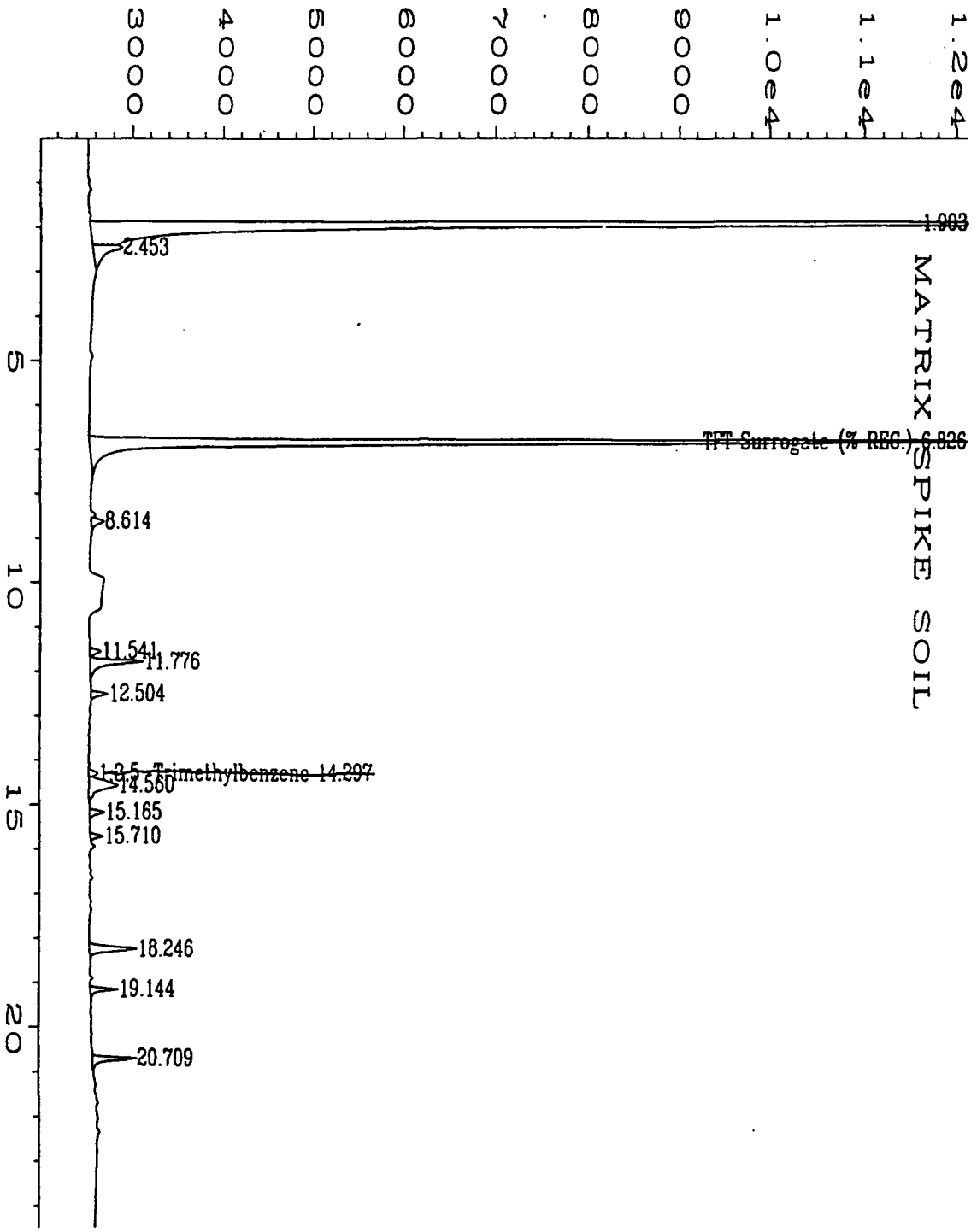

Data File Name : C:\HPCHEM\2\DATA\BX20328\016R0801.D
Operator : C.J. Cook
Instrument : BTEX2
Sample Name : X04565;1;5
Run Time Bar Code:
Acquired on : 28 Mar 95 09:58 PM
Report Created on: 18 Apr 95 01:10 AM
Last Recalib on : 14 APR 95 00:39 AM
Multiplier : 1

Page Number : 1
Vial Number : 16
Injection Number : 1
Sequence Line : 8
Instrument Method: BX20328
Analysis Method : BX20328...
Sample Amount : 0
ISTD Amount :

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BTEX Data Report

		Client Project No.	: 722450.21020 MacDill AFB
Client Sample Number	: Matrix Spike 3/17		
Lab Sample Number	: X04565DUP	Lab Project No.	: 95-0915
Date Sampled	: 3/17/95	Dilution Factor	: 1.00
Date Received	: 3/22/95	Method	: 8020
Date Extracted/Prepared	: 3/28/95	Matrix	: Soil
Date Analyzed	: 3/28/95,	Lab File No.	: BX2032817
Methanol Extract?	: No	Method Blank No.	: MEB032895
% Moisture	: 17.63%		

Compound Name	Cas Number	Sample Concentration* ug/kg		PQL* ug/kg
Benzene	71-43-2		U	4.9
Toluene	108-88-3		U	4.9
Ethyl Benzene	100-41-4		U	4.9
Total Xylenes	1330-20-7	2.0	JB	4.9
Chlorobenzene	108-90-7		U	4.9
1,3,5-trimethylbenzene	108-67-8		U	4.9
1,2,4-trimethylbenzene	95-63-6		U	4.9
1,2,3-trimethylbenzene	526-73-8		U	4.9
1,2,3,4-tetramethylbenzene	488-23-3		U	4.9

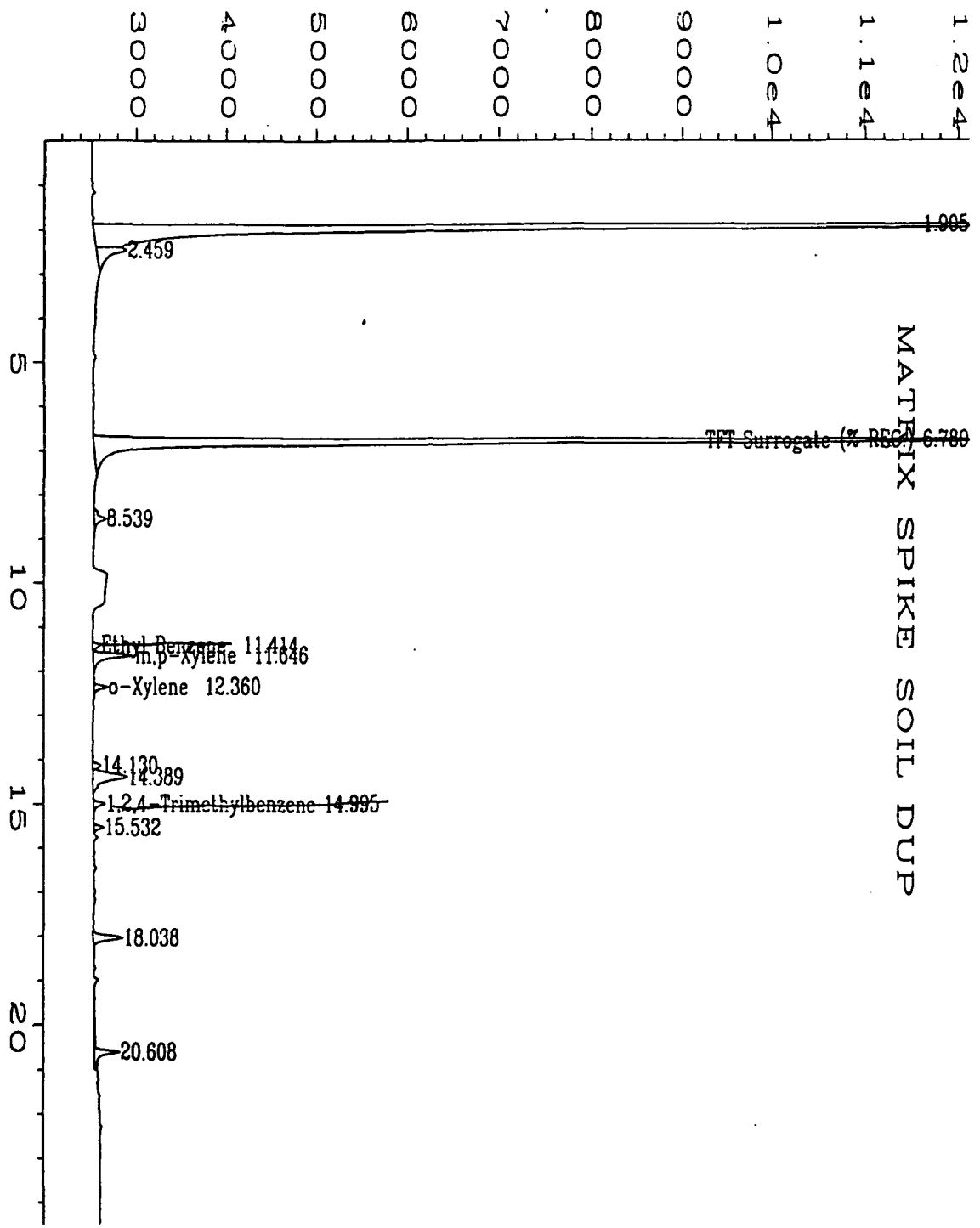
Surrogate Recovery (α,α,α-Trifluorotoluene):	111%	64%-130% (QC limits)

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene PQL is for a single peak.
* = Dry Weight Basis.

QUALIFIERS:
E = Extrapolated value
U = Compound analyzed for, but not detected.
B = Compound found in blank and sample. Compare blank and sample data.
J = Indicates an estimated value when the compound is detected, but is below the Practical Quantitation Limit (PQL).
PQL = Practical Quantitation Limit. The PQL is equal to the dilution factor multiplied by ten times the Method Detection Limit as determined by EPA SW846, Vol. 1B, Part II, pa. 8000-14.
NA = Not available.

Analyst

Approved



Data File Name	: C:\HPCHEM\2\DATA\BX20328\017R0801.D		
Operator	: C.J. Cook	Page Number	: 1
Instrument	: BTEX2	Vial Number	: 17
Sample Name	: X04565DUP;1;5	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 8
Acquired on	: 28 Mar 95 10:46 PM	Instrument Method	: BX20328
Report Created on	: 18 Apr 95 01:11 AM	Analysis Method	: BX20328[illegible]
Last Recalib on	: 14 APR 95 00:39 AM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:

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BTEX Data Report

		Client Project No.	: 722450.21020 MacDill AFB
Client Sample Number	: Rinsate Blank		
Lab Sample Number	: X04559	Lab Project No.	: 95-0915
Date Sampled	: 3/17/95	Dilution Factor	: 1.00
Date Received	: 3/22/95	Method	: 602
Date Extracted/Prepared	: 3/30/95	Matrix	: Water
Date Analyzed	: 3/30/95	Lab File No.	: BX2033015
Methanol Extract?	: No	Method Blank No.	: MB033095
% Moisture	: NA		

Compound Name	Cas Number	Sample Concentration ug/L	PQL ug/L
Benzene	71-43-2	U	4.0
Toluene	108-88-3	U	4.0
Ethyl Benzene	100-41-4	U	4.0
Total Xylenes	1330-20-7	U	4.0
Chlorobenzene	108-90-7	U	4.0
1,3,5-trimethylbenzene	108-67-8	U	4.0
1,2,4-trimethylbenzene	95-63-6	U	4.0
1,2,3-trimethylbenzene	526-73-8	U	4.0
1,2,3,4-tetramethylbenzene	488-23-3	U	4.0

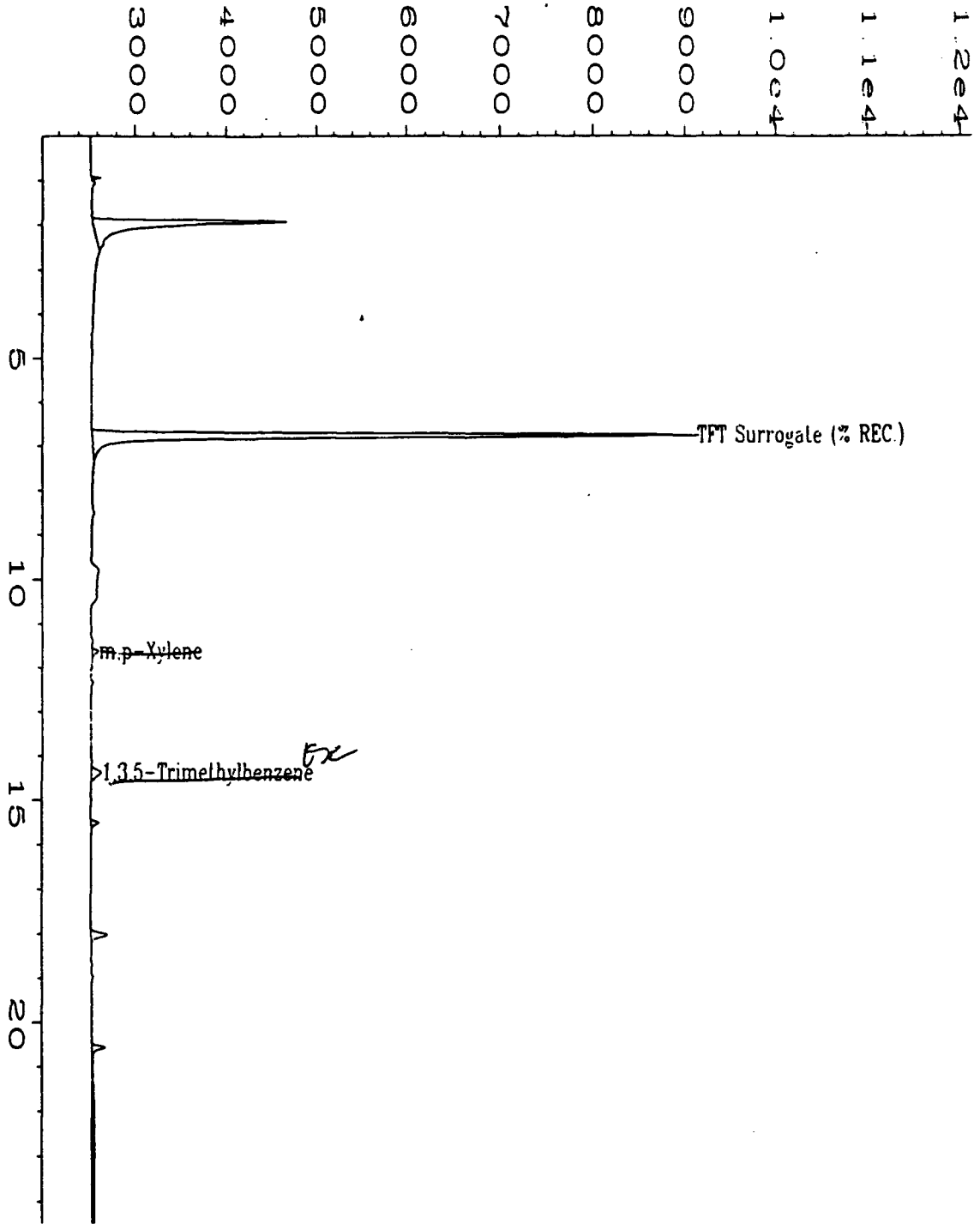
Surrogate Recovery (α,α,α-Trifluorotoluene):	93%	70%-130% (QC limits)

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene PQL is for a single peak.

QUALIFIERS:
E = Extrapolated value
U = Compound analyzed for, but not detected.
B = Compound found in blank and sample. Compare blank and sample data.
J = Indicates an estimated value when the compound is detected, but is below the Practical Quantitation Limit (PQL).
PQL = Practical Quantitation Limit. The PQL is equal to the dilution factor multiplied by ten times the Method Detection Limit as determined by EPA SW846, Vol. 1B, Part II, pa. 8000-14.
NA = Not available/Not Applicable.

Analyst

Approved



Data File Name : C:\HPCHEM\2\DATA\BX20330\015R0101.D
Operator : C.J. Cook
Instrument : BTEX2
Sample Name : X04559;1;5
Run Time Bar Code:
Acquired on : 30 Mar 95 09:41 PM
Report Created on: 31 Mar 95 08:45 AM
Last Recalib on : 31 MAR 95 08:24 AM
Multiplier : 1
Sample Info : Project#: 95-0915 Client#: Rinsate Blank Water

Page Number : 1
Vial Number : 15
Injection Number : 1
Sequence Line : 1
Instrument Method: BX20330
Analysis Method : BX20330...
Sample Amount : 0
ISTD Amount :

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(303) 425-6021

BTEX Data Report

		Client Project No.	: 722450.21020 MacDill AFB
Client Sample Number	: Trip Blank		
Lab Sample Number	: X04556	Lab Project No.	: 95-0915
Date Sampled	: 3/17/95	Dilution Factor	: 1.00
Date Received	: 3/22/95	Method	: 602
Date Extracted/Prepared	: 3/27/95	Matrix	: Water
Date Analyzed	: 3/27/95,	Lab File No.	: BX2032713
Methanol Extract?	: No	Method Blank No.	: MB032795
% Moisture	NA		

Compound Name	Cas Number	Sample Concentration ug/L	PQL ug/L
Benzene	71-43-2	U	4.0
Toluene	108-88-3	U	4.0
Ethyl Benzene	100-41-4	U	4.0
Total Xylenes	1330-20-7	U	4.0
Chlorobenzene	108-90-7	U	4.0
1,3,5-trimethylbenzene	108-67-8	U	4.0
1,2,4-trimethylbenzene	95-63-6	U	4.0
1,2,3-trimethylbenzene	526-73-8	U	4.0
1,2,3,4-tetramethylbenzene	488-23-3	U	4.0

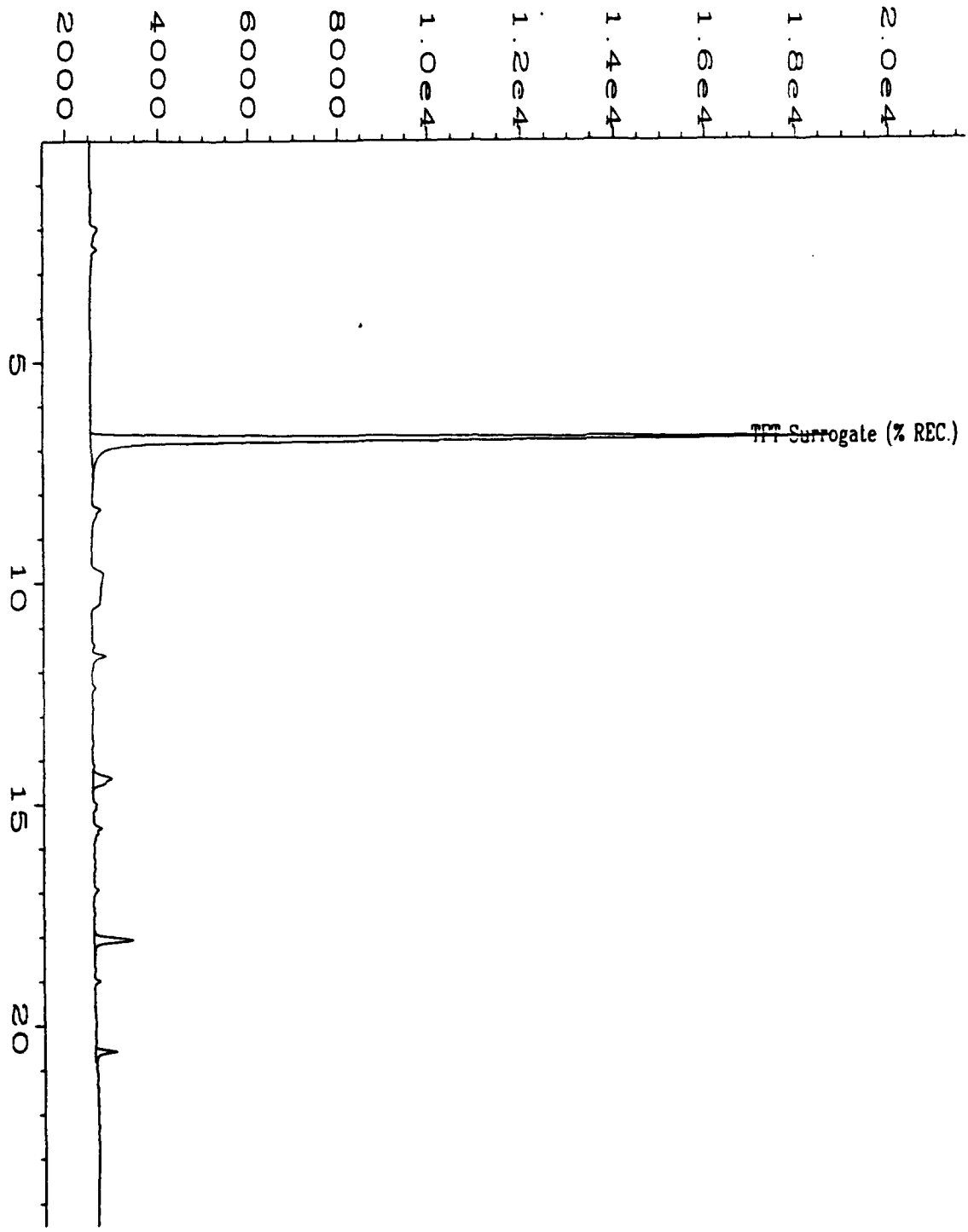
Surrogate Recovery (α,α,α-Trifluorotoluene):	95%	70%-130% (QC limits)

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene PQL is for a single peak.

QUALIFIERS:
E = Extrapolated value
U = Compound analyzed for, but not detected.
B = Compound found in blank and sample. Compare blank and sample data.
J = Indicates an estimated value when the compound is detected, but is below the Practical Quantitation Limit (PQL).
PQL = Practical Quantitation Limit. The PQL is equal to the dilution factor multiplied by ten times the Method Detection Limit as determined by EPA SW846, Vol. 1B, Part II, pa. 8000-14.
NA = Not available.

K. Cone
Analyst

P McClellan
Approved



Data File Name	: C:\HPCHEM\2\DATA\BX20327\013R0601.D		
Operator	: C.J. Cook	Page Number	: 1
Instrument	: BTEX2	Vial Number	: 13
Sample Name	: X04556;1;5	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 6
Acquired on	: 27 Mar 95 07:33 PM	Instrument Method	: BX20327
Report Created on	: 17 Apr 95 12:35 PM	Analysis Method	: BX20327A
Last Recalib on	: 14 APR 95 00:39 AM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:
Sample Info	: Project#: 95-0915 Client#: Trip Blank Water		

EVERGREEN ANALYTICAL, INC.
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BTEX Data Report
Method Blank Report

		Client Project No.	: 722450.21020 MacDill AFB
Method Blank Number	: MB032595		
Date Extracted/Prepared	: 3/25/95	Lab Project No.	: 95-0915
Date Analyzed	: 3/25/95	Dilution Factor	: 1.00
		Method	: 602
		Matrix	: Water
		Lab File No.	: BX2032509

Compound Name	Cas Number	Sample Concentration ug/L	PQL ug/L
Benzene	71-43-2	U	4.0
Toluene	108-88-3	U	4.0
Ethyl Benzene	100-41-4	U	4.0
Total Xylenes	1330-20-7	U	4.0
Chlorobenzene	108-90-7	U	4.0
1,3,5-trimethylbenzene	108-67-8	U	4.0
1,2,4-trimethylbenzene	95-63-6	U	4.0
1,2,3-trimethylbenzene	526-73-8	U	4.0
1,2,3,4-tetramethylbenzene	488-23-3	U	4.0

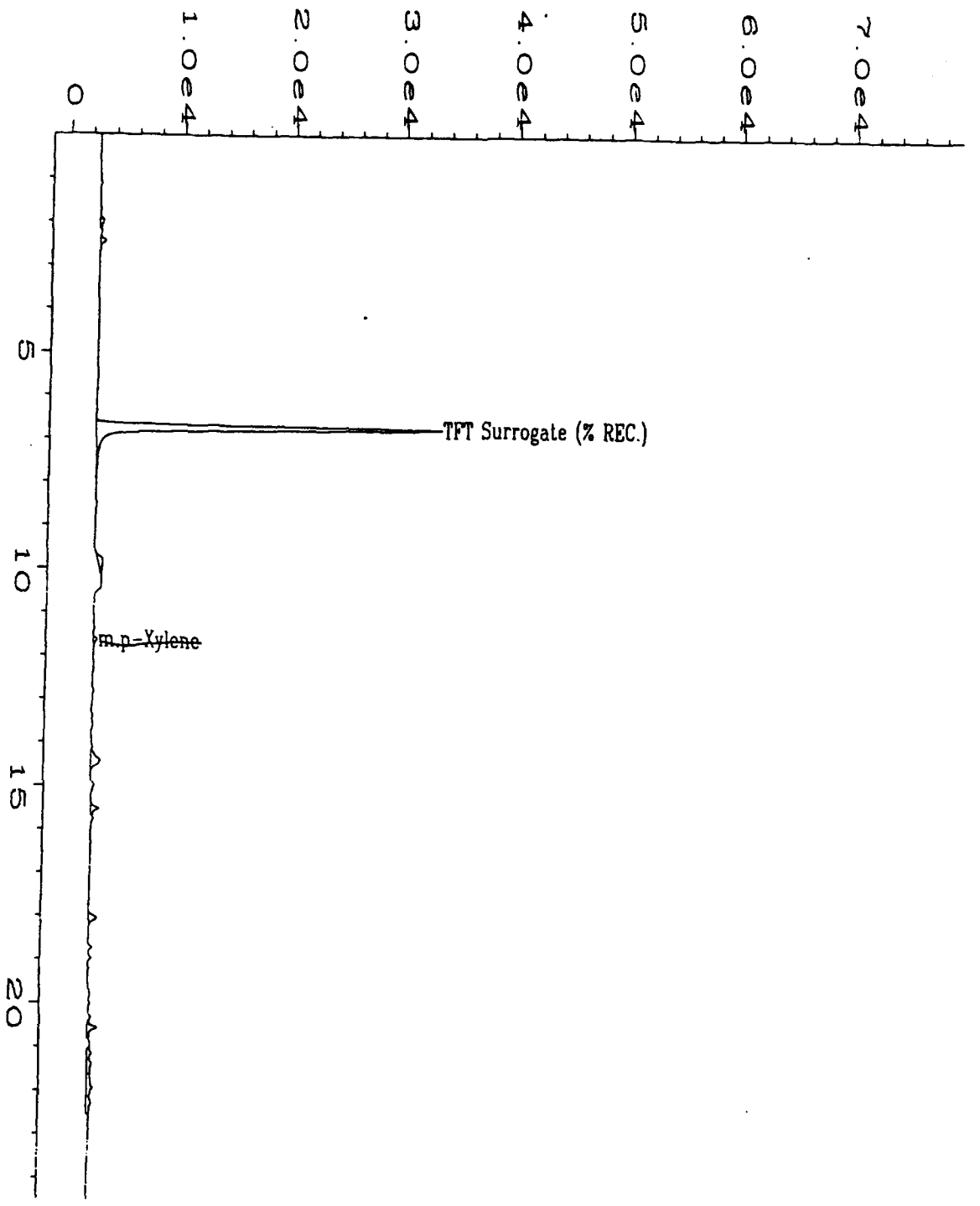
Surrogate Recovery (α,α,α-Trifluorotoluene):	102%	70%-130% (QC limits)

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene PQL is for a single peak.

QUALIFIERS:
E = Extrapolated value
U = Compound analyzed for, but not detected.
B = Compound found in blank and sample. Compare blank and sample data.
J = Indicates an estimated value when the compound is detected, but is below the Practical Quantitation Limit (PQL).
PQL = Practical Quantitation Limit. The PQL is equal to the dilution factor multiplied by ten times the Method Detection Limit as determined by EPA SW846, Vol. 1B, Part II, pa. 8000-14.
NA = Not available.

Analyst

Approved



Data File Name : C:\HPCHEM\2\DATA\BX20325\009R0801.D
Operator : T.L. Lockwood
Instrument : BTEX2 5
Sample Name : MB032495-WATER
Run Time Bar Code: T.Y
Acquired on : 25 Mar 95 07:23 PM
Report Created on: 17 Apr 95 01:01 PM
Last Recalib on : 14 APR 95 00:39 AM
Multiplier : 1

Page Number : 1
Vial Number : 9
Injection Number : 1
Sequence Line : 8
Instrument Method: BX20325.
Analysis Method : BX20325A.
Sample Amount : 0
ISTD Amount :

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(303) 425-6021

BTEX Data Report
Method Blank Report

		Client Project No.	: 722450.21020 MacDill AFB
Method Blank Number	: MB032695B		
Date Extracted/Prepared	: 3/26/95	Lab Project No.	: 95-0915
Date Analyzed	: 3/26/95	Dilution Factor	: 1.00
		Method	: 602
		Matrix	: Water
		Lab File No.	: BX2032610

Compound Name	Cas Number	Sample Concentration ug/L		PQL ug/L
Benzene	71-43-2		U	4.0
Toluene	108-88-3		U	4.0
Ethyl Benzene	100-41-4		U	4.0
Total Xylenes	1330-20-7	0.4	J	4.0
Chlorobenzene	108-90-7		U	4.0
1,3,5-trimethylbenzene	108-67-8		U	4.0
1,2,4-trimethylbenzene	95-63-6		U	4.0
1,2,3-trimethylbenzene	526-73-8		U	4.0
1,2,3,4-tetramethylbenzene	488-23-3		U	4.0

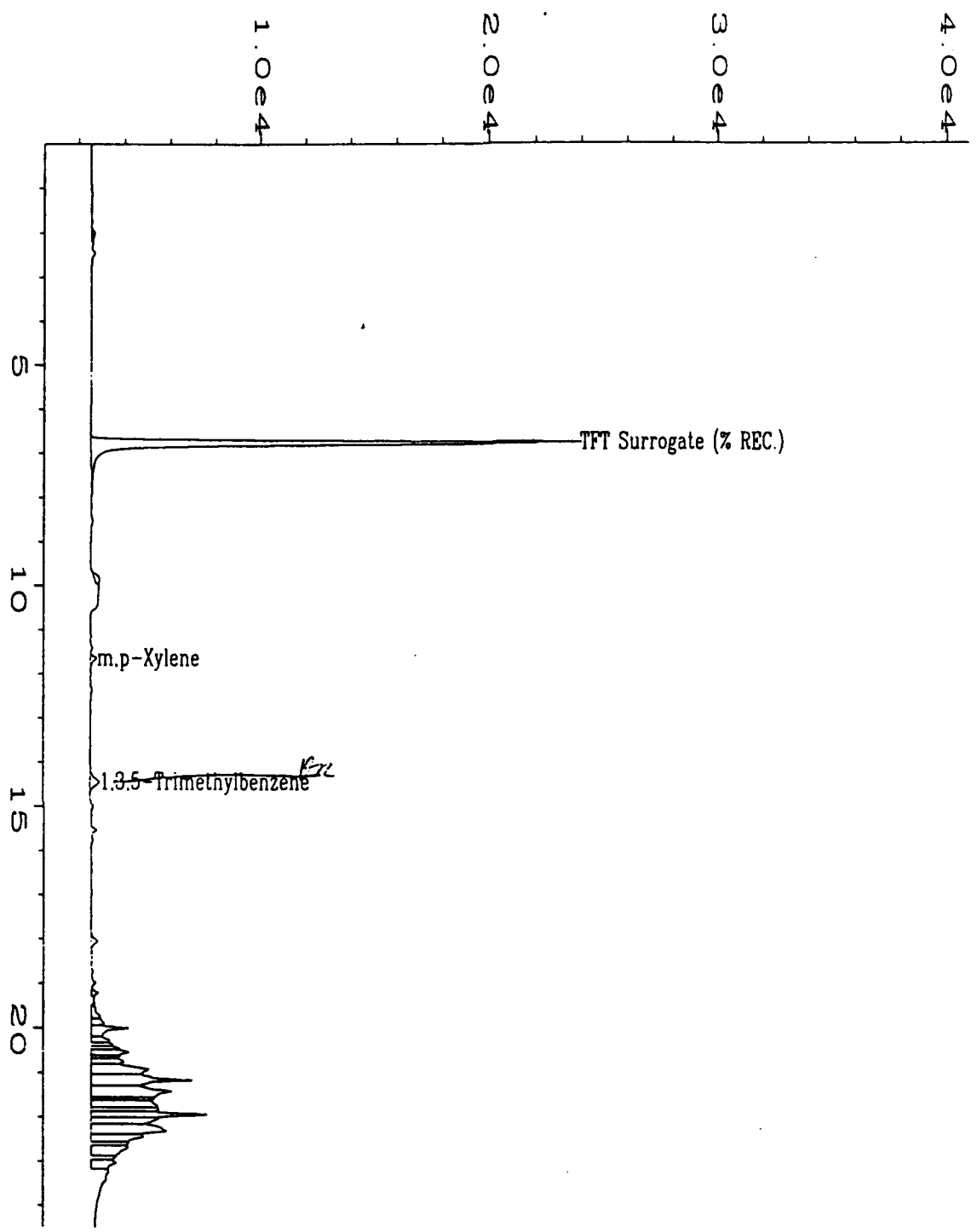
Surrogate Recovery (α,α,α-Trifluorotoluene):	111%	70%-130% (QC limits)

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene PQL is for a single peak.

QUALIFIERS:
E = Extrapolated value
U = Compound analyzed for, but not detected.
B = Compound found in blank and sample. Compare blank and sample data.
J = Indicates an estimated value when the compound is detected, but is below the Practical Quantitation Limit (PQL).
PQL = Practical Quantitation Limit. The PQL is equal to the dilution factor multiplied by ten times the Method Detection Limit as determined by EPA SW846, Vol. 1B, Part II, pa. 8000-14.
NA = Not available.

K. Cone
Analyst

P. McClellan
Approved



Data File Name	: C:\HPCHEM\2\DATA\BX20326\010R0801.D		
Operator	: T.L. Lockwood	Page Number	: 1
Instrument	: BTEX2	Vial Number	: 10
Sample Name	: ~~Blank~~ MB032695B	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 8
Acquired on	: 26 Mar 95 06:45 PM	Instrument Method	: BX20326
Report Created on	: 17 Apr 95 02:05 PM	Analysis Method	: BX20326A...
Last Recalib on	: 14 APR 95 00:39 AM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:

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BTEX Data Report
Method Blank Report

		Client Project No.	: 722450.21020
			MacDill AFB
Method Blank Number	: MB032795		
Date Extracted/Prepared	: 3/27/95	Lab Project No.	: 95-0915
Date Analyzed	: 3/27/95	Dilution Factor	: 1.00
		Method	: 602
		Matrix	: Water
		Lab File No.	: BX2032709

Compound Name	Cas Number	Sample Concentration ug/L	PQL ug/L
Benzene	71-43-2	U	4.0
Toluene	108-88-3	U	4.0
Ethyl Benzene	100-41-4	U	4.0
Total Xylenes	1330-20-7	U	4.0
Chlorobenzene	108-90-7	U	4.0
1,3,5-trimethylbenzene	108-67-8	U	4.0
1,2,4-trimethylbenzene	95-63-6	U	4.0
1,2,3-trimethylbenzene	526-73-8	U	4.0
1,2,3,4-tetramethylbenzene	488-23-3	U	4.0

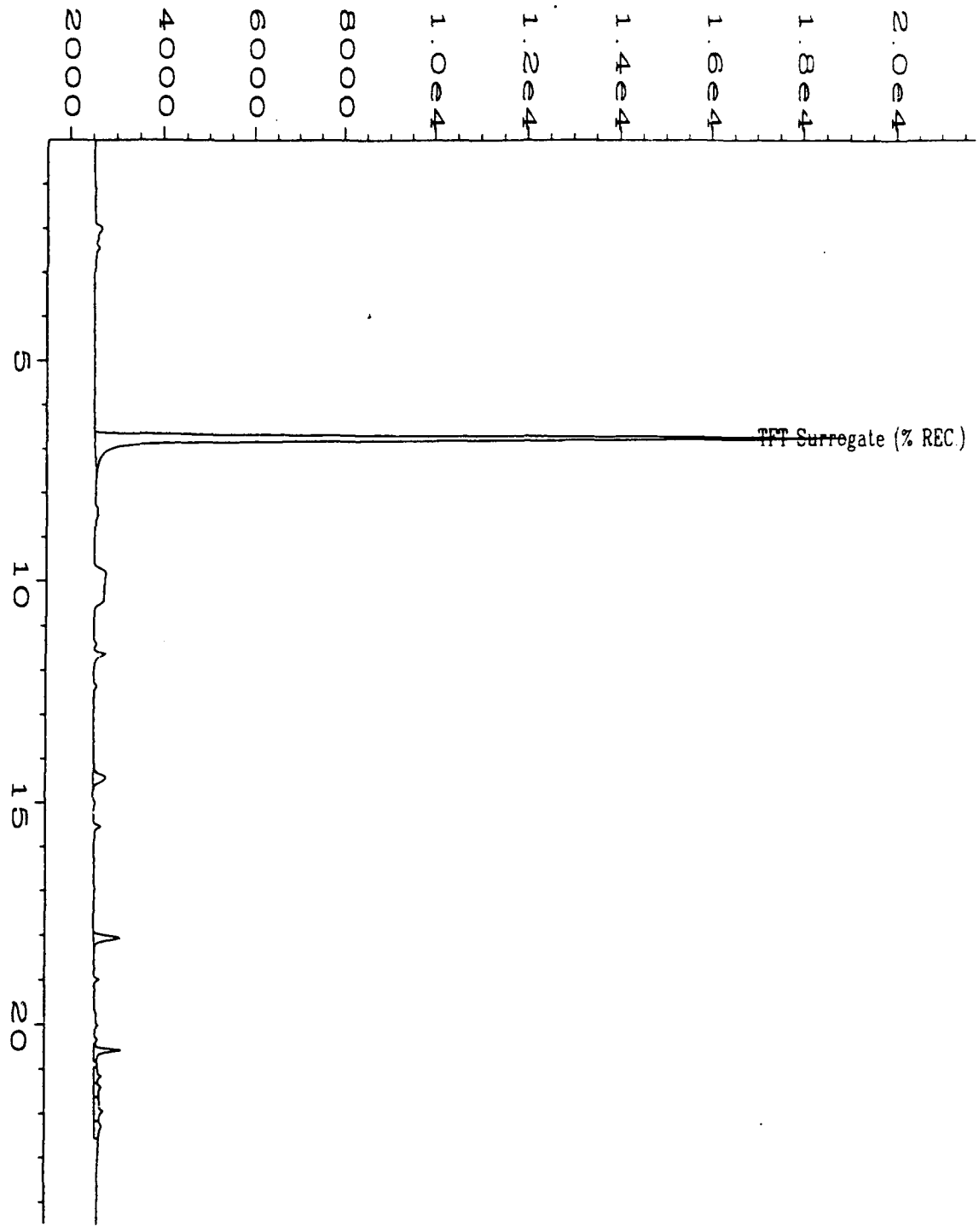
Surrogate Recovery (α,α,α-Trifluorotoluene):	98%	70%-130% (QC limits)

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene PQL is for a single peak.

QUALIFIERS:
E = Extrapolated value
U = Compound analyzed for, but not detected.
B = Compound found in blank and sample. Compare blank and sample data.
J = Indicates an estimated value when the compound is detected, but is below the Practical Quantitation Limit (PQL).
PQL = Practical Quantitation Limit. The PQL is equal to the dilution factor multiplied by ten times the Method Detection Limit as determined by EPA SW846, Vol. 1B, Part II, pa. 8000-14.
NA = Not available.

Analyst

K. Cone
Approved



Data File Name	: C:\HPCHEM\2\DATA\BX20327\009R0601.D		
Operator	: C.J. Cook	Page Number	: 1
Instrument	: BTEX2	Vial Number	: 9
Sample Name	: MB032795-WATER	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 6
Acquired on	: 27 Mar 95 04:37 PM	Instrument Method	: BX20327
Report Created on	: 17 Apr 95 12:34 PM	Analysis Method	: BX20327A
Last Recalib on	: 14 APR 95 00:39 AM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:

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BTEX Data Report
Method Blank Report

		Client Project No.	: 722450.21020
			MacDill AFB
Method Blank Number	: MB032895		
Date Extracted/Prepared	: 3/28/95	Lab Project No.	: 95-0915
Date Analyzed	: 3/28/95	Dilution Factor	: 1.00
		Method	: 602
		Matrix	: Water
		Lab File No.	: BX2032809

Compound Name	Cas Number	Sample Concentration ug/L	PQL ug/L
Benzene	71-43-2	U	4.0
Toluene	108-88-3	U	4.0
Ethyl Benzene	100-41-4	U	4.0
Total Xylenes	1330-20-7	U	4.0
Chlorobenzene	108-90-7	U	4.0
1,3,5-trimethylbenzene	108-67-8	U	4.0
1,2,4-trimethylbenzene	95-63-6	U	4.0
1,2,3-trimethylbenzene	526-73-8	U	4.0
1,2,3,4-tetramethylbenzene	488-23-3	U	4.0

Surrogate Recovery (α,α,α-Trifluorotoluene):	61% *	70%-130% (QC limits)

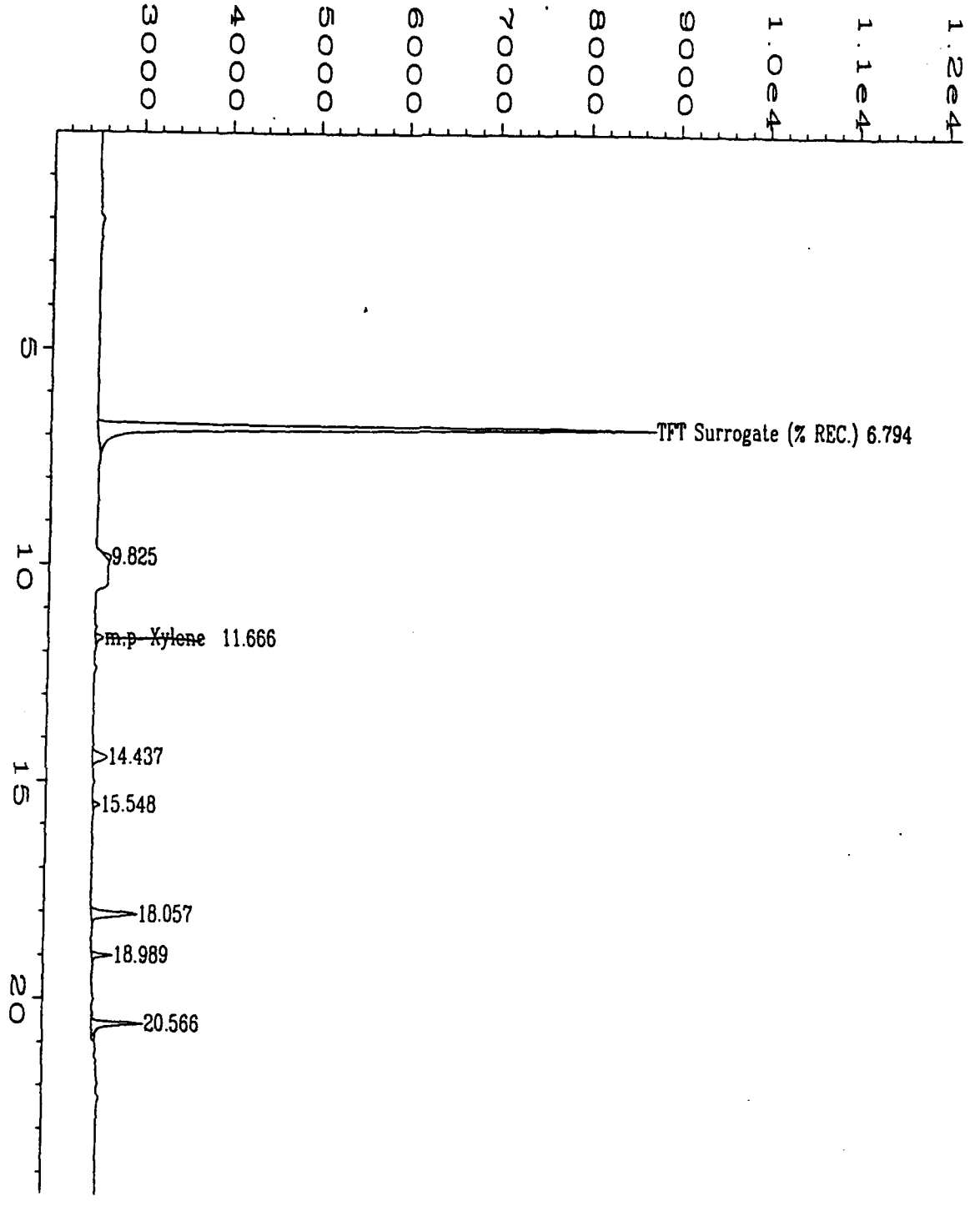
Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene PQL is for a single peak.

* SEE MEB032895 also.

QUALIFIERS:
E = Extrapolated value
U = Compound analyzed for, but not detected.
B = Compound found in blank and sample. Compare blank and sample data.
J = Indicates an estimated value when the compound is detected, but is below the Practical Quantitation Limit (PQL).
PQL = Practical Quantitation Limit. The PQL is equal to the dilution factor multiplied by ten times the Method Detection Limit as determined by EPA SW846, Vol. 1B, Part II, pa. 8000-14.
NA = Not available.

Analyst

K. Cone
Approved



Data File Name	: C:\HPCHEM\2\DATA\BX20328\009R0801.D		
Operator	: C.J. Cook	Page Number	: 1
Instrument	: BTEX2	Vial Number	: 9
Sample Name	: MB032895-WATER	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 8
Acquired on	: 28 Mar 95 04:21 PM	Instrument Method	: BX20328.
Report Created on	: 18 Apr 95 01:05 AM	Analysis Method	: BX20328B....
Last Recalib on	: 14 APR 95 00:39 AM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:

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(303) 425-6021

6

BTEX Data Report
Method Blank Report

		Client Project No.	: 722450.21020
			MacDill AFB
Method Blank Number	: MEB032895		
Date Extracted/Prepared	: 3/28/95	Lab Project No.	: 95-0915
Date Analyzed	: 3/29/95	Dilution Factor	: 1.00
		Method	: 8020
		Matrix	: MeOH/Water
		Lab File No.	: BX2032820

Compound Name	Cas Number	Sample Concentration ug/L		PQL ug/L
Benzene	71-43-2		U	4.0
Toluene	108-88-3		U	4.0
Ethyl Benzene	100-41-4		U	4.0
Total Xylenes	1330-20-7	0.8	J	4.0
Chlorobenzene	108-90-7		U	4.0
1,3,5-trimethylbenzene	108-67-8		U	4.0
1,2,4-trimethylbenzene	95-63-6		U	4.0
1,2,3-trimethylbenzene	526-73-8		U	4.0
1,2,3,4-tetramethylbenzene	488-23-3		U	4.0

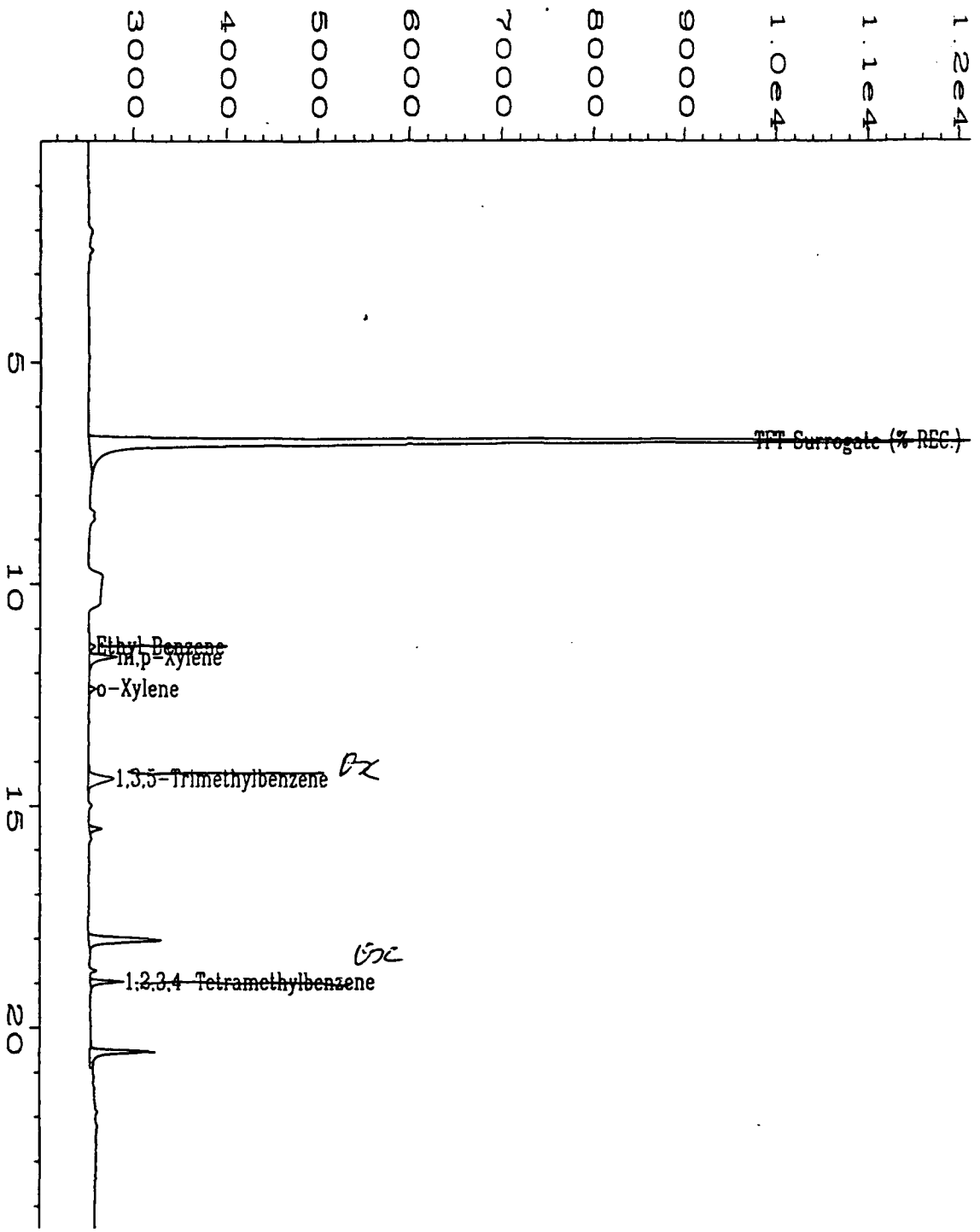
Surrogate Recovery (α,α,α-Trifluorotoluene):	97%	70%-130% (QC limits)

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene PQL is for a single peak.

QUALIFIERS:
E = Extrapolated value
U = Compound analyzed for, but not detected.
B = Compound found in blank and sample. Compare blank and sample data.
J = Indicates an estimated value when the compound is detected, but is below the Practical Quantitation Limit (PQL).
PQL = Practical Quantitation Limit. The PQL is equal to the dilution factor multiplied by ten times the Method Detection Limit as determined by EPA SW846, Vol. 1B, Part II, pa. 8000-14.
NA = Not available.

Analyst

Approved



Data File Name	: C:\HPCHEM\2\DATA\BX20328\020R0801.D		
Operator	: C.J. Cook	Page Number	: 1
Instrument	: BTEX2	Vial Number	: 20
Sample Name	: MEB032895	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 8
Acquired on	: 29 Mar 95 01:06 AM	Instrument Method	: BX20328
Report Created on	: 18 Apr 95 01:00 AM	Analysis Method	: BX20328.M
Last Recalib on	: 14 APR 95 00:39 AM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:

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BTEX Data Report
Method Blank Report

		Client Project No.	: 722450.21020 MacDill AFB
Method Blank Number	: MEB032995		
Date Extracted/Prepared	: 3/29/95	Lab Project No.	: 95-0915
Date Analyzed	: 3/30/95	Dilution Factor	: 1.00
		Method	: 8020
		Matrix	: MeOH/Water
		Lab File No.	: BX2032923

Compound Name	Cas Number	Sample Concentration ug/L		PQL ug/L
Benzene	71-43-2		U	4.0
Toluene	108-88-3		U	4.0
Ethyl Benzene	100-41-4		U	4.0
Total Xylenes	1330-20-7	0.6	J	4.0
Chlorobenzene	108-90-7		U	4.0
1,3,5-trimethylbenzene	108-67-8		U	4.0
1,2,4-trimethylbenzene	95-63-6		U	4.0
1,2,3-trimethylbenzene	526-73-8		U	4.0
1,2,3,4-tetramethylbenzene	488-23-3		U	4.0

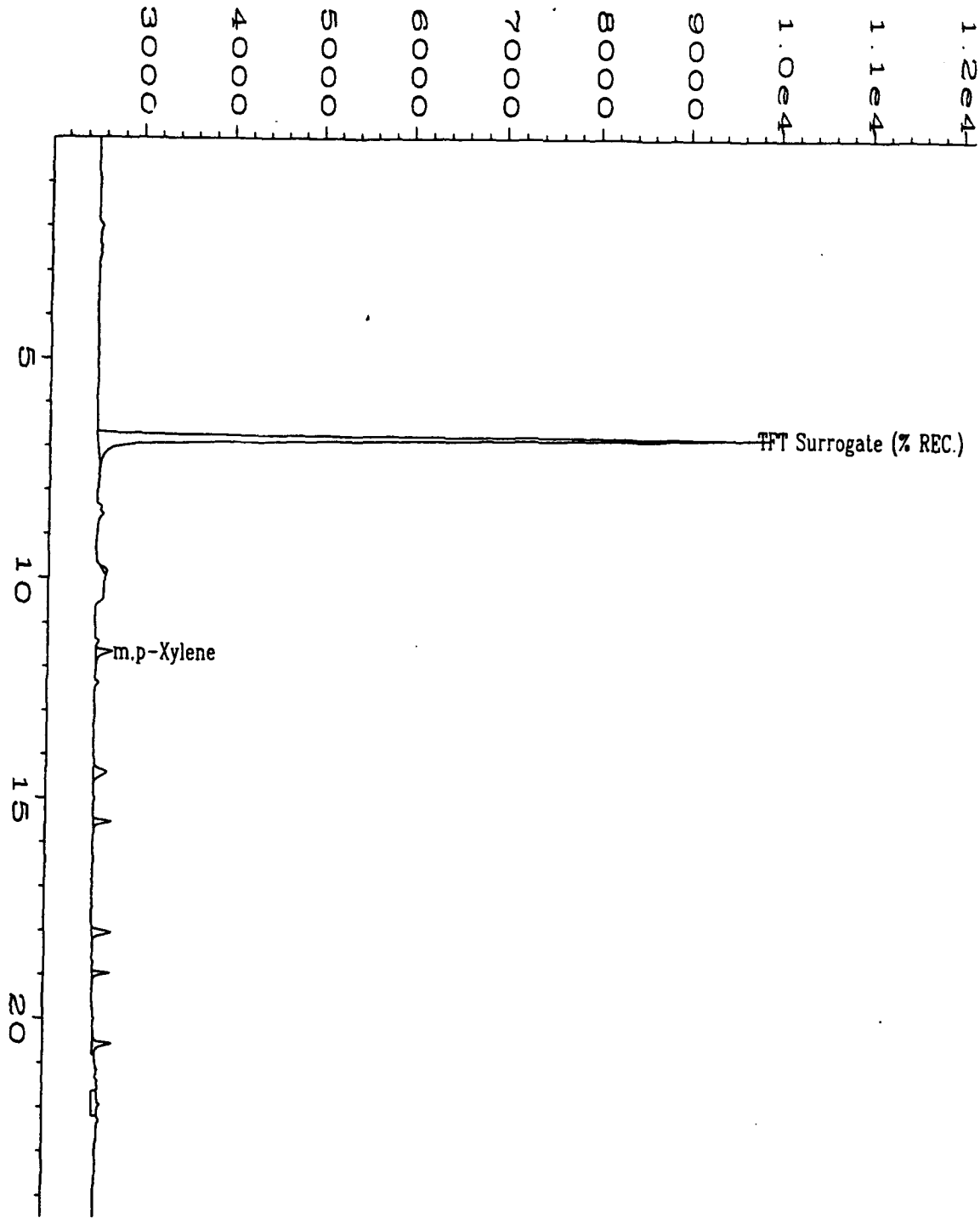
Surrogate Recovery (α,α,α-Trifluorotoluene):	79%	70%-130% (QC limits)

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene PQL is for a single peak.

QUALIFIERS:
E = Extrapolated value
U = Compound analyzed for, but not detected.
B = Compound found in blank and sample. Compare blank and sample data.
J = Indicates an estimated value when the compound is detected, but is below the Practical Quantitation Limit (PQL).
PQL = Practical Quantitation Limit. The PQL is equal to the dilution factor multiplied by ten times the Method Detection Limit as determined by EPA SW846, Vol. 1B, Part II, pa. 8000-14.
NA = Not available.

Analyst

K. Cone
Approved



Data File Name	: C:\HPCHEM\2\DATA\BX20329\023R0101.D		
Operator	: C.J. Cook	Page Number	: 1
Instrument	: BTEX2	Vial Number	: 23
Sample Name	: MEB032995	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 1
Acquired on	: 30 Mar 95 04:31 AM	Instrument Method	: BX20329
Report Created on	: 17 Apr 95 09:49 PM	Analysis Method	: BX20329B.M
Last Recalib on	: 14 APR 95 00:39 AM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:

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BTEX Data Report
Method Blank Report

		Client Project No.	: 722450.21020
			MacDill AFB
Method Blank Number	: MB032995		
Date Extracted/Prepared	: 3/29/95	Lab Project No.	: 95-0915
Date Analyzed	: 3/29/95	Dilution Factor	: 1.00
		Method	: 8020/602
		Matrix	: Water
		Lab File No.	: BX2032909

Compound Name	Cas Number	Sample Concentration ug/L		PQL ug/L
Benzene	71-43-2		U	4.0
Toluene	108-88-3		U	4.0
Ethyl Benzene	100-41-4		U	4.0
Total Xylenes	1330-20-7	0.8	J	4.0
Chlorobenzene	108-90-7		U	4.0
1,3,5-trimethylbenzene	108-67-8		U	4.0
1,2,4-trimethylbenzene	95-63-6		U	4.0
1,2,3-trimethylbenzene	526-73-8		U	4.0
1,2,3,4-tetramethylbenzene	488-23-3		U	4.0

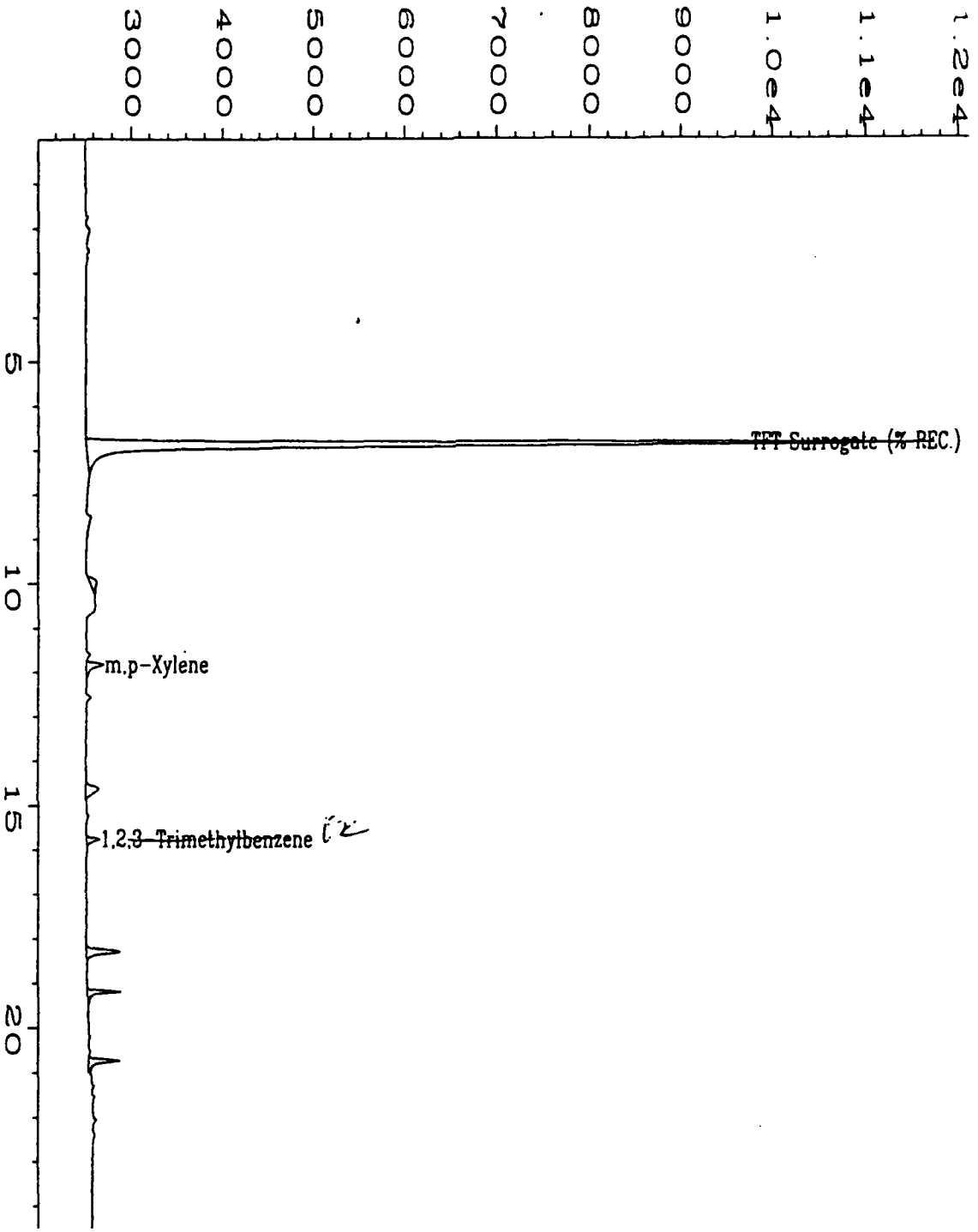
Surrogate Recovery (α,α,α-Trifluorotoluene):	101%	70%-130% (QC limits)

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene PQL is for a single peak.

QUALIFIERS:
E = Extrapolated value
U = Compound analyzed for, but not detected.
B = Compound found in blank and sample. Compare blank and sample data.
J = Indicates an estimated value when the compound is detected, but is below the Practical Quantitation Limit (PQL).
PQL = Practical Quantitation Limit. The PQL is equal to the dilution factor multiplied by ten times the Method Detection Limit as determined by EPA SW846, Vol. 1B, Part II, pa. 8000-14.
NA = Not available.

Analyst

K. Cone
Approved



Data File Name	: C:\HPCHEM\2\DATA\BX20329\009R0101.D		
Operator	: C.J. Cook	Page Number	: 1
Instrument	: BTEX2	Vial Number	: 9
Sample Name	: MB032995-WATER	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 1
Acquired on	: 29 Mar 95 05:06 PM	Instrument Method	: BX20329.
Report Created on	: 17 Apr 95 09:41 PM	Analysis Method	: BX20329B.
Last Recalib on	: 14 APR 95 00:39 AM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:

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BTEX Data Report
Method Blank Report

		Client Project No.	: 722450.21020 MacDill AFB
Method Blank Number	: MB033095		
Date Extracted/Prepared	: 3/30/95	Lab Project No.	: 95-0915
Date Analyzed	: 3/30/95	Dilution Factor	: 1.00
		Method	: 602
		Matrix	: Water
		Lab File No.	: NV-R0115

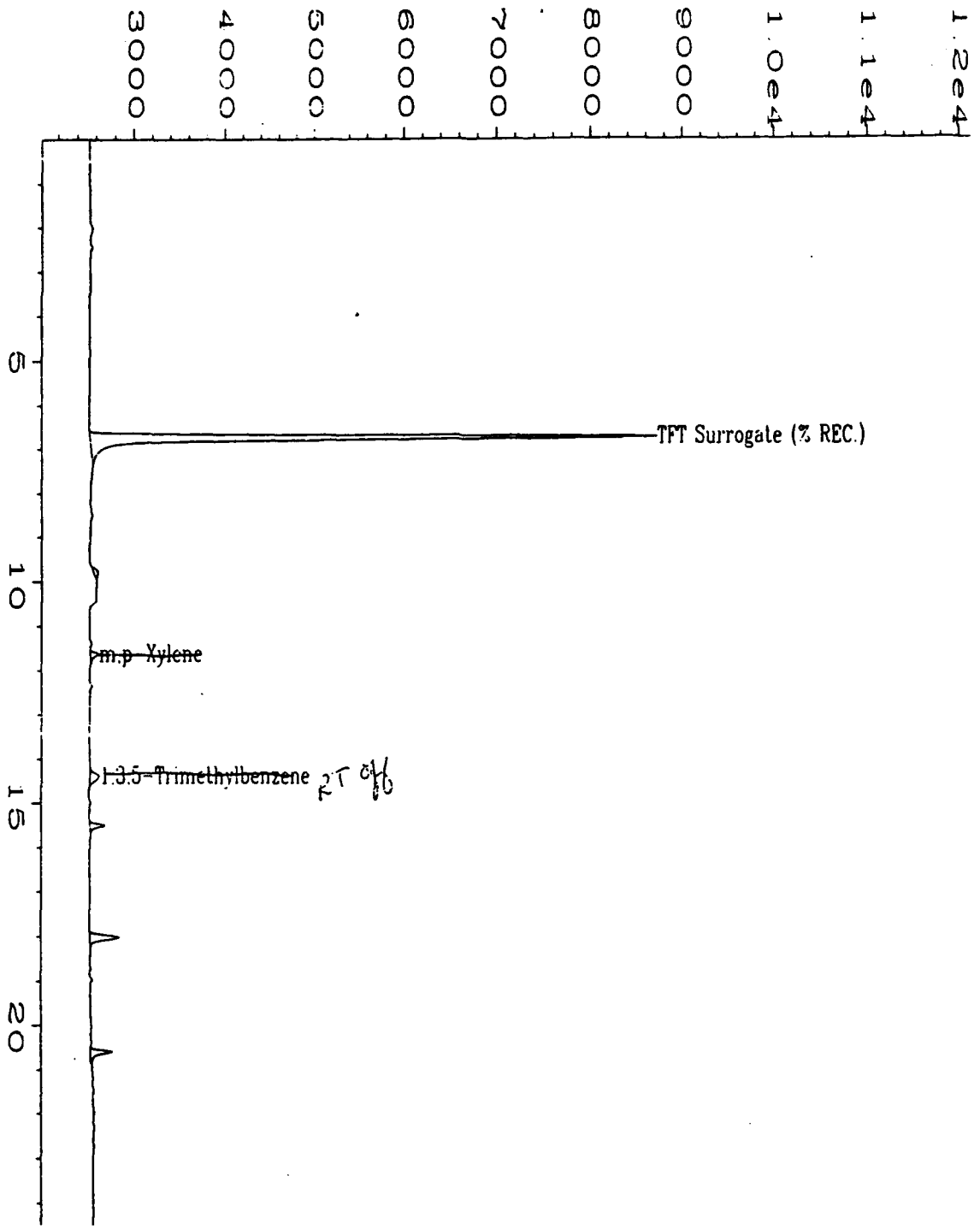
Compound Name	Cas Number	Sample Concentration ug/L	PQL ug/L
Benzene	71-43-2	U	4.0
Toluene	108-88-3	U	4.0
Ethyl Benzene	100-41-4	U	4.0
Total Xylenes	1330-20-7	U	4.0
Chlorobenzene	108-90-7	U	4.0
1,3,5-trimethylbenzene	108-67-8	U	4.0
1,2,4-trimethylbenzene	95-63-6	U	4.0
1,2,3-trimethylbenzene	526-73-8	U	4.0
1,2,3,4-tetramethylbenzene	488-23-3	U	4.0
Surrogate Recovery (α,α,α-Trifluorotoluene):		91%	70%-130% (QC limits)

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene PQL is for a single peak.

QUALIFIERS:
E = Extrapolated value
U = Compound analyzed for, but not detected.
B = Compound found in blank and sample. Compare blank and sample data.
J = Indicates an estimated value when the compound is detected, but is below the Practical Quantitation Limit (PQL).
PQL = Practical Quantitation Limit. The PQL is equal to the dilution factor multiplied by ten times the Method Detection Limit as determined by EPA SW846, Vol. 1B, Part II, pa. 8000-14.
NA = Not available.

Analyst

K. Cone
Approved



Data File Name	: C:\HPCHEM\2\DATA\NV-R0115.D		
Operator	:	Page Number	: 1
Instrument	: BTEX2	Vial Number	:
Sample Name	: MB033095 -WATER	Injection Number	:
Run Time Bar Code:		Sequence Line	:
Acquired on	: 30 Mar 95 05:18 PM	Instrument Method	: BX2033
Report Created on	: 31 Mar 95 08:50 AM	Analysis Method	: BX2033(
Last Recalib on	: 31 MAR 95 08:24 AM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:

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BTEX Data Report
Method Blank Report

		Client Project No.	: 722450.21020
			MacDill AFB
Method Blank Number	: MEB033095		
Date Extracted/Prepared	: 3/30/95	Lab Project No.	: 95-0915
Date Analyzed	: 3/30/95	Dilution Factor	: 1.00
		Method	: 8020
		Matrix	: MeOH/Water
		Lab File No.	: BX2033017

Compound Name	Cas Number	Sample Concentration ug/L		PQL ug/L
Benzene	71-43-2		U	4.0
Toluene	108-88-3		U	4.0
Ethyl Benzene	100-41-4		U	4.0
Total Xylenes	1330-20-7		U	4.0
Chlorobenzene	108-90-7		U	4.0
1,3,5-trimethylbenzene	108-67-8		U	4.0
1,2,4-trimethylbenzene	95-63-6		U	4.0
1,2,3-trimethylbenzene	526-73-8	2.1	J	4.0
1,2,3,4-tetramethylbenzene	488-23-3		U	4.0

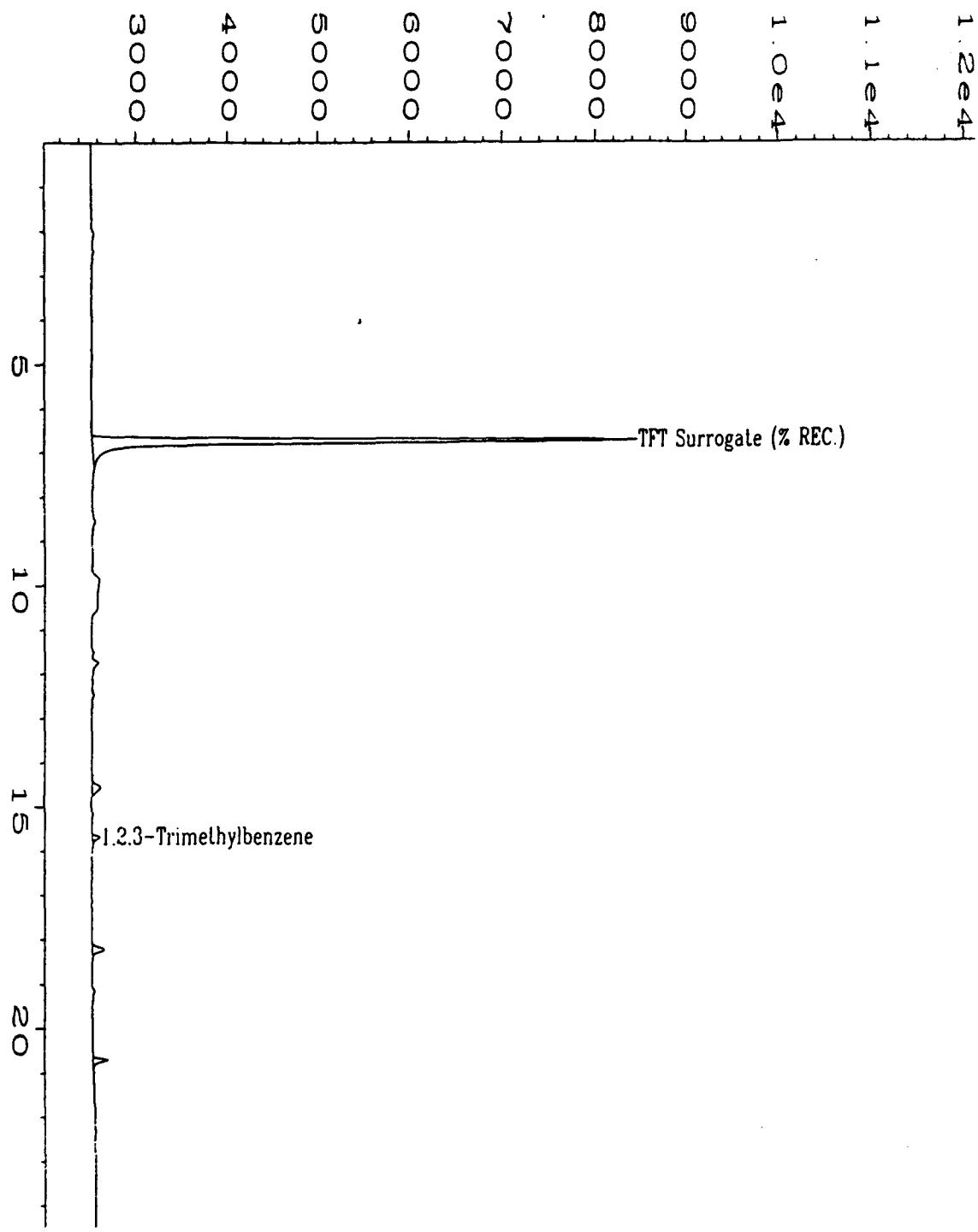
Surrogate Recovery (α,α,α-Trifluorotoluene):	86%	70%-130% (QC limits)

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene PQL is for a single peak.

QUALIFIERS:
E = Extrapolated value
U = Compound analyzed for, but not detected.
B = Compound found in blank and sample. Compare blank and sample data.
J = Indicates an estimated value when the compound is detected, but is below the Practical Quantitation Limit (PQL).
PQL = Practical Quantitation Limit. The PQL is equal to the dilution factor multiplied by ten times the Method Detection Limit as determined by EPA SW846, Vol. 1B, Part II, pa. 8000-14.
NA = Not available.

Analyst

Approved



Data File Name	: C:\HPCHEM\2\DATA\BX20330\017R0101.D		
Operator	: C.J. Cook	Page Number	: 1
Instrument	: BTEX2	Vial Number	: 17
Sample Name	: MEB033095	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 1
Acquired on	: 30 Mar 95 11:11 PM	Instrument Method	: BX20330
Report Created on	: 31 Mar 95 08:46 AM	Analysis Method	: BX20330.
Last Recalib on	: 31 MAR 95 08:24 AM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:

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BTEX Data Report
Laboratory Control Sample (LCS)

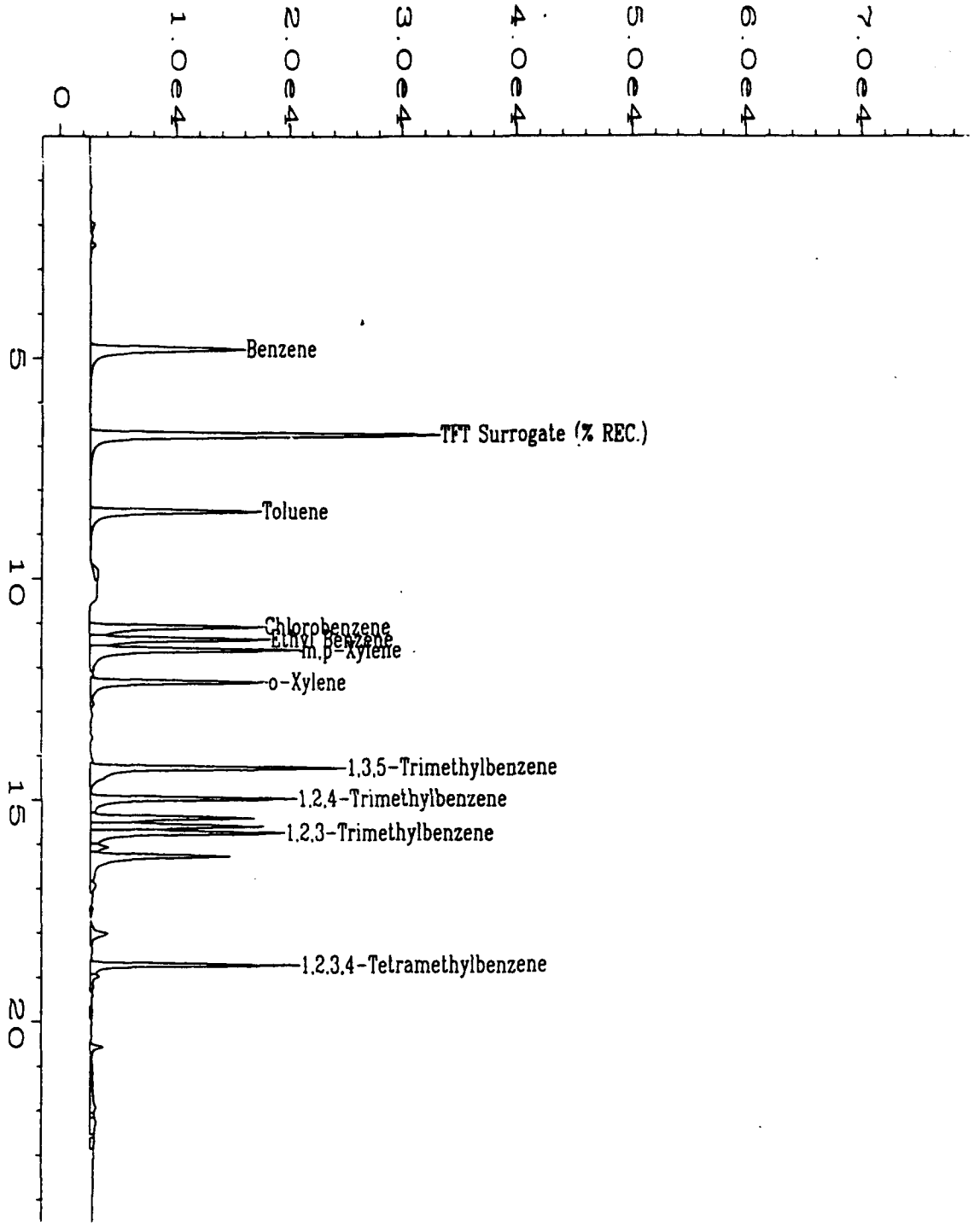
LCS Number	: LCS032595	Dilution Factor	: 1.00
Date Extracted/Prepared	: 3/25/95	Method	: 602
Date Analyzed	: 3/25/95	Matrix	: Water
Spike Amount (ug/L)	: 20.0	Lab File No.	: BX2032511

Compound Name	Cas Number	LCS Concentration ug/L	LCS % Recovery	QC Limit % Recovery
Benzene	71-43-2	15.4	77.0	71.0-119.0
Toluene	108-88-3	15.7	78.5	73.0-111.0
Chlorobenzene	108-90-7	16.5	82.5	64.0-119.0
Ethyl Benzene	100-41-4	15.9	79.5	75.0-114.0
m,p-Xylene	108-38-3	16.8	84.0	75.0-114.0
o-Xylene	106-42-3 95-47-6	15.7	78.5	64.0-119.0
1,3,5-Trimethylbenzene	108-67-8	16.9	84.5	50.0-150.0
1,2,4-Trimethylbenzene	95-63-6	17.8	89.0	50.0-150.0
1,2,3-Trimethylbenzene	526-73-8	20.2	101.0	50.0-150.0
1,2,3,4-Tetramethylbenzene	488-23-3	16.6	83.0	50.0-150.0
Surrogate Recovery (α,α,α-Trifluorotoluene):		97%	70%-130% (QC limits)	

QUALIFIERS:
E = Extrapolated value
U = Compound analyzed for, but not detected.
B = Compound found in blank and sample. Compare blank and sample data.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit (RL).
NA = Not available/Not analyzed.

K. Cone
Analyst

D McClellan
Approved



Data File Name	: C:\HPCHEM\2\DATA\BX20325\011R0801.D		
Operator	: T.L. Lockwood	Page Number	: 1
Instrument	: BTEX2	Vial Number	: 11
Sample Name	: LCS032495	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 8
Acquired on	: 25 Mar 95 08:54 PM	Instrument Method	: BX20325.
Report Created on	: 17 Apr 95 01:02 PM	Analysis Method	: BX20325A
Last Recalib on	: 14 APR 95 00:39 AM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:

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BTEX Data Report
Laboratory Control Sample (LCS)

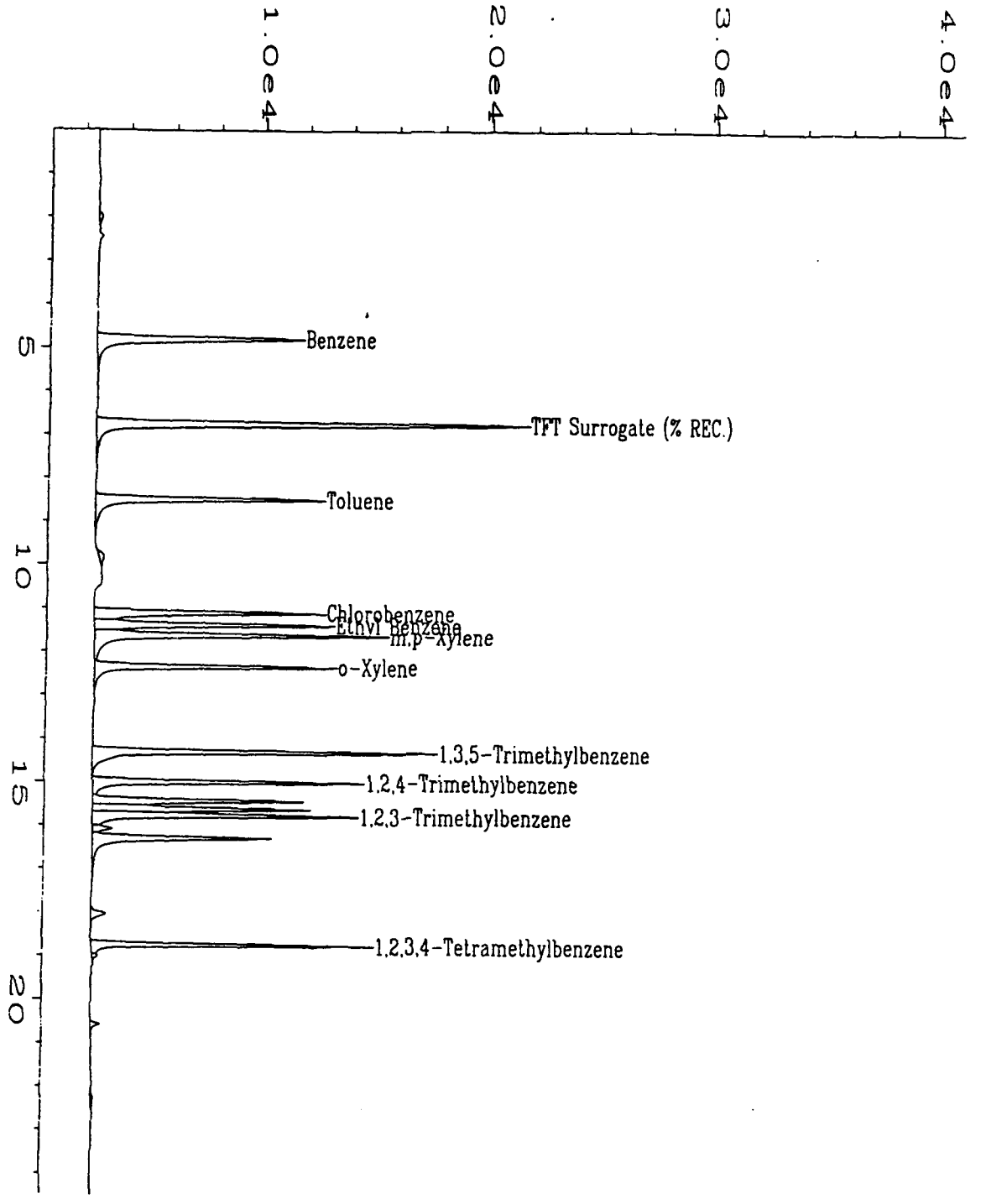
LCS Number	: LCS032695	Dilution Fact	: 1.00
Date Extracted/Prepared	: 3/26/95	Method	: 602
Date Analyzed	: 3/26/95	Matrix	: Water
Spike Amount (ug/L)	: 20.0	Lab File No.	: BX2032611

Compound Name	Cas Number	LCS Concentration ug/L	LCS % Recovery	QC Limit % Recovery
Benzene	71-43-2	16.2	81.0	71.0-119.0
Toluene	108-88-3	16.4	82.0	73.0-111.0
Chlorobenzene	108-90-7	17.0	85.0	64.0-119.0
Ethyl Benzene	100-41-4	16.9	84.5	75.0-114.0
m,p-Xylene	108-38-3	18.2	91.0	75.0-114.0
o-Xylene	106-42-3 95-47-6	16.6	83.0	64.0-119.0
1,3,5-Trimethylbenzene	108-67-8	16.6	83.0	50.0-150.0
1,2,4-Trimethylbenzene	95-63-6	18.0	90.0	50.0-150.0
1,2,3-Trimethylbenzene	526-73-8	21.4	107.0	50.0-150.0
1,2,3,4-Tetramethylbenzene	488-23-3	17.5	87.5	50.0-150.0
Surrogate Recovery (α,α,α-Trifluorotoluene):		101%	70%-130% (QC limits)	

QUALIFIERS:
E = Extrapolated value
U = Compound analyzed for, but not detected.
B = Compound found in blank and sample. Compare blank and sample data.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit (RL).
NA = Not available/Not analyzed.

K. Cone
Analyst

P. McClella
Approved



Data File Name : C:\HPCHEM\2\DATA\BX20326\011R0801.D
Operator : T.L. Lockwood
Instrument : BTEX2
Sample Name : LCS032695
Run Time Bar Code:
Acquired on : 26 Mar 95 07:29 PM
Report Created on: 17 Apr 95 02:06 PM
Last Recalib on : 14 APR 95 00:39 AM
Multiplier : 1

Page Number : 1
Vial Number : 11
Injection Number : 1
Sequence Line : 8
Instrument Method: BX20326.
Analysis Method : BX20326A.
Sample Amount : 0
ISTD Amount :

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(303) 425-6021

BTEX Data Report
Laboratory Control Sample (LCS)

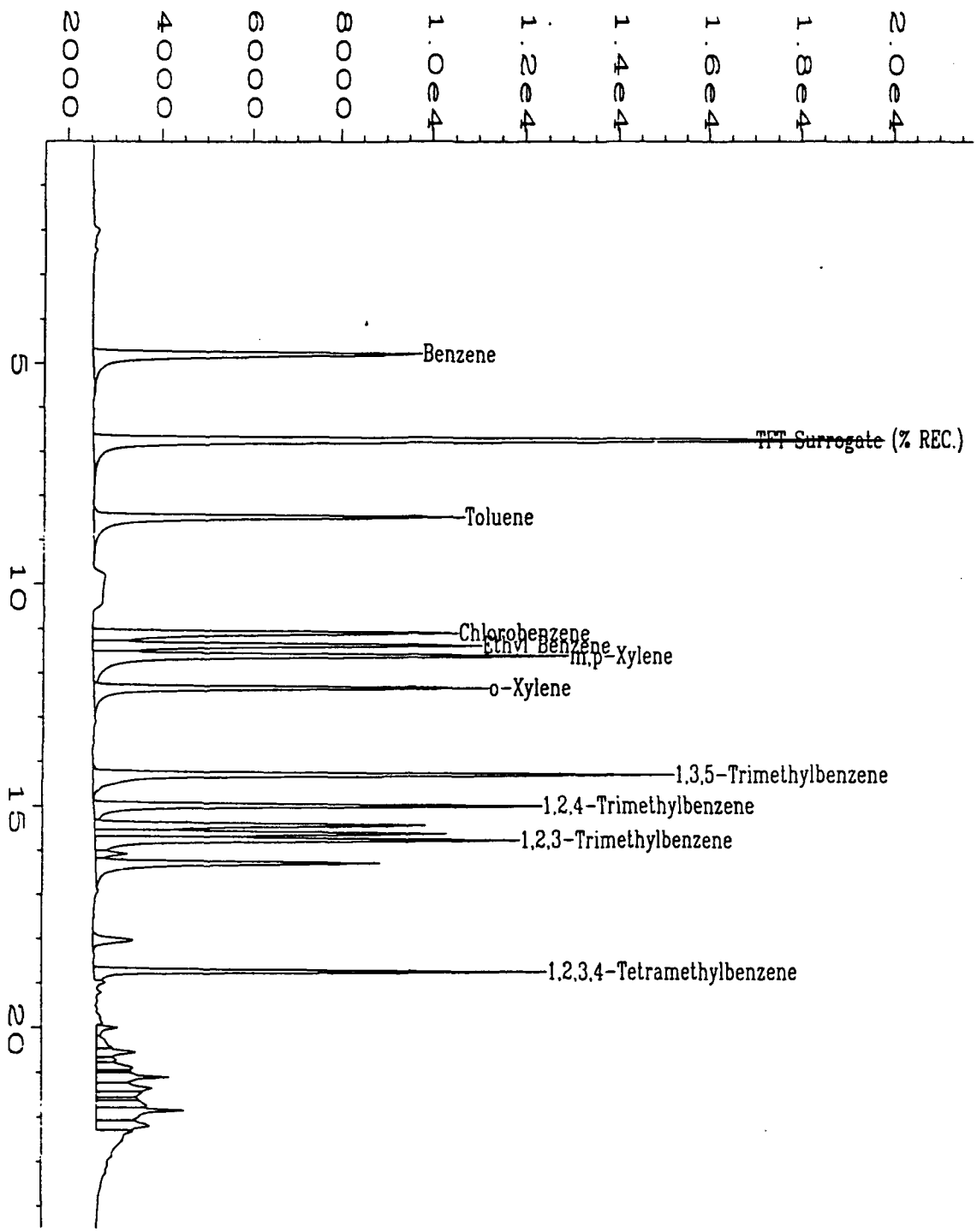
LCS Number	: LCS032795	Dilution Factor	: 1.00
Date Extracted/Prepared	: 3/27/95	Method	: 602
Date Analyzed	: 3/27/95	Matrix	: Water
Spike Amount (ug/L)	: 20.0	Lab File No.	: BX2032710

Compound Name	Cas Number	LCS Concentration ug/L	LCS % Recovery	QC Limit % Recovery
Benzene	71-43-2	17.1	85.5	71.0-119.0
Toluene	108-88-3	16.6	83.0	73.0-111.0
Chlorobenzene	108-90-7	18.1	90.5	64.0-119.0
Ethyl Benzene	100-41-4	17.1	85.5	75.0-114.0
m,p-Xylene	108-38-3	18.3	91.5	75.0-114.0
o-Xylene	106-42-3 95-47-6	16.9	84.5	64.0-119.0
1,3,5-Trimethylbenzene	108-67-8	17.8	89.0	50.0-150.0
1,2,4-Trimethylbenzene	95-63-6	18.2	91.0	50.0-150.0
1,2,3-Trimethylbenzene	526-73-8	20.2	101.0	50.0-150.0
1,2,3,4-Tetramethylbenzene	488-23-3	18.4	92.0	50.0-150.0
Surrogate Recovery (α,α,α-Trifluorotoluene):		99%	70%-130% (QC limits)	

QUALIFIERS:
E = Extrapolated value
U = Compound analyzed for, but not detected.
B = Compound found in blank and sample. Compare blank and sample data.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit (RL).
NA = Not available/Not analyzed.

K. Cone
Analyst

Approved



Data File Name	: C:\HPCHEM\2\DATA\BX20327\010R0601.D		
Operator	: C.J. Cook	Page Number	: 1
Instrument	: BTEX2	Vial Number	: 10
Sample Name	: LCS032795	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 6
Acquired on	: 27 Mar 95 05:21 PM	Instrument Method	: BX20327.
Report Created on	: 17 Apr 95 12:35 PM	Analysis Method	: BX20327
Last Recalib on	: 14 APR 95 00:39 AM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:

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(303) 425-6021

BTEX Data Report
Laboratory Control Sample (LCS)

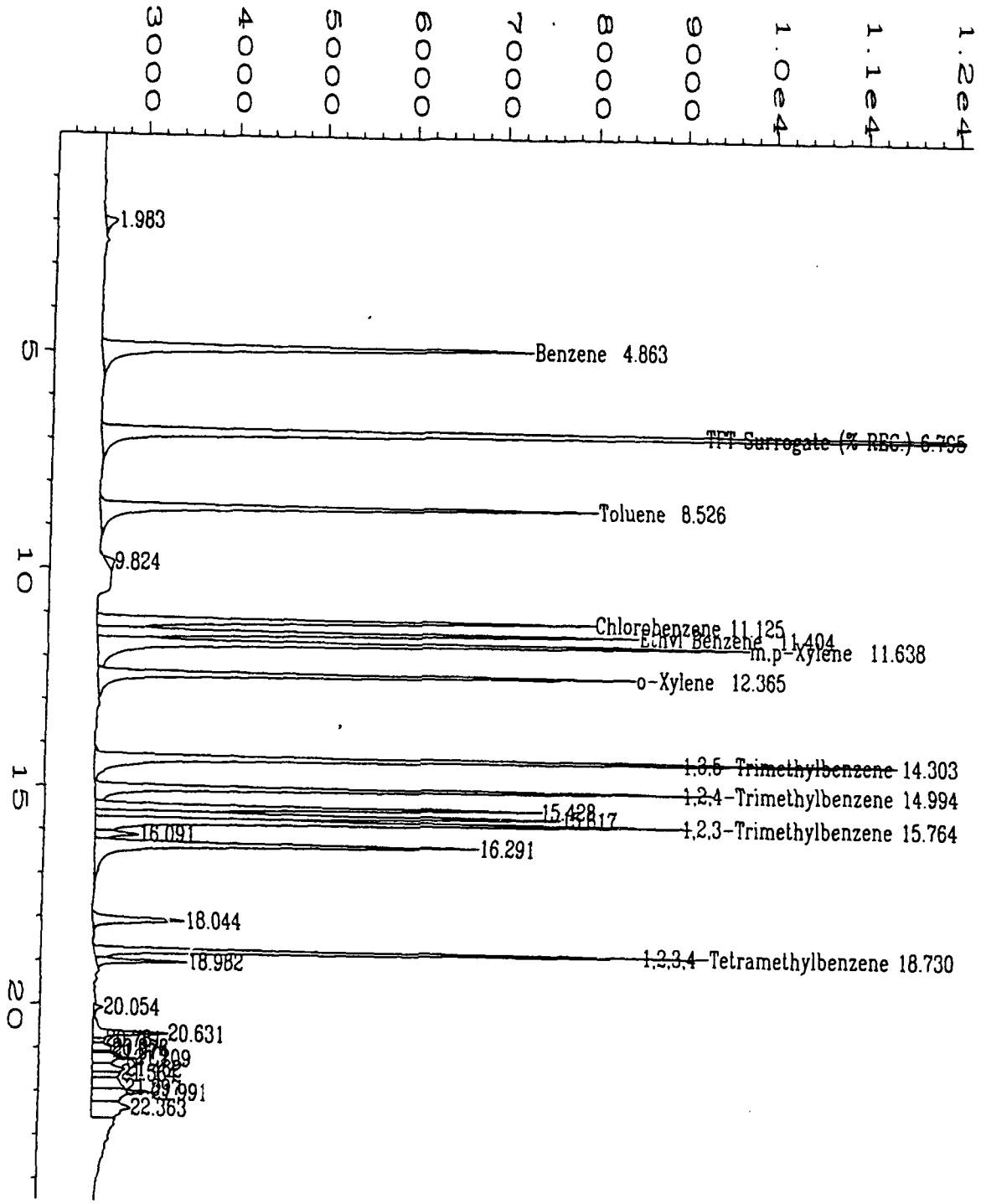
LCS Number	: LCS032895	Dilution Factor	: 1.00
Date Extracted/Prepared	: 3/28/95	Method	: 602
Date Analyzed	: 3/28/95	Matrix	: Water
Spike Amount (ug/L)	: 20.0	Lab File No.	: BX2032810

Compound Name	Cas Number	LCS Concentration ug/L	LCS % Recovery	QC Limit % Recovery
Benzene	71-43-2	15.0	75.0	71.0-119.0
Toluene	108-88-3	16.3	81.5	73.0-111.0
Chlorobenzene	108-90-7	15.5	77.5	64.0-119.0
Ethyl Benzene	100-41-4	16.5	82.5	75.0-114.0
m,p-Xylene	108-38-3	18.0	90.0	75.0-114.0
o-Xylene	106-42-3 95-47-6	16.6	83.0	64.0-119.0
1,3,5-Trimethylbenzene	108-67-8	15.9	79.5	50.0-150.0
1,2,4-Trimethylbenzene	95-63-6	17.7	88.5	50.0-150.0
1,2,3-Trimethylbenzene	526-73-8	20.6	103.0	50.0-150.0
1,2,3,4-Tetramethylbenzene	488-23-3	17.2	86.0	50.0-150.0
Surrogate Recovery (α,α,α-Trifluorotoluene):		107%	70%-130% (QC limits)	

QUALIFIERS:
E = Extrapolated value
U = Compound analyzed for, but not detected.
B = Compound found in blank and sample. Compare blank and sample data.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit (RL).
NA = Not available/Not analyzed.

K. Cone
Analyst

P. McClellan
Approved



Data File Name : C:\HPCHEM\2\DATA\BX20328\010R0801.D
Operator : C.J. Cook
Instrument : BTEX2
Sample Name : LCS032895
Run Time Bar Code:
Acquired on : 28 Mar 95 05:09 PM
Report Created on: 18 Apr 95 01:07 AM
Last Recalib on : 14 APR 95 00:39 AM
Multiplier : 1

Page Number : 1
Vial Number : 10
Injection Number : 1
Sequence Line : 8
Instrument Method: BX20328
Analysis Method : BX20328b
Sample Amount : 0
ISTD Amount :

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BTEX Data Report
Laboratory Control Sample (LCS)

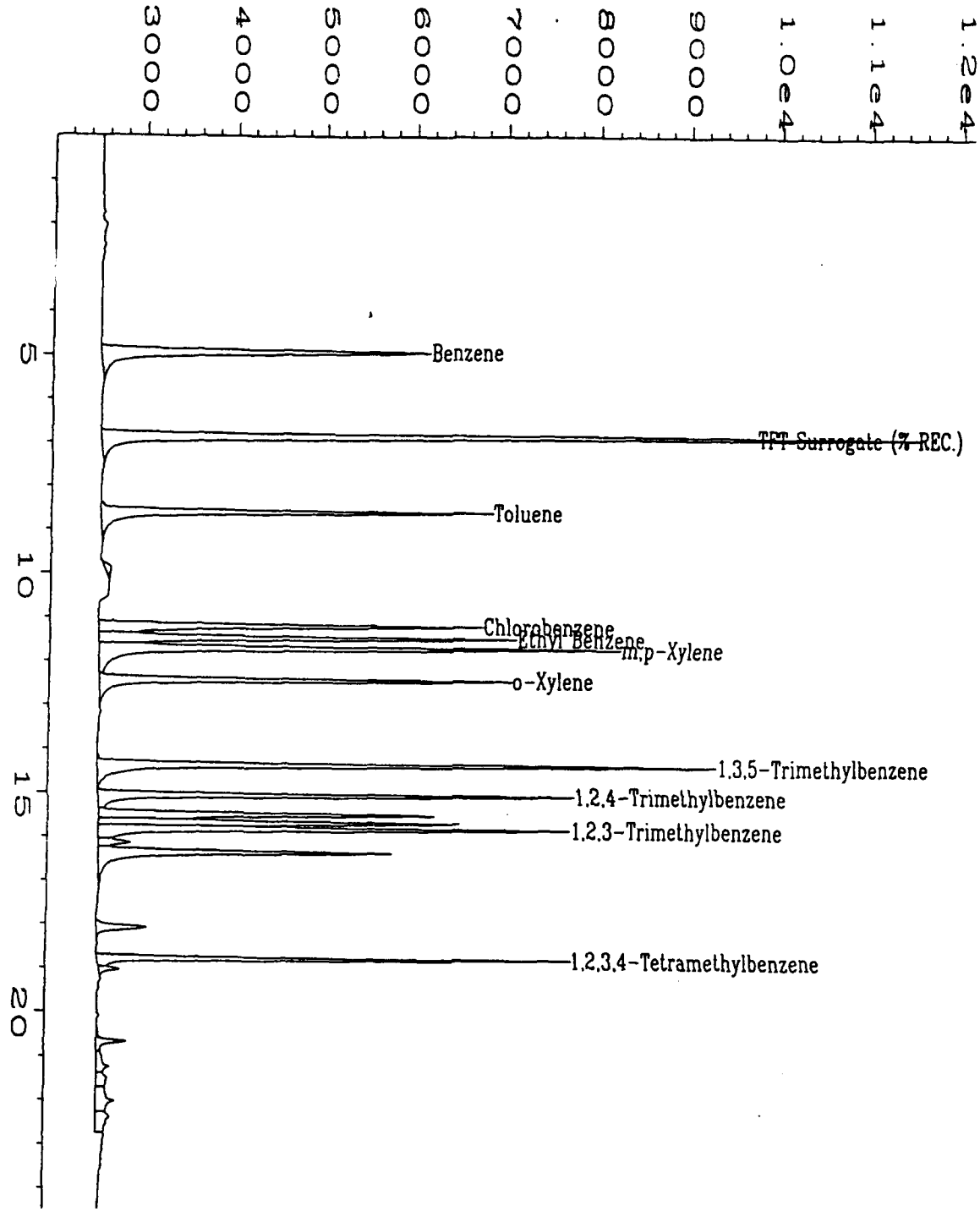
LCS Number	: LCS032995	**Dilution Factor**	: 1.00
Date Extracted/Prepared	: 3/29/95	**Method**	: 602
Date Analyzed	: 3/29/95	**Matrix**	: Water
Spike Amount (ug/L)	: 20.0	**Lab File No.**	: BX2032910

Compound Name	Cas Number	LCS Concentration ug/L	LCS % Recovery	QC Limit % Recovery
Benzene	71-43-2	18.3	91.5	71.0-119.0
Toluene	108-88-3	18.1	90.5	73.0-111.0
Chlorobenzene	108-90-7	19.8	99.0	64.0-119.0
Ethyl Benzene	100-41-4	17.7	88.5	75.0-114.0
m,p-Xylene	108-38-3	18.8	94.0	75.0-114.0
o-Xylene	106-42-3 95-47-6	18.7	93.5	64.0-119.0
1,3,5-Trimethylbenzene	108-67-8	17.8	89.0	50.0-150.0
1,2,4-Trimethylbenzene	95-63-6	20.3	101.5	50.0-150.0
1,2,3-Trimethylbenzene	526-73-8	25.1	125.5	50.0-150.0
1,2,3,4-Tetramethylbenzene	488-23-3	20.1	100.5	50.0-150.0
Surrogate Recovery (α,α,α-Trifluorotoluene):		94%	70%-130% (QC limits)	

QUALIFIERS:
E = Extrapolated value
U = Compound analyzed for, but not detected.
B = Compound found in blank and sample. Compare blank and sample data.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit (RL).
NA = Not available/Not analyzed.

K. Cone
Analyst

Approved



Data File Name	: C:\HPCHEM\2\DATA\BX20329\010R0101.D		
Operator	: C.J. Cook	Page Number	: 1
Instrument	: BTEX2	Vial Number	: 10
Sample Name	: LCS032995	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 1
Acquired on	: 29 Mar 95 05:55 PM	Instrument Method	: BX20329.
Report Created on	: 17 Apr 95 09:41 PM	Analysis Method	: BX20329E
Last Recalib on	: 14 APR 95 00:39 AM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:

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(303) 425-6021

BTEX Data Report
Laboratory Control Sample (LCS)

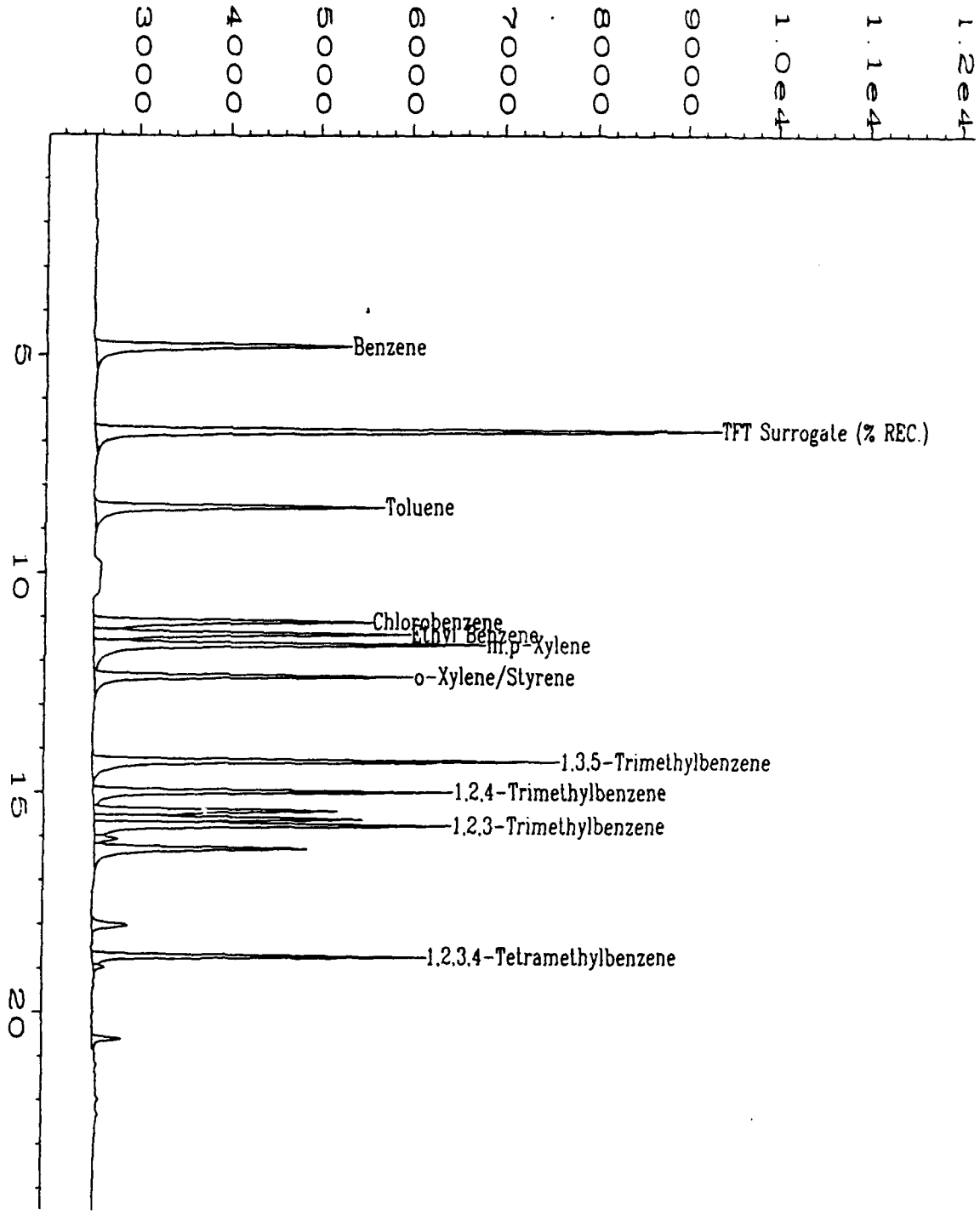
LCS Number	: LCS033095	Dilution Factor	: 1.00
Date Extracted/Prepared	: 3/30/95	Method	: 602
Date Analyzed	: 3/30/95	Matrix	: Water
Spike Amount (ug/L)	: 20.0	Lab File No.	: BX2033010

Compound Name	Cas Number	LCS Concentration ug/L	LCS % Recovery	QC Limit % Recovery
Benzene	71-43-2	16.9	84.5	71.0-119.0
Toluene	108-88-3	17.2	86.0	73.0-111.0
Chlorobenzene	108-90-7	17.3	86.5	64.0-119.0
Ethyl Benzene	100-41-4	17.8	89.0	75.0-114.0
m,p-Xylene	108-38-3	19.1	95.5	75.0-114.0
o-Xylene	106-42-3 95-47-6	17.2	86.0	64.0-119.0
1,3,5-Trimethylbenzene	108-67-8	18.1	90.5	50.0-150.0
1,2,4-Trimethylbenzene	95-63-6	18.4	92.0	50.0-150.0
1,2,3-Trimethylbenzene	526-73-8	22.4	112.0	50.0-150.0
1,2,3,4-Tetramethylbenzene	488-23-3	17.4	87.0	50.0-150.0
Surrogate Recovery (α,α,α-Trifluorotoluene):		95%	70%-130% (QC limits)	

QUALIFIERS:
E = Extrapolated value
U = Compound analyzed for, but not detected.
B = Compound found in blank and sample. Compare blank and sample data.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit (RL).
NA = Not available/Not analyzed.

K. Cone
Analyst

P. McCulla
Approved



Data File Name	: C:\HPCHEM\2\DATA\BX20330\010R0101.D		
Operator	: C.J. Cook	Page Number	: 1
Instrument	: BTEX2	Vial Number	: 10
Sample Name	: LCS033095	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 1
Acquired on	: 30 Mar 95 06:02 PM	Instrument Method	: BX20330
Report Created on	: 31 Mar 95 08:44 AM	Analysis Method	: BX203
Last Recalib on	: 31 MAR 95 08:24 AM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:

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(303) 425-6021

TOTAL VOLATILE HYDROCARBONS (TVH)
Laboratory Control Sample (LCS)

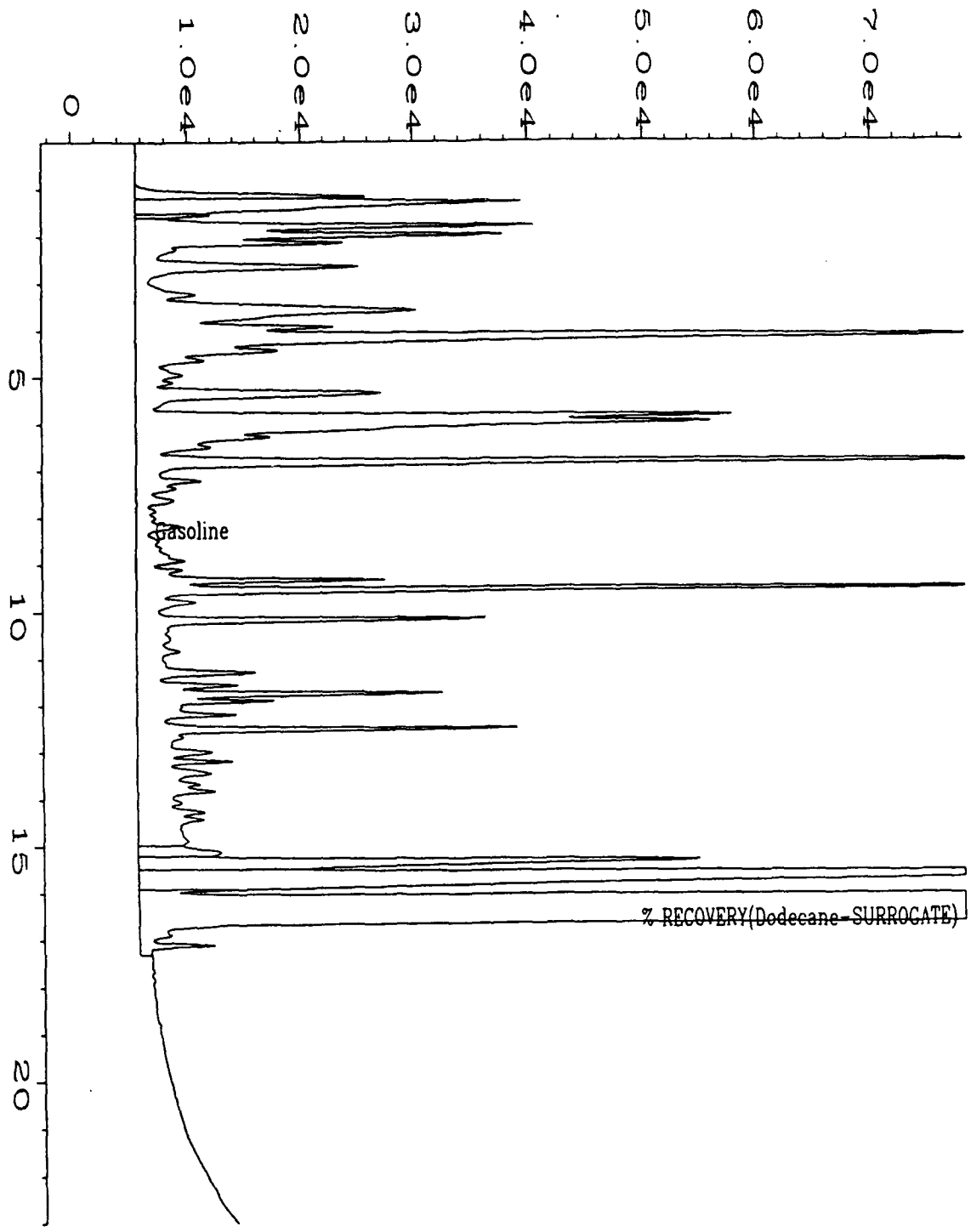
LCS Number	: LCS032995	Matrix	: WATER
Date Prepared	: 3/29/95	Method Number	: 8030/MOD.8015
Date Analyzed	: 3/29/95		
Sequence Number	: TVH19		

Compound Name	Theoretical Concentration mg/L	LCS Concentration mg/ L	LCS % Recovery	QC Limit % Recovery
Gasoline	2.00	1.91	96%	70%-130%

QUALIFIERS
U = TVH analyzed for but not detected.
B = TVH found in blank as well as sample (blank data should be compared).
E = Extrapolated value.
NA = Not Available.

Analyst

Approved



Data File Name	: C:\HPCHEM\1\DATA\tvh0329\019F0201.D		
Operator	: kaprie s. cone	Page Number	: 1
Instrument	: TVH	Vial Number	: 19
Sample Name	: LCS032995	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 2
Acquired on	: 29 Mar 95 09:26 PM	Instrument Method	: TVH0329.
Report Created on	: 29 Mar 95 09:50 PM	Analysis Method	: TVH0329.
Last Recalib on	: 29 Mar 95 08:06 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:

EVERGREEN ANALYTICAL, INC.
4036 Youngfield, Wheat Ridge, CO 80033
(303) 425-6021

TOTAL VOLATILE HYDROCARBONS (TVH-GASOLINE)

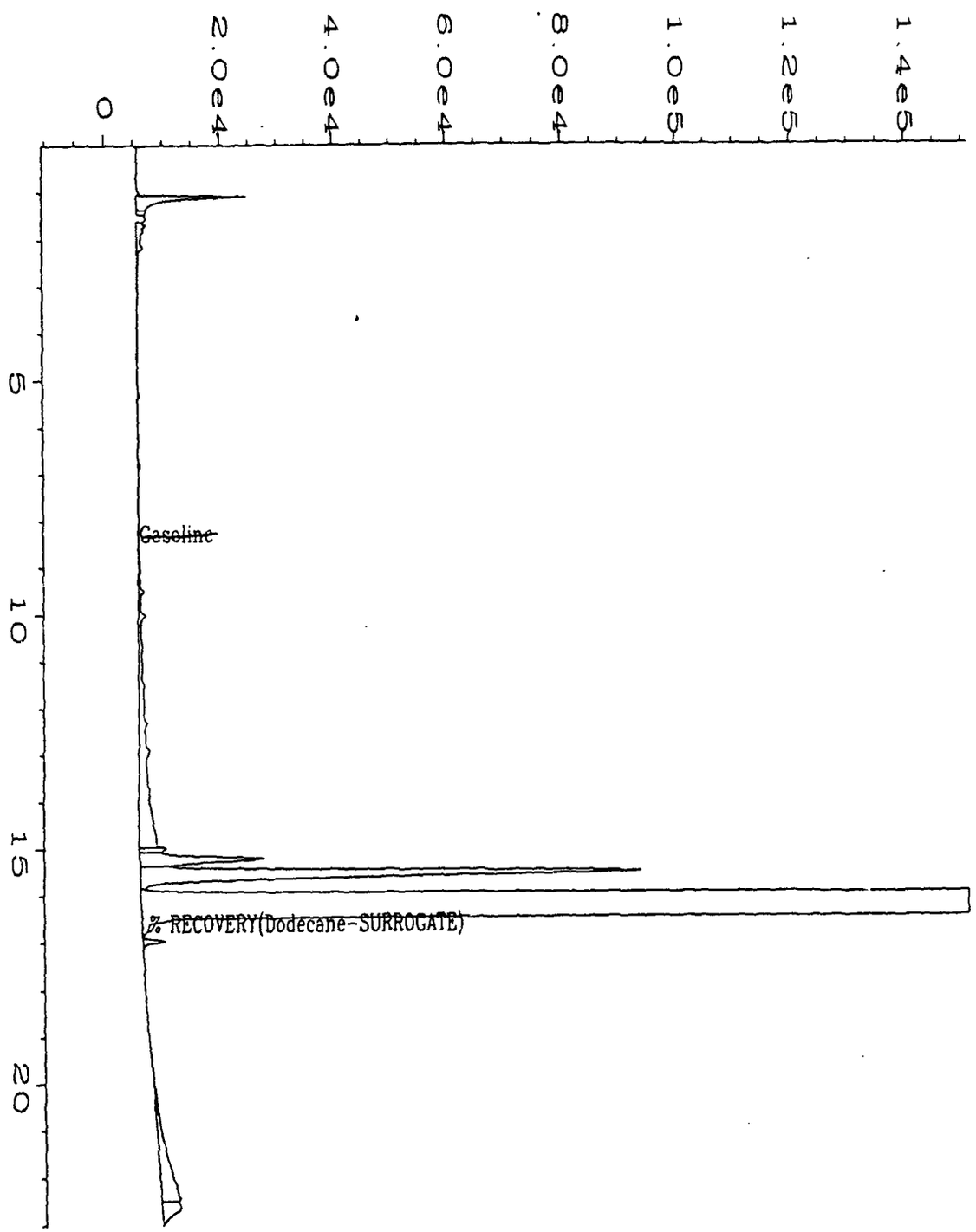
Date Sampled	: 3/17,20/95	Client Project Number	: 7220450.21020/MACDILL
Date Received	: 3/22/95	Lab Project Number	: 95-0915
Date Prepared	: 3/30/95,4/2/95	Matrix	: Soil
Date Analyzed	: 3/30,31/95,4/2,3/95	Method Number	: 5030/Mod.8015

Evergreen Sample #	Client Sample #	Surrogate Recovery	TVH* mg/Kg	RL* mg/Kg
MB033095	METHOD BLANK	100%	U	0.10
MB033195	METHOD BLANK	100%	U	0.10
MB040295	METHOD BLANK	100%	U	0.10
MB040395	METHOD BLANK	100%	U	0.10
X04557	56MP-1(4-6)	101%	U	0.12
X04558	56MP-1(8-10)	103%	U	0.13
X04558 DUP	56MP-1(8-10)	109%	U	0.13
X04560	56MP-2(6-8)	107%	U	0.12
X04561	56MP-2(13-15)	107%	U	0.13
X04562	56MP-3(4-6)	106%	U	0.12
X04563	56MP-3(11-13)	104%	U	0.12
X04564	56SS-1(8-10)	99%	0.41	0.12
X04566	56MP-5(4-6)	108%	3700E	6.5
X04567	56MP-5(9-11)	99%	U	0.12
X04568	56MP-6(4-6)	102%	U	0.12
X04569	56MP-6(10-11)	105%	U	0.12
X04571	MATRIX SPIKE	103%	U	0.13
X04572	56MP-16(4-6)	0% **	U	0.13
X04572 DUP	56MP-16(4-6)	104%	U	0.13

** = Sample reanalyzed. Low surrogate recovery due to matrix interference confirmed.
* = Based on dry weight values.
QUALIFIERS
U = TVH analyzed for but not detected.
B = TVH found in blank.
E = Extrapolated value.
RL = Reporting Limit.

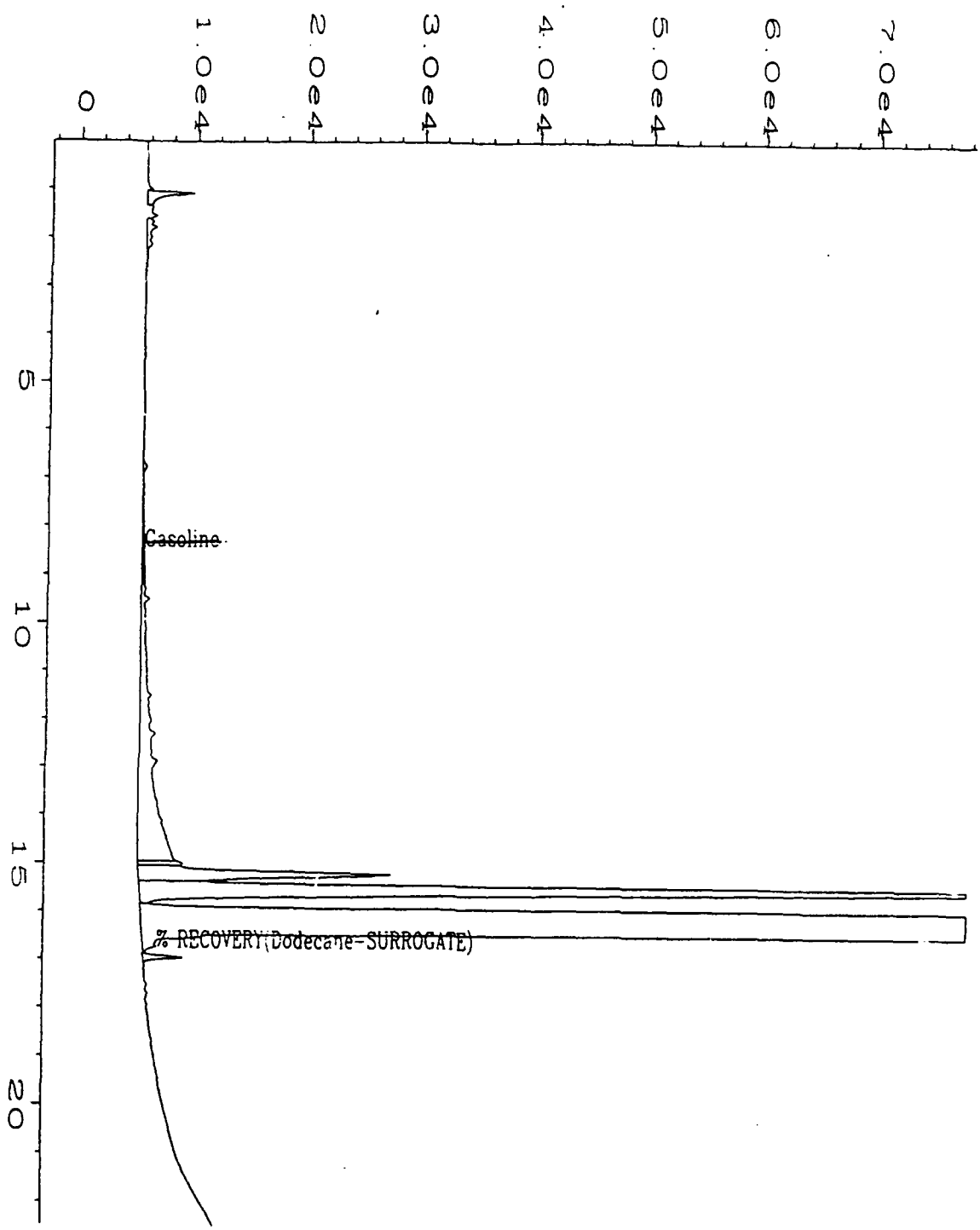
Analyst

Approved



Data File Name	: C:\HPCHEM\1\DATA\TVH0330\002F0201.D		
Operator	: Dawn N. Guildner	Page Number	: 1
Instrument	: TVH	Vial Number	: 2
Sample Name	: MB033095	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 2
Acquired on	: 30 Mar 95 06:28 PM	Instrument Method	: TVH032.
Report Created on:	31 Mar 95 09:00 AM	Analysis Method	: TVH033(
Last Recalib on	: 29 MAR 95 08:06 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:

pm 4/17/95



Data File Name : C:\HPCHEM\1\DATA\tvh0331\002F0201.D
Operator : Dawn N. Guildner
Instrument : TVH
Sample Name : MB033195
n Time Bar Code:
-quired on : 31 Mar 95 09:59 AM
Report Created on: 31 Mar 95 10:22 AM
Last Recalib on : 31 Mar 95 09:48 AM
Multiplier : 1

Page Number : 1
Vial Number : 2
Injection Number : 1
Sequence Line : 2
Instrument Method: TVH0331.MTH
Analysis Method : TVH0331.MTH
Sample Amount : 0
ISTD Amount :

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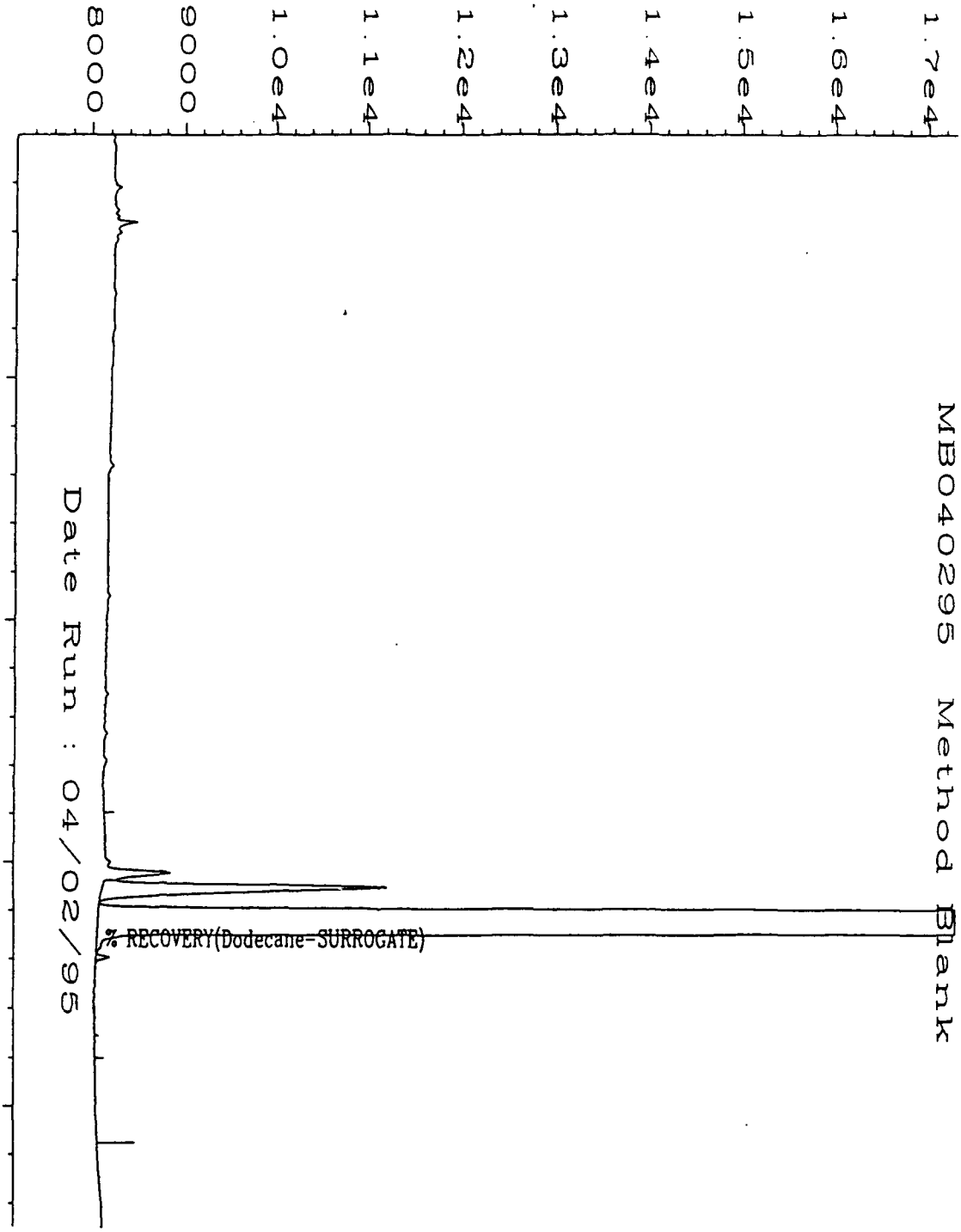
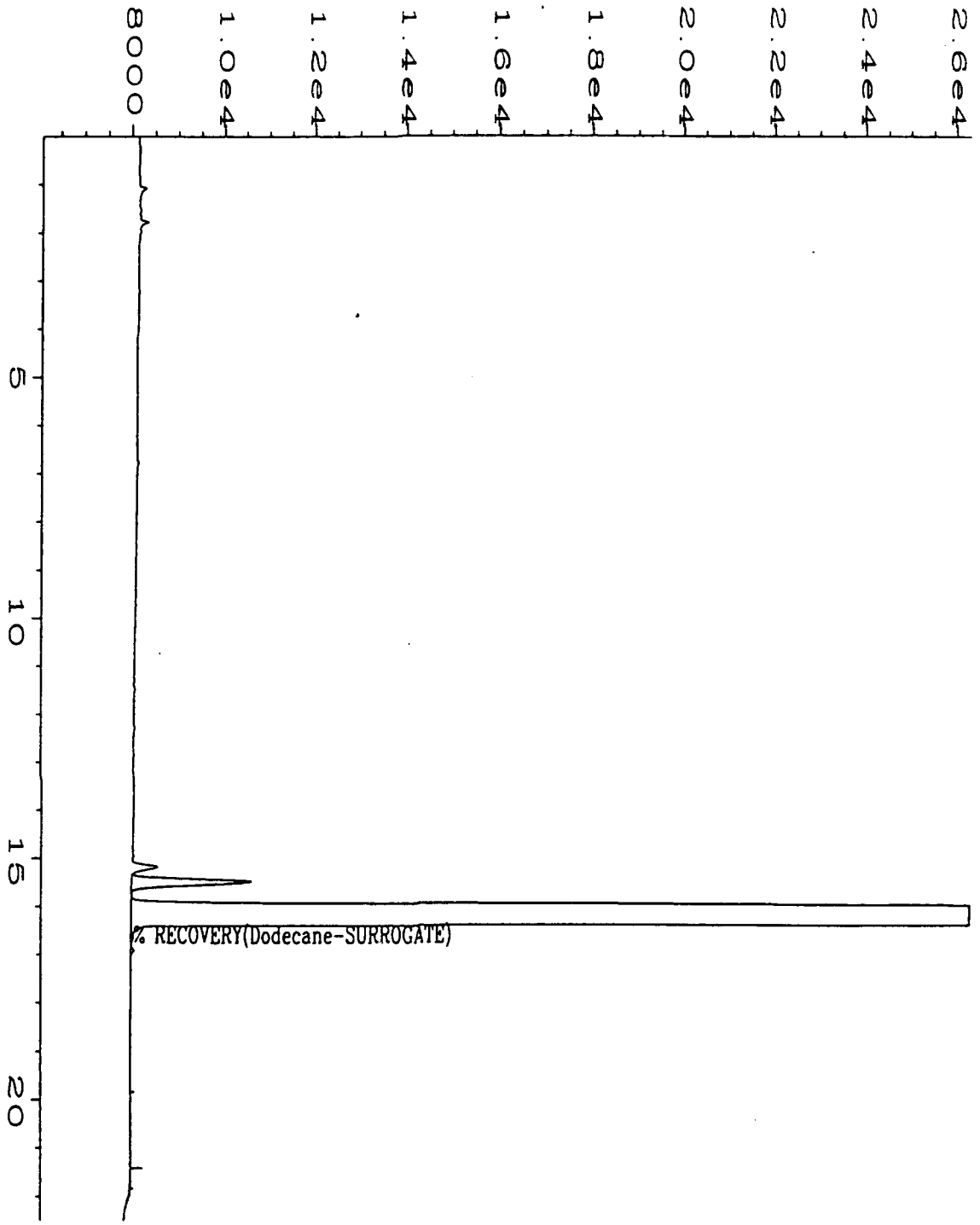
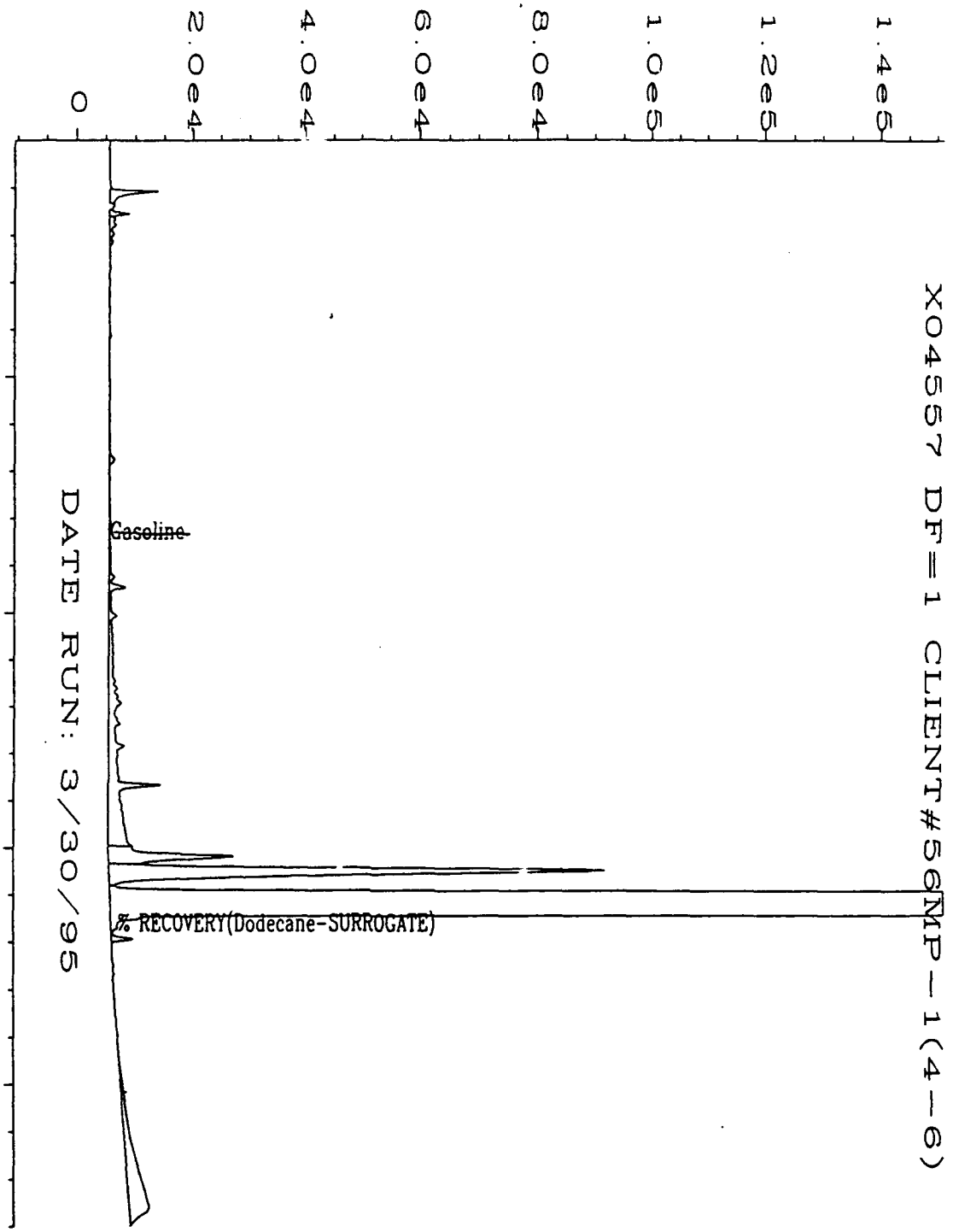


Data File Name	: C:\HPCHEM\1\DATA\TVH0402\007F0701.D		
Operator	: S.W. Tyson	Page Number	: 1
Instrument	: TVH	Vial Number	: 7
Sample Name	: MB040295	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 7
Acquired on	: 02 Apr 95 01:46 PM	Instrument Method	: TVH0402.
Report Created on	: 02 Apr 95 04:15 PM	Analysis Method	: TVH0402.MAC
Last Recalib on	: 02 Apr 95 01:38 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:

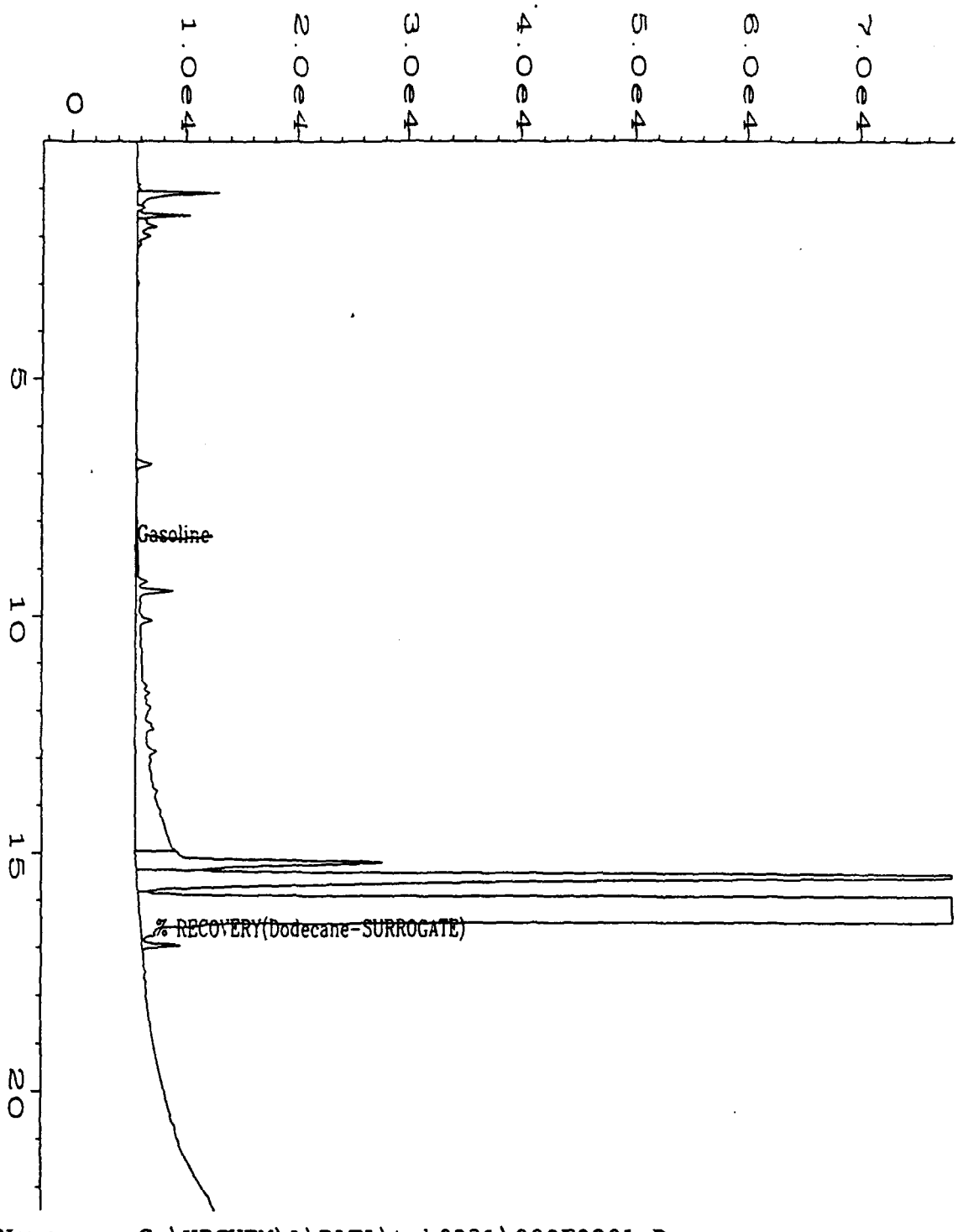


Data File Name	: C:\HPCHEM\1\DATA\tvh0402\028F0801.D		
Operator	: S.W. Tyson	Page Number	: 1
Instrument	: TVH	Vial Number	: 28
Sample Name	: MB040395	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 8
Acquired on	: 03 Apr 95 08:24 AM	Instrument Method	: TVH0402.MTH
Report Created on	: 03 Apr 95 08:47 AM	Analysis Method	: TVH0402.MTH
Last Recalib on	: 02 Apr 95 01:36 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:



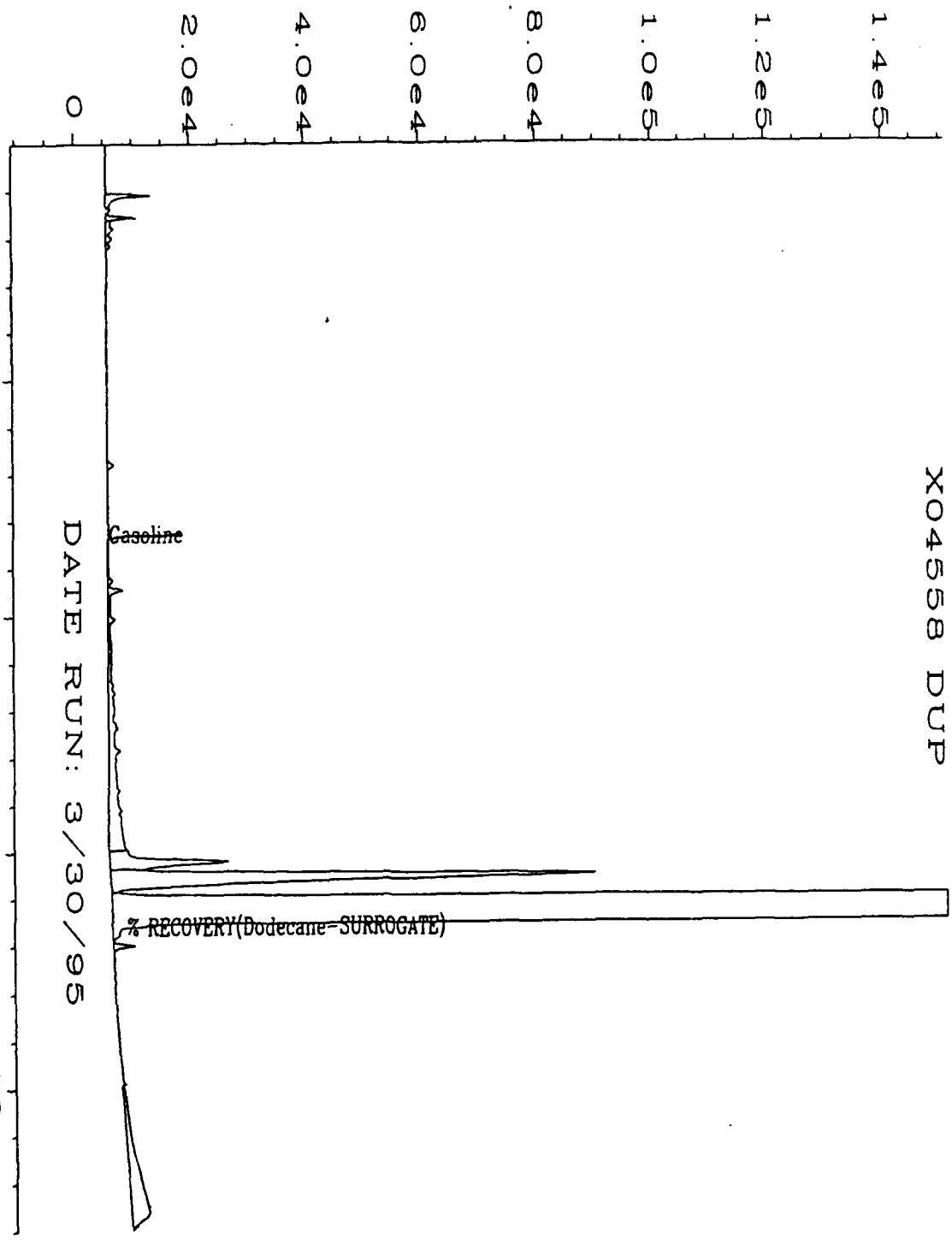
Data File Name	: C:\HPCHEM\1\DATA\TVH0330\003F0201.D		
Operator	: Dawn N. Guildner	Page Number	: 1
Instrument	: TVH	Vial Number	: 3
Sample Name	: X04557 DF=1, 5	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 2
Acquired on	: 30 Mar 95 07:02 PM	Instrument Method	: TVH032
Report Created on	: 31 Mar 95 09:43 AM	Analysis Method	: TVH0330.MT
Last Recalib on	: 29 MAR 95 08:06 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:

dm 4/17/95



Data File Name	: C:\HPCHEM\1\DATA\tvh0331\009F0201.D		
Operator	: Dawn N. Guildner	Page Number	: 1
Instrument	: TVH	Vial Number	: 9
Sample Name	: X04558 DF=1, 5	Injection Number	: 1
In Time Bar Code:		Sequence Line	: 2
Acquired on	: 31 Mar 95 01:56 PM	Instrument Method	: TVH0331.MTH
Report Created on	: 31 Mar 95 02:19 PM	Analysis Method	: TVH0331.MTH
Last Recalib on	: 31 Mar 95 09:48 AM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:
Sample Info	: PROJECT # 95-0915 CLIENT # 56MP-1(5-10) SOIL		

DW 4/17/95

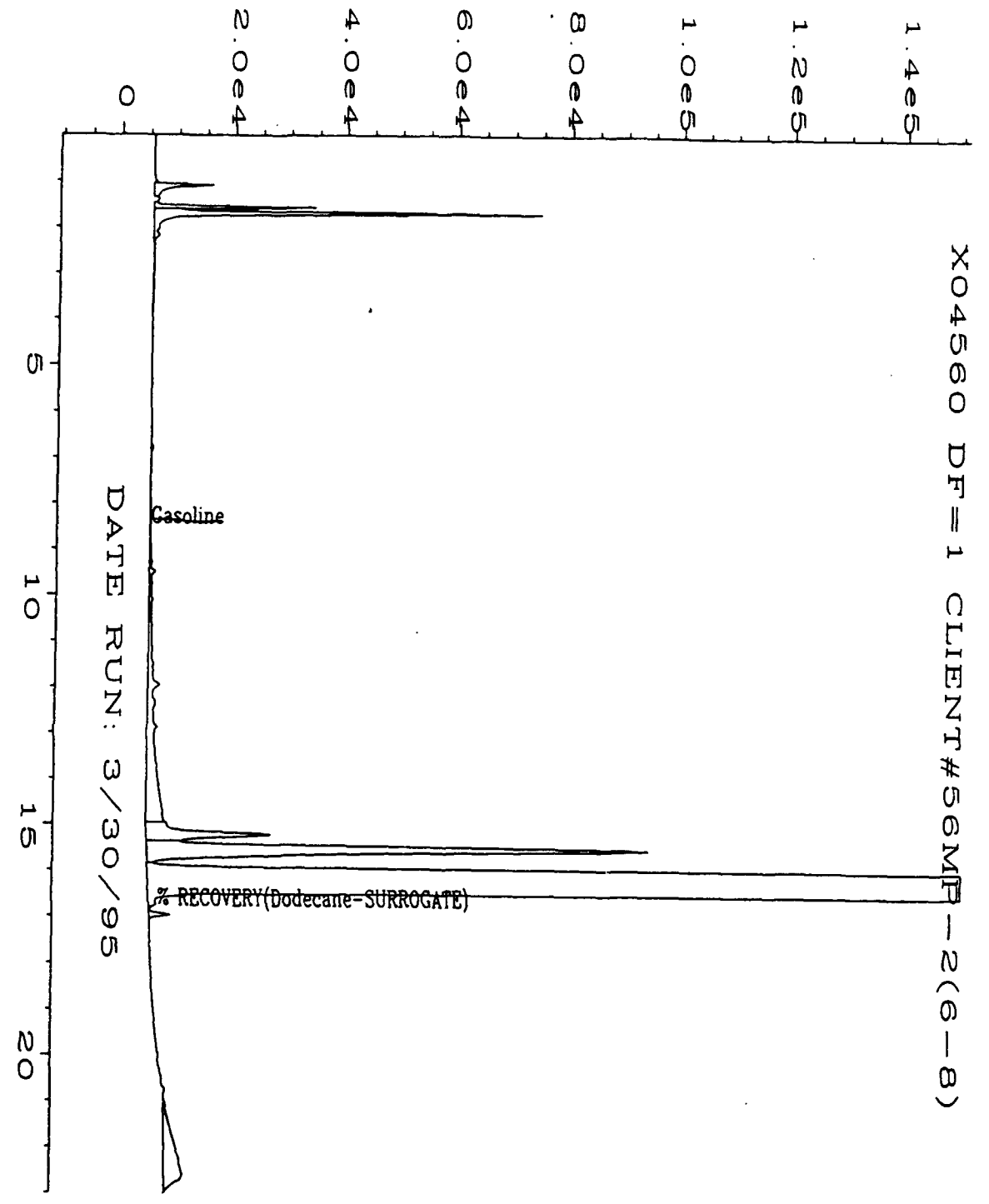


Data File Name : C:\HPCHEM\1\DATA\TVH0330\008F0201.D
Operator : Dawn N. Guildner
Instrument : TVH
Sample Name : X04558 DUP
Run Time Bar Code:
Acquired on : 30 Mar 95 09:51 PM
Report Created on: 31 Mar 95 09:50 AM
Last Recalib on : 29 MAR 95 08:06 PM
Multiplier : 1

Page Number : 1
Vial Number : 8
Injection Number : 1
Sequence Line : 2
Instrument Method: TVH0323
Analysis Method : TVH0330...
Sample Amount : 0
ISTD Amount :

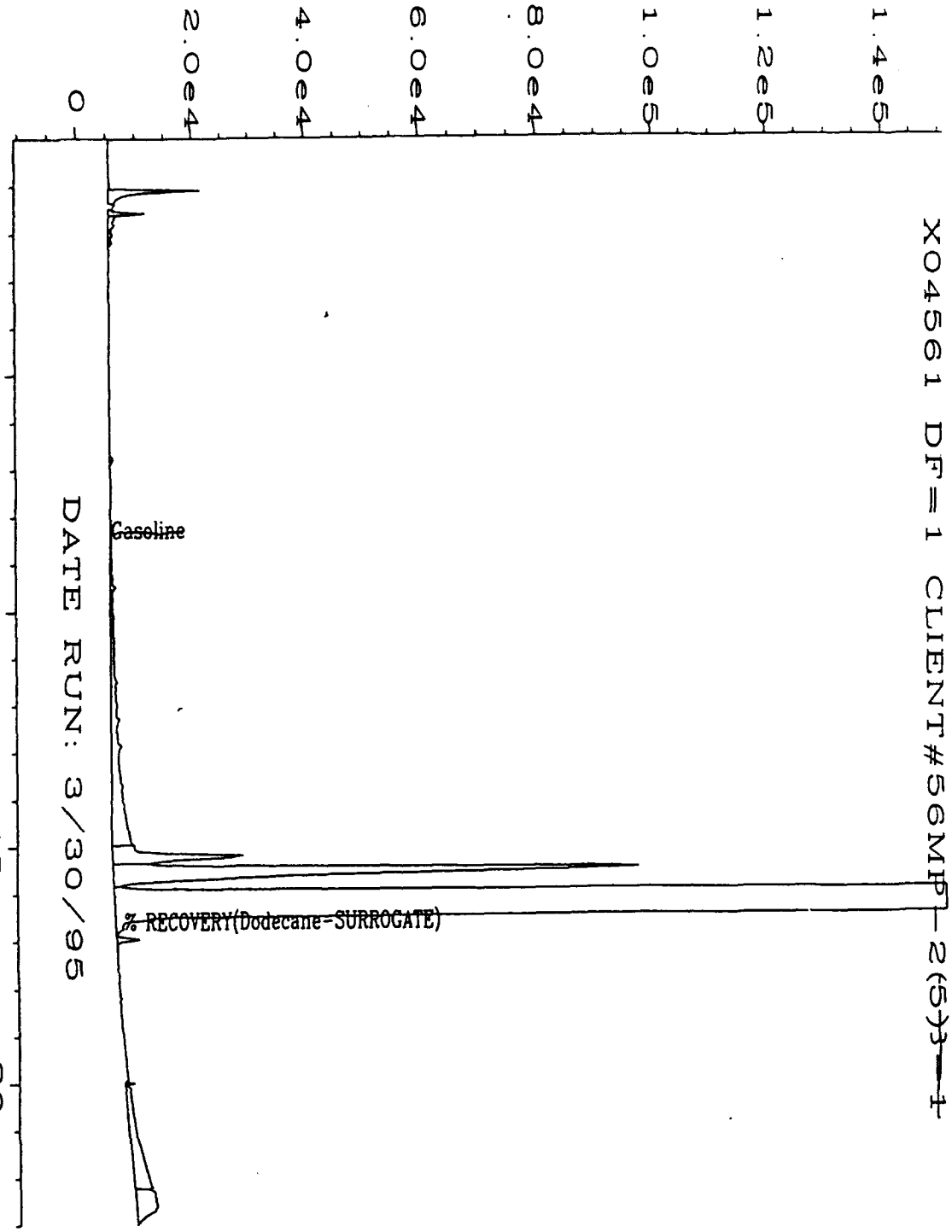
Client # SBMP-1(8-10) Dup

pm 4/17/95



Data File Name	: C:\HPCHEM\1\DATA\TVH0330\009F0201.D		
Operator	: Dawn N. Guildner	Page Number	: 1
Instrument	: TVH	Vial Number	: 9
Sample Name	: X04560 DF=1,5	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 2
Acquired on	: 30 Mar 95 10:25 PM	Instrument Method	: TVH0323.MTH
Report Created on	: 31 Mar 95 09:52 AM	Analysis Method	: TVH0330.MTH
Last Recalib on	: 29 MAR 95 08:06 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:

pm 4/17/95

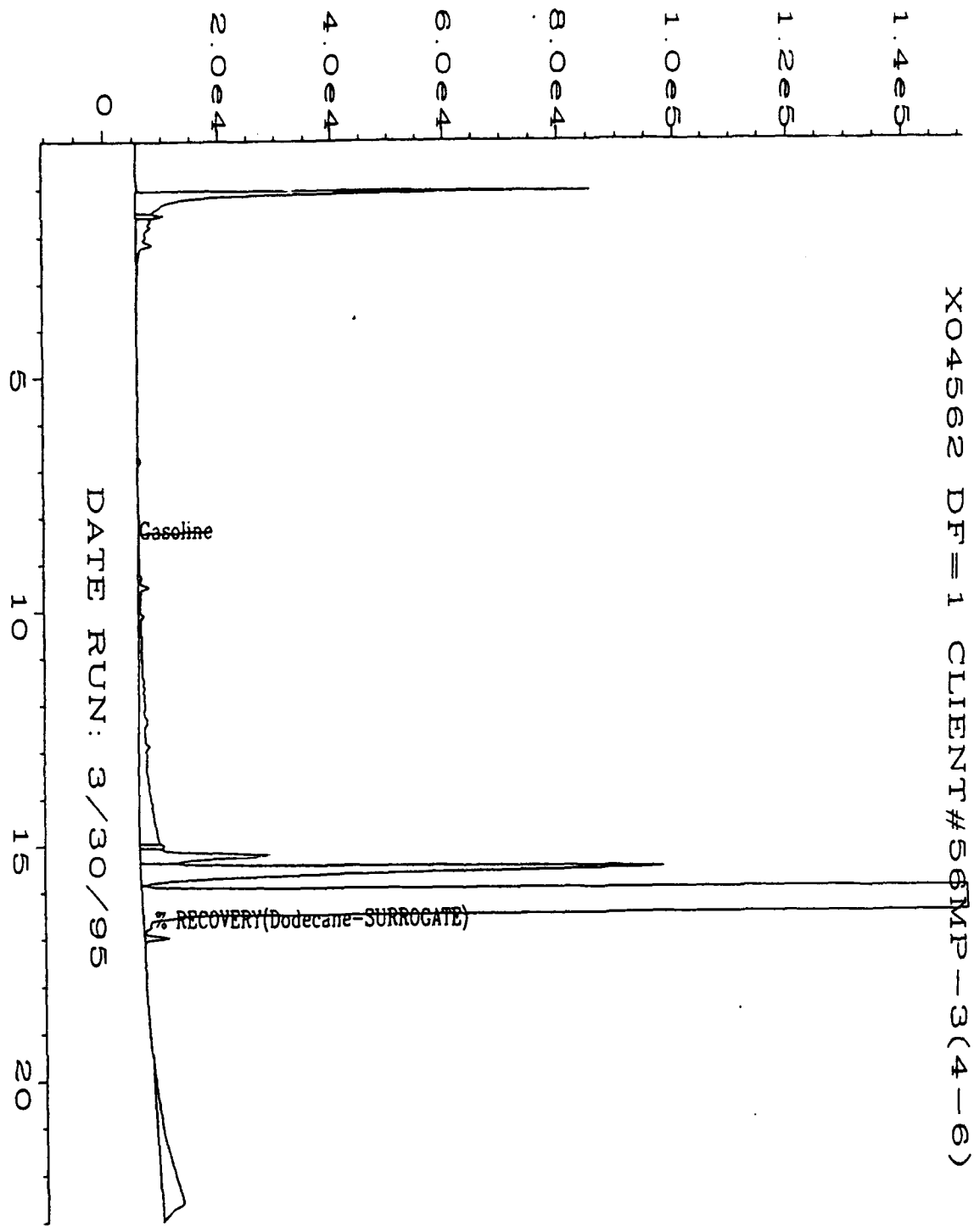


(13-15)

Data File Name : C:\HPCHEM\1\DATA\TVH0330\010F0201.D
Operator : Dawn N. Guildner
Instrument : TVH
Sample Name : X04561 DF=1,5
Run Time Bar Code:
Acquired on : 30 Mar 95 10:59 PM
Report Created on: 31 Mar 95 09:54 AM
Last Recalib on : 29 MAR 95 08:06 PM
Multiplier : 1

Page Number : 1
Vial Number : 10
Injection Number : 1
Sequence Line : 2
Instrument Method: TVH032?
Analysis Method : TVH033C
Sample Amount : 0
ISTD Amount :

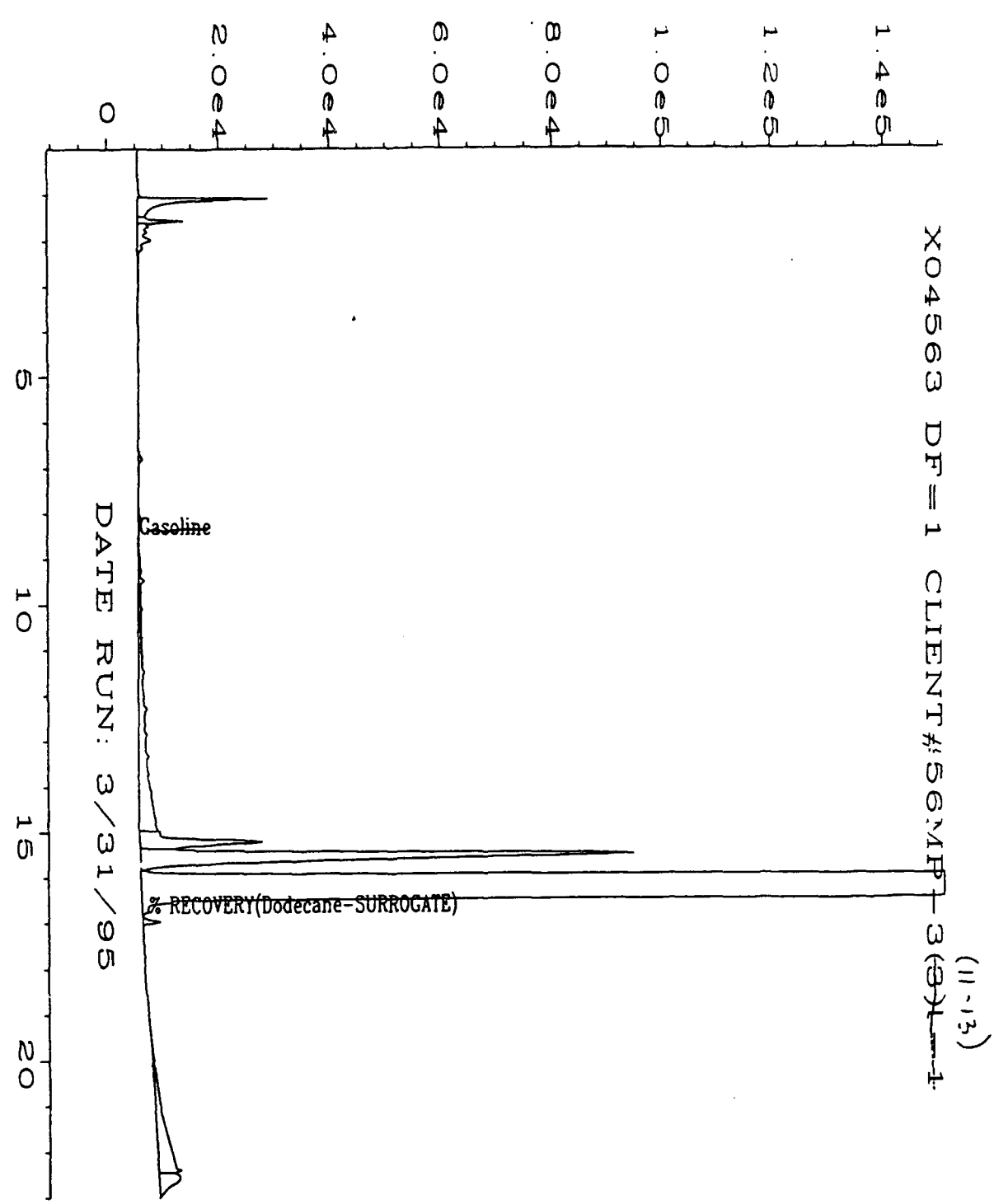
4/17/95



Data File Name : C:\HPCHEM\1\DATA\TVH0330\011F0201.D
Operator : Dawn N. Guildner
Instrument : TVH
Sample Name : X04562 DF=1,5
Run Time Bar Code:
quired on : 30 Mar 95 11:33 PM
eport Created on: 31 Mar 95 09:56 AM
Last Recalib on : 29 MAR 95 08:06 PM
Multiplier : 1

Page Number : 1
Vial Number : 11
Injection Number : 1
Sequence Line : 2
Instrument Method: TVH0323.MTH
Analysis Method : TVH0330.MTH
Sample Amount : 0
ISTD Amount :

pm 4/17/95

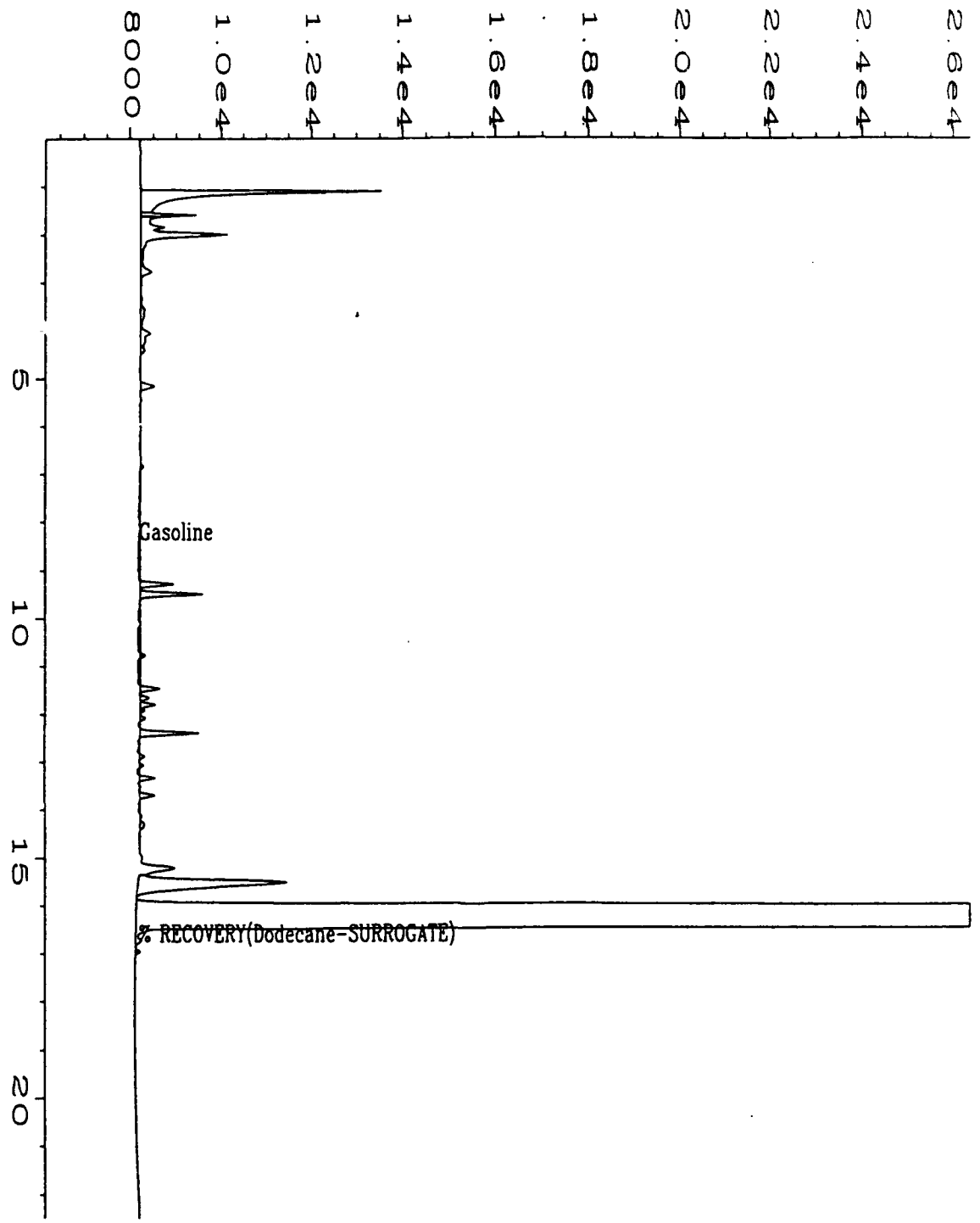


(11-13)

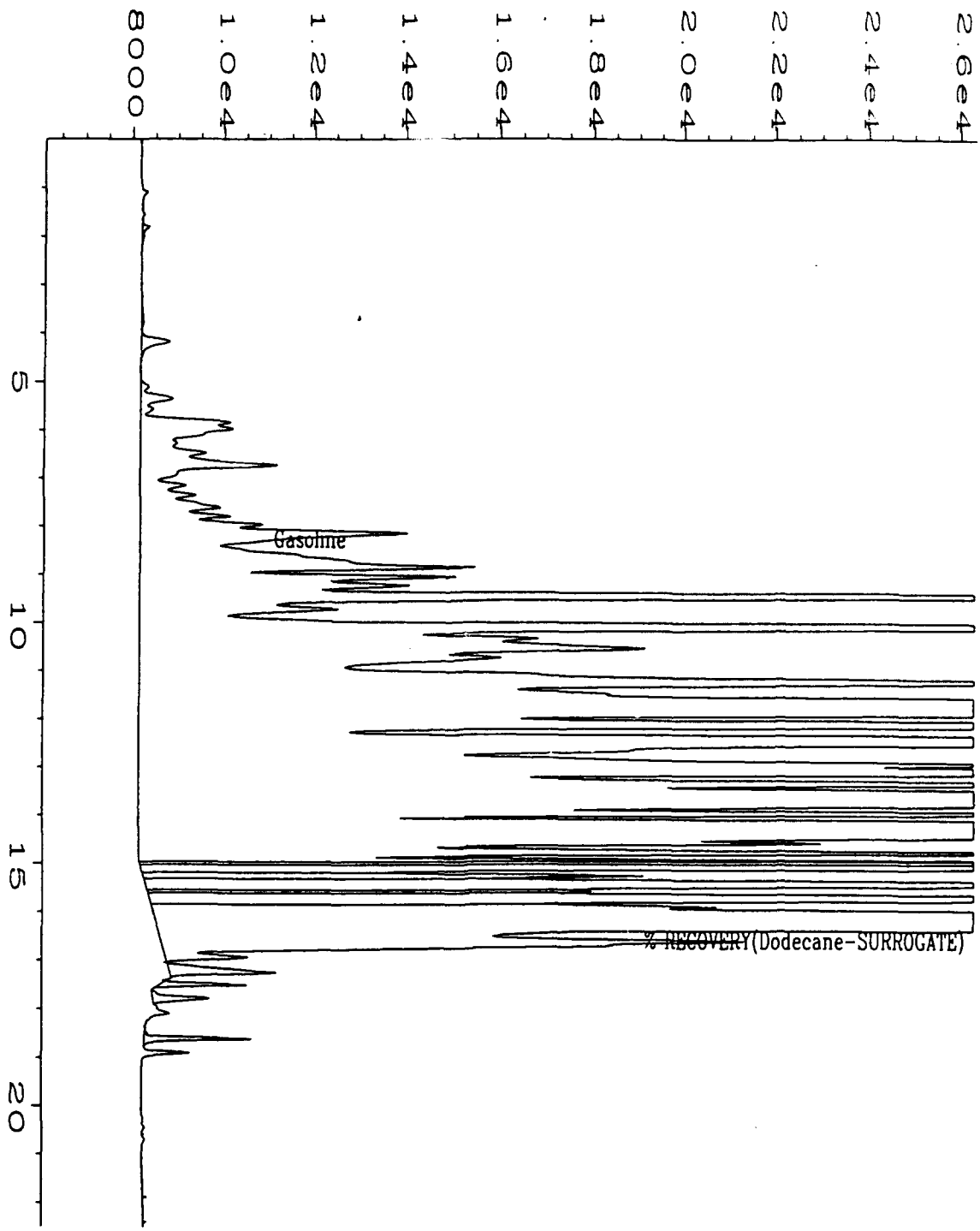
Data File Name : C:\HPCHEM\1\DATA\TVH0330\012F0201.D
Operator : Dawn N. Guildner
Instrument : TVH
Sample Name : X04563 DF=1,5
Run Time Bar Code:
Acquired on : 31 Mar 95 00:07 AM
Report Created on: 31 Mar 95 09:58 AM
Last Recalib on : 29 MAR 95 08:06 PM
Multiplier : 1

Page Number : 1
Vial Number : 12
Injection Number : 1
Sequence Line : 2
Instrument Method: TVH032
Analysis Method : TVH0330...
Sample Amount : 0
ISTD Amount :

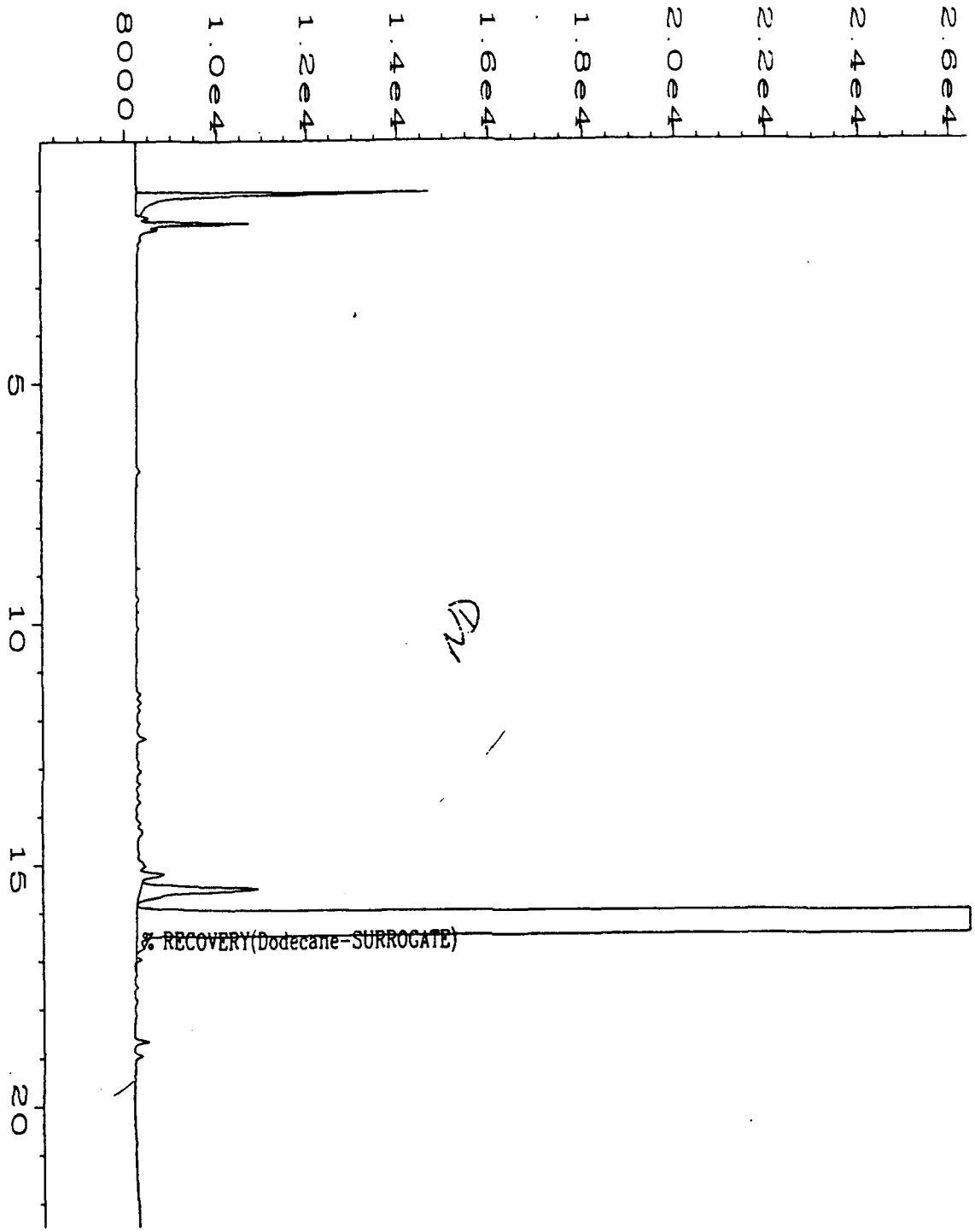
pm 4/17/95



Data File Name	: C:\HPCHEM\1\DATA\TVH0402\014F0801.D		
Operator	: S.W. Tyson	Page Number	: 1
Instrument	: TVH	Vial Number	: 14
Sample Name	: X04564;1;5	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 8
quired on	: 02 Apr 95 05:43 PM	Instrument Method	: TVH0402.MTH
Report Created on	: 18 Apr 95 01:40 PM	Analysis Method	: TVH0402.MTH
Last Recalib on	: 11 APR 95 11:20 AM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:



Data File Name	: C:\HPCHEM\1\DATA\tvh0402\029F0801.D		
Operator	: S.W. Tyson	Page Number	: 1
Instrument	: TVH	Vial Number	: 29
Sample Name	: X04566;50;0.1	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 8
Acquired on	: 03 Apr 95 08:58 AM	Instrument Method	: TVH0402
Report Created on	: 03 Apr 95 09:21 AM	Analysis Method	: TVH0402
Last Recalib on	: 02 Apr 95 01:36 PM	Sample Amount	: 0
Multiplier	: 50	ISTD Amount	:
Sample Info	: Project # 95-0915 Client # 56MP-5(4-6) Soil		

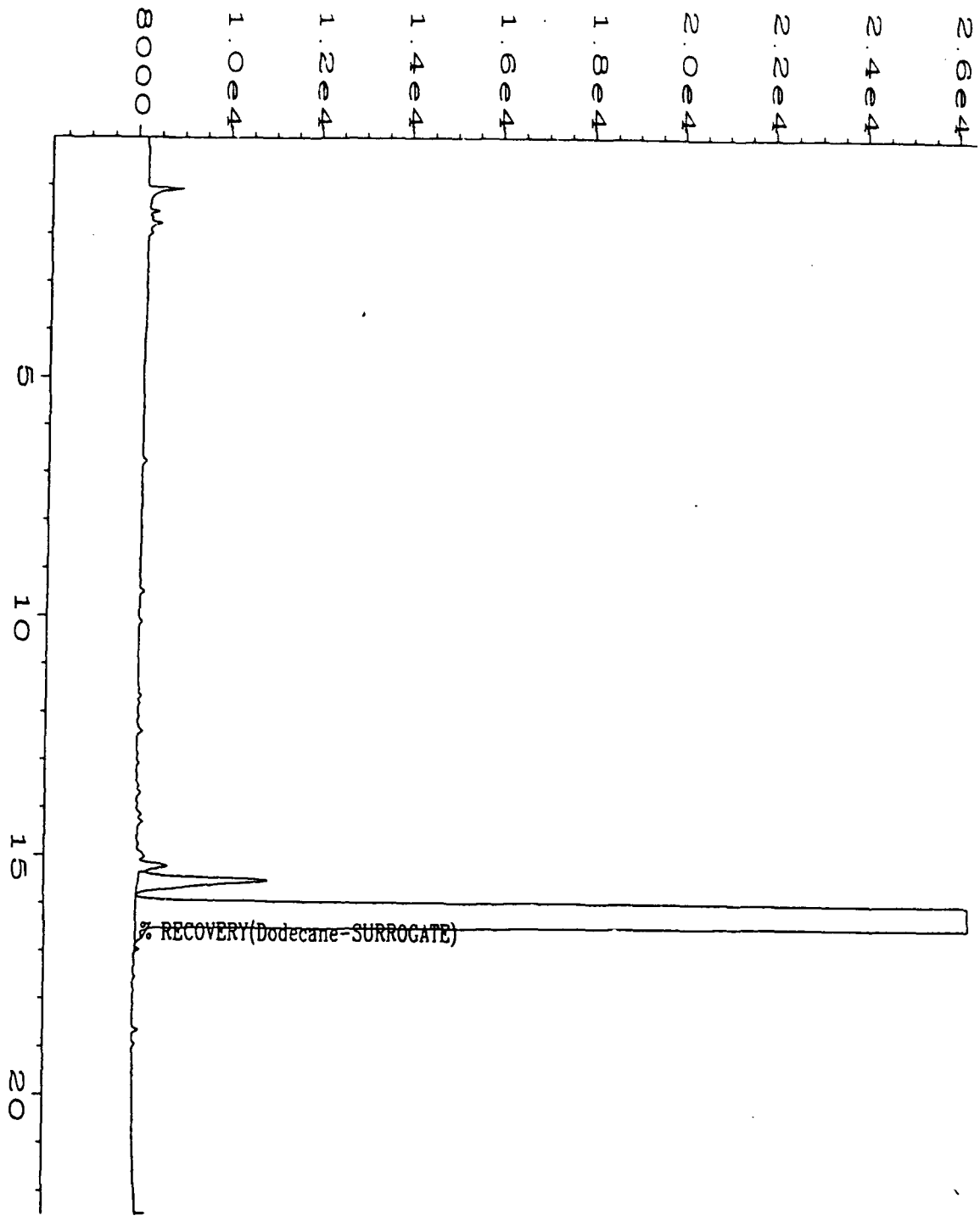


Data File Name : C:\HPCHEM\1\DATA\tvh0402\016F0801.D
Operator : S.W. Tyson
Instrument : TVH
Sample Name : X04567;1;5
Run Time Bar Code:
Acquired on : 02 Apr 95 06:51 PM
Report Created on: 02 Apr 95 07:14 PM
Last Recalib on : 02 Apr 95 01:36 PM
Multiplier : 1
Sample Info : Project # 95-0915 Client # 56MP-5(8-11) Soil

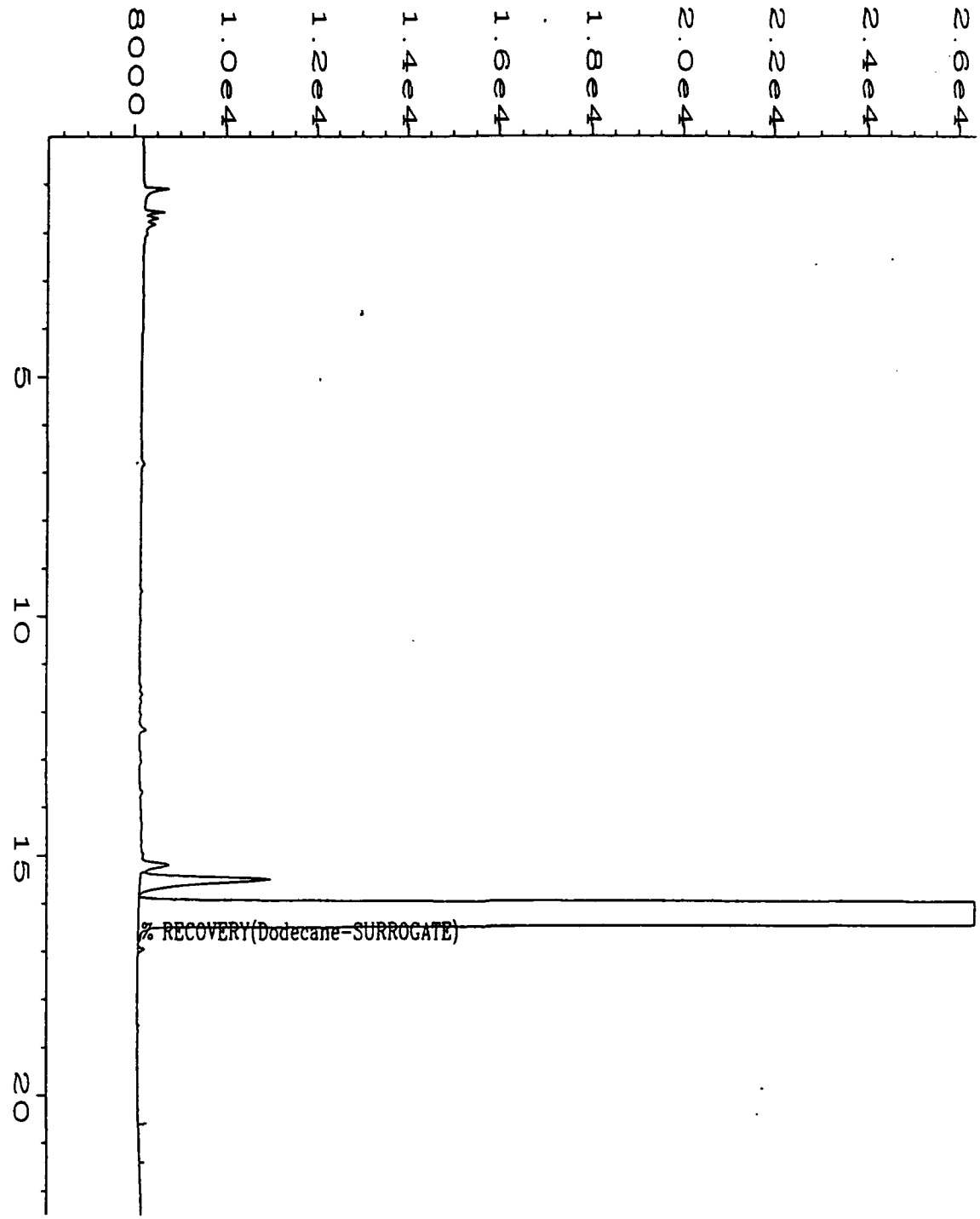
Page Number : 1
Vial Number : 16
Injection Number : 1
Sequence Line : 8
Instrument Method: TVH0402.MTH
Analysis Method : TVH0402.MTH
Sample Amount : 0
ISTD Amount :

9

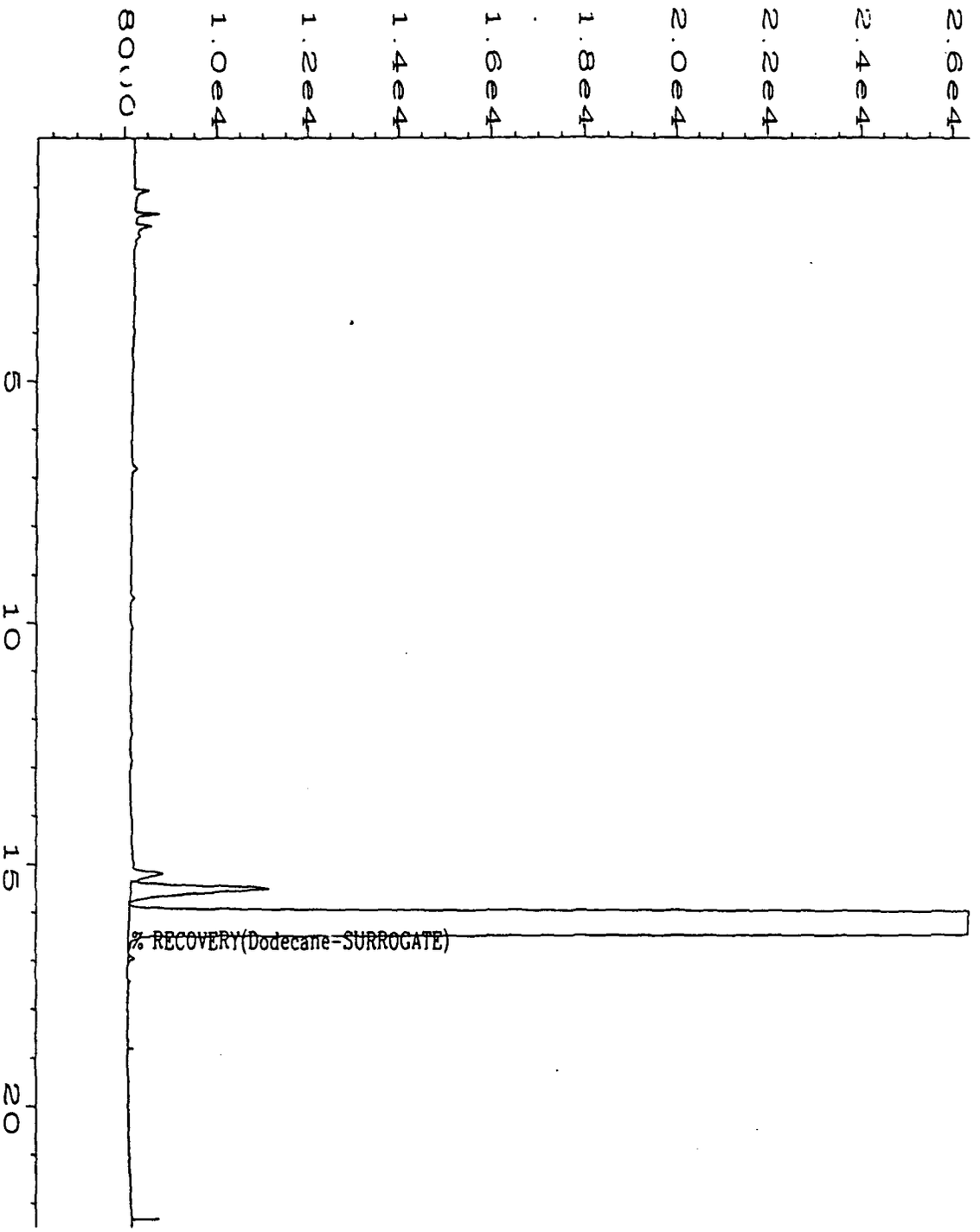
pm 4/17/95



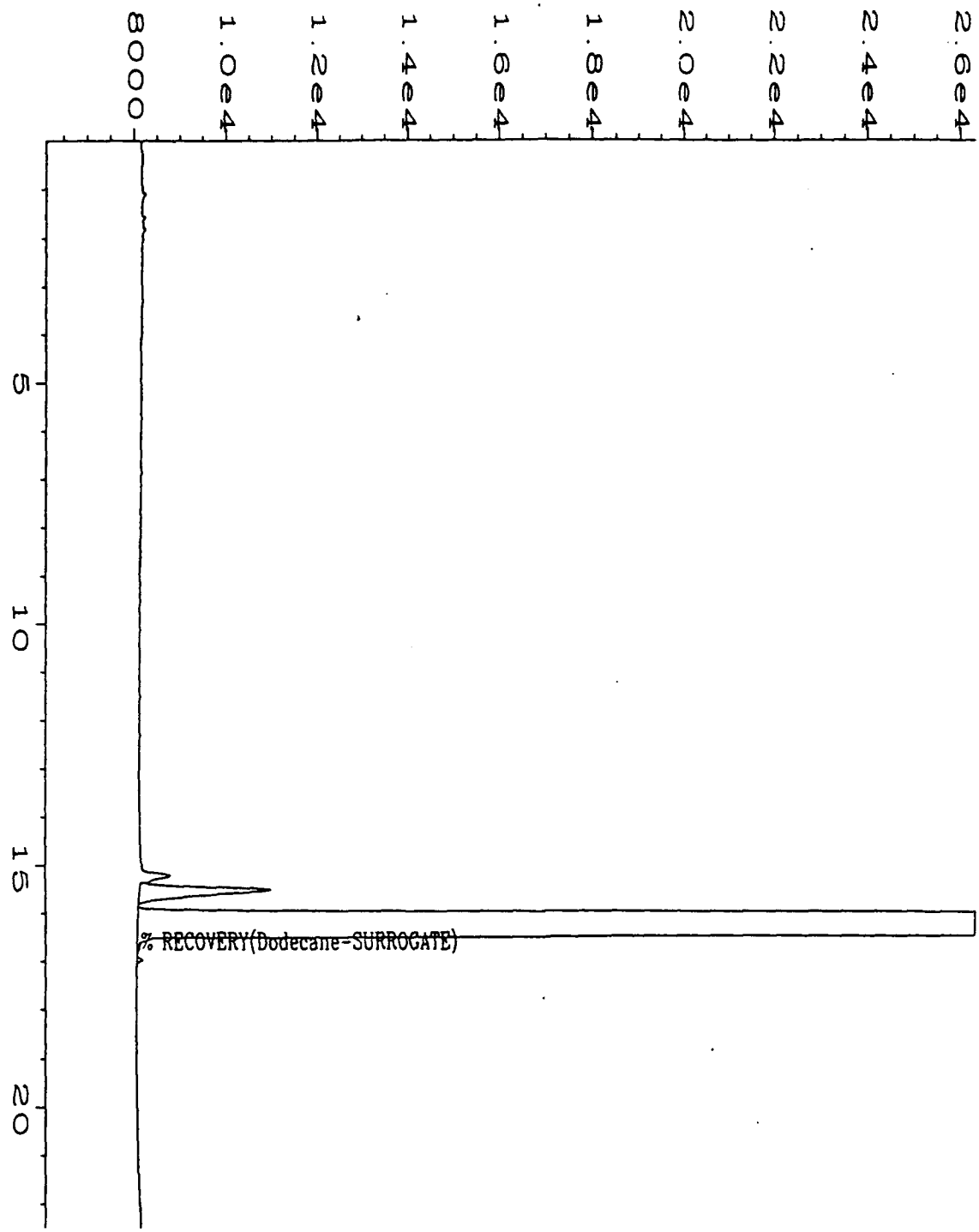
Data File Name	: C:\HPCHEM\1\DATA\tvh0402\030F0801.D		
Operator	: S.W. Tyson	Page Number	: 1
Instrument	: TVH	Vial Number	: 30
Sample Name	: X04568;1;5	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 8
Acquired on	: 03 Apr 95 09:32 AM	Instrument Method	: TVH0402
Report Created on	: 03 Apr 95 09:55 AM	Analysis Method	: TVH0402
Last Recalib on	: 02 Apr 95 01:36 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:
Sample Info	: Project # 95-0915 Client # 56MP-6(4-6) Soil		



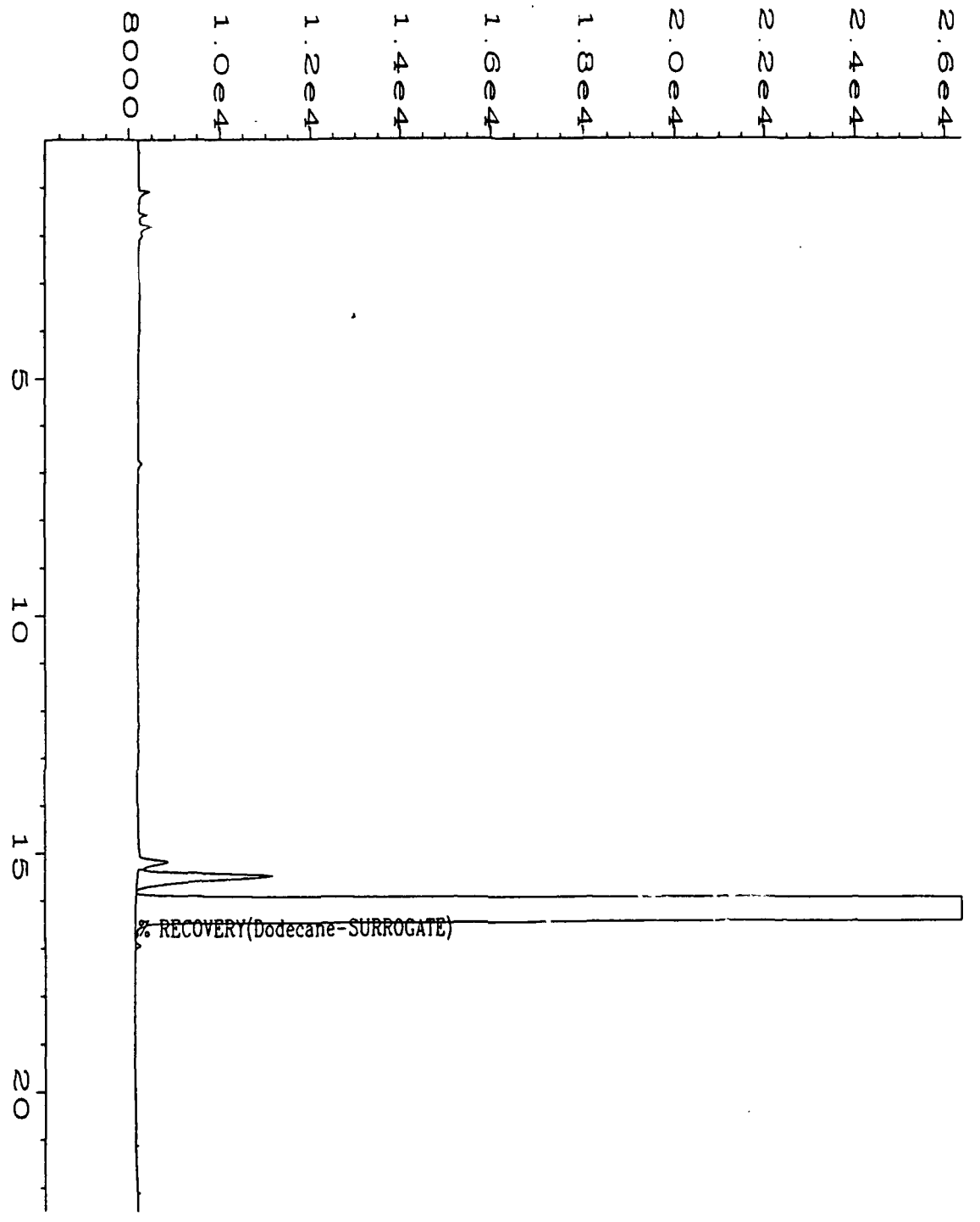
Data File Name	: C:\HPCHEM\1\DATA\tvh0402\019F0801.D		
Operator	: S.W. Tyson	Page Number	: 1
Instrument	: TVH	Vial Number	: 19
Sample Name	: X04569;1;5	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 8
quired on	: 02 Apr 95 08:33 PM	Instrument Method	: TVH0402.MTH
eport Created on	: 02 Apr 95 08:56 PM	Analysis Method	: TVH0402.MTH
Last Recalib on	: 02 Apr 95 01:36 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:
Sample Info	: Project # 95-0915 Client # 56MP-6(10-11) Soil		



Data File Name	: C:\HPCHEM\1\DATA\tvh0402\020F0801.D		
Operator	: S.W. Tyson	Page Number	: 1
Instrument	: TVH	Vial Number	: 20
Sample Name	: X04571;1;5	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 8
Acquired on	: 02 Apr 95 09:07 PM	Instrument Method	: TVH0402.
Report Created on	: 02 Apr 95 09:30 PM	Analysis Method	: TVH0402.M...
Last Recalib on	: 02 Apr 95 01:36 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:
Sample Info	: Project # 95-0915 Client # Matrix Spike Soil		



Data File Name	: C:\HPCHEM\1\DATA\tvh0402\040F0801.D		
Operator	: S.W. Tyson	Page Number	: 1
Instrument	: TVH	Vial Number	: 40
Sample Name	: X04572;1;1	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 8
Acquired on	: 03 Apr 95 03:11 PM	Instrument Method	: TVH0402.MTH
Report Created on	: 03 Apr 95 03:34 PM	Analysis Method	: TVH0402.MTH
Last Recalib on	: 02 Apr 95 01:36 PM	Sample Amount	: 0
Multiplier	: 5	ISTD Amount	:
Sample Info	: Project # 95-0915 Client # 56MP-16(4-6) Soil		



Data File Name	: C:\HPCHEM\1\DATA\tvh0402\024F0801.D		
Operator	: S.W. Tyson	Page Number	: 1
Instrument	: TVH	Vial Number	: 24
Sample Name	: X04572 Dupl.	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 8
Acquired on	: 02 Apr 95 11:23 PM	Instrument Method	: TVH0402
Report Created on	: 02 Apr 95 11:46 PM	Analysis Method	: TVH0402.M1
Last Recalib on	: 02 Apr 95 01:36 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:
Sample Info	: Project # 95-0915 Client # 56MP-16(4-6) Soil Dupl.		

EVERGREEN ANALYTICAL, INC.
4036 Youngfield, Wheat Ridge, CO 80033
(303) 425-6021

TOTAL EXTRACTABLE HYDROCARBONS (TEH)
Jet Fuel A Boiling Range

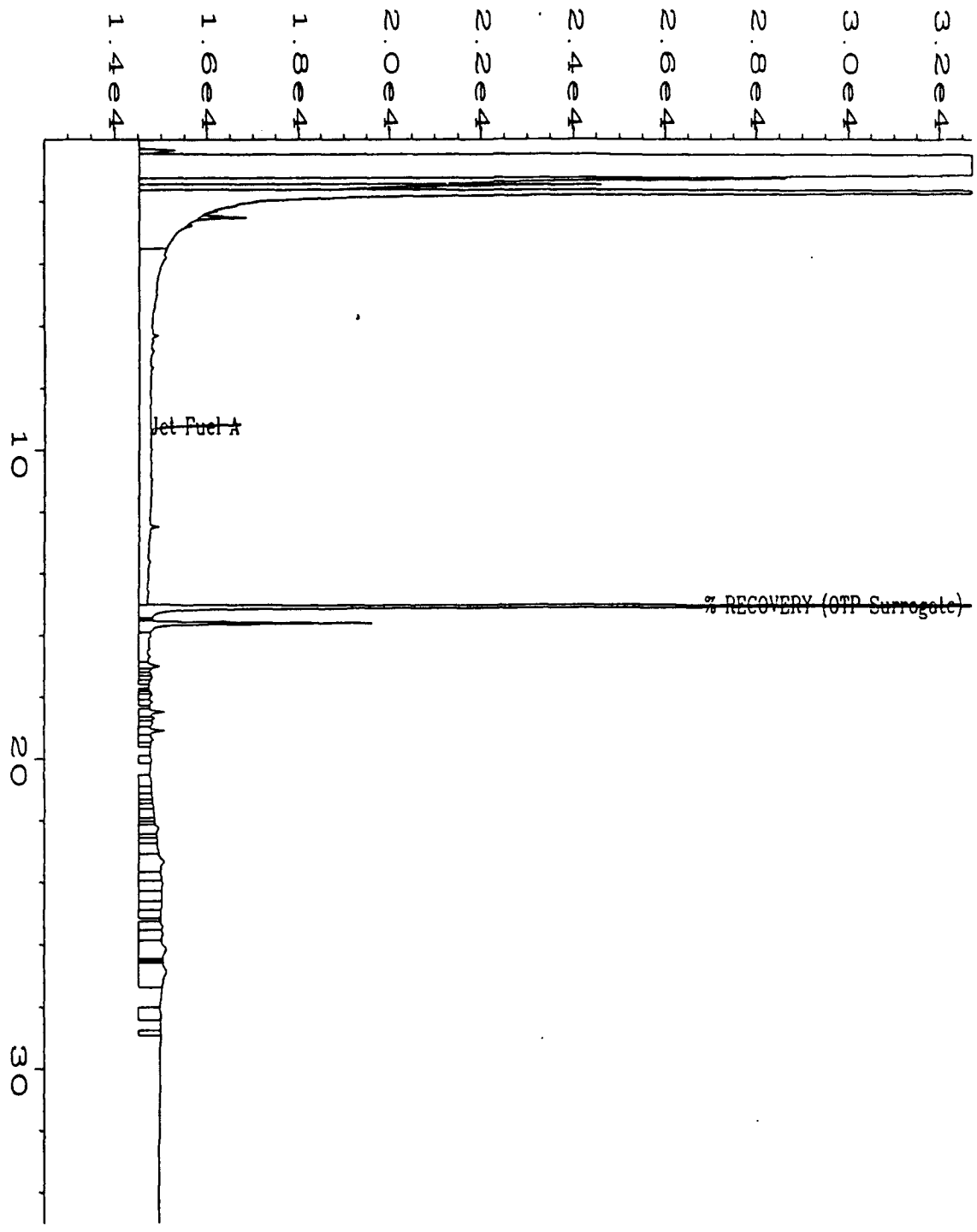
Date Sampled	: 3/17,20/95	Client Project Number	: 722450.21020 Mac Dill AFB
Date Received	: 3/22/95		
Date Prepared	: 3/24/95	Lab Project Number	: 95-0915
Date Analyzed	: 3/25,28/95	Matrix	: Soil
		Method Number	: 3500/Mod. 8015

Evergreen Sample #	Client Sample #	Surrogate Recovery	TEH* mg/Kg	RL* mg/Kg
SB032495	Soil Method Blank	94%	U	10
X04557	56MP-1(4-6)	96%	U	12
X04557 Dupl	56MP-1(4-6)	97%	U	12
X04558	56MP-1(8-10)	98%	U	13
X04560	56MP-2(6-8)	83%	U	12
X04561	56MP-2(13-15)	86%	U	13
X04562	56MP-3(4-6)	97%	U	12
X04566	56MP-5(4-6)	[1]	2900	630
X04568	56MP-6(4-6)	93%	U	12
X04571	Matrix Spike	93%	U	13
X04572	56MP-16(4-6)	87%	U	13

* = Based on dry weight.
[1] = Surrogate diluted out of sample.
QUALIFIERS
U = TEH analyzed for but not detected.
B = TEH found in blank as well as sample (blank data should be compared).
E = Extrapolated value.
RL = Reporting Limit

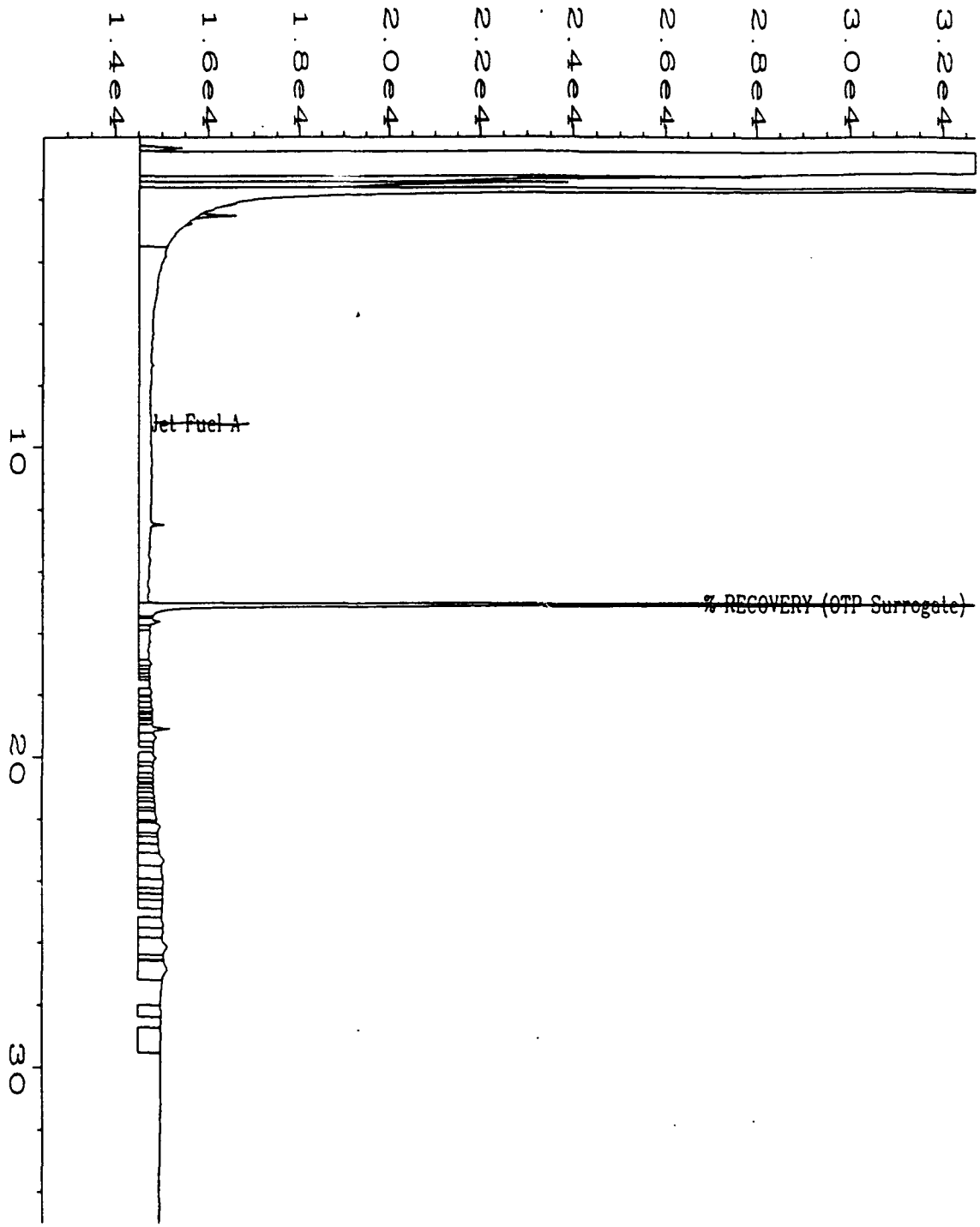
Analyst

Approved



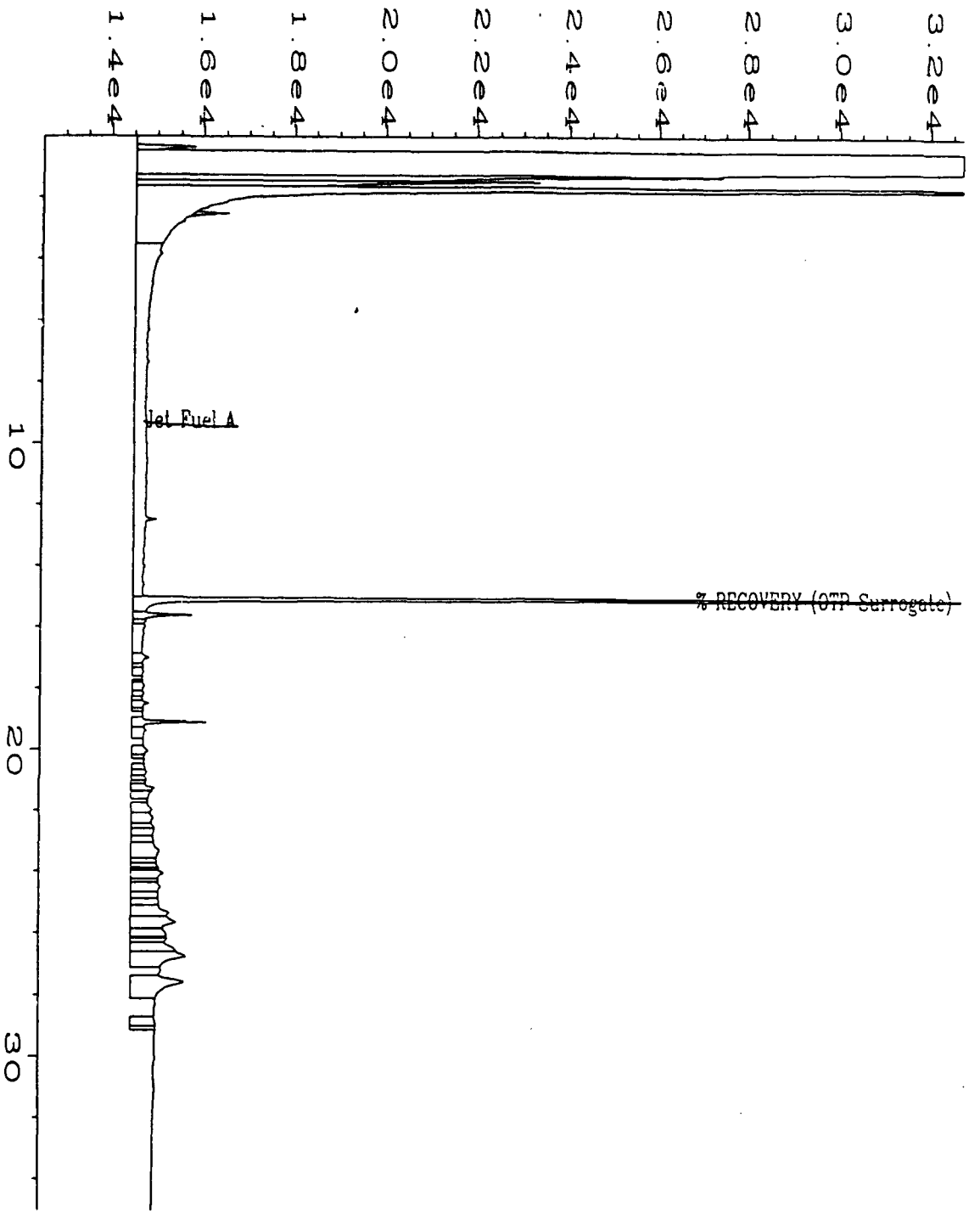
Data File Name	: C:\HPCHEM\2\DATA\JET0323\035R0101.D		
Operator	: Dawn N. Guildner	Page Number	: 1
Instrument	: TEH	Vial Number	: 35
Sample Name	: X04557;DF=1;30	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 1
Acquired on	: 25 Mar 95 03:48 AM	Instrument Method	: JET0323
Report Created on	: 25 Mar 95 04:24 AM	Analysis Method	: JET0323.
Last Recalib on	: 24 MAR 95 08:06 AM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:
Sample Info	: Project # 95-0915 Client # 56MP-1(4-6) Soil		

pm 4/17/95



Data File Name	: C:\HPCHEM\2\DATA\JET0323\036R0101.D		
Operator	: Dawn N. Guildner	Page Number	: 1
Instrument	: TEH	Vial Number	: 36
Sample Name	: X04557 Dupl;	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 1
Acquired on	: 25 Mar 95 04:38 AM	Instrument Method	: JET0323.MTH
Report Created on	: 25 Mar 95 05:13 AM	Analysis Method	: JET0323.MTH
Last Recalib on	: 24 MAR 95 08:06 AM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:
Sample Info	: Project # 95-0915 Client # 56MP-1(4-6) Soil		

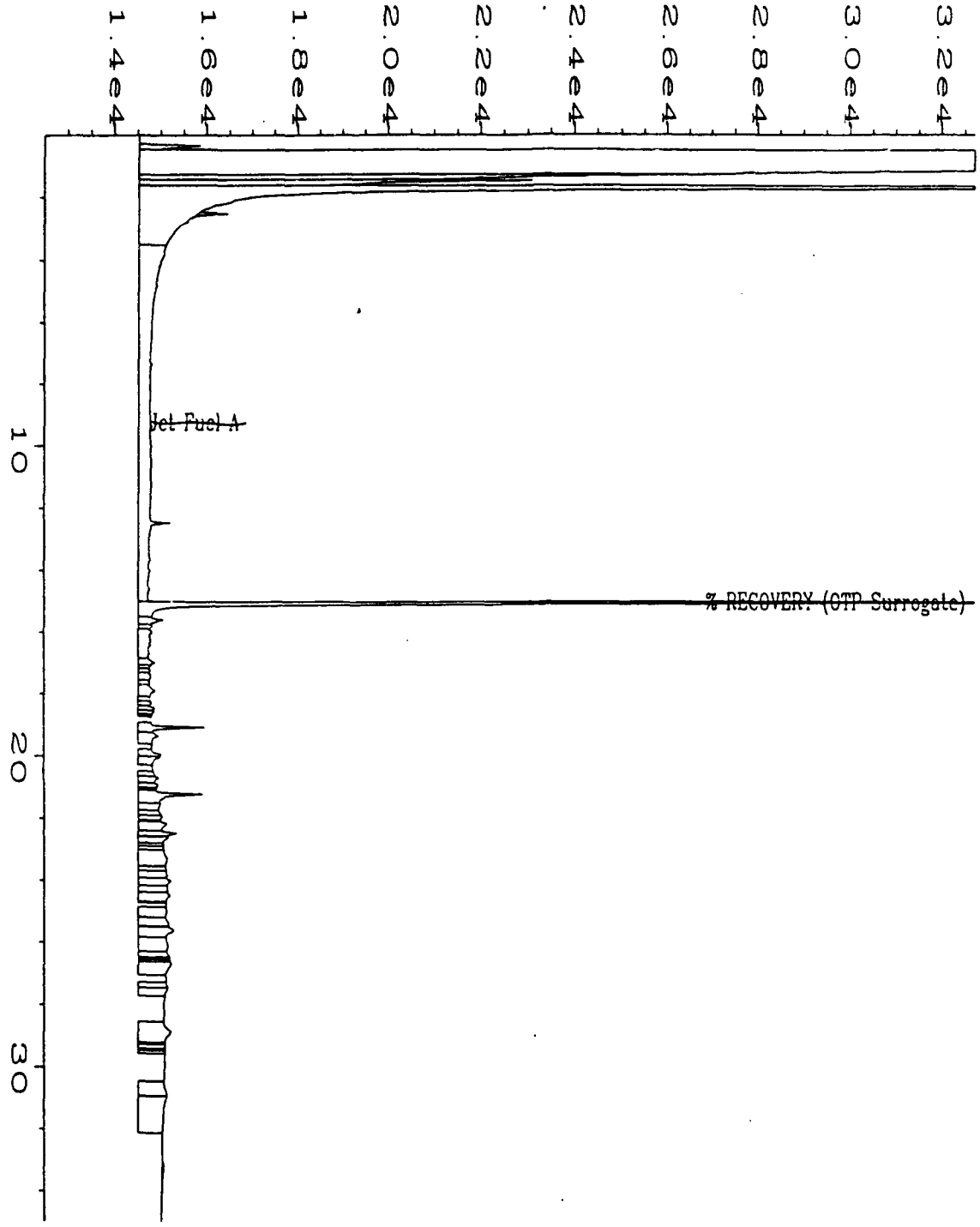
pm 4/17/95



Data File Name : C:\HPCHEM\2\DATA\JET0323\037R0101.D
Operator : Dawn N. Guildner
Instrument : TEH
Sample Name : X04558;DF=1;30
Run Time Bar Code:
Acquired on : 25 Mar 95 05:27 AM
Report Created on: 25 Mar 95 06:03 AM
Last Recalib on : 24 MAR 95 08:06 AM
Multiplier : 1
Sample Info : Project # 95-0915 Client # 56MP-1(8-10) Soil

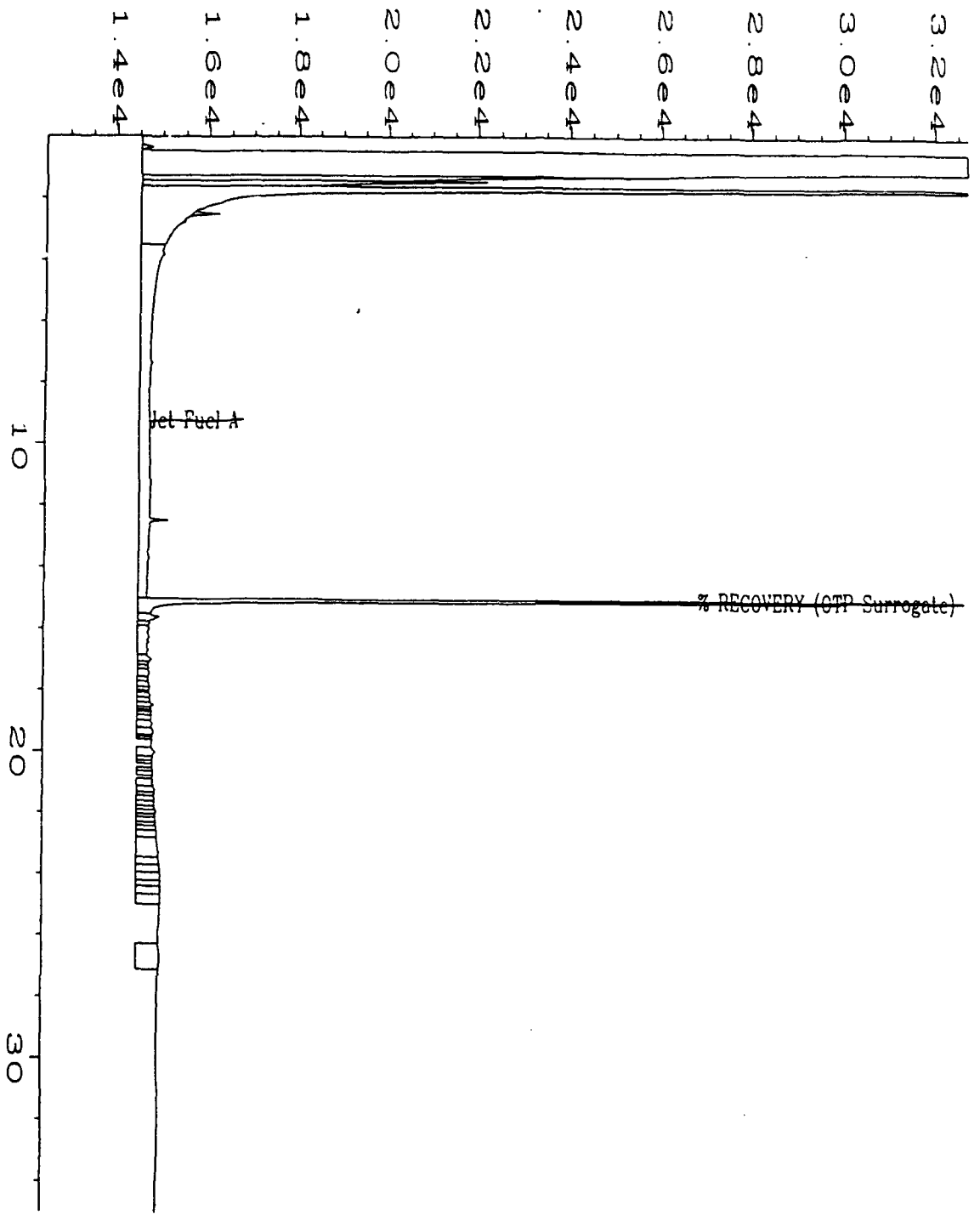
Page Number : 1
Vial Number : 37
Injection Number : 1
Sequence Line : 1
Instrument Method: JET0323
Analysis Method : JET0323
Sample Amount : 0
ISTD Amount :

pm 4/17/95



Data File Name	: C:\HPCHEM\2\DATA\JET0323\038R0101.D		
Operator	: Dawn N. Guildner	Page Number	: 1
Instrument	: TEH	Vial Number	: 38
Sample Name	: X04560;DF=1;30	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 1
Acquired on	: 25 Mar 95 06:17 AM	Instrument Method	: JET0323.MTH
Report Created on	: 25 Mar 95 06:52 AM	Analysis Method	: JET0323.MTH
Last Recalib on	: 24 MAR 95 08:06 AM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:
Sample Info	: Project # 95-0915 Client # 56MP-2(6-8) Soil		

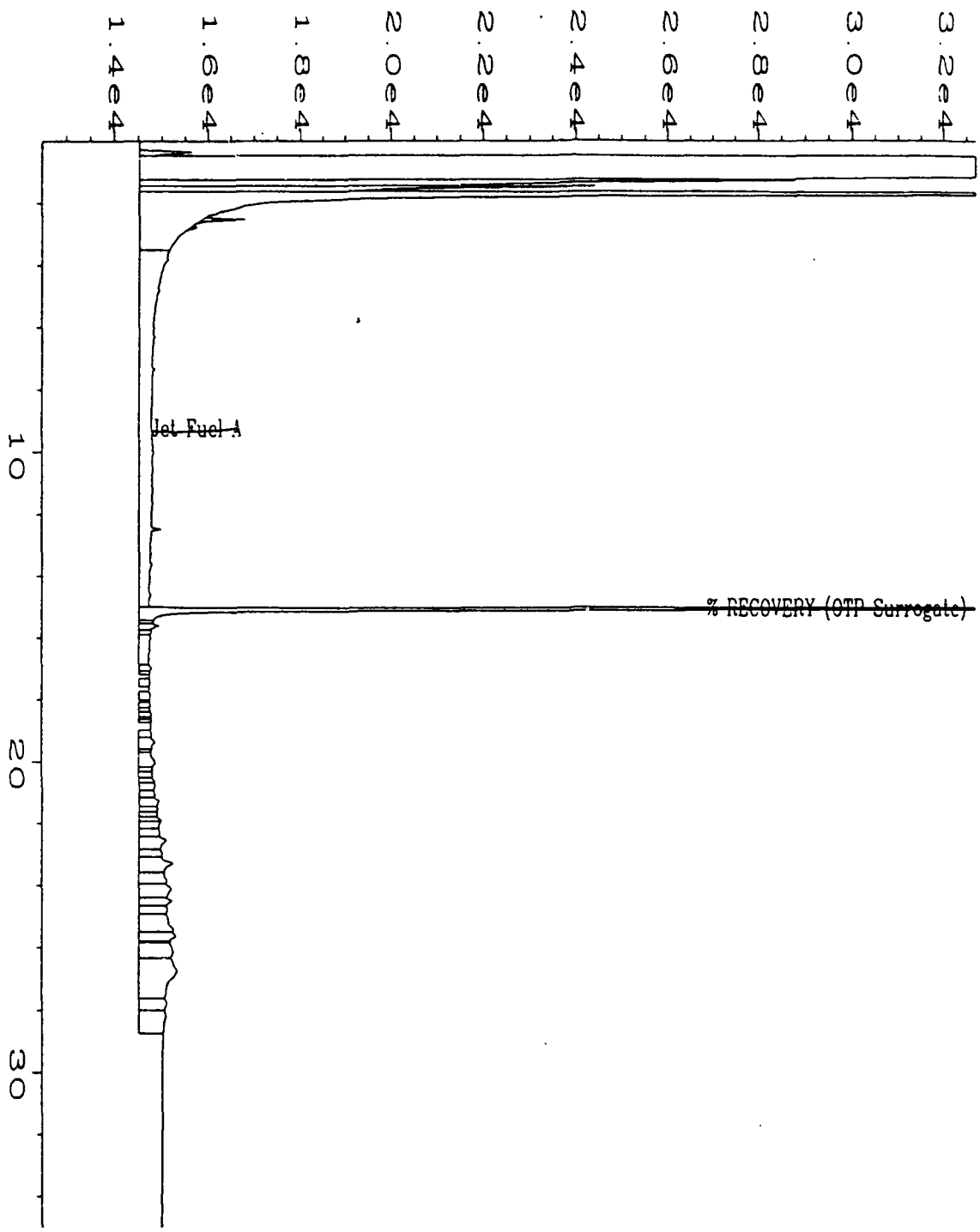
Dm 4/17/95



Data File Name : C:\HPCHEM\2\DATA\JET0323\039R0101.D
Operator : Dawn N. Guildner
Instrument : TEH
Sample Name : X04561;DF=1;30
Run Time Bar Code:
Acquired on : 25 Mar 95 07:07 AM
Report Created on: 25 Mar 95 07:42 AM
Last Recalib on : 24 MAR 95 08:06 AM
Multiplier : 1
Sample Info : Project # 95-0915 Client # 56MP-2(13-15) Soil

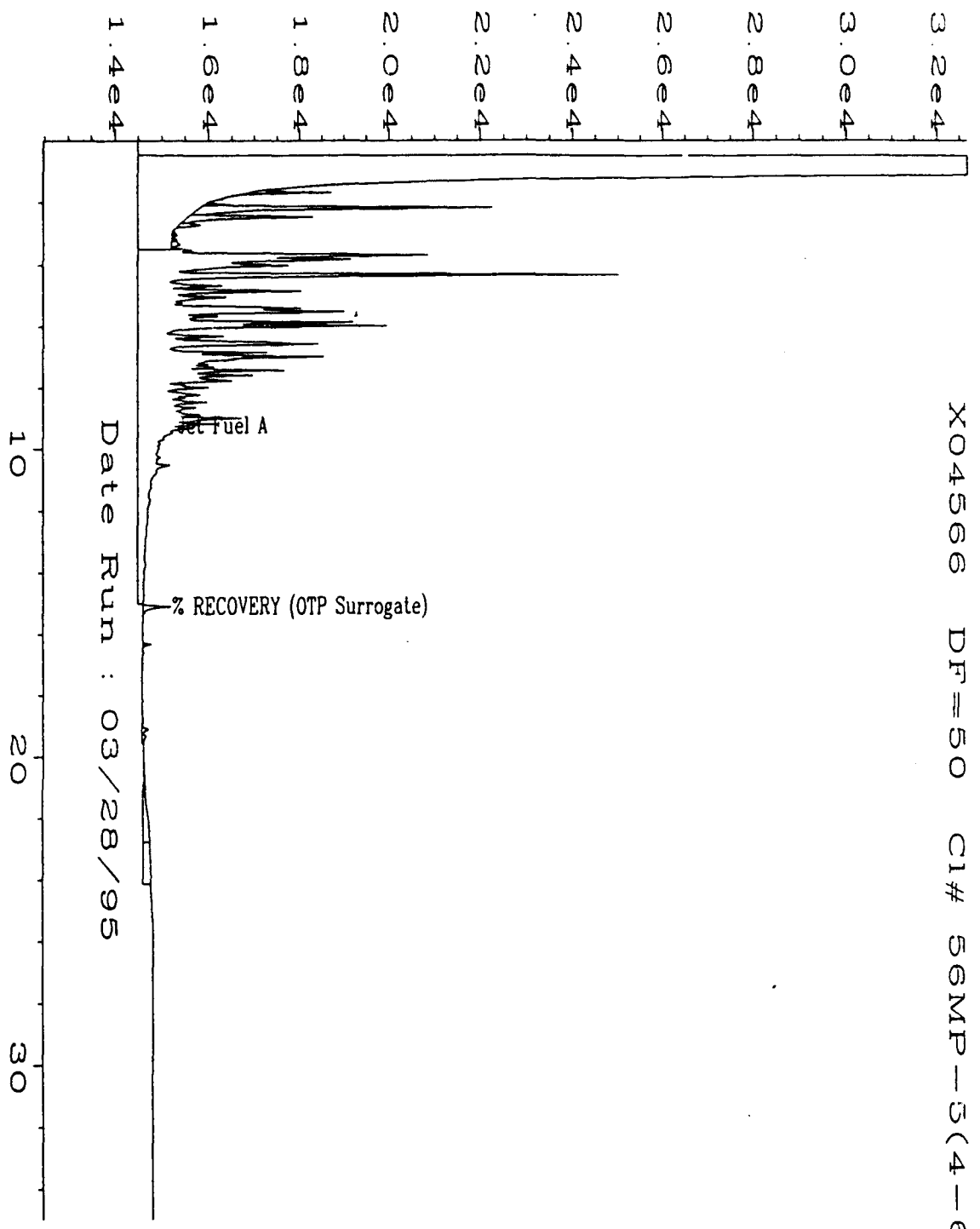
Page Number : 1
Vial Number : 39
Injection Number : 1
Sequence Line : 1
Instrument Method: JET032?
Analysis Method : JET0323...?
Sample Amount : 0
ISTD Amount :

DM 4/17/95

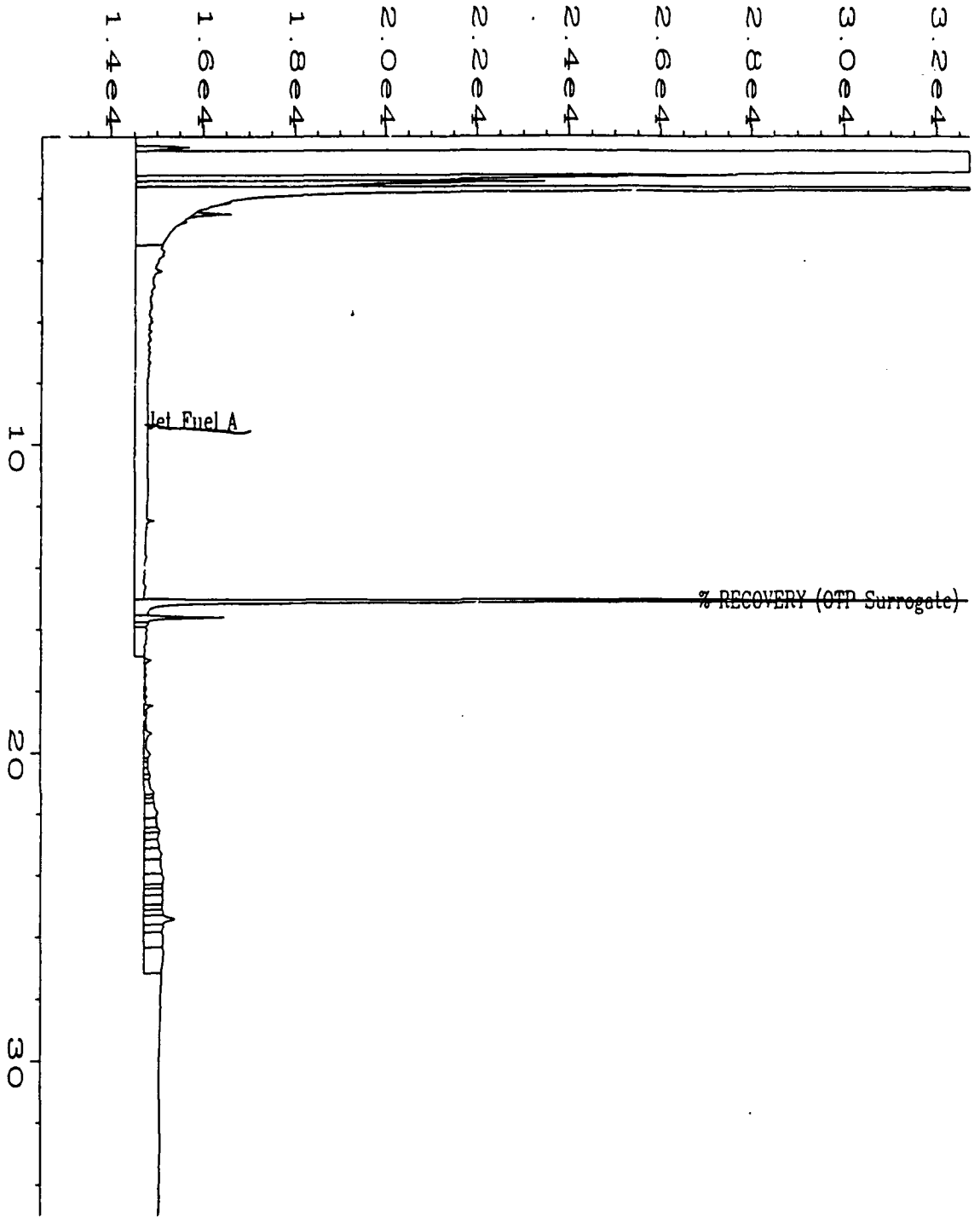


ata File Name	: C:\HPCHEM\2\DATA\JET0323\040R0101.D		
perator	: Dawn N. Guildner	Page Number	: 1
nstrument	: TEH	Vial Number	: 40
ample Name	: X04562;DF=1;30	Injection Number	: 1
in Time Bar Code:		Sequence Line	: 1
quired on	: 25 Mar 95 07:56 AM	Instrument Method	: JET0323.MTH
port Created on	: 25 Mar 95 08:31 AM	Analysis Method	: JET0323.MTH
ast Recalib on	: 24 MAR 95 08:06 AM	Sample Amount	: 0
ultiplier	: 1	ISTD Amount	:
ample Info	: Project # 95-0915 Client # 56MP-3(4-6) Soil		

pm 4/17/95



Data File Name	: C:\HPCHEM\2\DATA\TEH0327\025R0101.D		
Operator	: Dawn N. Guildner	Page Number	: 1
Instrument	: TEH	Vial Number	: 25
Sample Name	: X04566 DF=50	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 1
Acquired on	: 28 Mar 95 12:16 PM	Instrument Method	: JET032
Report Created on	: 28 Mar 95 06:41 PM	Analysis Method	: JET032
Last Recalib on	: 24 MAR 95 08:06 AM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:



Data File Name	: C:\HPCHEM\2\DATA\JET0323\042R0101.D		
Operator	: Dawn N. Guildner	Page Number	: 1
Instrument	: TEH	Vial Number	: 42
Sample Name	: X04568;DF=1;30	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 1
quired on	: 25 Mar 95 09:35 AM	Instrument Method	: JET0323.MTH
eport Created on:	25 Mar 95 10:11 AM	Analysis Method	: JET0323.MTH
Last Recalib on	: 24 MAR 95 08:06 AM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:
Sample Info	: Project # 95-0915 Client # 56MP-6(4-6) Soil		

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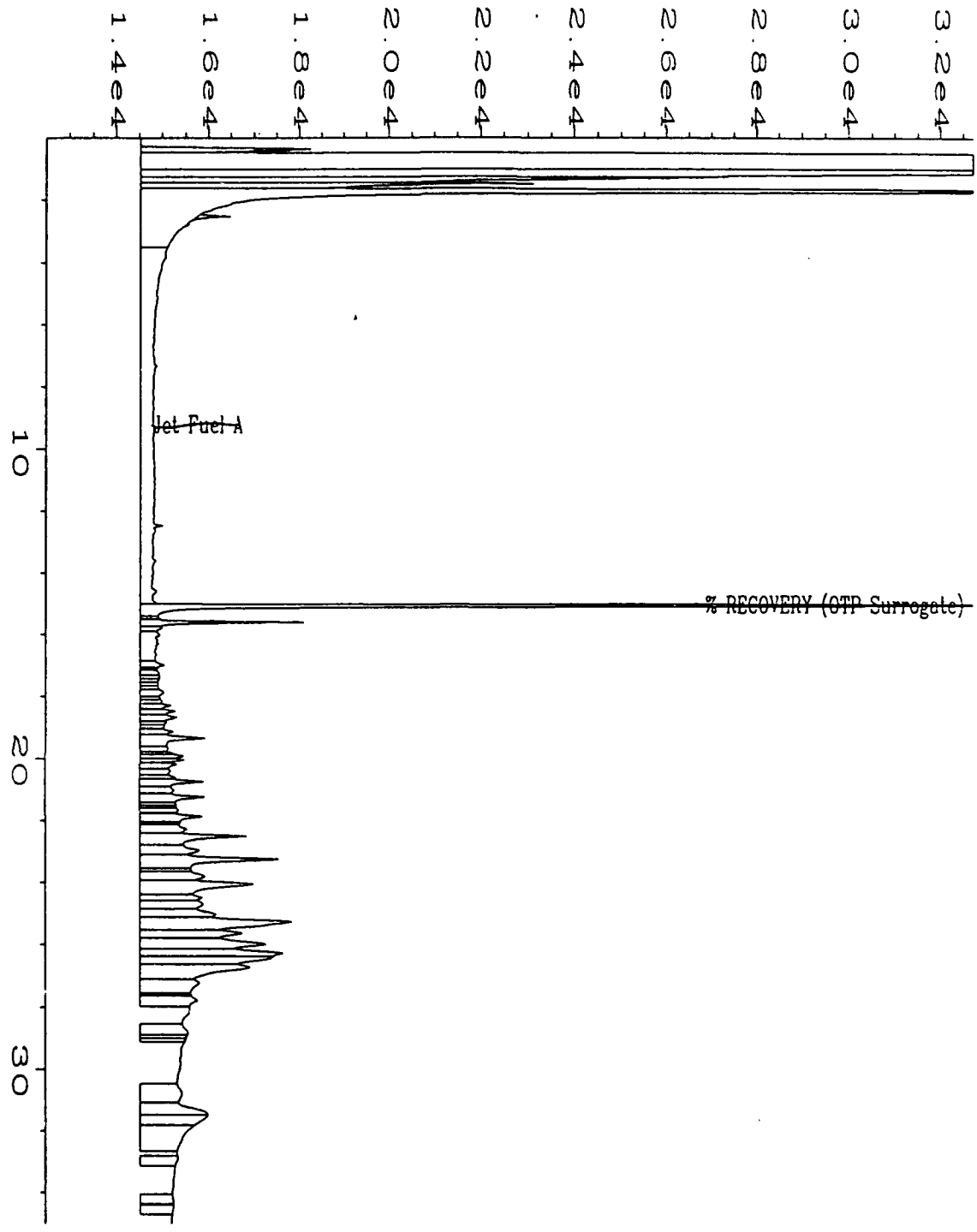

Data File Name	: C:\HPCHEM\2\DATA\JET0323\044R0101.D		
Operator	: Dawn N. Guildner	Page Number	: 1
Instrument	: TEH	Vial Number	: 44
Sample Name	: X04571;DF=1;30	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 1
Acquired on	: 25 Mar 95 11:14 AM	Instrument Method	: JET0323
Report Created on	: 27 Mar 95 11:09 AM	Analysis Method	: JET0323..
Last Recalib on	: 24 MAR 95 08:06 AM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:
Sample Info	: Project # 95-0915 Client # Matrix Spike Soil		

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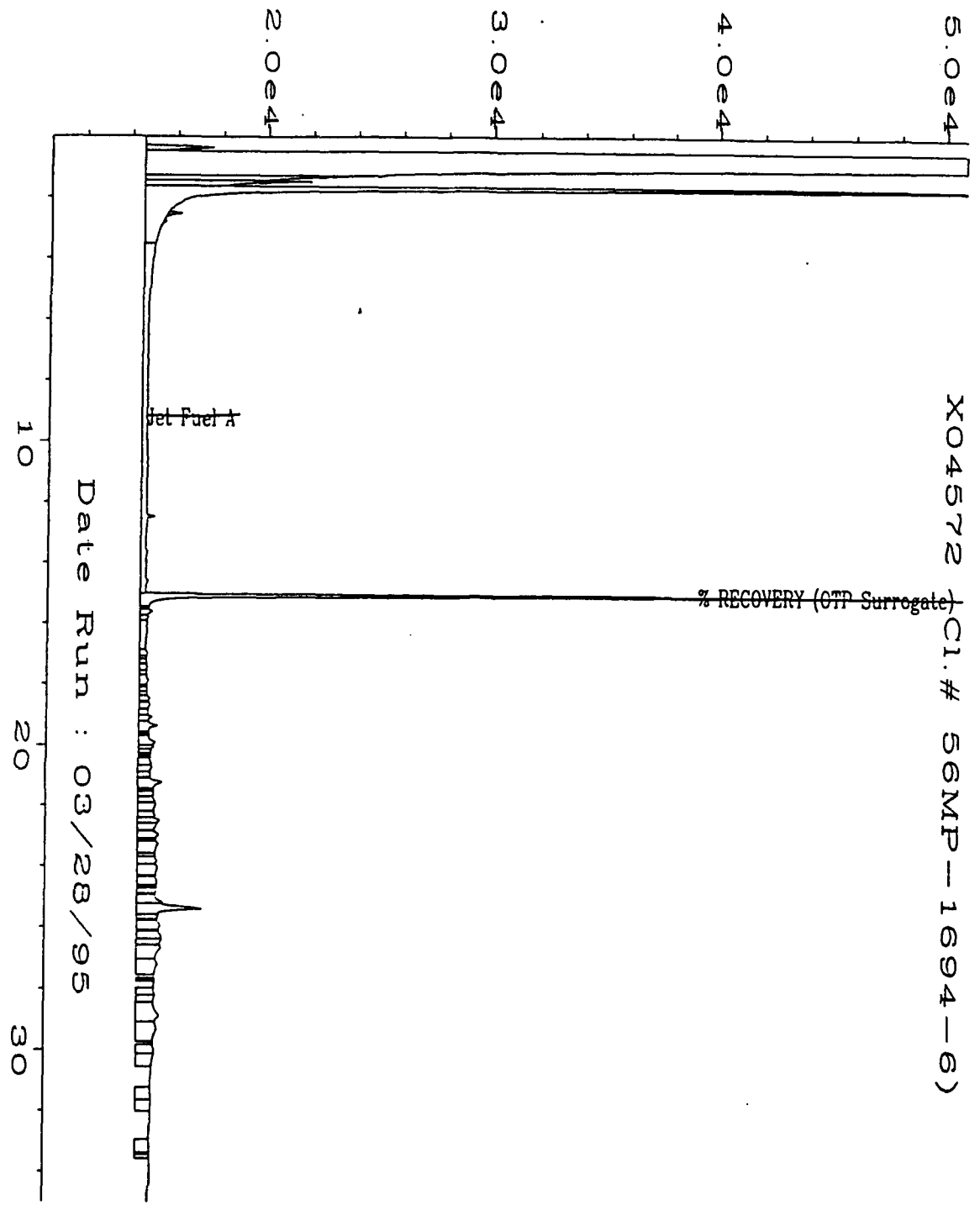

Data File Name	: C:\HPCHEM\2\DATA\TEH0327\027R0101.D		
Operator	: Dawn N. Guildner	Page Number	: 1
Instrument	: TEH	Vial Number	: 27
Sample Name	: X04572 DF=1	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 1
quired on	: 28 Mar 95 01:55 PM	Instrument Method	: JET0327.MTH
port Created on	: 28 Mar 95 06:44 PM	Analysis Method	: JET0327.MTH
Last Recalib on	: 24 MAR 95 08:06 AM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:

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Evergreen Analytical, Inc.
4036 Youngfield, Wheat Ridge, CO 80033
(303) 425-6021

TOTAL EXTRACTABLE HYDROCARBONS
TEH Matrix Spike/Matrix Spike Duplicate Data Report

Client Sample No.	: Matrix Spike	Client Project No.	: 722450.2102
Lab Sample No.	: X04571		Mac Dill AFB
Date Sampled	: 3/20/95	Lab Project No.	: 95-0915
Date Received	: 3/22/95	EPA Method No.	: 8015 Mod.
Date Prepared	: 3/24/95	Matrix	: Soil
Date Analyzed	: 3/25,28/95	Method Blank	: SB032495

Compound	Spike Added (ug/mL)	Sample Concentration (ug/mL)	MS Concentration (ug/L)	MS %REC	QC Limits %REC
Jet Fuel A	1000	0	1020	102	60-140

Compound	Spike Added (ug/mL)	MSD Concentration (ug/mL)	MS %REC	RPD	QC Limits RPD	QC Limits %REC
Jet Fuel A	1000	922	92	10.1	50	60-140

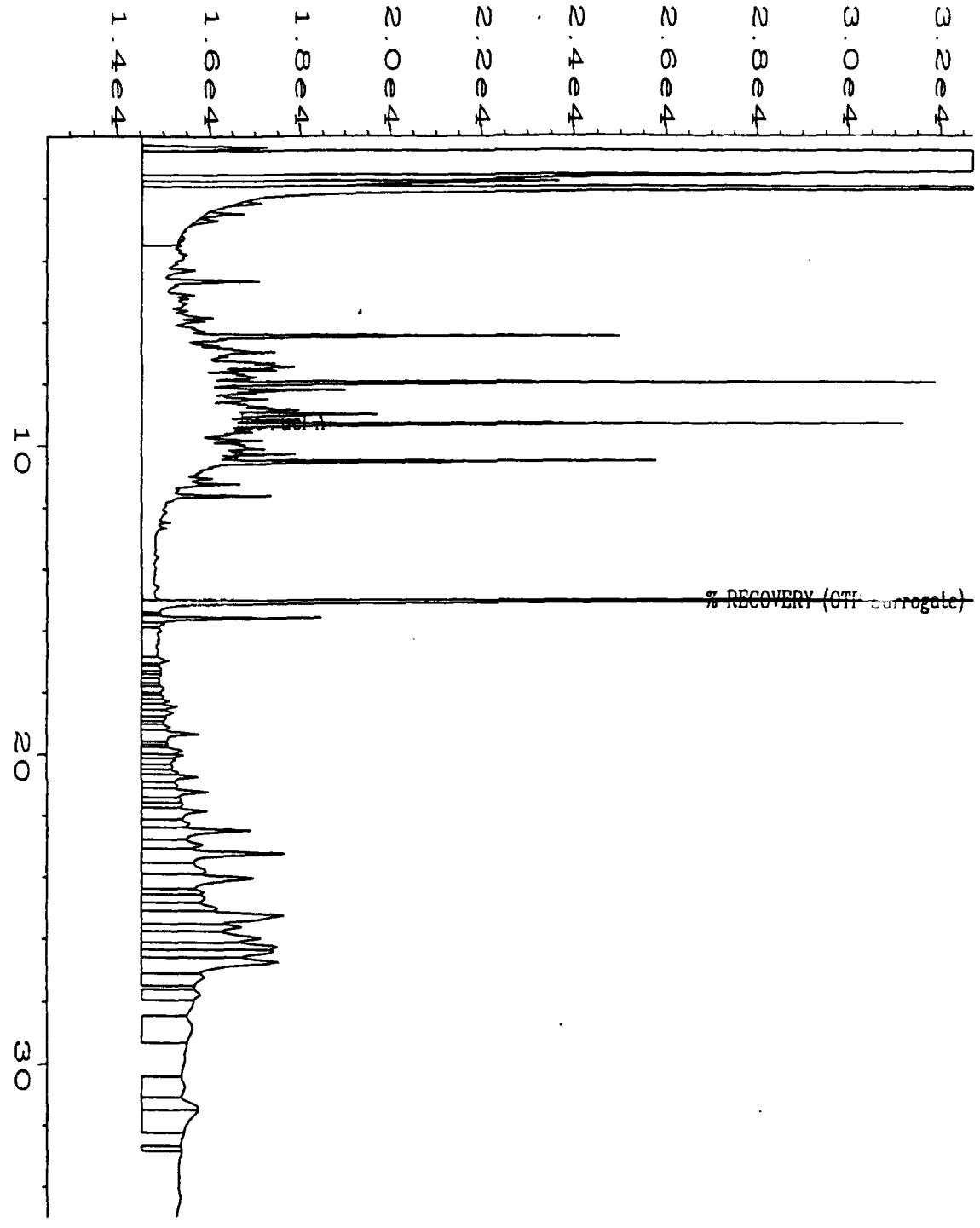
* = Values outside of QC limits.

RPD: 0 out of (1) outside limits.

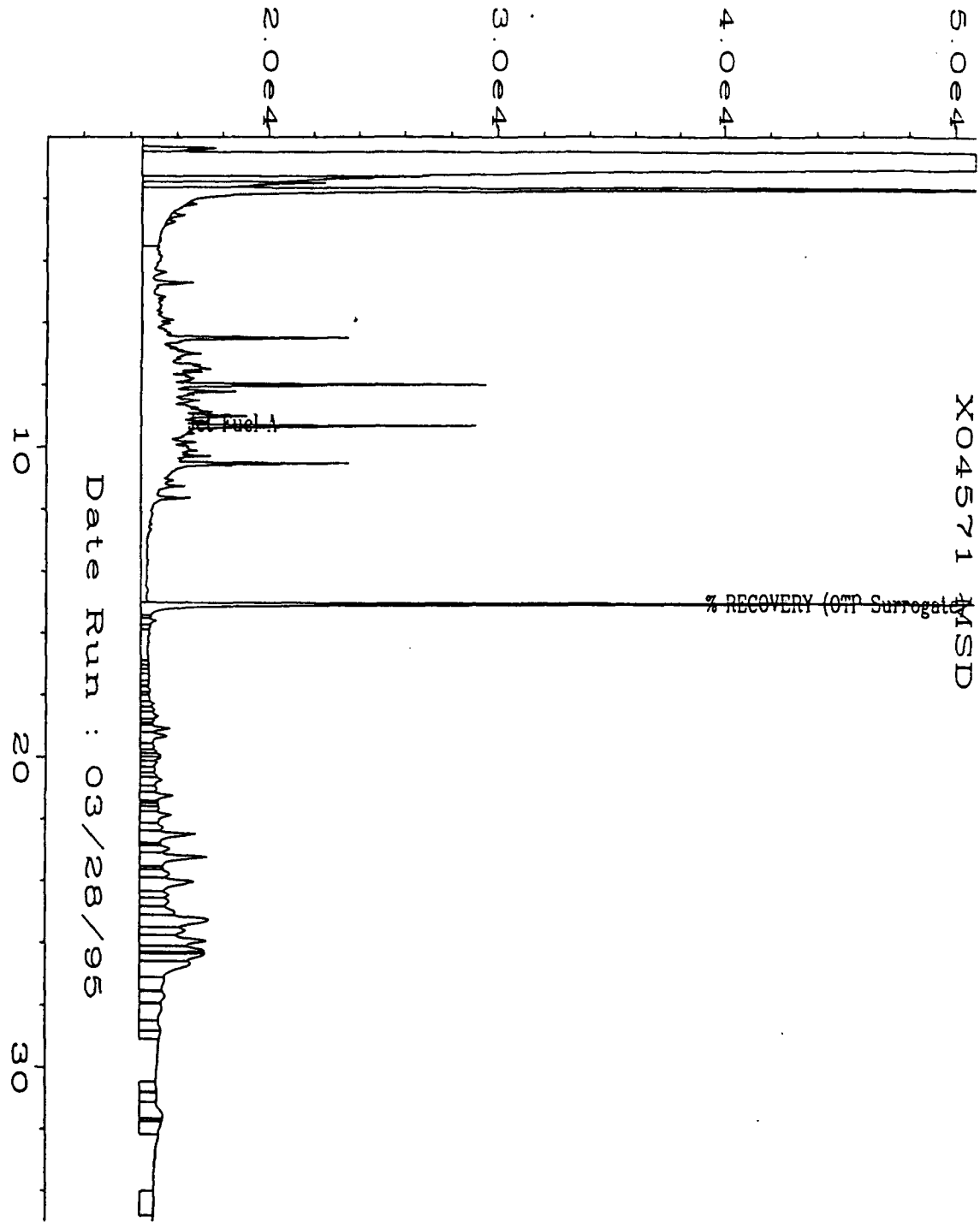
Spike Recovery: 0 out of (1) outside limits.

Comments: NA = Not analyzed/not applicable.

pc



Data File Name	: C:\HPCHEM\2\DATA\JET0323\045R0101.D		
Operator	: Dawn N. Guildner	Page Number	: 1
Instrument	: TEH	Vial Number	: 45
Sample Name	: X04571 MS;DF=1	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 1
quired on	: 25 Mar 95 12:04 PM	Instrument Method	: JET0323.MTH
eport Created on	: 27 Mar 95 11:09 AM	Analysis Method	: JET0323.MTH
Last Recalib on	: 24 MAR 95 08:06 AM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:
Sample Info	: Project # 95-0915 Client # Matrix Spike		



Data File Name	: C:\HPCHEM\2\DATA\TEH0327\026R0101.D		
Operator	: Dawn N. Guildner	Page Number	: 1
Instrument	: TEH	Vial Number	: 26
Sample Name	: X04571 MSD	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 1
Acquired on	: 28 Mar 95 01:05 PM	Instrument Method	: JET0327
Report Created on:	28 Mar 95 06:42 PM	Analysis Method	: JET0327...
Last Recalib on	: 24 MAR 95 08:06 AM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:

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TOTAL EXTRACTABLE HYDROCARBONS (TEH)
Laboratory Control Sample (LCS)

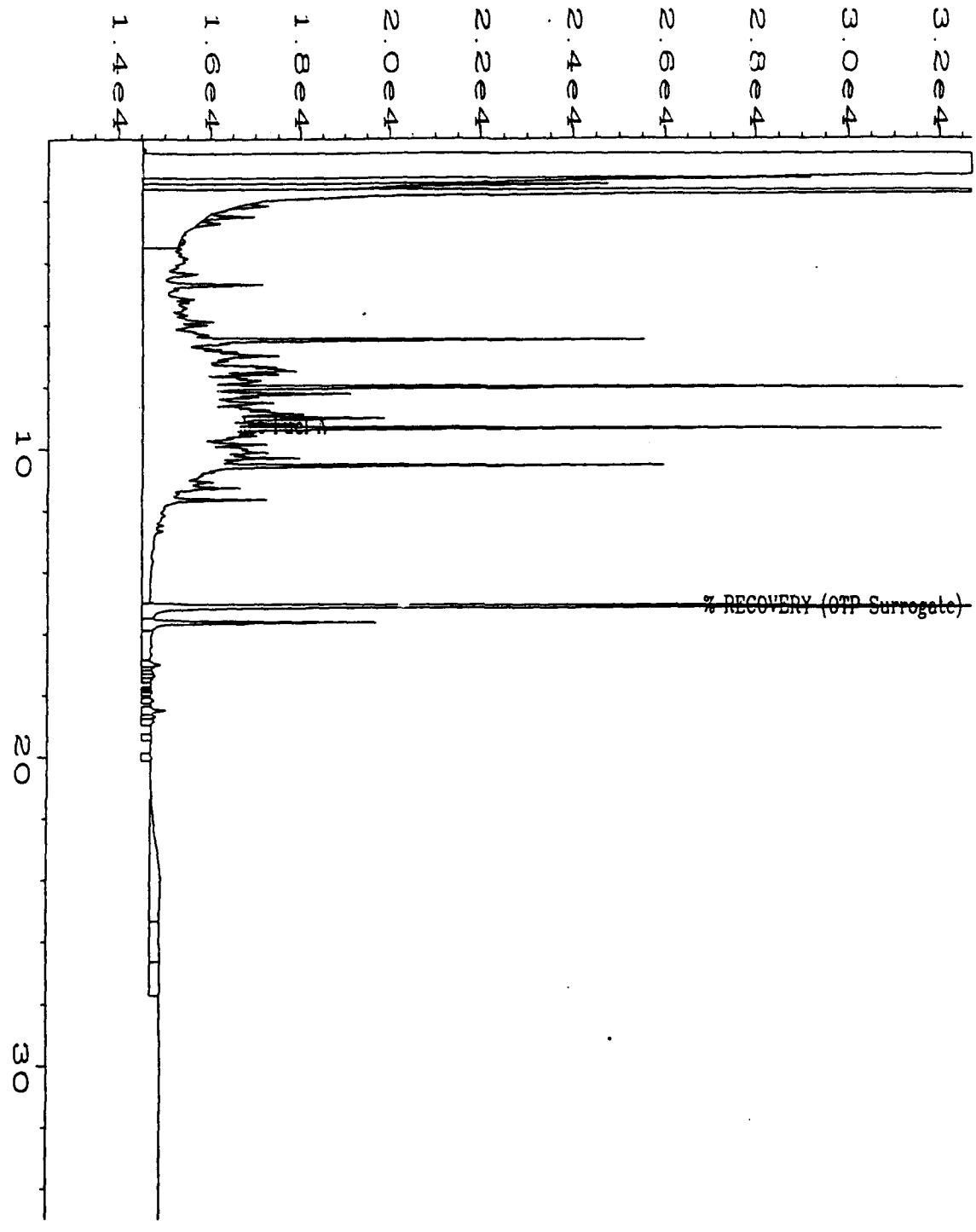
LCS Number	: LCS032495	Client Project Number	: 722450.21020/MACDILL AFB
Date Prepared	: 3/24/95	Lab Project Number	: 95-0915
Date Analyzed	: 3/25/95	Matrix	: SOIL
Sequence Number	: TEH33	Method Number	: 3500/Mod. 8015

Compound Name	Theoretical Concentration mg/L	LCS Concentration mg/L	QC Limit mg/L
JET FUEL	1000	1020	600-1400

QUALIFIERS
U = TEH analyzed for but not detected.
B = TEH found in blank as well as sample (blank data should be compared).
E = Extrapolated value.
NA = Not Available.

Analyst

Approved



Data File Name	: C:\HPCHEM\2\DATA\JET0323\033R0101.D		
Operator	: Dawn N. Guildner	Page Number	: 1
Instrument	: TEH	Vial Number	: 33
Sample Name	: LCS032495	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 1
Acquired on	: 25 Mar 95 02:09 AM	Instrument Method	: JET032?
Report Created on	: 25 Mar 95 02:45 AM	Analysis Method	: JET032
Last Recalib on	: 24 MAR 95 08:06 AM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:

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TOTAL VOLATILE HYDROCARBONS
TVH Matrix Spike/Matrix Spike Duplicate Data Report

Client Sample No.	: MATRIX SPIKE	Client Project No.	: 722450.2102C/MAC
Lab Sample No.	: X04571	Lab Project No.	: 95-0915
Date Sampled	: 3/20/95	EPA Method No.	: 5030/8015 Mod.
Date Received	: 3/22/95	Matrix	: SOIL
Date Prepared	: 4/2/95	Method Blank	: MB040295
Date Analyzed	: 4/2/95		

Compound	Spike Added (mg/kg)	Sample Concentration (mg/kg)	MS Concentration (mg/kg)	MS %REC	QC Limits %REC
Gasoline	2.00	0.00	2.05	103%	60-140

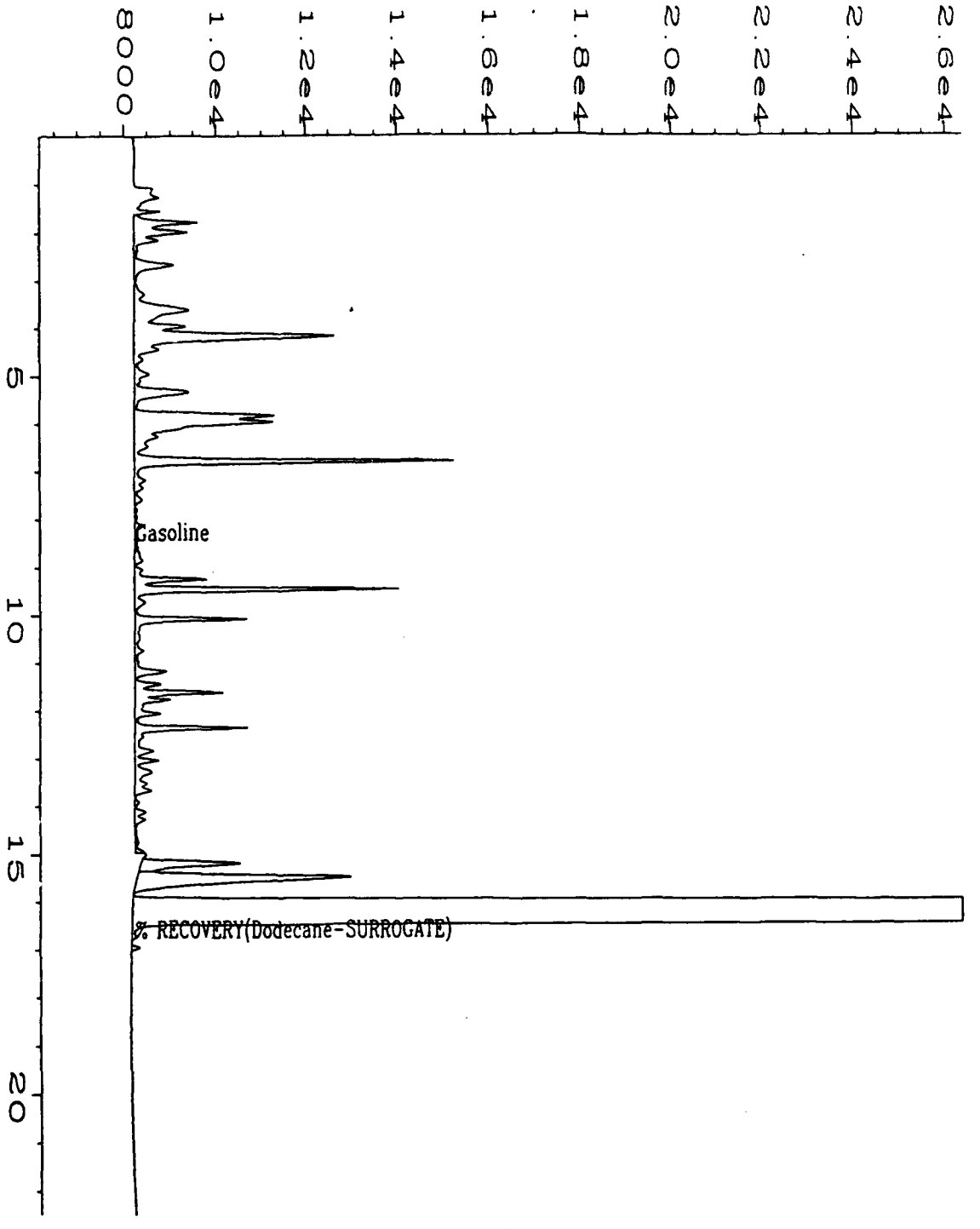
Compound	Spike Added (mg/kg)	MSD Concentration (mg/kg)	MS %REC	RPD	QC Limits RPD	QC Limits %REC
Gasoline	2.00	1.83	92%	11	50	60-140

* - Values outside of QC limits.

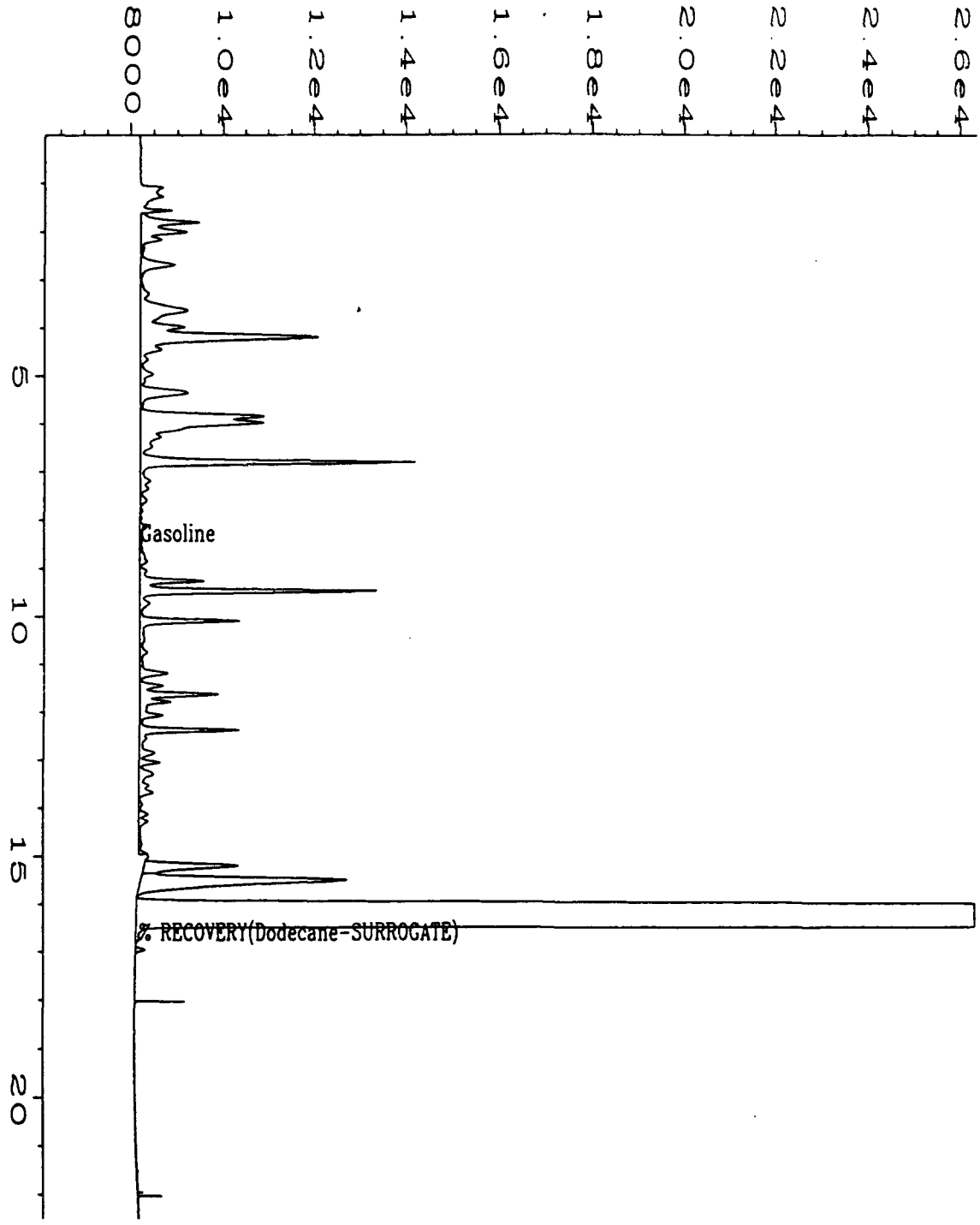
RPD: 0 out of (1) outside limits.

Spike Recovery: 0 out of (2) outside limits.

Comments: NA = Not analyzed/not applicable.



Data File Name	: C:\HPCHEM\1\DATA\tvh0402\021F0801.D		
Operator	: S.W. Tyson	Page Number	: 1
Instrument	: TVH	Vial Number	: 21
Sample Name	: X04571MS;1;5	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 8
Acquired on	: 02 Apr 95 09:41 PM	Instrument Method	: TVH0402
Report Created on	: 02 Apr 95 10:05 PM	Analysis Method	: TVH0402
Last Recalib on	: 02 Apr 95 01:36 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:
Sample Info	: Matrix Spike -2 ppm Gasoline		



Data File Name	: C:\HPCHEM\1\DATA\tvh0402\022F0801.D		
Operator	: S.W. Tyson	Page Number	: 1
Instrument	: TVH	Vial Number	: 22
Sample Name	: X04571MSD;1;5	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 8
quired on	: 02 Apr 95 10:15 PM	Instrument Method	: TVH0402.MTH
port Created on	: 02 Apr 95 10:38 PM	Analysis Method	: TVH0402.MTH
Last Recalib on	: 02 Apr 95 01:36 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:
Sample Info	: Soil Spike Duplicate - 2 ppm Gasoline		

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TOTAL VOLATILE HYDROCARBONS (TVH)
Laboratory Control Sample (LCS)

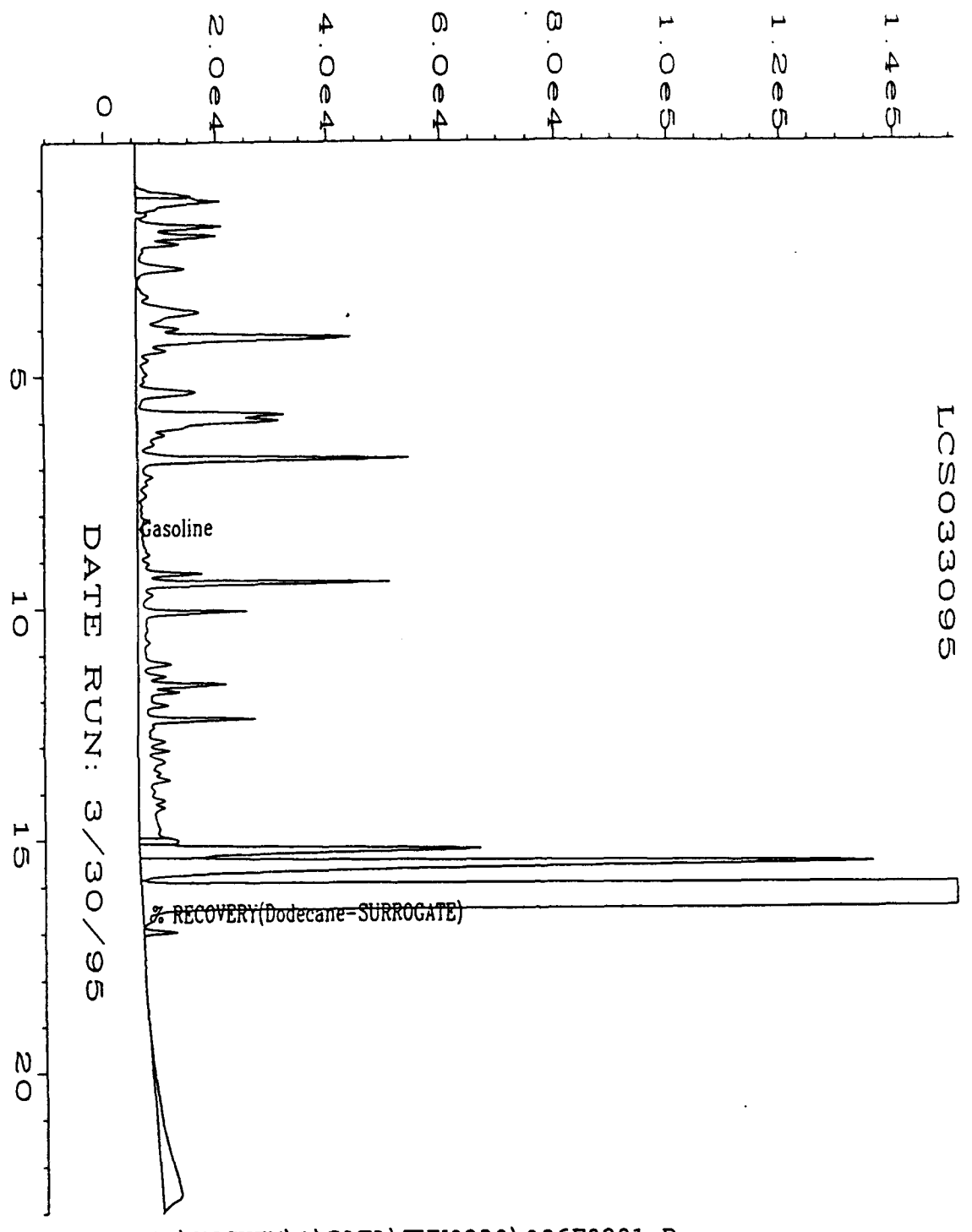
LCS Number	: LCS033095	Matrix	: SOIL
Date Prepared	: 3/30/95	Method Number	: 5030/MOD.8015
Date Analyzed	: 3/30/95		
Sequence Number	: TVH6		

Compound Name	Theoretical Concentration mg/L	LCS Concentration mg/ L	LCS % Recovery	QC Limit % Recovery
Gasoline	1.00	0.87	87%	70%-130%

QUALIFIERS
U = TVH analyzed for but not detected.
B = TVH found in blank as well as sample (blank data should be compared).
E = Extrapolated value.
NA = Not Available.

Analyst

K. Cone
Approved



Data File Name	: C:\HPCHEM\1\DATA\TVH0330\006F0201.D		
Operator	: Dawn N. Guildner	Page Number	: 1
Instrument	: TVH	Vial Number	: 6
Sample Name	: LCS033095	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 2
quired on	: 30 Mar 95 08:43 PM	Instrument Method	: TVH0323.MTH
Report Created on	: 31 Mar 95 09:47 AM	Analysis Method	: TVH0330.MTH
Last Recalib on	: 29 MAR 95 08:06 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:

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TOTAL VOLATILE HYDROCARBONS (TVH)
Laboratory Control Sample (LCS)

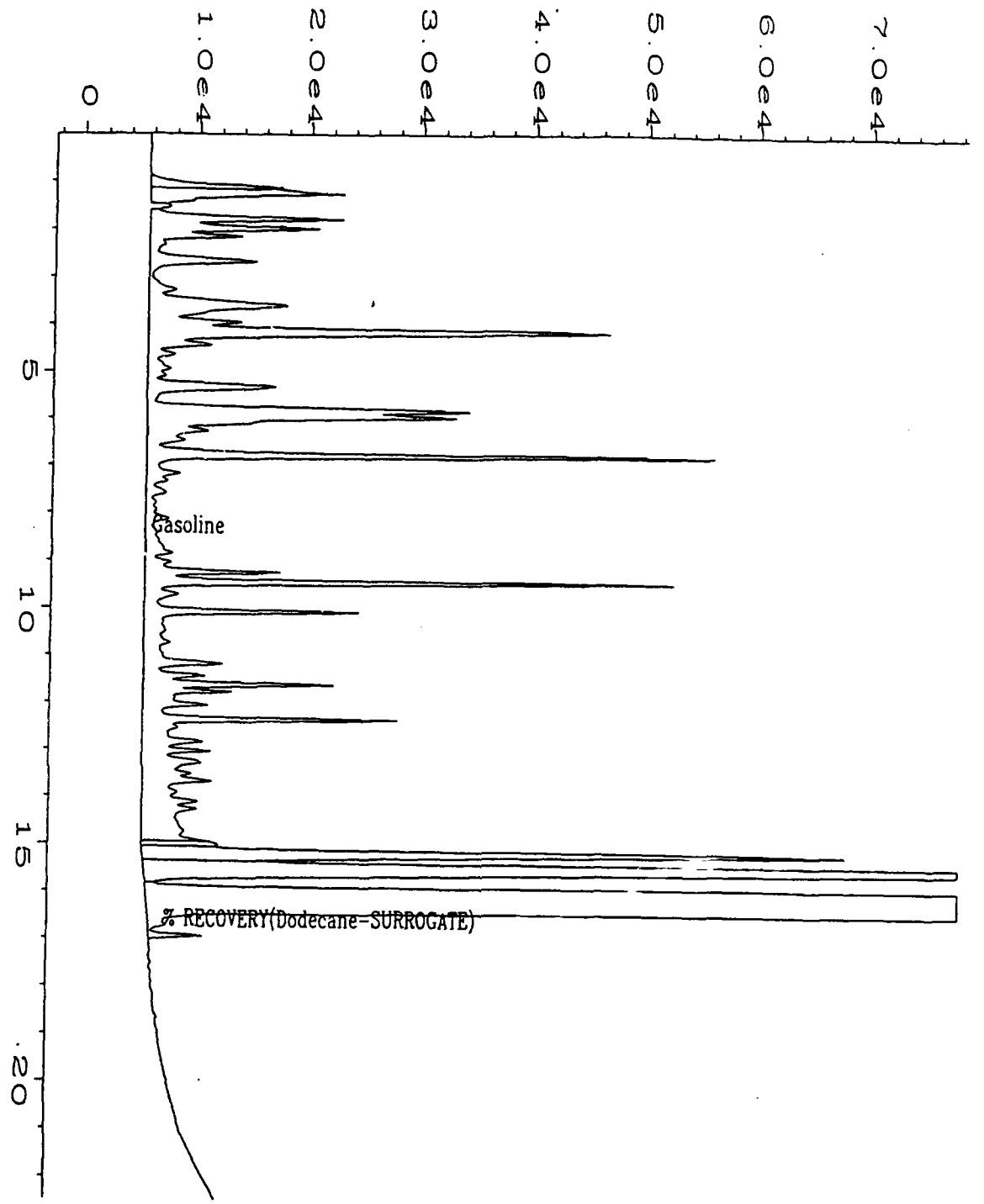
LCS Number	: LCS033195	Matrix	: SOIL
Date Prepared	: 3/31/95	Method Number	: 5030/MOD.8015
Date Analyzed	: 3/31/95		
Sequence Number	: TVH3		

Compound Name	Theoretical Concentration mg/L	LCS Concentration mg/ L	LCS % Recovery	QC Limit % Recovery
Gasoline	1.00	0.75	75%	70%-130%

QUALIFIERS
U = TVH analyzed for but not detected.
B = TVH found in blank as well as sample (blank data should be compared).
E = Extrapolated value.
NA = Not Available.

Analyst

K Cone
Approved



Data File Name	: C:\HPCHEM\1\DATA\tvh0331\003F0201.D		
Operator	: Dawn N. Guildner	Page Number	: 1
Instrument	: TVH	Vial Number	: 3
Sample Name	: LCS033195	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 2
Acquired on	: 31 Mar 95 10:33 AM	Instrument Method	: TVH0331.MTH
Report Created on	: 31 Mar 95 10:56 AM	Analysis Method	: TVH0331.MTH
Last Recalib on	: 31 Mar 95 09:48 AM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:

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TOTAL VOLATILE HYDROCARBONS (TVH)
Laboratory Control Sample (LCS)

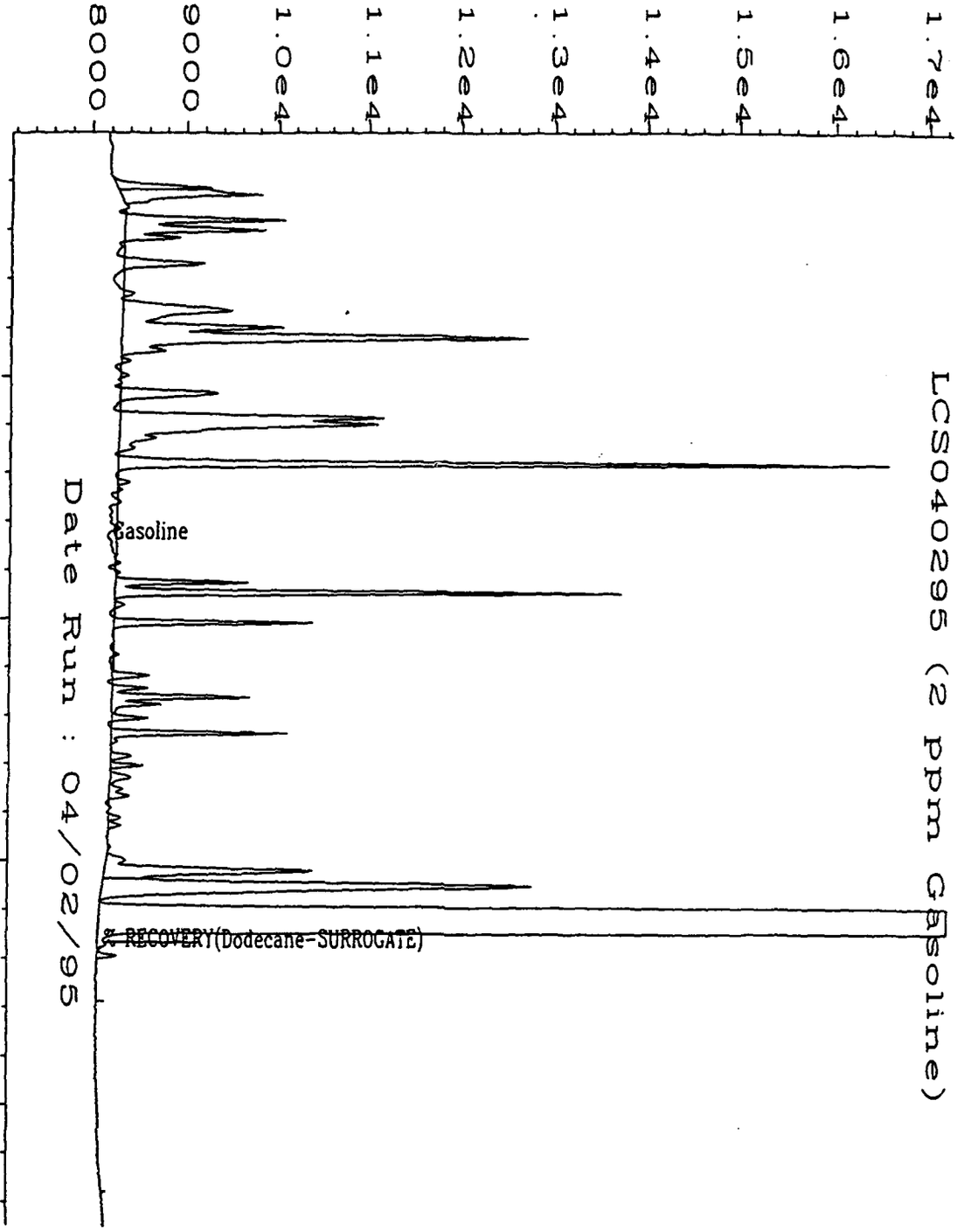
LCS Number	: LCS040295	Matrix	: SOIL
Date Prepared	: 4/2/95	Method Number	: 5030/MOD.8015
Date Analyzed	: 4/2/95		
Sequence Number	: TVH8		

Compound Name	Theoretical Con entration mg/L	LCS Concentration mg/ L	LCS % Recovery	QC Limit % Recovery
Gasoline	2.00	1.75	88%	70%-130%

QUALIFIERS
U = TVH analyzed for but not detected.
B = TVH found in blank as well as sample (blank data should be compared).
E = Extrapolated value.
NA = Not Available.

Analyst

Approved



Data File Name	: C:\HPCHEM\1\DATA\TVH0402\008F0801.D		
Operator	: S.W. Tyson	Page Number	: 1
Instrument	: TVH	Vial Number	: 8
Sample Name	: LCS040295	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 8
Acquired on	: 02 Apr 95 02:20 PM	Instrument Method	: TVH0402.MTH
Report Created on	: 02 Apr 95 04:17 PM	Analysis Method	: TVH0402.MTH
Last Recalib on	: 02 Apr 95 01:38 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:

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Miscellaneous Analyses

Date Sampled	: 3/17,20/95	Client Project ID.	: Mac Dill AFB
Date Received	: 3/22/95	Lab Project No.	: 95-0915
Date Prepared	: 3/24,27/95	Matrix	: Soils
Date Analyzed	: 3/24,27/95	Method	: EPA 160.3

Evergreen Sample #	Client Sample ID	Moisture (%)
X04557	56MP-1(4-6)	14.2
X04558	56MP-1(3-10)	20.2
X04560	56MP-2(6-8)	18.7
X04561	56MP-2(13-15)	20.7
X04562	56MP-3(4-6)	17.7
X04563	56MP-3(11-13)	17.5
X04566	56MP-5(4-6)	20.7
X04568	56MP-6(4-6)	17.3
X04571	Matrix spike	23.6
X04572	56MP-16(4-6)	21.8

Analyst

Approved

0915tm.4

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NON-CLP ANALYSIS RESULTS

Date: 04/04/95
Lab Name: Huffman Labs
Contact: Sue Zeller
Sample Matrix:

Client: Evergreen Analytical
Contact: Patty McClellan
Huffman Lab #: 147195

Client Smp#	Lab ID #	Element/ Compound	Dilution Factor	Results	Units	Prep Date	Analysis Date	Sample Size (g)	Method #	Instrument ID
56MP-3(4-6)	14719501	TC	NA	0.36	%	NA	03/31/95	0.412	Leco CR12	#7
56MP-3(4-6)	14719501	TC	NA	0.29	%	NA	03/31/95	0.820	Leco CR12	#7
56MP-6(4-6)	14719502	TC	NA	0.30	%	NA	03/31/95	0.611	Leco CR12	#7
56SS-2(4-6)	14719503	TC	NA	0.08	%	NA	03/31/95	0.952	Leco CR12	#7
56SS-12(4-6)	14719504	TC	NA	0.08	%	NA	03/31/95	0.925	Leco CR12	#7
56MP-3(4-6)	14719501	CC	NA	<0.02	%	NA	03/27/95	1.276	COU-02	tower
56MP-3(4-6)	14719501	CC	NA	<0.02	%	NA	03/27/95	1.407	COU-02	tower
56MP-6(4-6)	14719502	CC	NA	<0.02	%	NA	03/27/95	1.931	COU-02	tower
56SS-2(4-6)	14719503	CC	NA	<0.02	%	NA	03/27/95	1.271	COU-02	tower
56SS-12(4-6)	14719504	CC	NA	<0.02	%	NA	03/27/95	1.819	COU-02	tower
		% moisture		adjusted result						
56MP-3(4-6)	14719501	17.66 TOC	NA	0.36	0.44 %	NA	NA	NA	by calc	NA
56MP-3(4-6)	14719501	17.66 TOC	NA	0.29	0.35 %	NA	NA	NA	by calc	NA
56MP-6(4-6)	14719502	17.33 TOC	NA	0.30	0.36 %	NA	NA	NA	by calc	NA
56SS-2(4-6)	14719503	30.18 TOC	NA	0.08	0.10 %	NA	NA	NA	by calc	NA
56SS-12(4-6)	14719504	19.57 TOC	NA	0.08	0.10 %	NA	NA	NA	by calc	NA

Samples analyzed and results reported on as as received basis.
Soil samples are not homogeneous.
Values reported below Detection Limits are for reference only.
TC detection limit = 0.05%
CC detection limit = 0.02%
TOC detection limit = 0.05%

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NON-CLP ANALYSIS RESULTS
LABORATORY CONTROL STANDARD

Date: 04/04/95 Client: Evergreen Analytical
Lab Name: Huffman Labs Contact: Patty McClellan
Contact: Sue Zeller Huffman Lab #: 147195

LABORATORY CONTROL STANDARD

Lab ID #	Source	Element/ Compound	True Value	Found Value	% R	Units	Date	Method #	Instrument ID
LCS	BN 4851	TC	3.35	3.41	102	%	03/31/95	Leco CR12	#7
LCS	BN 4056	CC	11.33	11.29	100	%	03/27/95	COU-02	tower

SPIKE RECOVERY

Lab ID #	Source	Element/ Compound	True Value	Found Value	% R	Units	Date	Method #	Instrument ID
SPIKE	BN 4712	TC	17280	16231	94	ug C	03/31/95	Leco CR12	#7
SPIKE DUP	BN 4712	TC	18000	17490	97	ug C	03/31/95	Leco CR12	#7
SPIKE	BN 4712	CC	1408	1410	100	ug C	03/27/95	COU-02	tower
SPIKE DUP	BN 4712	CC	1355	1344	99	ug C	03/27/95	COU-02	tower

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ANALYSIS	CARBONATE CARBON	METHOD	SOP COU-02
ANALYZER #	6	COULOMETER #	[illegible]
BALANCE #	10		

CALCIUM CARBONATE (STD # 333) $CaCO_3$	BOTTLE # 4712	% C THEORY = 12.00%	SODIUM CARBONATE Na_2CO_3	BOTTLE # 4056	%C THEORY = 11.33 %

SAMPLE NO.	TARE WT. GRAMS	TARE + SAMPLE WT.	SAMPLE WT. GRAMS	NOTES	COUNTS µ GRAMS	LESS BLANK 7.	% CARBON AS CARBONATE CARBON		% RECOVERY	
BL	—	—	—		5.1	—	—	MB		
BL	—	—	—		7.2	—	—	MB		
BL	—	—	—	< 0 mch	7.0	—	—	IB		
$CaCO_3$	0.483673	0.491952	0.008279		997.9	990.9	11.97	ICS	99.7	
Na_2CO_3	0.549259	0.559053	0.009794		1112.5	1105.5	11.29	LCS	99.6	x3 AD C
144301	4.203316	7.194362	2.991046	3cc SYRINGE BACKWEIGHED	433.0	426.0	0.0142	DUP ± 0.00%	521. mg/L CO_2	0.0
144301	4.210786	7.232688	3.021902		435.3	428.3	0.0143	OF MEAN	524. mg/L CO_2	0.0
144301	~~4.2053~~ 4.205293	7.202797	2.997504		1366.3	1359.3				
+SPIKE Na_2CO_3	4.211001	7.201190	2.990189							
144301	4.204548	7.229002	3.024454		1383.1	1376.1				
SPIKE Na_2CO_3	4.206192	7.232466	3.026274							
SPIKE Na_2CO_3	4.206700	7.219944	3.013244		953.5	946.5	0.0316		1151. mg/L CO_2	0.1
SPIKE Na_2CO_3	4.207313	7.204383	2.997076		949.0	942.0	0.0314		1151. mg/L CO_2	0.1
144302	4.208907	7.239396	3.030489		534.9	527.9	0.0176		645. mg/L CO_2	0.0
144303	4.201825	7.206739	3.004914	↓	857.7	850.7	0.0284		1041. mg/L CO_2	0.1
~~LIMS 3-27~~ $CaCO_3$	0.537116	0.566900	0.009784		1177.8	1170.8	11.97	CCS	99.7	
[redacted]										

ANALYST Carol Simcak	DATE 3-27-95 3-26-95	REVIEWED [illegible]	DATE 3/28/95	PAGE 1 OF 2

REVISED : 00/00/00

SPIKE IS SODIUM BICARBONATE 2164 0.1% CO_2 / 0.03 % CO_3
Prep Date 9/24/94

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NON-CLP QA/QC ANALYSIS RESULTS
INITIAL AND CONTINUING CALIBRATION VERIFICATION

Date: 04/04/95 Client: Evergreen Analytical
Lab Name: Huffman Labs Contact: Patty McClellan
Contact: Sue Zeller Huffman Lab #: 147195

INITIAL CALIBRATION

Lab ID #	Source	Element/ Compound	True Value	Found Value	% R	Units	Date	Method #	Instrument ID
ICS	BN 4712	TC	12.00	12.05	100	%	03/31/95	Leco CR12	#7
ICS	BN 4712	CC	12.00	11.97	100	%	03/27/95	COU-02	tower

Slope = NA
Intercept = NA Single point calibrations for this test.
95% Correlation Coefficient = NA

CONTINUING CALIBRATION VERIFICATION

Lab ID #	Source	Element/ Compound	True Value	Found Value	% R	Units	Date	Method #	Instrument ID
CCS	BN 4712	TC	12.00	11.83	99	%	03/31/95	Leco CR12	#7
CCS	BN 4712	TC	12.00	12.26	102	%	03/31/95	Leco CR12	#7
CCS	BN 4712	TC	12.00	12.23	102	%	03/31/95	Leco CR12	#7
CCS	BN 4712	CC	12.00	11.97	100	%	03/27/95	COU-02	tower
CCS	BN 4712	CC	12.00	11.92	99	%	03/27/95	COU-02	tower

Evergreen

CASE NARRATIVE

Evergreen Analytical Laboratory (EAL) Project #: 95-1044

Parsons Engineering Science, Inc. (PES) Project: MacDill AFB (722450.21020)

Sample Receipt

On March 31, 1995, 26 water samples, one field blank and two trip blanks were received in good condition at EAL with the following discrepancies: the alkalinity bottle for MD75-MW5 was labeled MW4; all bottles for MD75-2 were labeled MD75-MW2 except the bottle for anions which was labeled MW1; alkalinity and TOC bottles were missing for 75MP-8D; there were extra TOC bottles for 75MP-8S and 75MP-9D; TOC bottles were missing for 75MP-8S MSD, and 75MP-9S; alkalinity bottles were missing for 75MP-9D, 75MP-9S and MD75-MW13; anion bottles were received but not listed on the chain of custody for 75MP-9D, 75MP-9S and MD75-MW13.

These discrepancies were handled as follows per instructions from John Hicks and Mark Vessely of PES: the alkalinity bottle MD75-MW4 was relabeled MW5; the sample IDs for MD75-2 were corrected to read MD75-MW2; alkalinity and TOC samples were not taken for 75MP-8D; the TOC bottle labeled for 75MP-9D was relabeled 75MP-9S; bottles for alkalinity 75MP-9D, 75MP-9S and MD75-MW13 were reassigned for anions.

There were several sets of MS/MSD samples submitted to cover those missing from previous sample shipments. The aliquots had already been taken for those samples, therefore, only one set of MS/MSD samples per method were used on this project.

Refer to the EAL Sample Log Sheet for specific log-in information and cross-reference of EAL and PES sample identifications.

BTEX, Water Matrix, Method 602

All samples were analyzed within holding times except MD75-MW9 which was re-run outside holding times to confirm low surrogate recovery,(64% vs 70%). The sample was also analyzed at a 10x dilution 4 days out of holding time for 1,2,3,4-tetramethyl-benzene. The original results are reported.

The Method Blank MB041295 exhibited toluene and total xylene contamination at less than 1 ppb.

There were no other quality control anomalies to report.

Total Volatile Hydrocarbons (TVH), Water Matrix, Method 8015M
There were no quality control anomalies to report.

General Chemistry
Samples submitted for MS/MSD analyses for alkalinity and TOC are not appropriate to the method.

There were no quality control anomalies to report.

P. McClellan

Patricia A. McClellan, Project Manager

Evergreen Analytical Sample Log Sheet

Project # 95-1044

Date(s) Sampled: 03/29,30/95 COC

Date Due: 04/05/95-BTEX,TVPH
04/14/95-OTHERS

Date Received: 03/31/95 0900

Holding Time(s): 3/31,4/1-NO_2^-,NO_3^-
04/12,13-BTEX,TVPH,ALKALINITY

Client Project I.D. 722450.21020/MAC DILL

Rush STANDARD

Client: Parsons Engineering Science, Inc.

Address: 1700 Broadway Suite 900
Denver, CO 80290

Contact: TODD WEIDEMEIER

Client P.O. _____

Phone #831-8100 Fax #831-8208

Shipping Charges N/A

E.A. Cooler # 218,612

Airbill # FED EX 9581826380,
9581826542

Custody Seal Intact? Y
Cooler X Bottles ___
COC Present Y
Sample Tags Present? Y
Sample Tags Listed? Y
Sample(s) Sealed? Y

Special Invoicing/Billing _____

Special Instructions AN MS/MSD AND LAB DUPLICATE IS TO ANALYZED ON THIS PROJECT. * ALL BTEX SAMPLES ARE TO INCLUDE CHLOROBENZENE, TMB AND TEMB

★SAMPLE ID PER SPECIAL INSTRUCTIONS ATTACHED.

Lab #	Client ID#	Analysis	Mtx	Btl	Loc
X05056A/B	56 MP-2S	* BTEX	W	40V	2
X05057A/B	56 MP-7S	* BTEX	W	40V	2
X05058C/D	MATRIX SPIKE	HOLD	W	40V	2
X05059C/D	MATRIX SPIKE DUP	HOLD	W	40V	2
X05060A/B	MD56-MW4	* BTEX	W	40V	2
X05061C/D	MATRIX SPIKE	HOLD	W	40V	2
X05062C/D	MATRIX SPIKE DUP	HOLD	W	40V	2
X05063A/B	MD 75-MW5	* BTEX	W	40V	2
X05064C/D	MATRIX SPIKE	HOLD	W	40V	2
X05065C/D	MATRIX SPIKE DUP	HOLD	W	40V	2
X05066A/B	MD75-MW1	* BTEX	W	40V	2
X05067A/B	75MP-5D	* BTEX	W	40V	2
X05068A/B	75MP-6D	* BTEX	W	40V	2
X05069A/B	MD75-MW2	* BTEX	W	40V	2
X05070A	TRIP BLANK	* BTEX	W	40V	2

R=Sample to be returned

Date GC/MS ___ GC 3 Metals ___ Wet Chem 3 SxPrep ___ Acctg 1

To

SxRec C QA/QC C Sales C File Orig

Page 1 of 1 Page(s)

Custodian/Date: 3/31/95
Rm 4/4/95

	Client ID#	Analysis	Mtx	Btl	Loc
71A/B	75MP-8D	* BTEX	W	40V	2
072A/B	75MP-8S	* BTEX	W	40V	2
73A/B	75MP-28S	* BTEX	W	40V	2
74A/B	75MP-8S (MS)	* BTEX	W	40V	2
075A/B	75MP-8S (MSD)	* BTEX	W	40V	2
076A	RINSEATE BLANK	* BTEX	W	40V	2
077A	FIELD BLANK	* BTEX	W	40V	2
078A/B	75MP-9D	* BTEX	W	40V	2
079A/B	75MP-9S	* BTEX	W	40V	2
080A/B	MD75-MW13	* BTEX	W	40V	2
081A/B	MD75-MW11	* BTEX	W	40V	2
082A/B	MD75-MW10	* BTEX	W	40V	2
083A/B	MD75-MW9	* BTEX	W	40V	2
084A/B	TRIP BLANK	* BTEX	W	40V	2
056C/D	56 MP-2S	TVPH	W	40V	2
057C/D	56 MP-7S	TVPH	W	40V	2
5058C/D	MATRIX SPIKE	HOLD	W	40V	2
5059C/D	MATRIX SPIKE DUP	HOLD	W	40V	2
060C/D	MD56-MW4	TVPH	W	40V	2
061C/D	MATRIX SPIKE	HOLD	W	40V	2
062C/D	MATRIX SPIKE DUP	HOLD	W	40V	2
063C/D	MD75-MW5	TVPH	W	40V	2
064C/D	MATRIX SPIKE	HOLD	W	40V	2
065C/D	MATRIX SPIKE DUP	HOLD	W	40V	2
066C/D	MD75-MW1	TVPH	W	40V	2
5067C/D	75MP-5D	TVPH	W	40V	2
5068C/D	75MP-6D	TVPH	W	40V	2
5069C/D	MD75-MW2	TVPH	W	40V	2
5071C	75MP-8D	TVPH	W	40V	2
5072C/D	75MP-8S	TVPH	W	40V	2
5073C/D	75MP-28S	TVPH	W	40V	2
5074C/D	75MP-8S (MS)	TVPH	W	40V	2
5075C	75MP-8S (MSD)	TVPH	W	40V	2
5078C/D	75MP-9D	TVPH	W	40V	2
5079C	75MP-9S	TVPH	W	40V	2
5080C/D	MD75-MW13	TVPH	W	40V	2

Project # 95- 1044

Sample to be returned

Lab ID #	Client ID#	Analysis	Mtx	Btl	Loc
X05081C/D	MD75-MW11	TVPH	W	40V	2
X05082C/D	MD75-MW10	TVPH	W	40V	2
X05083C/D	MD75-MW9	TVPH	W	40V	2
X05056	56 MP-2S	ANIONS Cl^-,NO_2^-,NO_4^-, SO_4^{-2}	W	125P	C2
X05057	56 MP-7S	ANIONS Cl^-,NO_2^-,NO_4^-, SO_4^{-2}	W	125P	C2
X05058	MATRIX SPIKE	HOLD	W	125P	2
X05059	MATRIX SPIKE DUP	HOLD	W	125P	2
X05060	MD56-MW4	ANIONS Cl^-,NO_2^-,NO_4^-, SO_4^{-2}	W	125P	C2
X05061	MATRIX SPIKE	HOLD	W	125P	2
X05062	MATRIX SPIKE DUP	HOLD	W	125P	2
X05063	MD75-MW5	ANIONS Cl^-,NO_2^-,NO_4^-, SO_4^{-2}	W	125P	C2
X05064	MATRIX SPIKE	HOLD	W	125P	2
X05065	MATRIX SPIKE DUP	HOLD	W	125P	2
X05066	MD75-MW1	ANIONS Cl^-,NO_2^-,NO_4^-, SO_4^{-2}	W	125P	C2
X05067	75MP-5D	ANIONS Cl^-,NO_2^-,NO_4^-, SO_4^{-2}	W	125P	C2
X05068	75MP-6D	ANIONS Cl^-,NO_2^-,NO_4^-, SO_4^{-2}	W	125P	C2
X05069	★ MD75-MW2	ANIONS Cl^-,NO_2^-,NO_4^-, SO_4^{-2}	W	125P	C2
X05072	75MP-8S	ANIONS Cl^-,NO_2^-,NO_4^-, SO_4^{-2}	W	125P	C2
X05073	75MP-28S	ANIONS Cl^-,NO_2^-,NO_4^-, SO_4^{-2}	W	125P	C2
X05074	75MP-8S (MS)	ANIONS Cl^-,NO_2^-,NO_4^-, SO_4^{-2}	W	125P	C2
X05075	75MP-8S (MSD)	ANIONS Cl^-,NO_2^-,NO_4^-, SO_4^{-2}	W	125P	C2
X05081	MD75-MW11	ANIONS Cl^-,NO_2^-,NO_4^-, SO_4^{-2}	W	125P	C2
X05082	MD75-MW10	ANIONS Cl^-,NO_2^-,NO_4^-, SO_4^{-2}	W	125P	C2
X05083	MD75-MW9	ANIONS Cl^-,NO_2^-,NO_4^-, SO_4^{-2}	W	125P	C2
X05071	75MP-8D	ANIONS Cl^-,NO_2^-,NO_4^-, SO_4^{-2}	W	125P	C2
X05078	75MP-9D	ANIONS Cl^-,NO_2^-,NO_4^-,SO_4^{-2}	W	250P	C2
X05079	75MP-9S	ANIONS Cl^-,NO_2^-,NO_4^-,SO_4^{-2}	W	250P	C2
X05080	MD75-MW13	ANIONS Cl^-,NO_2^-,NO_4^-,SO_4^{-2}	W	250P	C2
X05057	56 MP-7S	ALKALINITY	W	250P	C2
X05060	MD56-MW4	ALKALINITY	W	250P	C2
X05063	★ MD75-MW5	ALKALINITY	W	250P	C2
X05072	75MP-8S	ALKALINITY	W	250P	C2
X05073	75MP-28S	ALKALINITY	W	250P	C2
X05074	75MP-8S (MS)	HOLD	W	250P	C2

Project # 95-1044

R=Sample to be returned

#	Client ID#	Analysis	Mtx	Btl	Loc
75	75MP-8S (MSD)	HOLD	W	250P	C2
081	MD75-MW11	ALKALINITY	W	250P	C2
057	56 MP-7S	TOC	W	250A	C2
060	MD56-MW4	TOC	W	250A	C2
063	M 75-MW5	TOC	W	250A	C2
075	75MP-8S (MSD)	TOC	W	250A	C2
072	75MP-8S	TOC	W	250A	C2
073	75MP-28S	TOC	W	250A	C2
074	75MP-8S (MS)	TOC	W	250A	C2
079	75MP-9S	TOC	W	250A	C2

CHAIN OF CUSTODY RECORD / ANALYTICAL SERVICES REQUEST

Page 1 of 2

Evergreen Analytical Inc.
4036 Youngfield St.
Wheat Ridge, Colorado 80033
(303) 425-6021
FAX (303) 425-6854
(800) 845-7400

COMPANY Parsons Engineering Science
ADDRESS 1700 Broadway, Suite 900
CITY Denver STATE CO ZIP 80290
PHONE# 303-831-8100 FAX # _____ FAX RESULTS Y / N

CLIENT CONTACT (print) Todd Niedermeier
PROJECT I.D. 722450.21020
EAL. QUOTE # _____ P.O.# _____
TURNAROUND REQUIRED* 30 days
*expedited turnaround subject to additional fee

Sampler Name:
(signature) Mark Vessely
(print) MARK VESSELY

Evergreen Analytical Cooler No. 218
Cooler Received _____

Please **PRINT** all information:

CLIENT SAMPLE IDENTIFICATION	DATE SAMPLED	TIME	No. of Containers	MATRIX: Water-Drinking/Discharge/Ground (circle)	MATRIX: Soil / Solid	MATRIX: Oil / Sludge	TCLP VOA/BNA/Pest/Herb/Metals (circle)	VOA 8260/624/524.2 (circle)	BNA 8270/625 (circle)	Pesticides 8080/608 (circle)	Pest/PCBs 8080/608/508 (circle)	Herbicides 8150/515 (circle)	PCB Screen 40 V	BTEX 8020/602 (circle)/MTBE (circle)	TRPH 418.1/Oil & Grease 413.1 (circle)	TVPH 8015mod. (Gasoline) 40 V	TEPH 8015mod. (Diesel)	Total Metals-DW / NPDES / SW846 (circle & list metals below)	Dissolved Metals - DW / SW846 (circle & list metals below)	Alkalinity 250P	Toc 425A	Anions 125P					EAL Sample No.
56 MP-25-	3/29/95	8:00	25	X										X		X						X					X0505 56
56 MP-75-	3/29/95	8:45	27	X										X		X				X	X	X					57
MATRIX Spike	3/29/95	8:45	5	X						HOLD				X		X						X					58
Matrix Spike dup	3/29/95	8:45	5	X						HOLD				X		X						X					59
MD56-MW4	3/29/95	9:45	7	X										X		X				X	X	X					60
matrix Spike	3/29/95	9:45	5	X						HOLD				X		X						X					61
matrix Spike dup	3/29/95	9345	5	X						HOLD				X		X						X					62
MD75-MW5	3/29/95	10:45	7	X										X		X		Tubular Pump		X	X	X					63
matrix Spike	3/29/95	10:45	5	X						HOLD				Y		X						X					64
Matrix Spike dup	3/29/95	10:45	5	X						HOLD				X		A						X					65
HT:																											Location C2,2
DD:																											Container Size

EAL use only
Do not write in shaded area
EAL Project # 1044
Custodian _____

Instructions: Samples packed in ICE

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time	Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time
Mark Vessely	3/29/95 1700	Fed ex		Fedex		Rel Mann	3/31/95

COMPANY [illegible]

ADDRESS 1700 Broadway, Suite 900

CITY Denver STATE CO ZIP 80290

PHONE# 303-831-8100 FAX # FAX RESULTS Y / N

[illegible]
4036 Youngfield St.
Wheat Ridge, Colorado 80033
(303) 425-6021
FAX (303) 425-6854
(800) 845-7400

PROJECT I.D. 722450.21020

EAL. QUOTE # P.O.#

TURNAROUND REQUIRED* 30 DAYS

*expedited turnaround subject to additional fee

Sampler Name:

(signature) Mark Vessely

(print) MARK VESSELY

Evergreen Analytical Cooler No. 218

Cooler Received

Please **PRINT** all information:

CLIENT SAMPLE IDENTIFICATION	DATE SAMPLED	TIME	No. of Containers	MATRIX: Water-Drinking/Discharge/Ground (circle)	MATRIX: Soil / Solid	MATRIX: Oil / Sludge	ANALYSIS REQUESTED: TCLP VOA/BNA/Pest/Herb/Metals (circle)	VOA 8260/624/524.2 (circle)	BNA 8270/625 (circle)	Pesticides 8080/608 (circle)	Pest/PCBs 8080/608/508 (circle)	Herbicides 8150/515 (circle)	PCB Screen 4DV	BTEX 8020/602 (circle) MTBE (circle) Time Trip MR	TRPH 418.1/Oil & Grease 413.1 (circle)	TVPH 8015mod. (Gasoline) 4DV	TEPH 8015mod. (Diesel)	Total Metals-DW / NPDES / SW846 (circle & list metals below)	Dissolved Metals - DW / SW846 (circle & list metals below)	Alkalinity 250	Anions 300.0A	Tox 1251				EAL Sample No.
MO75-MW1	3/29/95	11:30	5	X										X		X				X	1				X050666
75MP-5D	3/29/95	12:15	5	X										X		X				X	1				67
75MP-6D	3/29/95	13:30	5	X										X		X				X	1				68
MO75-2MW2	3/29/95	14:15	5	X										X		X				X	1				69
Trip Blank			1											X						(X)	1	labeled MW1 and MW2			70
HT:																									Location C2,2
DD:																									Container Size

EAL use only
Do not write in shaded area

EAL Project # 1044

Custodian

Instructions: See Page 1

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time	Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time
Mark Vessely	3/29/95 1700	Fedex		Fedex		Fed Courier	3/31/95 9:00

Evergreen Analytical Inc.

4036 Youngfield St.
Wheat Ridge, Colorado 80033
(303) 425-6021
FAX (303) 425-6854
(800) 845-7400

COMPANY Pa ...s Engineering Science
ADDRESS 1700 Broadway, Suite 900
CITY Denver STATE CO ZIP 80290
PHONE# 303-831-8100 FAX # _____ FAX RESULTS Y / N

CLIENT CONTACT (print) Todd Wiedemeier
PROJECT I.D. 722450.21020
EAL. QUOTE # _____ P.O.# _____
TURNAROUND REQUIRED* 30 days
*expedited turnaround subject to additional fee

Sampler Name:
(signature) Mark Vessely
(print) MARK VESSELY

Evergreen Analytical Cooler No. 612
Cooler Received _____

Please **PRINT** all information:

CLIENT SAMPLE IDENTIFICATION	DATE SAMPLED	TIME	No. of Containers	MATRIX: Water-Drinking/Discharge (circle)	MATRIX: Soil / Solid	MATRIX: Oil / Sludge	ANALYSIS REQUESTED: TCLP VOA/BNA/Pest/Herb/Metals (circle)	VOA 8260/624/524.2 (circle)	BNA 8270/625 (circle)	Pesticides 8080/608 (circle)	Pest/PCBs 8080/608/508 (circle)	Herbicides 8150/515 (circle)	PCB Screen	BTEX 8020/602 (circle)/MTBE (circle) Type A	TRPH 418.1/Oil & Grease 413.1 (circle)	TVPH 8015mod. (Gasoline)	TEPH 8015mod. (Diesel)	Total Metals-DW / NPDES / SW846 (circle & list metals below)	Dissolved Metals - DW / SW846 (circle & list metals below)	Anions (Cl, NO3, SO4)	Alkalinity	TOC	EAL Sample No.
75MP-8D	3/30/95	10:45	6	X									X		X					X	X	X	X05071
75MP-8S	3/30/95	11:15	7	X									X		X					X	X	X	72
75MP-28S	3/30/95	11:15	7	X									X		X					X	X	X	73
MATRIX Spike	3/30/95	11:15	7	X									X		X					X	X	X	74
Matrix Spike Dup	3/30/95	11:15	6	X									X		X					X	X	X	75
Rinsate Blank	3/30/95	11:15	1	X									X										76
Field Blank	3/30/95	11:15	1										X										77
75MP-9D	3/30/95	12:00	6	X									X		X					X	X		78
75MP-9S	3/30/95	12:30	6	X									X		X					X	X	X	79
MD75-MW13	3/30/95	1320	5	X									X		X					X	X		80
HT:																							Location
DD:																							Container Size

Extra 75MP-8S bottle labels - 75MP-9D & MW13

EAL use only
Do not write in shaded area
EAL Project # 1044
Custodian _____

Instructions: Samples Packed in Ice

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time	Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time
Mark Vessely	3/30/95 17:00	Fed ex		Fed ex		Lu Common	3/31/95

COMPANY Parsons Engineering Science
ADDRESS 1700 Broadway, Suite 900
CITY Denver STATE CO ZIP 80290
PHONE# 303-831-8100 FAX # FAX RESULTS Y / N

4036 [illegible]
Wheat Ridge, Colorado 80033
(303) 425-6021
FAX (303) 425-6854
(800) 845-7400

CLIENT CONTACT (print) Todd Wiedemeier
PROJECT I.D. 722450.21020
EAL. QUOTE # P.O.#
TURNAROUND REQUIRED* 30 days
*expedited turnaround subject to additional fee

Sampler Name:
(signature)
(print) MARK VESSELY

Evergreen Analytical Cooler No. 612
Cooler Received

Please **PRINT** all information:

CLIENT SAMPLE IDENTIFICATION	DATE SAMPLED	TIME	No. of Containers	MATRIX: Water-Drinking/Discharge/Ground (circle)	MATRIX: Soil / Solid	MATRIX: Oil / Sludge	TCLP VOA/BNA/Pest/Herb/Metals (circle)	VOA 8260/624/524.2 (circle)	BNA 8270/625 (circle)	Pesticides 8080/608 (circle)	Pest/PCBs 8080/608/508 (circle)	Herbicides 8150/515 (circle)	PCB Screen	BTEX 8020/602 (circle)/MTBE (circle) Tx&R + Tetra ntR	TRPH 418.1/Oil & Grease 413.1 (circle)	TVPH 8015mod. (Gasoline)	TEPH 8015mod. (Diesel)	Total Metals-DW / NPDES / SW846 (circle & list metals below)	Dissolved Metals - DW / SW846 (circle & list metals below)	Alkalinity	Anions (Cl, NO3, SO4)	TOC	10-MW	EAL Sample No.
MO75-MW11	3/30/95	14:15	5	X									X		X					X	X	X		X05081
MO75-MW10	3/30/95	15:00	5	X									X		X					X				82
MO75-MW9	3/30/95	16:00	5	X									X		X					X				83
Trip Blank			2										X											84
HT:																								Location
DD:																								Container Size

EAL use only
Do not write in shaded area

EAL Project # 1044
Custodian

Instructions: See Page 1

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time	Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time
Mark Vessely	3/30/95 17:10	Fed ex		Fed ex		Lee Cormier	3/31/95 0730

95-1044

PROJECT SPECIAL INSTRUCTIONS ~~94~~

Date: 3/31 EAL Contact: Patty Client Contact: John Hicks Parsons ES

INSTRUCTIONS: Several discrepancies will be handled as follows:

X05071 75MP-8D try to analyze alkalinity from anions - wait on TC

X05072 75MP-8S hold TOC ~~75MP 8S~~

X05074 & X05075 are the MS & MSD for X05072. TOC is missing for spike dup - can we use the matrix spike bottle for lab

(05089) X05078 & X05079 = Analyze anions and alkalinity from anion bottles (marked alkalinity on COC).

X05078 - ~~Hold TOC bottle~~ - No TOC Requested on COC

X05069 - mis ID'd on COC. Should be MD75-MW2

X05063 - alkalinity mislabled. Should read MD75-MW5

X05058, X05059, X05061, X05062, X05064 and X05065 are cancelled.

From : LMC Motel PHONE No. : 813 526 9294 Mar. 31 1995 7:00PM P01

AT TOA: PATTY [illegible]

FROM: MARK VESSELY, PARSONS E.S.

WITH REGARD TO THE COC MIX UP:

1) Alalinity bottle mw4 SHOULD be labeled MD5 - my mistake

2) Bottles should read MD75-mw2; THE simple name was wrong ON the C-O-C. Again, MW1 should be MW2 - mislabeled

Alkalinity bottles and Toc bottles were not taken at 75 MP-BD. I accidently checked the Alkalinity and Toc. Boxes

THE Extra TOC BOTTLE for 75 MP-BS should be for 75 MP-BS2 MSD, I mislabeled the bottle.

THE Toc BOTTLE for 75 MP-90 should be for 75 MP-95. Again, I mislabeled the sample

AS For the missing Alkalinity BOTTLES; 75 MP-90 75 MP-95, & MD75-MW3. I checked the wrong box on the COC. They were intended for Anion tests

Sorry about the mix up — I hope this fax will straighten things out.

MARK VESSELY
Parsons E.S.

Evergreen Analytical Sample Receipt/Check-in Record

Date & Time Rec'd: 3/31/95 900 Shipped Via: FedEx 9581826 8
(Airbill # if applicable)

Client : Parsons Eng.

Client Project ID(s): 722450.21020

EAL Project #(s): 95-1044 EAL Cooler(s): (Y) N

Cooler#	218								
Ice packs	(Y)	N	Y	N	Y	N	Y	N	Y	N
Temperature °C	cold								

	Y	N	N/A
1. Custody seal(s) present:	✓		
Seals on cooler intact	✓		
Seals on bottle intact			✓
2. Chain of Custody present:	✓		
3. Containers broken or leaking: (Comment on COC if Y)		✓	
4. Containers labeled:	✓		
5. COC agrees w/ bottles received: (Comment on COC if N)	✓		
6. COC agrees w/ labels: (Comment on COC if N)	✓		
7. Headspace in VOA vials-waters only (comment on COC if Y)		✓	
8. VOA samples preserved:	✓		
9. pH measured on metals, cyanide or phenolics*:			✓
List discrepancies			
*Non-EAL provided containers only, water samples only.			
10. Metal samples present:			✓
Total _____ , Dissolved _____			
D or PD to be filtered:			
T,TR,D,PD to be Preserved:			
11. Short holding times:		✓	
Specify parameters			
12. Multi-phase sample(s) present:		✓	
13. COC signed w/ date/time:	✓		

Comments: _____

(Additional comments on back)
Custodian Signature/Date: Lee Connor 3/31/95

COMPANY Parsons Engineering Science
ADDRESS 1700 Broadway, Suite 900
CITY Denver STATE CO ZIP 80290
PHONE# 303-831-8100 FAX #

4036 Youngfield St.
Wheat Ridge, Colorado 80033
(303) 425-6021
FAX (303) 425-6854
(800) 845-7400

FAX RESULTS Y / N

CLIENT CONTACT (print) Jeff Niedermeier
PROJECT I.D. 722450.21020
EAL. QUOTE # P.O.#
TURNAROUND REQUIRED* 30 days
*expedited turnaround subject to additional fee

Sampler Name:
(signature) Mark Vessely
(print) MARK VESSELY

Evergreen Analytical Cooler No. 218
Cooler Received

Please **PRINT** all information:

CLIENT SAMPLE IDENTIFICATION	DATE SAMPLED	TIME	No. of Containers	MATRIX: Water-Drinking/Discharge/Ground (circle)	MATRIX: Soil / Solid	MATRIX: Oil / Sludge	ANALYSIS REQUESTED: TCLP VOA/BNA/Pest/Herb/Metals (circle)	VOA 8260/624/524.2 (circle)	BNA 8270/625 (circle)	Pesticides 8080/608 (circle)	Pest/PCBs 8080/608/508 (circle)	Herbicides 8150/515 (circle)	PCB Screen	BTEX 8020/602 (circle)/MTBE (circle)	TRPH 418.1/Oil & Grease 413.1 (circle)	TVPH 8015mod. (Gasoline)	TEPH 8015mod. (Diesel)	Total Metals-DW / NPDES / SW846 (circle & list metals below)	Dissolved Metals - DW / SW846 (circle & list metals below)	Alkalinity	Toc	Anions	EAL Sample No.
56 MP-2S	3/29/95	8:00	5	X										X		X						X	
56 MP-7S	3/29/95	8:45	7	X										X		X				X	X	X	
MATRIX Spike	3/29/95	8:45	5	X										X		X						X	
Matrix Spike dup	3/29/95	8:45	5	X										X		X						X	
MD56-MW4	3/29/95	9:45	7	X										X		X				X	X	X	
matrix Spike	3/29/95	9:45	5	X										X		X						X	
matrix Spike dup	3/29/95	9845	5	X										X		X						X	
MD75-MW5	3/29/95	10:45	7	X										X		X		labeled MW5		X	X	X	
matrix Spike	3/29/95	10:45	5	X										X		X						X	
Matrix Spike dup	3/29/95	10:45	5	X										X		X						X	
HT:																							Location
DD:																							Container Size

EAL use only
Do not write in shaded area

EAL
Project #
Custodian

Instructions: Samples packed in Ice

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time	Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time
Mark Vessely	3/29/95 17:00	Fed ex		Fed ex		Rec Comm	3/31/95

Evergreen Analytical Inc.

4668 Youngfield St.
Wheat Ridge, Colorado 80033
(303) 425-6021
FAX (303) 425-6854
(800) 845-7400

COMPANY Purvis Engineering Science
ADDRESS 1700 Broadway, Suite 900
CITY Denver STATE CO ZIP 80290
PHONE # 303-831-8100 FAX # _____ FAX RESULTS Y / N

CLIENT CONTACT (print) Todd Wiedemeier
PROJECT I.D. 722450.21020
EAL. QUOTE # _____ P.O. # _____
TURNAROUND REQUIRED* 30 days
*expedited turnaround subject to additional fee

Sampler Name:
(signature) Mark Vessely
(print) MARK VESSELY

Evergreen Analytical Cooler No. 218
Cooler Received _____

Please **PRINT** all information:

CLIENT SAMPLE IDENTIFICATION	DATE SAMPLED	TIME	No. of Containers	MATRIX: Water-Drinking/Discharge/Ground (circle)	MATRIX: Soil / Solid	MATRIX: Oil / Sludge	TCLP VOA/BNA/Pest/Herb/Metals (circle)	VOA 8260/624/524.2 (circle)	BNA 8270/625 (circle)	Pesticides 8080/608 (circle)	Pest/PCBs 8080/608/508 (circle)	Herbicides 8150/515 (circle)	PCB Screen	BTEX 8020/602 (circle)/MTBE (circle) Time permitting	TRPH 418.1/Oil & Grease 413.1 (circle)	TVPH 8015mod. (Gasoline)	TEPH 8015mod. (Diesel)	Total Metals-DW / NPDES / SW846 (circle & list metals below)	Dissolved Metals - DW / SW846 (circle & list metals below)	Alkalinity	Anions	TOC				EAL Sample No.
MO75-MW1	3/29/95	11:30	5	X										X		X					X					
75MP-5D	3/29/95	12:15	5	X										X		X					X					
75MP-6D	3/29/95	13:30	5	X										X		X					X					
MO75-2	3/29/95	14:15	5	X										X		X					X					
Trip Blank			1											X												
HT:																									Location	
DD:																									Container Size	

Labeled MW1

EAL use only
Do not write in shaded area

EAL
Project # _____
Custodian _____

Instructions: See Page 1

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time	Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time
Mark Vessely	3/29/95 1700	Fedex		Fedex		Fed Connor	3/31/95 0755

Evergreen Analytical Sample Receipt/Check-in Record

Date & Time Rec'd: 3/31/95 900 Shipped Via: Fed Ex 958182654
(Airbill # if applicable)

Client : Parsons

Client Project ID(s): 722450.2120

EAL Project #(s): 95- 1044 EAL Cooler(s): (Y) N

Cooler#	1&2								
Ice packs	(Y)	N	Y	N	Y	N	Y	N	Y	N
Temperature °C	cold								

	Y	N	N/A
1. Custody seal(s) present:		✓	
Seals on cooler intact			✓
Seals on bottle intact			
2. Chain of Custody present:	✓		
3. Containers broken or leaking: (Comment on COC if Y)		✓	
4. Containers labeled:	✓		
5. COC agrees w/ bottles received: (Comment on COC if N)	✓		
6. COC agrees w/ labels: (Comment on COC if N)	✓		
7. Headspace in VOA vials-waters only (comment on COC if Y)		✓	
8. VOA samples preserved:	✓		
9. pH measured on metals, cyanide or phenolics*:			✓
List discrepancies			
*Non-EAL provided containers only, water samples only.			
10. Metal samples present:			✓
Total _____ , Dissolved _____			
D or PD to be filtered:			
T,TR,D,PD to be Preserved:			
11. Short holding times:		✓	
Specify parameters			
12. Multi-phase sample(s) present:		✓	
13. COC signed w/ date/time:	✓		

Comments:

(Additional comments on back)
Custodian Signature/Date: Kell Common 3/31/95

Evergreen Analytical Inc.

40. Jungfield St.
Wheat Ridge, Colorado 80033
(303) 425-6021
FAX (303) 425-6854
(800) 845-7400

COMPANY Pa s Engineering Science
ADDRESS 1700 Broadway, Suite 900
CITY Denver STATE CO ZIP 80290
PHONE# 303-831-8100 FAX # FAX RESULTS Y / N

CLIENT CONTACT (print) Todd Wiedemeier
PROJECT I.D. 722450.21020
EAL. QUOTE # P.O.#
TURNAROUND REQUIRED* 30 days
*expedited turnaround subject to additional fee

Sampler Name:
(signature) Mark Vessely
(print) MARK VESSELY

Evergreen Analytical Cooler No. 612
Cooler Received

Please **PRINT** all information:

CLIENT SAMPLE IDENTIFICATION	DATE SAMPLED	TIME	No. of Containers	MATRIX: Water-Drnking/Discharge (circle)	MATRIX: Soil / Solid	MATRIX: Oil / Sludge	TCLP VOA/BNA/Pest/Herb/Metals (circle)	VOA 8260/624/524.2 (circle)	BNA 8270/625 (circle)	Pesticides 8080/608 (circle)	Pest/PCBs 8080/608/508 (circle)	Herbicides 8150/515 (circle)	PCB Screen	BTEX 8020/602 (circle)/MTBE (circle)	TRPH 418.1/Oil & Grease 413.1 (circle)	TVPH 8015mod. (Gasoline)	TEPH 8015mod. (Diesel)	Total Metals-DW / NPDES / SW846 (circle & list metals below)	Dissolved Metals - DW / SW846 (circle & list metals below)	Anions (Cl, NO3, SO4)	Alkalinity	TOC	EAL Sample No.
75MP-8D	3/30/95	10:45	5	X										X		X				X	X	X	
75MP-8S	3/30/95	11:15	7	X										X		X				X	X	X	
75MP-28S	3/30/95	11:15	7	X										X		X				X	X	X	
MATRIX Spike	3/30/95	11:15	7	X										X		X				X	X	X	
Matrix Spike Dup	3/30/95	11:15	7	X										X		X				X	X	X	
Rinsate Blank	3/30/95	11:15	1	X										X									
Field Blank	3/30/95	11:15	1											X									
75MP-9D	3/30/95	12:00	5	X										X		X				·	X		
75MP-9S	3/30/95	12:30	6	X										X		X					X	X	
MD75-MW13	3/30/95	1320	5	X										X		X					X		
HT:																							Location
DD:																							Container Size

EAL use only
Do not write in shaded area

EAL
Project #
Custodian

Instructions: Samples Packed in Ice

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time	Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time
Mark Vessely	3/30/95 17:00	Fed ex		Fed ex		Lee Cochran	3/31/95

Tetra Tech
4036 Youngfield St.
Wheat Ridge, Colorado 80033
(303) 425-6021
FAX (303) 425-6854
(800) 845-7400

ADDRESS 1700 BROADWAY, SUITE 900
CITY Denver STATE CO ZIP 80290
PHONE# 303-831-8100 FAX # FAX RESULTS Y / N

CLIENT CONTACT (print) Todd Wiedemeier
PROJECT I.D. 722450.21020
EAL. QUOTE # P.O.#
TURNAROUND REQUIRED* 30 days
*expedited turnaround subject to additional fee

Sampler Name:
(signature) Mark Vessely
(print) MARK VESSELY

Evergreen Analytical Cooler No. 612
Cooler Received

Please **PRINT** all information:

CLIENT SAMPLE IDENTIFICATION	DATE SAMPLED	TIME	No. of Containers	MATRIX: Water-Drinking/Discharge/Groundwater (circle)	MATRIX: Soil / Solid	MATRIX: Oil / Sludge	TCLP VOA/BNA/Pest/Herb/Metals (circle)	VOA 8260/624/524.2 (circle)	BNA 8270/625 (circle)	Pesticides 8080/608 (circle)	Pest/PCBs 8080/608/508 (circle)	Herbicides 8150/515 (circle)	PCB Screen	BTEX 8020/602 (circle)/MTBE (circle) TtAB & Tetra only	TRPH 418.1/Oil & Grease 413.1 (circle)	TVPH 8015mod. (Gasoline)	TEPH 8015mod. (Diesel)	Total Metals-DW / NPDES / SW846 (circle & list metals below)	Dissolved Metals - DW / SW846 (circle & list metals below)	Alkalinity	Anions (Cl, NO3, SO4)	TOC	10-MW				EAL Sample No.
MO75-MW11	3/30/95	14:15	5	X										X		X				X	X	X					
MO75-MW10	3/30/95	15:00	5	X										X		X					X						
MO75-MW9	3/30/95	16:00	5	X										X		X					X						
Trip Blank			1											X													
HT:																											Location
DD:																											Container Size

EAL use only
Do not write in shaded area

EAL
Project #
Custodian

Instructions: See Page 1

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time	Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time
Mark Vessely	3/30/95 17:00	Fed ex		Fed ex		Fed Courier	3/31/95

Mar. 31 1995 7:17PM P

PHONE No. : 813 526 9254

COMPANY Ivans Engineering Science

ADDRESS 600 Broadway, Suite 900

CITY Denver STATE CO ZIP 80290

PHONE # 303-831-8100 FAX #

Sampler Name:

(signature) Mark Vessely

(print) MARK VESSELY

Evergreen Analytical Cooler No. 1012

Cooler Received

Evergr Analytical Inc.
4036 Youngfield St.
Wheat Ridge, Colorado 80033
(303) 425-6021
FAX (303) 425-6854
(800) 845-7400

FAX RESULTS Y / N

Page 1 of

CLIENT CONTACT (print): Ted Wiedemeier

PROJECT I.D. 722450.21020

EAL QUOTE # P.O.#

TURNAROUND REQUIRED* 30 days

*expedited turnaround subject to additional fee

Please **PRINT** all information:

CLIENT SAMPLE IDENTIFICATION	DATE SAMPLED	TIME	No. of Containers	MATRIX: Water-Drinking/Discharge/Ground (circle)	Soil / Solid	Oil / Sludge	TCLP VOA/BNA/Pest/Herb/Metals (circle)	VOA 8260/624/524.2 (circle)	BNA 8270/625 (circle)	Pesticides 8080/608 (circle)	Pest/PCBs 8080/608/508 (circle)	Herbicides 8150/515 (circle)	PCB Screen	BTEX 8020/602 (circle)/MTBE (circle)	TRPH 418.1/Oil & Grease 413.1 (circle)	TVPH 8015mod. (Gasoline)	TEPH 8015mod. (Diesel)	Total Metals-DW / NPDES / SW846 (circle & list metals below)	Dissolved Metals - DW / SW846 (circle & list metals below)	Anions (Cl, NO3, NO2, SO4)	Alkalinity	TOC						EAL Sample No.
75MP-8D	3/30/95	10:45	5	X									X		X				X	X	X	X					
75 MP-8S	3/30/95	11:15	7	X									X		X				X	X	X	X					
75 MP-28S	3/30/95	11:15	7	X									X		X				X	X	X	X					
MATRIX Spike	3/30/95	11:15	7	X									X		X				X	X	X	X					
Matrix Spike Dup	3/30/95	11:15	7	X									X		X				X	X	X	X					
Rinsate Blank	3/30/95	11:15	1	X									X		X				X	X	X						
Field Blank	3/30/95	11:15	1										X														
75MP-9D	3/30/95	12:00	5	X									X														
75 MP-9S	3/30/95	12:30	6	X									X		X				X	X	X	X					
MD75-MW12	3/30/95	1320	5	X									X		X				X	X	X						
FB:													X		X				X	X	X						
DD:																											

EAL use only
Do not write in shaded area

EAL Project #

Custodian

Location

Container Size

Instructions: Samples packed in Ice

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time	Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time
		Fed Ex		Fed Ex			

...way, Suite 700
CITY Denver STATE CO ZIP 80290
PHONE# 303-831-8100 FAX # FAX RESULTS Y / N

Wheat Ridge, Colorado 80033
(303) 425-6021
FAX (303) 425-6854
(800) 845-7400

CLIENT CONTACT (print) Mark Vessely
PROJECT I.D. 722450.21020
EAL QUOTE # P.O.#
TURNAROUND REQUIRED* 30 days
*expedited turnaround subject to additional fee

Sampler Name:
(signature) Mark Vessely
(print) MARK VESSELY

Evergreen Analytical Cooler No. 1012
Cooler Received

Please **PRINT** all information:

CLIENT SAMPLE IDENTIFICATION	DATE SAMPLED	TIME	No. of Containers	MATRIX: Water-Drinking/Discharge/Groundwater (circle)	MATRIX: Soil / Solid	MATRIX: Oil / Sludge	ANALYSIS REQUESTED: TCLP VOA/BNA/Pest/Herb/Metals (circle)	VOA 8260/624/524.2 (circle)	BNA 8270/625 (circle)	Pesticides 8080/608 (circle)	Pest/PCBs 8080/808/508 (circle)	Herbicides 8150/515 (circle)	PCB Screen	BTEX 8020/602 (circle) Purge & Trap Method	TRPH 418.1/Oil & Grease 413.1 (circle)	TVPH 8015mod. (Gasoline)	TEPH 8015mod. (Diesel)	Total Metals-DW / NPDES / SW846 (circle & list metals below)	Dissolved Metals - DW / SW846 (circle & list metals below)	Anions (Cl, NO3, NO2, SO4)	Alkalinity	TDC					EAL Sample No.
75MP-8D	3/30/95	10:45	5	X										X		X				X	X	X				
75 MP-8S	3/30/95	11:15	7	X										X		X				X	X	X				
75MP-28S	3/30/95	11:15	7	X										X		X				X	X	X				
MATRIX Spike	3/30/95	11:15	7	X										X		X				X	X	X				
MATRIX Spike Dup	3/30/95	11:15	7	X										X		X				X	X	X				
Rinsate Blank	3/30/95	11:11	1	X										X												
Field Blank	3/30/95	11:15	1											X												
75MP-9D	3/30/95	12:00	5	X										X		X				X	X					
75MP-9S	3/30/95	12:30	6	X										X		X				X	X	X				
MD75-MW13	3/30/95	13:20	5	X										X		X				X	X					
HI:																										Location
DD:																										Container Size

EAL use only
Do not write in shaded area
EAL Project
Custodian

Instructions: Samples Packed in Ice

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time	Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time

95-1044

Memo to Patty McClellan, Evergreen Analytical
3/31/95
Subject: Your fax of earlier today

Here's a list of the discrepencies between the samples and the COC, and the resolution that we agreed on over the phone. Since then, I have talked to the field people, and their clarifications/comments are also described below (**in bold**). They will send you a marked-up copy of the COCs showing the corrections (via fax I think).

Alkalinity bottle labeled MW4--will assume is MW5. **Field people say that should have been MW5.**

Bottles labeled MW2 except anion labeled MW1--will assume all are MW2. **Field people say that MW2 is correct.**

Alkalinity and TOC bottles missing for 75MP-8D--will take alkalinity sample from anions bottle, and will hold on TOC for our instructions. **TOC will not be collected from this well.**

Extra TOC for 75MP-8S and 9D, and missing TOC for 75MP8S MSD and 9S--hold per our instructions. **TOC for 75MP-8S should be 75MP-8S MSD, and 9D should be 9S.**

Alkalinity (should be anions, not alkalinity) bottles missing for 75MP-9D, 9S, and MD75-MW13 (bottles say anions but COC says alkalinity). Will run both analyses on the samples. **They checked the alkalinity box by mistake. Should be run for anions and not alkalinity.**

Anions received but not on COC for 75MP-9D, 9S, and MD75-MW13--will run the anions definitely, and also do alkalinity if have enough sample.
Alkalinity not scoped, so just run anions.

I said to expect about 11 samples not including QC on Saturday. This is about right. **Will also receive 8 TEH samples tomorrow.**

Patty will check whether the TOC is being filtered. **Did you find out? If so, please call me today.**

John Hicks

F2245.

Post-it™ Fax Note 7671	Date 3/31/95	# of pages ▶ 1
To Patty McClellan	From John Hicks	
Co./Dept. Evergreen	Co. Parsons ES	
Phone #	Phone # 831-8100	
Fax # 425-6854	Fax # -8201	

EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303) 425-6021

Method 602 Data Report

Client Sample Number	: 56MP-2S	Client Project No.	: 722450.21020/MacDill
Lab Sample Number	: X05056	Lab Project No.	: 95-1044
Date Sampled	: 3/29/95	Dilution Factor	: 1.00
Date Received	: 3/31/95	Method	: 602
Date Prepared	: 4/12/95	Matrix	: Water
Date Analyzed	: 4/12/95	Lab File No.	: BX1041212
		Method Blank No.	: MB041295

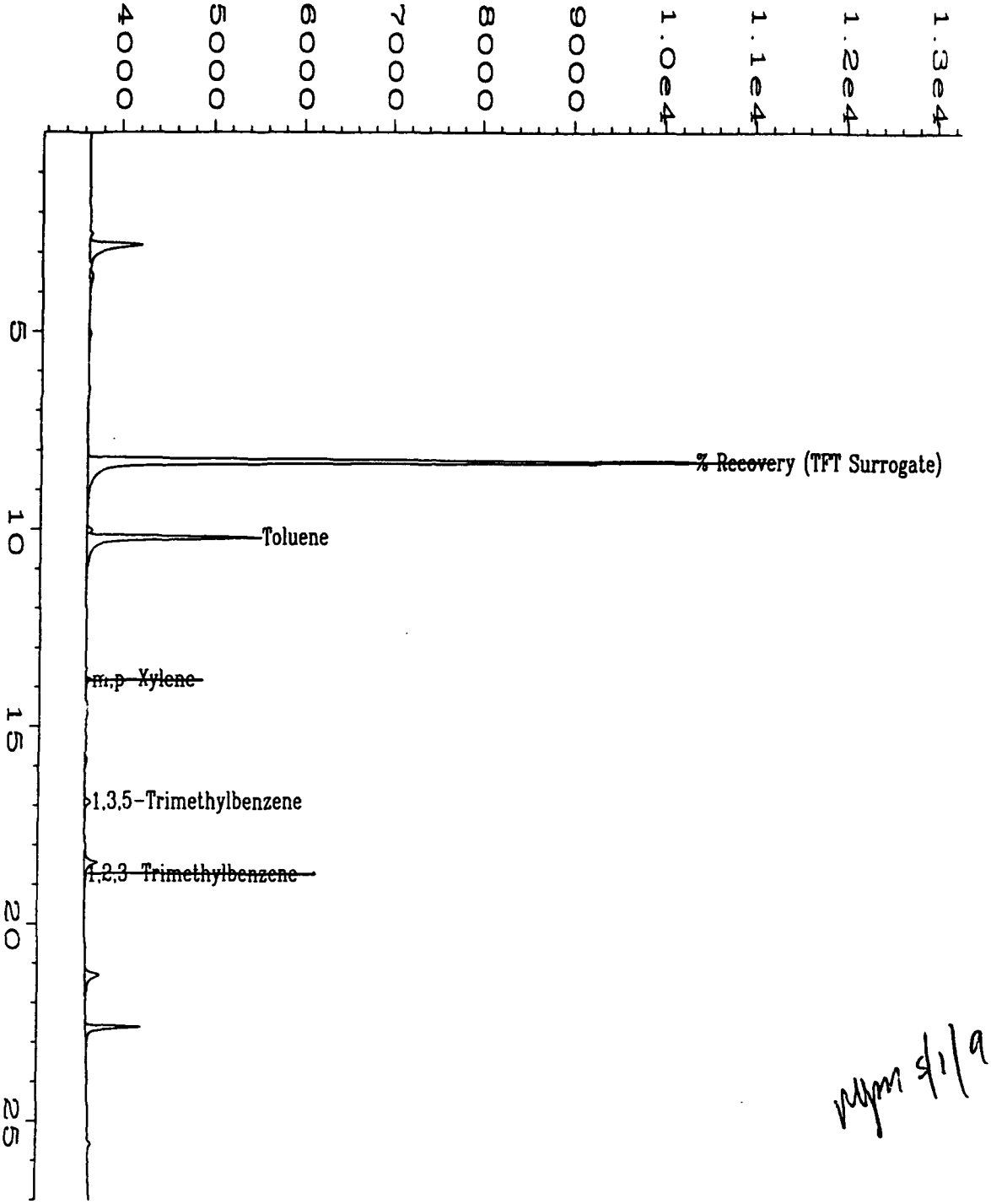
Compound Name	Cas Number	Sample Concentration ug/L		RL ug/L
Benzene	71-43-2		U	0.4
Toluene	108-88-3	10	B	0.4
Chlorobenzene	108-90-7		U	0.4
Ethyl Benzene	100-41-4		U	0.4
Total Xylenes (m, p & o)	108-38-3, 106-42-3 and 95-47-6		U	0.4
1,3,5-Trimethylbenzene	108-67-8	0.4		0.4
1,2,4-Trimethylbenzene	95-63-6		U	0.4
1,2,3-Trimethylbenzene	526-73-8		U	0.4
1,2,3,4-Tetramethylbenzene	488-23-3		U	0.4
Surrogate Recovery (α,α,α-Trifluorotoluene):		94%		70%-130% (QC limits)

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene RL is for a single peak.

QUALIFIERS:
E = Extrapolated value.
U = Compound analyzed for, but not detected.
B = Compound also found in the blank.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit (RL).
RL = Reporting Limit.
NA = Not Available/Not Applicable.

K. Cone
Analyst

Approved



mpm 5/1/95

Data File Name : C:\HPCHEM\1\DATA\BX10412\012F0801.D
Operator : S.W. Tyson
Instrument : BTEX1
Sample Name : X05056;1;5
Run Time Bar Code:
quired on : 12 Apr 95 08:38 AM
port Created on: 28 Apr 95 07:36 PM
Last Recalib on : 28 APR 95 07:11 PM
Multiplier : 1
Sample Info : Project # 95-1044 Client # 56MP-2S Water

Page Number : 1
Vial Number : 12
Injection Number : 1
Sequence Line : 8
Instrument Method: BX10408.MTH
Analysis Method : BX10412B.MTH
Sample Amount : 0
ISTD Amount :

EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303) 425-6021

Method 602 Data Report

Client Sample Number	: 56MP-7S	Client Project No.	: 722450.21020/MacDill
Lab Sample Number	: X05057	Lab Project No.	: 95-1044
Date Sampled	: 3/29/95	Dilution Factor	: 1.00
Date Received	: 3/31/95	Method	: 602
Date Prepared	: 4/12/95	Matrix	: Water
Date Analyzed	: 4/12/95	Lab File No.	: BX1041213
		Method Blank No.	: MB041295

Compound Name	Cas Number	Sample Concentration ug/L		RL ug/L
Benzene	71-43-2		U	0.4
Toluene	108-88-3	5.9	B	0.4
Chlorobenzene	108-90-7		U	0.4
Ethyl Benzene	100-41-4		U	0.4
Total Xylenes (m, p & o)	108-38-3, 106-42-3 and 95-47-6		U	0.4
1,3,5-Trimethylbenzene	108-67-8		U	0.4
1,2,4-Trimethylbenzene	95-63-6		U	0.4
1,2,3-Trimethylbenzene	526-73-8		U	0.4
1,2,3,4-Tetramethylbenzene	488-23-3		U	0.4

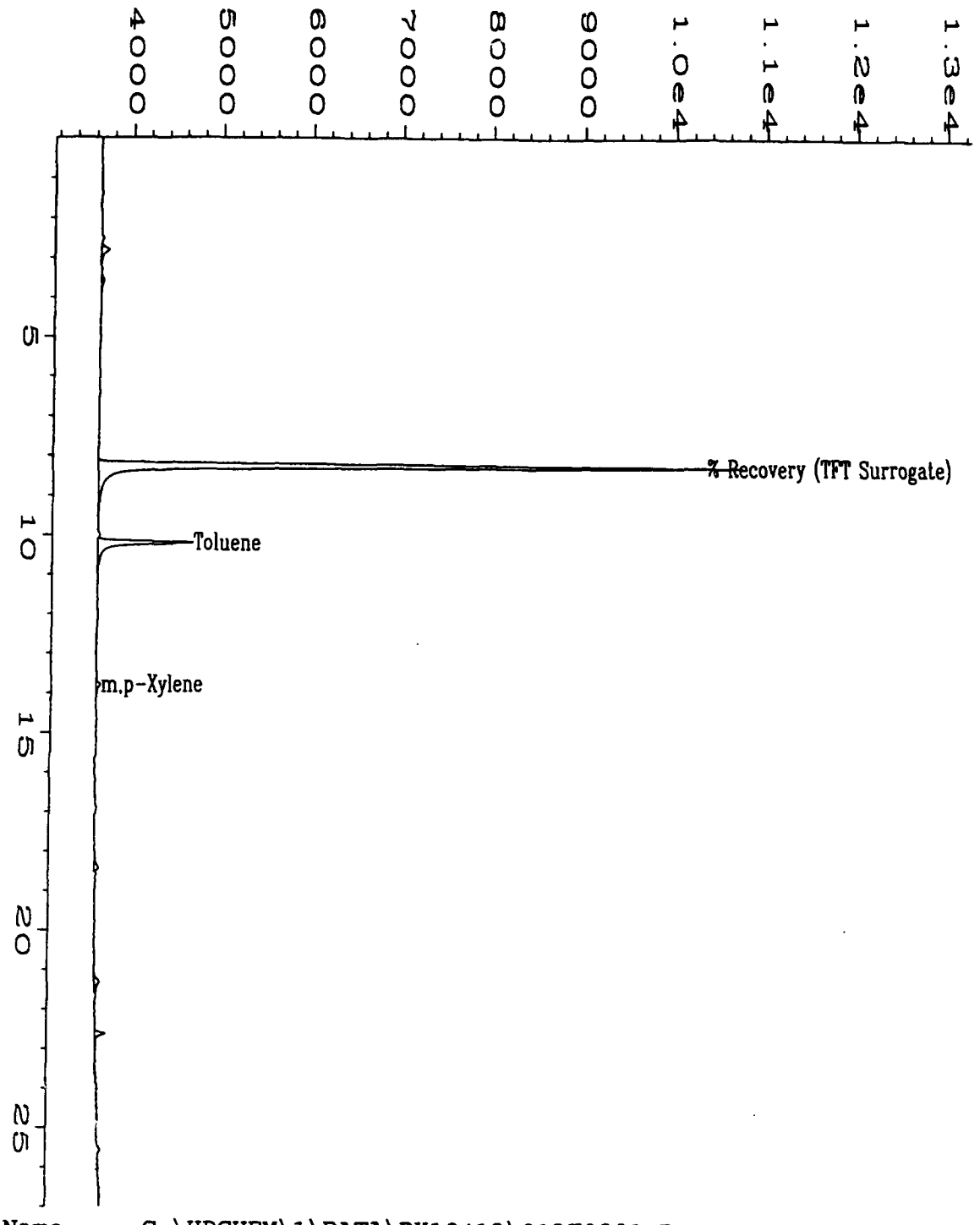
Surrogate Recovery (α,α,α-Trifluorotoluene):	88%	70%-130% (QC limits)

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene RL is for a single peak.

QUALIFIERS:
E = Extrapolated value.
U = Compound analyzed for, but not detected.
B = Compound also found in the blank.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit (RL).
RL = Reporting Limit.
NA = Not Available/Not Applicable.

K. Cone
Analyst

Approved



Data File Name	: C:\HPCHEM\1\DATA\BX10412\013F0801.D		
Operator	: S.W. Tyson	Page Number	: 1
Instrument	: BTEX1	Vial Number	: 13
Sample Name	: X05057;1;5	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 8
uired on	: 12 Apr 95 09:17 AM	Instrument Method	: BX10408.MTH
ort Created on	: 28 Apr 95 07:37 PM	Analysis Method	: BX10412B.MTH
Last Recalib on	: 28 APR 95 07:11 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:
Sample Info	: Project # 95-1044 Client # 56MP-7S Water		

EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303) 425-6021

Method 602 Data Report

ent Sample Number	: MD56-MW4	Client Project No.	: 722450.21020/MacDill
Sample Number	: X05060	Lab Project No.	: 95-1044
te Sampled	: 3/29/95	Dilution Factor	: 1.00
te Received	: 3/31/95	Method	: 602
ate Prepared	: 4/12/95	Matrix	: Water
ate Analyzed	: 4/12/95	Lab File No.	: BX1041214
		Method Blank No.	: MB041295

Compound Name	Cas Number	Sample Concentration ug/L		RL ug/L
enzene	71-43-2		U	0.4
oluene	108-88-3	0.6	B	0.4
Chlorobenzene	108-90-7		U	0.4
Ethyl Benzene	100-41-4		U	0.4
Total Xylenes (m, p & o)	108-38-3, 106-42-3 and 95-47-6		U	0.4
1,3,5-Trimethylbenzene	108-67-8		U	0.4
1,2,4-Trimethylbenzene	95-63-6		U	0.4
,2,3-Trimethylbenzene	526-73-8		U	0.4
1,2,3,4-Tetramethylbenzene	488-23-3		U	0.4

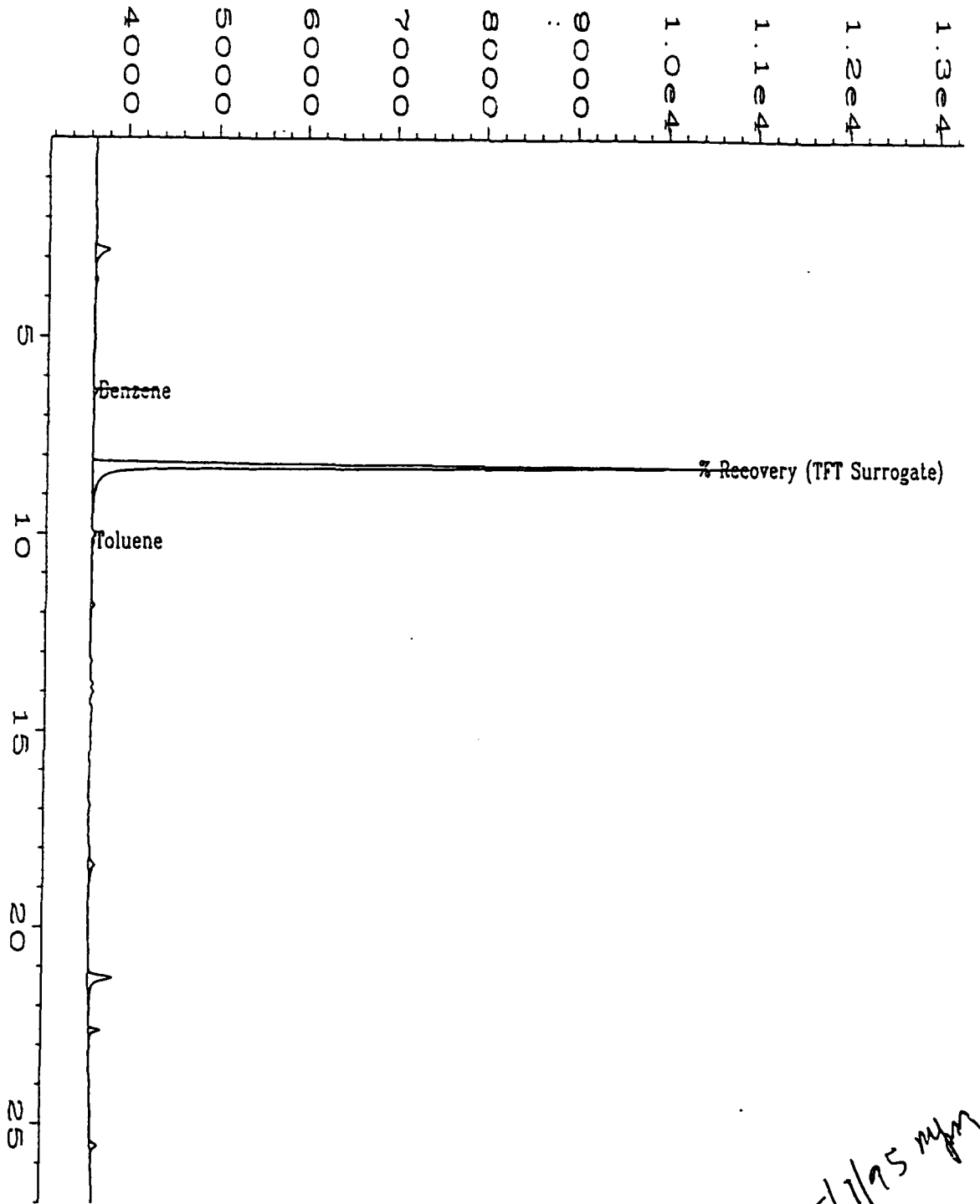
Surrogate Recovery (α,α,α-Trifluorotoluene):	91%	70%-130% (QC limits)

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene RL is for a single peak.

QUALIFIERS:
E = Extrapolated value.
U = Compound analyzed for, but not detected.
B = Compound also found in the blank.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit (RL).
RL = Reporting Limit.
NA = Not Available/Not Applicable.

K. Cone
Analyst

Approved



5/1/95 mjm

Data File Name	: C:\HPCHEM\1\DATA\BX10412\014F0801.D		
Operator	: S.W. Tyson	Page Number	: 1
Instrument	: BTEX1	Vial Number	: 14
Sample Name	: X05060;1;5	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 8
Acquired on	: 12 Apr 95 09:55 AM	Instrument Method	: BX10408.MTH
Report Created on	: 28 Apr 95 07:37 PM	Analysis Method	: BX10412B.MTH
Last Recalib on	: 28 APR 95 07:11 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:
Sample Info	: Project # 95-1044 Client # MD56-MW4 Water		

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BTEX Matrix Spike/Matrix Spike Duplicate Data Report

Client Sample No.	: 75MP-8S	Client Project No.	: 722450.21020/MacDill
Lab Sample No.	: X05072	Lab Project No.	: 95-1044
Date Sampled	: 3/30/95	EPA Method No.	: 602
Date Received	: 3/31/95	Matrix	: Water
Date Prepared	: 4/13/95	Lab File Number(s)	: BX1041312,13
Date Analyzed	: 4/13/95	Method Blank	: MB041395

Compound	Spike Added (ug/L)	Sample Concentration (ug/L)	MS Concentration (ug/L)	MS %REC	QC Limits %REC
Benzene	20.0	0.0	11.0	55	50-150
Toluene	20.0	0.0	19.1	96	50-148
Ethyl Benzene	20.0	0.0	18.3	92	50-150
m,p-Xylene	40.0	0.0	37.4	94	50-150
o-Xylene	20.0	0.0	18.4	92	50-150
Chlorobenzene	20.0	0.0	18.0	90	55-135
1,3,5-TMB	20.0	0.0	18.4	92	50-150
1,2,4-TMB	20.0	0.0	18.3	92	50-150
1,2,3-TMB	20.0	0.0	18.7	94	50-150
1,2,3,4-TeMB	20.0	0.0	19.4	97	50-150

Compound	Spike Added (ug/L)	MSD Concentration (ug/L)	MSD %REC	RPD	QC Limits RPD	QC Limits %REC
Benzene	20.0	10.4	52	5.6	25	50-150
Toluene	20.0	18.0	90	5.9	25	50-148
Ethyl Benzene	20.0	17.4	87	5.0	25	50-150
m,p-Xylene	40.0	35.1	88	6.3	25	50-150
o-Xylene	20.0	17.5	88	5.0	25	50-150
Chlorobenzene	20.0	17.0	85	5.7	25	55-135
1,3,5-TMB	20.0	17.3	87	6.2	25	50-150
1,2,4-TMB	20.0	16.8	84	8.5	25	50-150
1,2,3-TMB	20.0	17.2	86	8.4	25	50-150
1,2,3,4-TeMB	20.0	16.6	83	15.6	25	50-150

* = Values outside of QC limits.

RPD: 0 out of (10) outside limits.

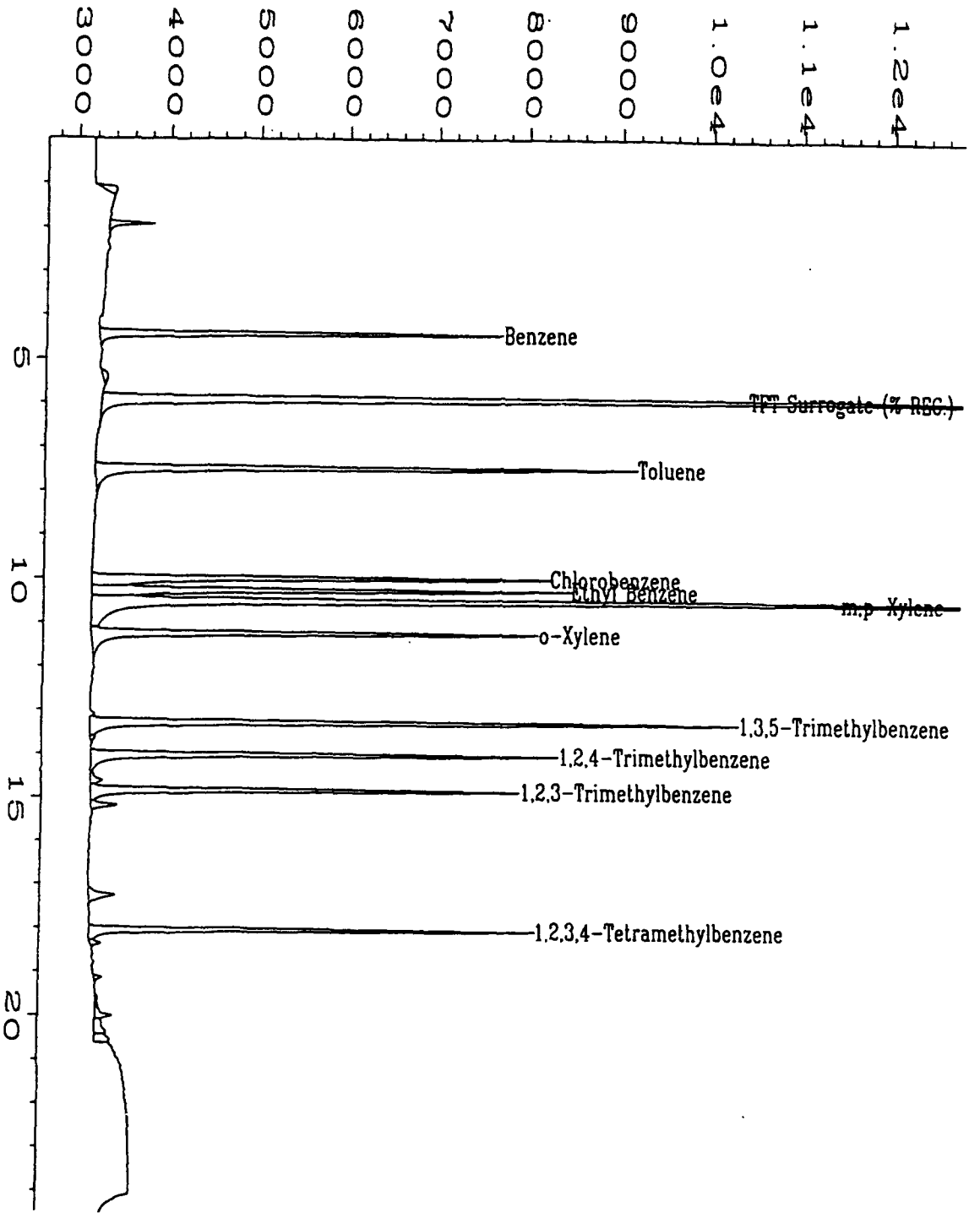
Spike Recovery: 0 out of (20) outside limits.

Comments:

K. Cone
Analyst

Approved

MS1044B.XLS



Data File Name : C:\HPCHEM\2\DATA\BX20413\012R0701.D
Operator : SW Tyson
Instrument : BTEX2
Sample Name : X05072MS;1;5
Run Time Bar Code:
Acquired on : 13 Apr 95 06:19 AM
Report Created on: 13 Apr 95 10:22 AM
Last Recalib on : 13 APR 95 02:16 AM
Multiplier : 1

Page Number : 1
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Injection Number : 1
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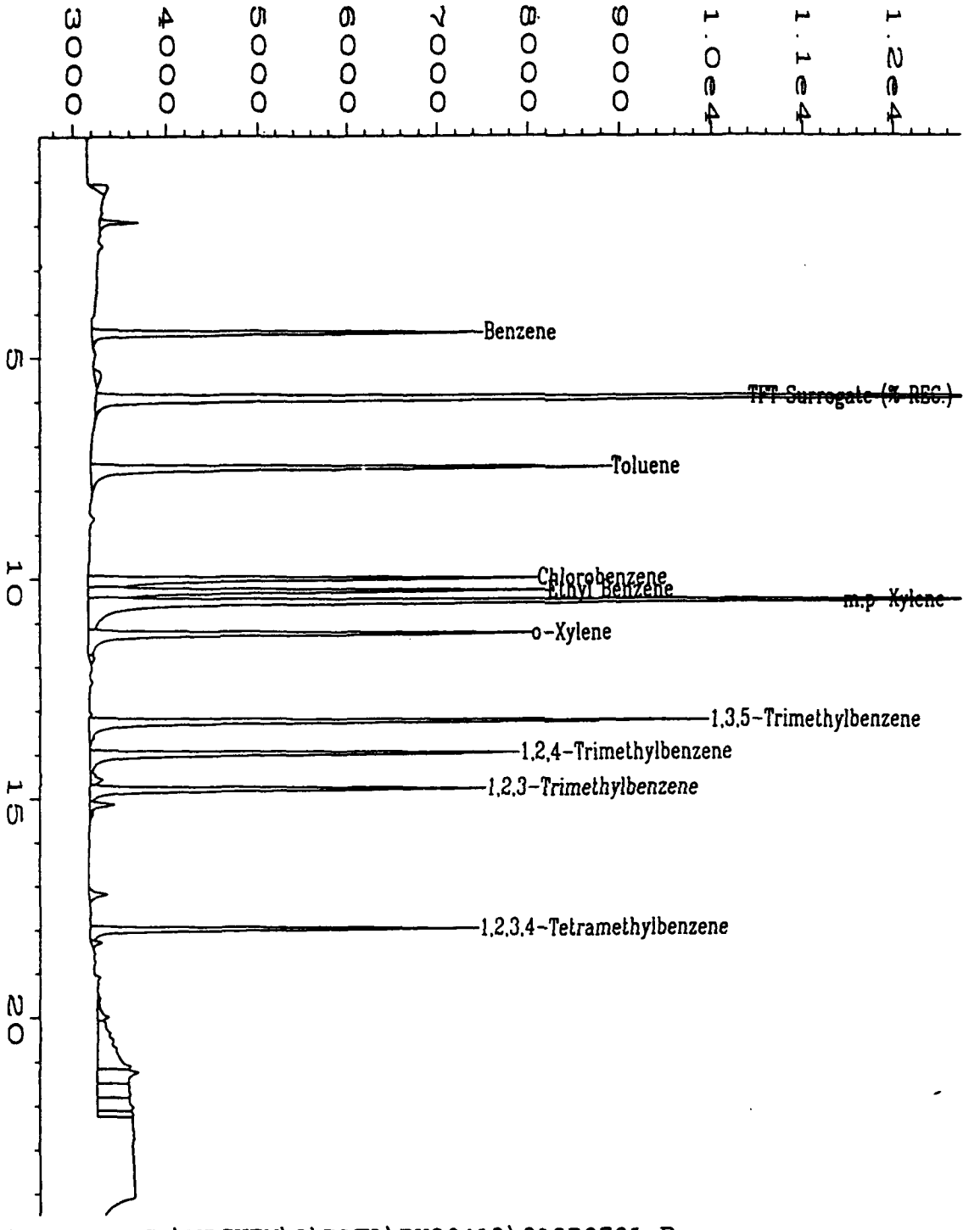
ISTD Amount :



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ator	: SW Tyson	Page Number	: 1
ument	: BTEX2	Vial Number	: 13
le Name	: X05072MSD;1;5	Injection Number	: 1
Time Bar Code:		Sequence Line	: 7
ired on	: 13 Apr 95 07:04 AM	Instrument Method	: BX20413.MTH
rt Created on	: 13 Apr 95 10:22 AM	Analysis Method	: BX20413.MTH
Recalib on	: 13 APR 95 02:16 AM	Sample Amount	: 0
iplier	: 1	ISTD Amount	:

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(303) 425-6021

TOTAL VOLATILE HYDROCARBONS

TVH Matrix Spike/Matrix Spike Duplicate Data Report

Client Sample No.	: 56MP-2S	**Client Project No.**	: 722450.21020\MAC
Lab Sample No.	: X05056	**Lab Project No.**	: 95-1044
Date Sampled	: 3/29/95	**EPA Method No.**	: 5030/8015 Mod.
Date Received	: 3/31/95	**Matrix**	: Water
Date Prepared	: 4/11/95	**Method Blank**	: MB041295
Date Analyzed	: 4/12/95		

Compound	Spike Added (mg/L)	Sample Concentration (mg/L)	MS Concentration (mg/L)	MS %REC	QC Limits %REC
Gasoline	2.00	0.00	2.07	104%	60-140

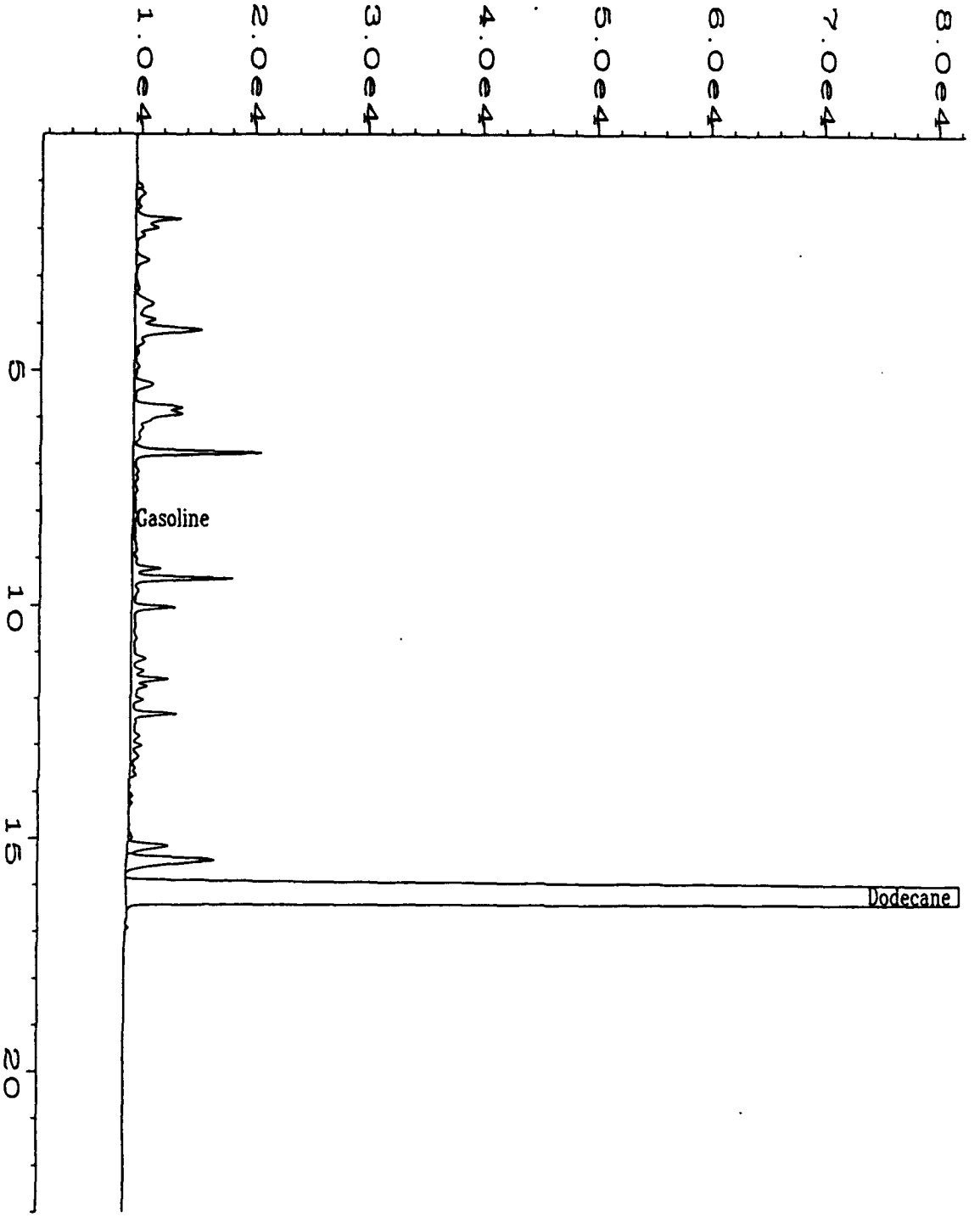
Compound	Spike Added (mg/L)	MSD Concentration (mg/L)	MS %REC	RPD	QC Limits RPD	QC Limits %REC
Gasoline	2.00	1.95	98%	6	50	60-140

* = Values outside of QC limits.

RPD: 0 out of (1) outside limits.

Spike Recovery: 0 out of (2) outside limits.

Comments: NA = Not analyzed/not applicable.



ta File Name	: C:\HPCHEM\1\DATA\tvh0412\011F0101.D		
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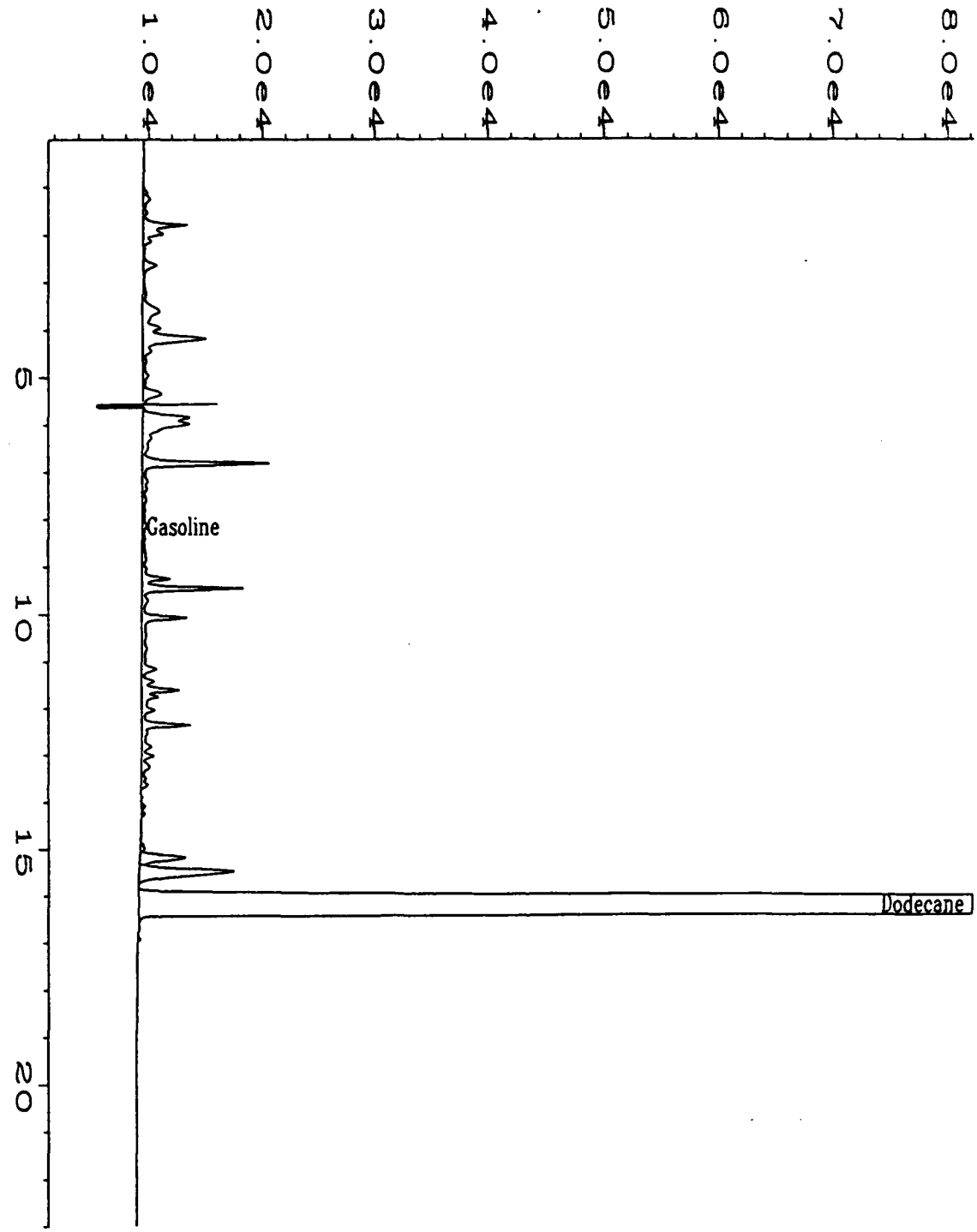
strument	: TVH	Vial Number	: 11
mple Name	: X05056 MS	Injection Number	: 1
Time Bar Code	:	Sequence Line	: 1
quired on	: 12 Apr 95 06:01 AM	Instrument Method	: TVH1BASE.MT
port Created on	: 12 Apr 95 10:04 AM	Analysis Method	: TVH0412.MTH
st Recalib on	: 12 APR 95 10:00 AM	Sample Amount	: 0
ltiplier	: 1	ISTD Amount	:



Data File Name	: C:\HPCHEM\1\DATA\tvh0412\012F0101.D		
Operator	: Dawn N. Guildner	Page Number	: 1
Instrument	: TVH	Vial Number	: 12
Sample Name	: X05056 MSD	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 1
Acquired on	: 12 Apr 95 06:37 AM	Instrument Method	: TVH1BASE.MTH
Report Created on	: 12 Apr 95 10:05 AM	Analysis Method	: TVH0412.MTH
Last Recalib on	: 12 APR 95 10:00 AM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:

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TOTAL VOLATILE HYDROCARBONS
TVH Matrix Spike/Matrix Spike Duplicate Data Report

Client Sample No.	: 75MP-8S	Client Project No.	: 722450.21020\MAC
Lab Sample No.	: X05074,75	Lab Project No.	: 95-1044
Date Sampled	: 3/30/95	EPA Method No.	: 5030/8015 Mod.
Date Received	: 3/31/95	Matrix	: Water
Date Prepared	: 4/13/95	Method Blank	: MB041295
Date Analyzed	: 4/13/95		MB041395

Compound	Spike Added (mg/L)	Sample Concentration (mg/L)	MS Concentration (mg/L)	MS %REC	QC Limits %REC
Gasoline	2.00	0.00	1.89	95%	60-140

Compound	Spike Added (mg/L)	MSD Concentration (mg/L)	MS %REC	RPD	QC Limits RPD	QC Limits %REC
Gasoline	2.00	1.65	83%	14	50	60-140

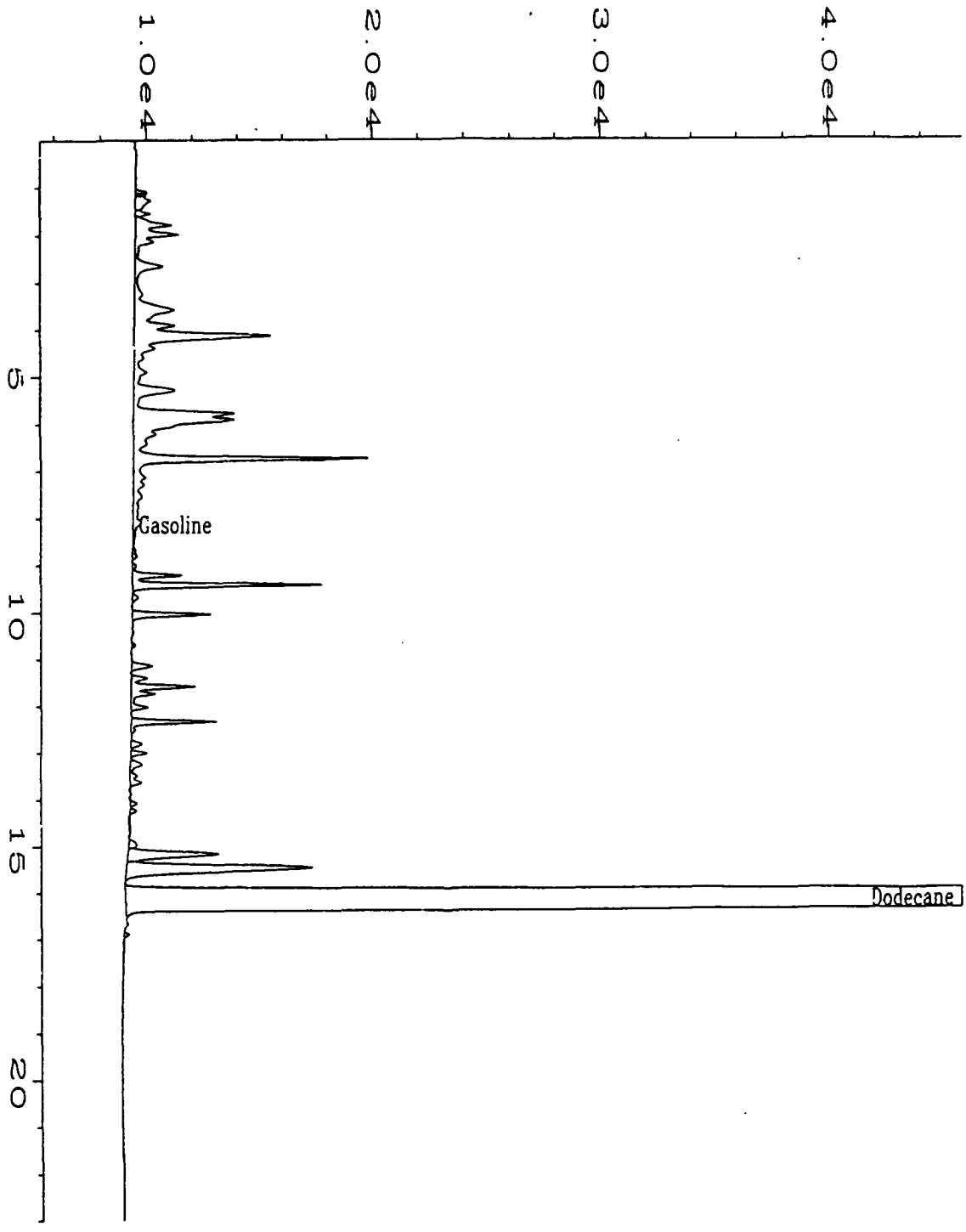
* = Values outside of QC limits.

RPD: 0 out of (1) outside limits.

Spike Recovery: 0 out of (2) outside limits.

Comments: NA = Not analyzed/not applicable.

pm



Data File Name	: C:\HPCHEM\1\DATA\tvh0413\012F0101.D		
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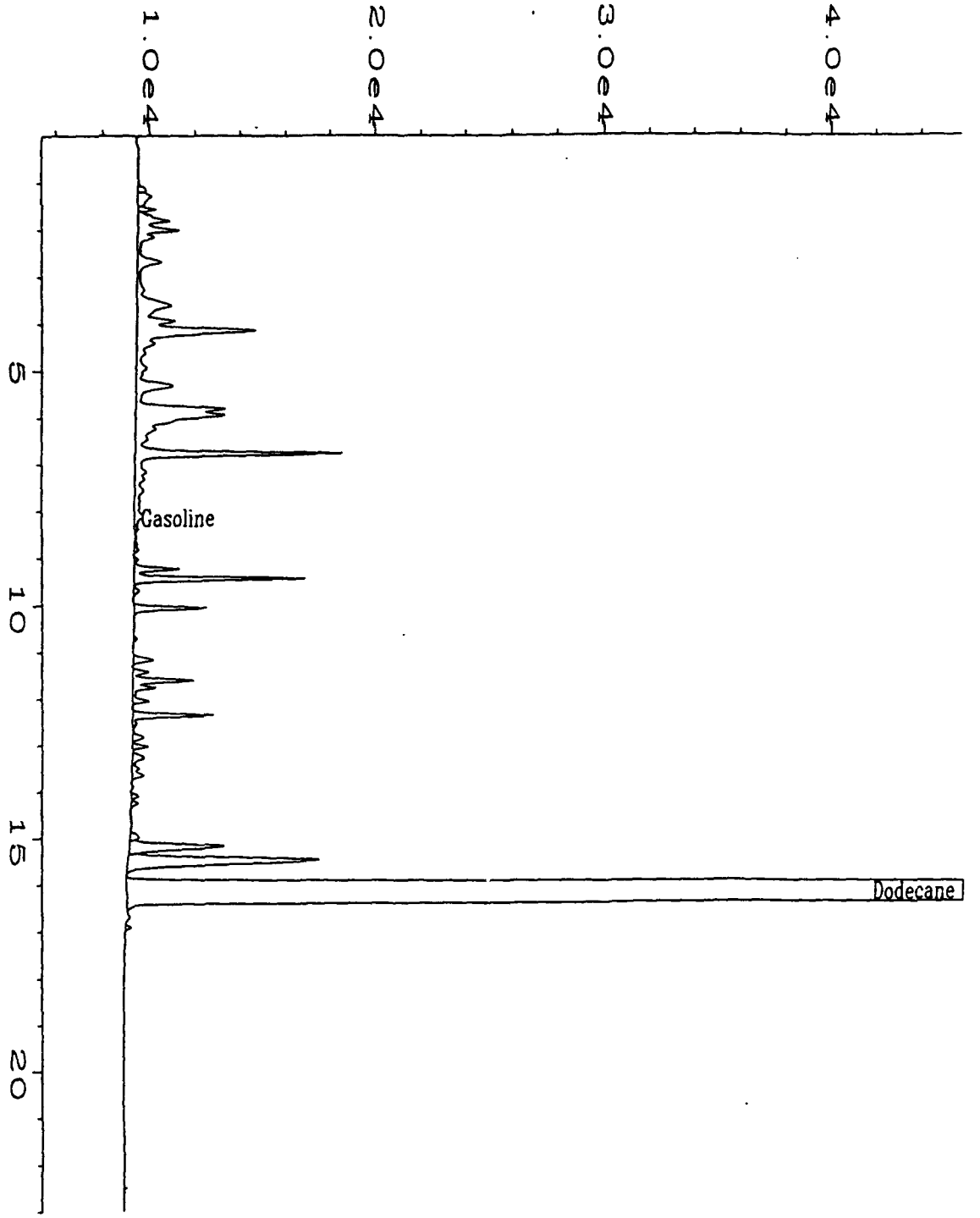
Instrument	: TVH	Vial Number	: 12
Sample Name	: X05074 MS	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 1
uired on	: 13 Apr 95 04:48 PM	Instrument Method	: TVH1BASE.MTH
ort Created on	: 14 Apr 95 09:48 AM	Analysis Method	: TVH0413.MTH
Last Recalib on	: 13 APR 95 02:21 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:
Sample Info	: PROJECT # 95-1044 CLIENT # MATRIX SPIKE WATER		



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Instrument	: TVH	Vial Number	: 13
Sample Name	: X05075 MSD	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 1
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Report Created on	: 14 Apr 95 09:48 AM	Analysis Method	: TVH0413.M1a
Last Recalib on	: 13 APR 95 02:21 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:
Sample Info	: PROJECT # 95-1044 CLIENT # MATRIX SPIKE DUP WATER		

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Method 602 Data Report

Client Sample Number	: Field Blank	Client Project No.	: 722450.21020/MacDill
Lab Sample Number	: X05077	Lab Project No.	: 95-1044
Date Sampled	: 3/30/95	Dilution Factor	: 1.00
Date Received	: 3/31/95	Method	: 602
Date Prepared	: 4/13/95	Matrix	: Water
Date Analyzed	: 4/13/95	Lab File No.	: BX2041316
		Method Blank No.	: MB041395

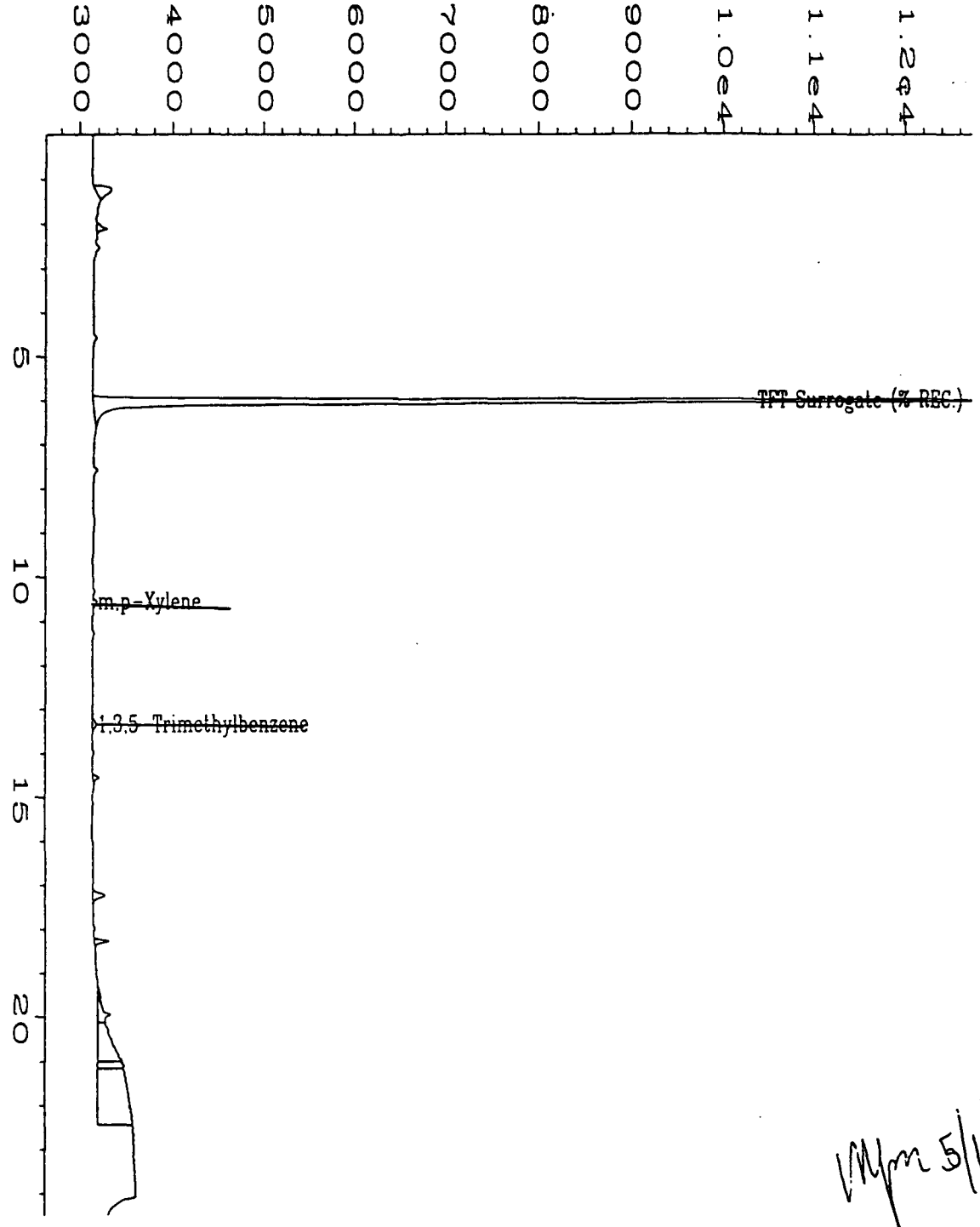
Compound Name	Cas Number	Sample Concentration ug/L		RL ug/L
Benzene	71-43-2	U		0.4
Toluene	108-88	U		0.4
Chlorobenzene	108-90-7	U		0.4
Ethyl Benzene	100-41-4	U		0.4
Total Xylenes (m, p & o)	108-38-3, 106-42-3 and 95-47-6	U		0.4
1,3,5-Trimethylbenzene	108-67-8	U		0.4
1,2,4-Trimethylbenzene	95-63-6	U		0.4
1,2,3-Trimethylbenzene	526-73-8	U		0.4
1,2,3,4-Tetramethylbenzene	488-23-3	U		0.4
Surrogate Recovery (α,α,α-Trifluorotoluene):		84%		70%-130% (QC limits)

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene RL is for a single peak.

QUALIFIERS:
E = Extrapolated value.
U = Compound analyzed for, but not detected.
B = Compound also found in the blank.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit (RL).
RL = Reporting Limit.
= Not Available/Not Applicable.

K. Cone
Analyst

Approved



WMm 5/1/95

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trument	: BTEX2	Vial Number	: 16
ple Name	: X05077;1;5	Injection Number	: 1
Time Bar Code:		Sequence Line	: 7
uired on	: 13 Apr 95 09:20 AM	Instrument Method	: BX20413.MTH
ort Created on	: 13 Apr 95 10:11 AM	Analysis Method	: BX20413.MTH
t Recalib on	: 13 APR 95 02:16 AM	Sample Amount	: 0
iplier	: 1	ISTD Amount	:

Field Blank

EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303) 425-6021

Method 602 Data Report

Client Sample Number	: Rinseate Blank	Client Project No.	: 722450.21020/MacDill
Lab Sample Number	: X05076	Lab Project No.	: 95-1044
Date Sampled	: 3/30/95	Dilution Factor	: 1.00
Date Received	: 3/31/95	Method	: 602
Date Prepared	: 4/13/95	Matrix	: Water
Date Analyzed	: 4/13/95	Lab File No.	: BX2041315
		Method Blank No.	: MB041395

Compound Name	Cas Number	Sample Concentration ug/L	RL ug/L
Benzene	71-43-2	U	0.4
Toluene	108-88-3	U	0.4
Chlorobenzene	108-90-7	U	0.4
Ethyl Benzene	100-41-4	U	0.4
Total Xylenes (m, p & o)	108-38-3, 106-42-3 and 95-47-6	U	0.4
1,3,5-Trimethylbenzene	108-67-8	U	0.4
1,2,4-Trimethylbenzene	95-63-6	U	0.4
1,2,3-Trimethylbenzene	526-73-8	U	0.4
1,2,3,4-Tetramethylbenzene	488-23-3	U	0.4

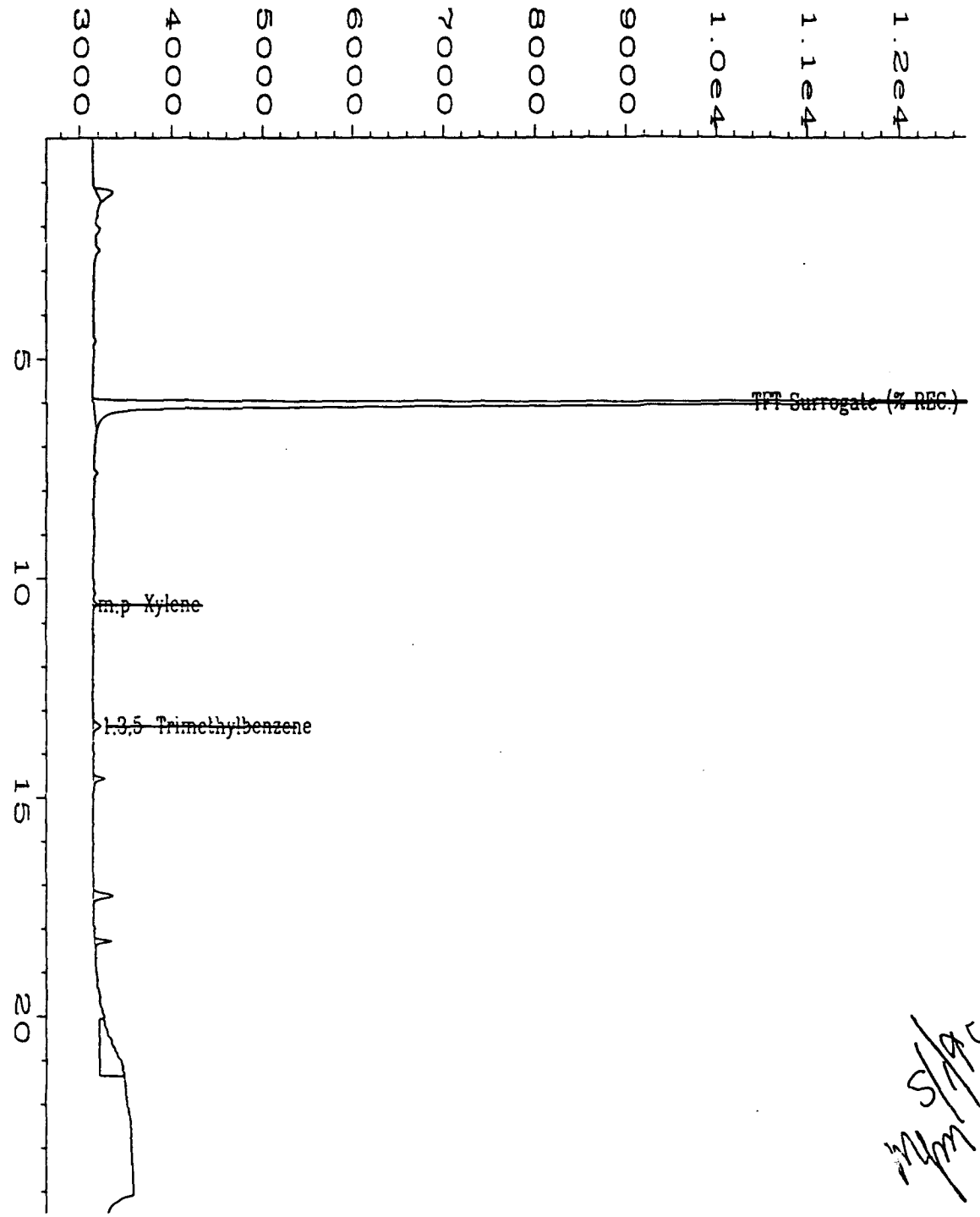
Surrogate Recovery (α,α,α-Trifluorotoluene):	92%	70%-130% (QC limits)

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene RL is for a single peak.

QUALIFIERS:
E = Extrapolated value.
U = Compound analyzed for, but not detected.
B = Compound also found in the blank.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit (RL).
RL = Reporting Limit.
= Not Available/Not Applicable.

Analyst

Approved



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ator	: SW Tyson	Page Number	: 1
ument	: BTEX2	Vial Number	: 15
le Name	: X05076;1;5	Injection Number	: 1
ime Bar Code:		Sequence Line	: 7
red on	: 13 Apr 95 08:35 AM	Instrument Method	: BX20413.MTH
t Created on	: 13 Apr 95 10:11 AM	Analysis Method	: BX20413.MTH
Recalib on	: 13 APR 95 02:16 AM	Sample Amount	: 0
plier	: 1	ISTD Amount	:

Rinsate Blank

EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
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Method 602 Data Report

Client Sample Number	: Trip Blank	Client Project No.	: 722450.21020/MacDill
Lab Sample Number	: X05070	Lab Project No.	: 95-1044
Date Sampled	: NA	Dilution Factor	: 1.00
Date Received	: 3/31/95	Method	: 602
Date Prepared	: 4/12/95	Matrix	: Water
Date Analyzed	: 4/12/95	Lab File No.	: BX1041224
		Method Blank No.	: MB041295

Compound Name	Cas Number	Sample Concentration ug/L	RL ug/L
Benzene	71-43-2	U	0.4
Toluene	108-88-3	U	0.4
Chlorobenzene	108-90-7	U	0.4
Ethyl Benzene	100-41-4	U	0.4
Total Xylenes (m, p & o)	108-38-3, 106-42-3 and 95-47-6	U	0.4
1,3,5-Trimethylbenzene	108-67-8	U	0.4
1,2,4-Trimethylbenzene	95-63-6	U	0.4
1,2,3-Trimethylbenzene	526-73-8	U	0.4
1,2,3,4-Tetramethylbenzene	488-23-3	U	0.4

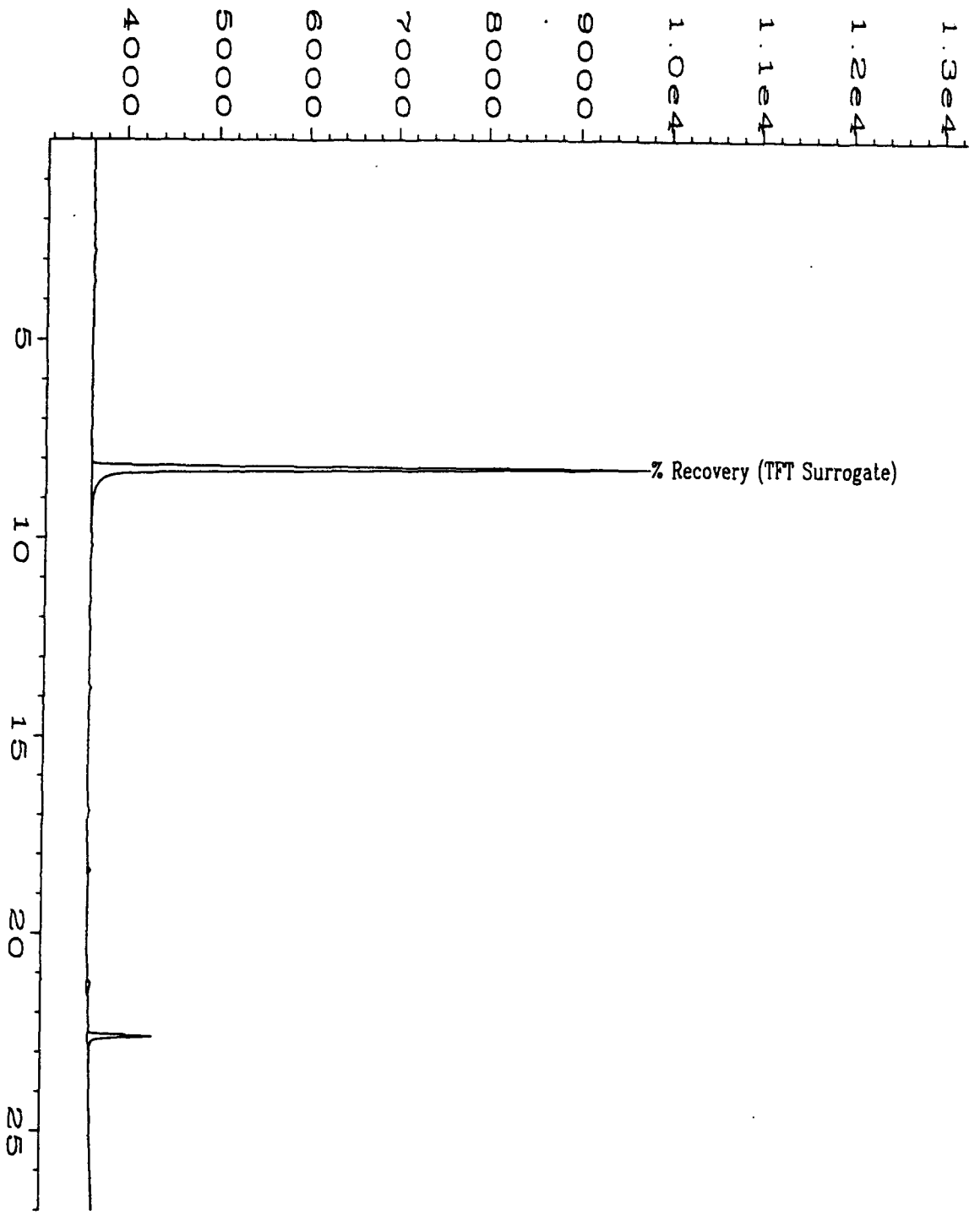
Surrogate Recovery (α,α,α-Trifluorotoluene):	77%	70%-130% (QC limits)

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene RL is for a single peak.

QUALIFIERS:
E = Extrapolated value.
U = Compound analyzed for, but not detected.
B = Compound also found in the blank.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit (RL).
RL = Reporting Limit.
\ = Not Available/Not Applicable.

K. Cone
Analyst

Approved



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strument	: BTEX1	Vial Number	: 24
mple Name	: X05070;1;5	Injection Number	: 1
n Time Bar Code:		Sequence Line	: 9
quired on	: 12 Apr 95 04:20 PM	Instrument Method	: BX10412.MTH
port Created on	: 28 Apr 95 07:41 PM	Analysis Method	: BX10412B.MTH
t Recalib on	: 28 APR 95 07:11 PM	Sample Amount	: 0
tiplier	: 1	ISTD Amount	:
ple Info	: Project # 95-1044 Client # Trip Blank Water		

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4036 Youngfield St. Wheat Ridge, CO 80033
(303) 425-6021

Method 602 Data Report

Client Sample Number	: Trip Blank	Client Project No.	: 722450.21020/MacDill
Lab Sample Number	: X05084	Lab Project No.	: 95-1044
Date Sampled	: NA	Dilution Factor	: 1.00
Date Received	: 3/31/95	Method	: 602
Date Prepared	: 4/13/95	Matrix	: Water
Date Analyzed	: 4/13/95	Lab File No.	: BX2041326
		Method Blank No.	: MB041395

Compound Name	Cas Number	Sample Concentration ug/L	RL ug/L
Benzene	71-43-2	U	0.4
Toluene	108-88-3	U	0.4
Chlorobenzene	108-90-7	U	0.4
Ethyl Benzene	100-41-4	U	0.4
Total Xylenes (m, p & o)	108-38-3, 106-42-3 and 95-47-6	U	0.4
3,5-Trimethylbenzene	108-67-8	U	0.4
1,2,4-Trimethylbenzene	95-63-6	U	0.4
1,2,3-Trimethylbenzene	526-73-8	U	0.4
1,2,3,4-Tetramethylbenzene	488-23-3	U	0.4

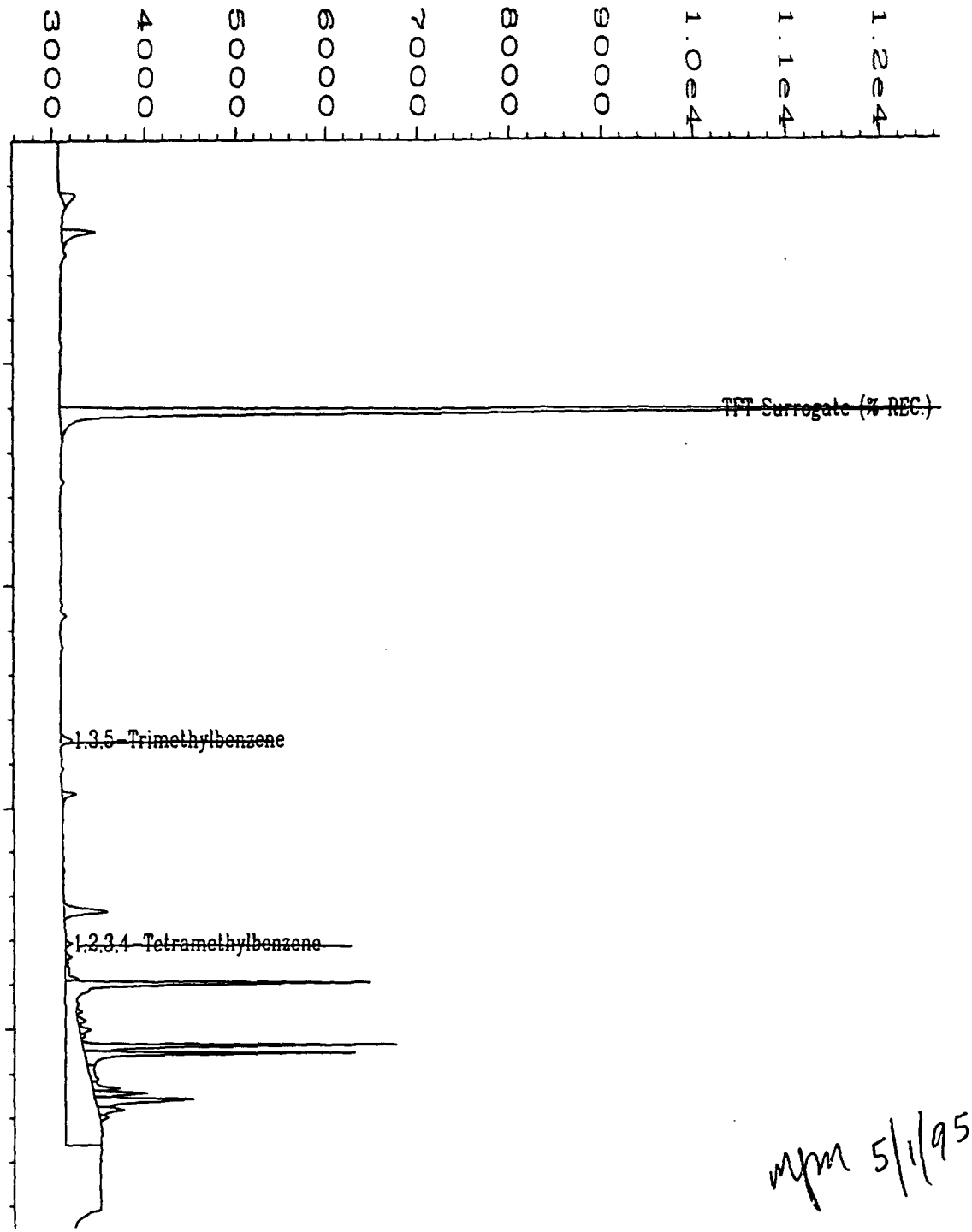
Surrogate Recovery (α,α,α-Trifluorotoluene):	84%	70%-130% (QC limits)

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene RL is for a single peak.

QUALIFIERS:
E = Extrapolated value.
U = Compound analyzed for, but not detected.
B = Compound also found in the blank.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit (RL).
RL = Reporting Limit.
= Not Available/Not Applicable.

Analyst

Approved



mpm 5/1/95

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ator	: SW Tyson	Page Number	: 1
rument	: BTEX2	Vial Number	: 26
le Name	: X05084;1;5	Injection Number	: 1
ime Bar Code:		Sequence Line	: 1
red on	: 13 Apr 95 05:00 PM	Instrument Method	: BX20413.MTH
t Created on	: 13 Apr 95 05:25 PM	Analysis Method	: BX20413.MTH
Recalib on	: 13 APR 95 02:16 AM	Sample Amount	: 0
plier	: 1	ISTD Amount	:
e Info	: Project # 95-1044 Client # Trip Blank Water		

EVERGREEN ANALYTICAL, INC.
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(303) 425-6021

Method 602 Data Report
Method Blank Report

Method Blank Number	: MB041295	Client Project No.	: 722450.21020/MacDill
Date Prepared	: 4/12/95	Lab Project No.	: 95-1044
Date Analyzed	: 4/12/95	Dilution Factor	: 1.00
		Method	: 602/8020
		Matrix	: Water
		Lab File No.	: BX1041211

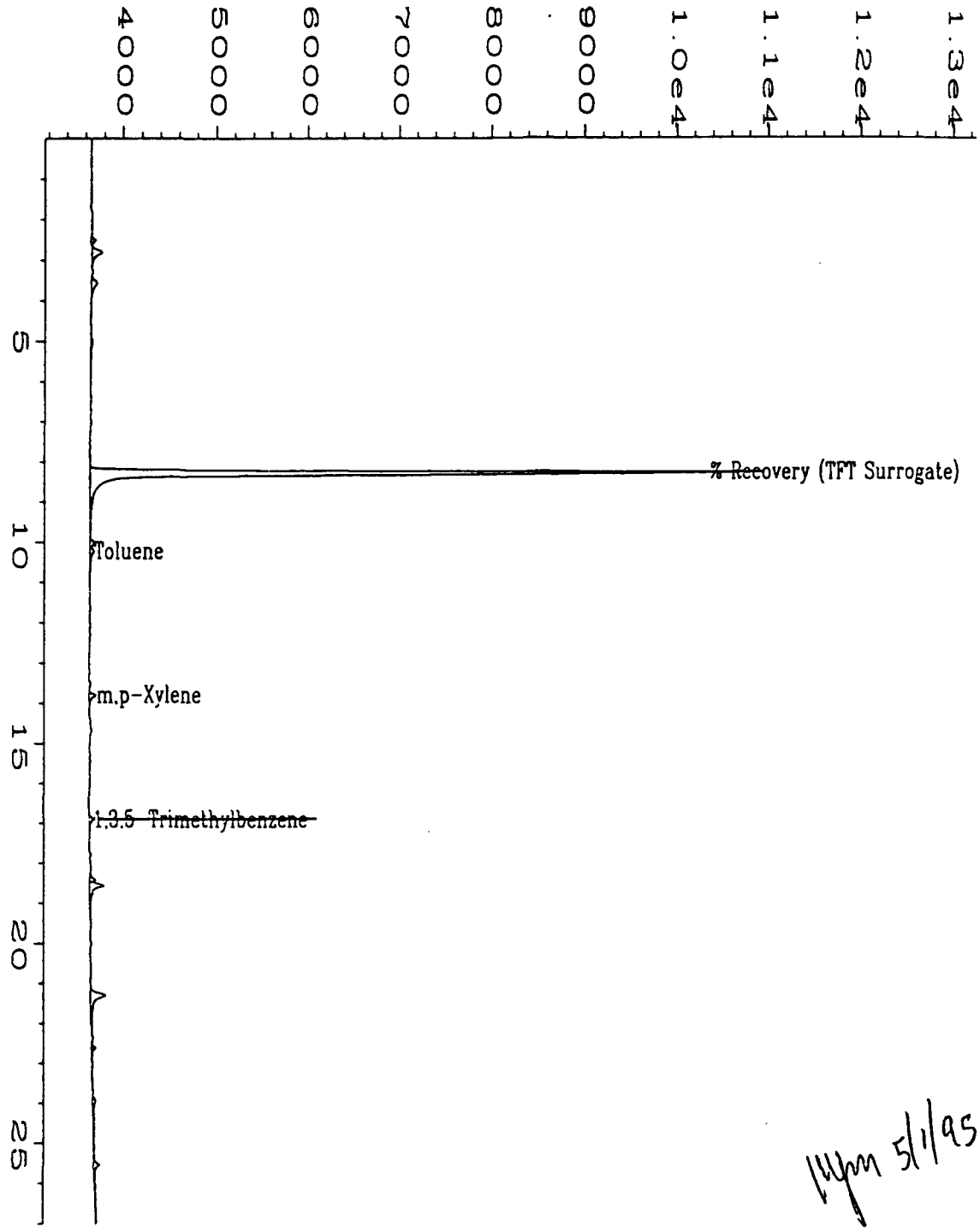
Compound Name	Cas Number	Sample Concentration ug/L		RL ug/L
Benzene	71-43-2		U	0.4
Toluene	108-88-3	0.7		0.4
Chlorobenzene	108-90-7		U	0.4
Ethyl Benzene	100-41-4		U	0.4
Total Xylenes (m, p & o)	108-38-3, 106-42-3 and 95-47-6	0.4		0.4
3,5-Trimethylbenzene	108-67-8		U	0.4
1,2,4-Trimethylbenzene	95-63-6		U	0.4
1,2,3-Trimethylbenzene	526-73-8		U	0.4
1,2,3,4-Tetramethylbenzene	488-23-3		U	0.4
Surrogate Recovery (α,α,α-Trifluorotoluene):		90%		70%-130% (QC limits)

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene RL is for a single peak.

QUALIFIERS:
E = Extrapolated value.
U = Compound analyzed for, but not detected.
B = Compound also found in the blank.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit (RL).
RL = Reporting Limit.
A = Not Available/Not Applicable.

K. Cone
Analyst

Approved



1/4pm 5/1/95

ta File Name : C:\HPCHEM\1\DATA\BX10412\011F0801.D
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trument : BTEX1
ple Name : MB041295
1 Time Bar Code:
uired on : 12 Apr 95 08:00 AM
port Created on: 28 Apr 95 07:32 PM
st Recalib on : 28 APR 95 07:11 PM
tiplier : 1

Page Number : 1
Vial Number : 11
Injection Number : 1
Sequence Line : 8
Instrument Method: BX10408.MTH
Analysis Method : BX10412B.MTH
Sample Amount : 0
ISTD Amount :

EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303) 425-6021

Method 602 Data Report
Method Blank Report

Method Blank Number	: MB041395	Client Project No.	: 722450.21020/MacDill
Date Prepared	: 4/13/95	Lab Project No.	: 95-1044
Date Analyzed	: 4/13/95	Dilution Factor	: 1.00
		Method	: 602/8020
		Matrix	: Water
		Lab File No.	: BX2041309

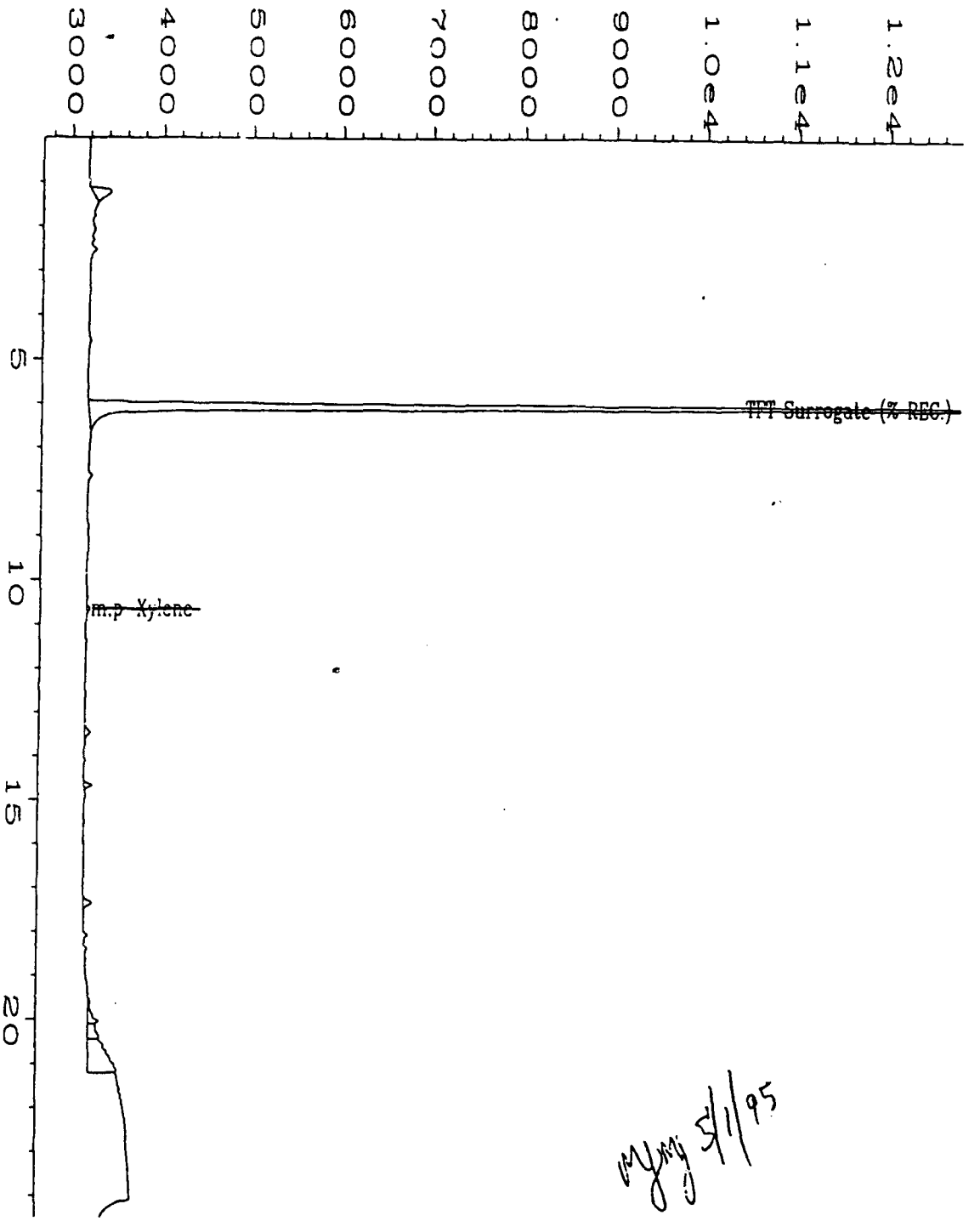
Compound Name	Cas Number	Sample Concentration ug/L	RL ug/L
Benzene	71-43-2	U	0.4
Toluene	108-88-3	U	0.4
Chlorobenzene	108-90-7	U	0.4
Ethyl Benzene	100-41-4	U	0.4
Total Xylenes (m, p & o)	108-38-3, 106-42-3 and 95-47-6	U	0.4
1,3,5-Trimethylbenzene	108-67-8	U	0.4
1,2,4-Trimethylbenzene	95-63-6	U	0.4
1,2,3-Trimethylbenzene	526-73-8	U	0.4
1,2,3,4-Tetramethylbenzene	488-23-3	U	0.4
Surrogate Recovery (α,α,α-Trifluorotoluene):		99%	70%-130% (QC limits)

Note: Total Xylenes consist of three isomers, two of which co-elute.
The Xylene RL is for a single peak.

QUALIFIERS:
E = Extrapolated value.
U = Compound analyzed for, but not detected.
B = Compound also found in the blank.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit (RL).
RL = Reporting Limit.
` = Not Available/Not Applicable.

Analyst

K. Cone
Approved



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ument	: BTEX2	Vial Number	: 9
e Name	: MB041395	Injection Number	: 1
ime Bar Code:		Sequence Line	: 7
red on	: 13 Apr 95 04:04 AM	Instrument Method	: BX20413.MTH
t Created on:	13 Apr 95 09:48 AM	Analysis Method	: BX20413.MTH
Recalib on	: 13 APR 95 02:16 AM	Sample Amount	: 0
plier	: 1	ISTD Amount	:

EVERGREEN ANALYTICAL, INC.
4036 Youngfield, Wheat Ridge, CO 80033
(303) 425-6021

TOTAL VOLATILE HYDROCARBONS (TVH)
Laboratory Control Sample (LCS)

LCS Number	: LCS041295	Matrix	: WATER
Date Prepared	: 4/11/95	Method Number	: 5030/MOD.8015
Date Analyzed	: 4/12/95		
Sequence Number	: TVH8		

Compound Name	Theoretical Concentration mg/L	LCS Concentration mg/ L	LCS % Recovery	QC Limit % Recovery
Gasoline	5.00	5.22	104%	70%-130%

QUALIFIERS
U = TVH analyzed for but not detected.
B = TVH found in blank as well as sample (blank data should be compared).
E = Extrapolated value.
NA = Not Available.

Analyst

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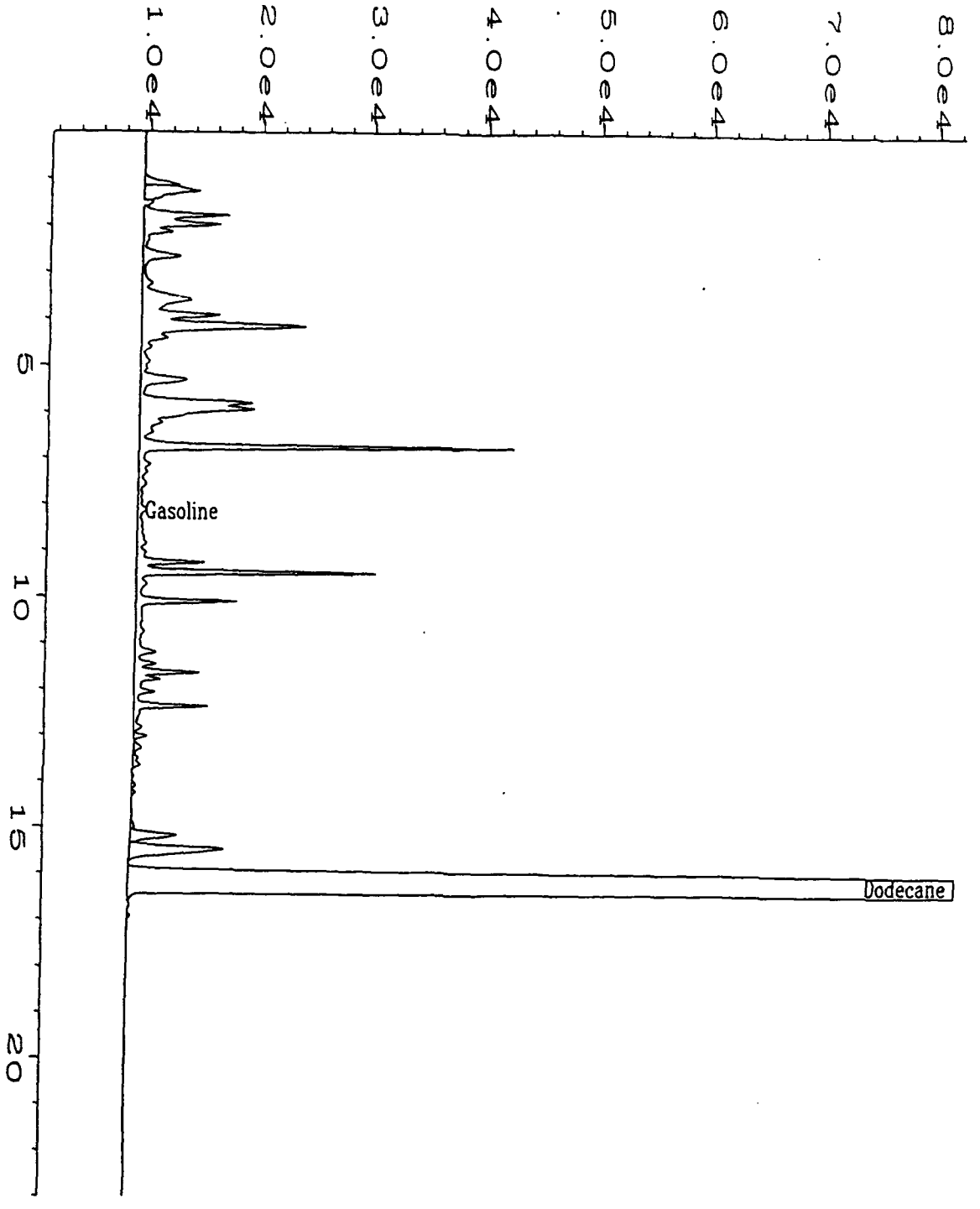


ta File Name	: C:\HPCHEM\1\DATA\tvh0412\008F0101.D		
erator	: Dawn N. Guildner	Page Number	: 1
strument	: TVH	Vial Number	: 8
mple Name	: LCS041295	Injection Number	: 1
n Time Bar Code:		Sequence Line	: 1
quired on	: 12 Apr 95 04:13 AM	Instrument Method	: TVH1BASE.MTH
port Created on	: 12 Apr 95 10:04 AM	Analysis Method	: TVH0412.MTH
t Recalib on	: 12 APR 95 10:00 AM	Sample Amount	: 0
tiplier	: 1	ISTD Amount	:

EVERGREEN ANALYTICAL, INC.
4036 Youngfield, Wheat Ridge, CO 80033
(303) 425-6021

TOTAL VOLATILE HYDROCARBONS (TVH)
Laboratory Control Sample (LCS)

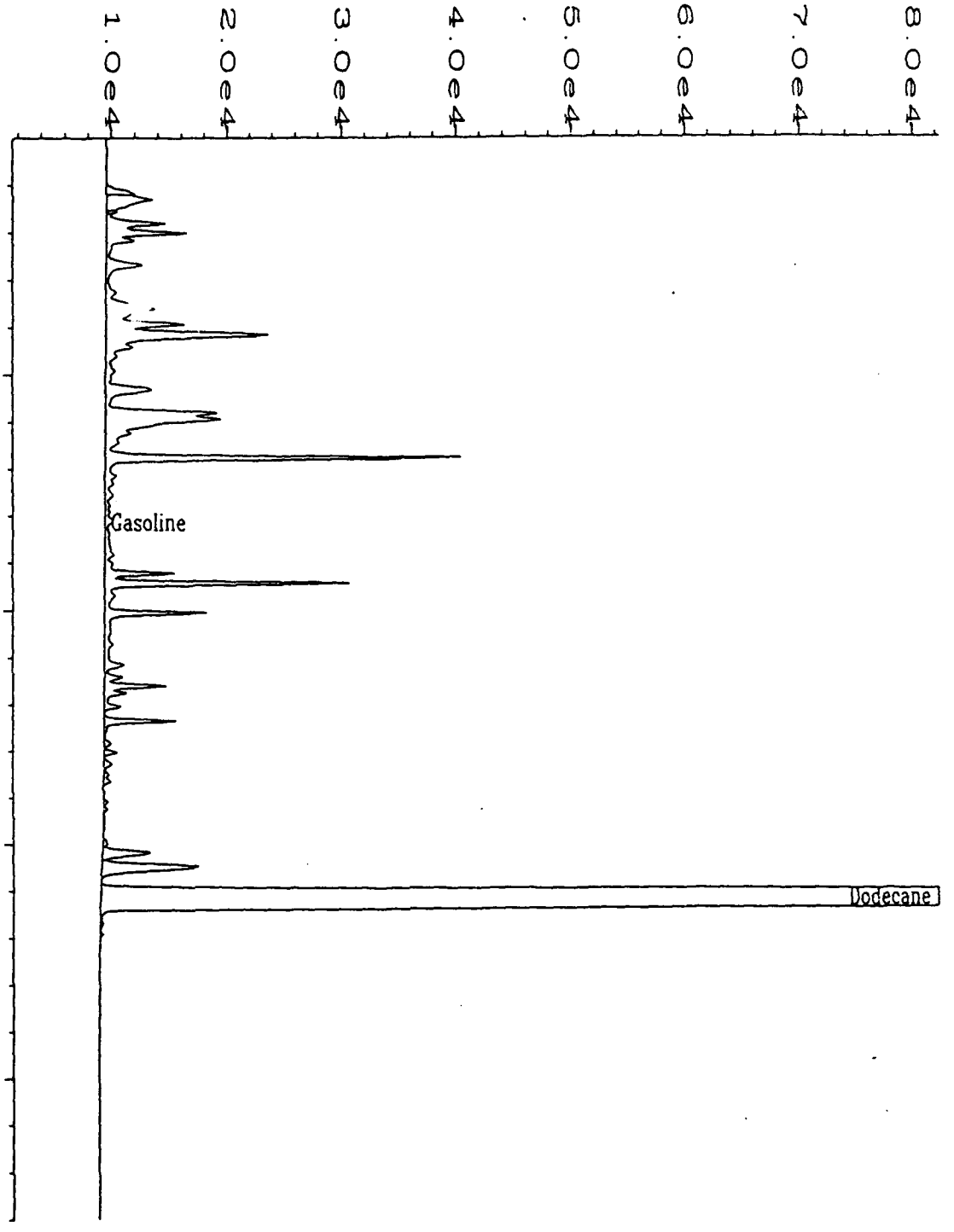
LCS Number	: LCS041395	Matrix	: WATER
Date Prepared	: 4/12/95	Method Number	: 5030/MOD.8015
Date Analyzed	: 4/13/95		
Sequence Number	: TVH8		

Compound Name	Theoretical Concentration mg/L	LCS Concentration mg/ L	LCS % Recovery	QC Limit % Recovery
Gasoline	5.00	5.17	103%	70%-130%

QUALIFIERS
U = TVH analyzed for but not detected.
B = TVH found in blank as well as sample (blank data should be compared).
E = Extrapolated value.
NA = Not Available.

Analyst

K. Cone
Approved



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strument	: TVH	Vial Number	: 8
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n Time Bar Code	:	Sequence Line	: 1
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port Created on	: 13 Apr 95 02:48 PM	Analysis Method	: TVH0413.MTH
st Recalib on	: 13 Apr 95 02:21 PM	Sample Amount	: 0
tiplier	: 1	ISTD Amount	:

EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303)425-6021

Anions

			722450.21020
Date Sampled	: 3/29,30/95	Client Project ID.	: /MacDill AFB
Date Received	: 3/31/95	Lab Project No.	: 95-1044
Date Prepared	: 3/31/95	Method	: EPA 300.0
Date Analyzed	: 3/31/95	Matrix	: Water
		Detection Limit	: 0.250 mg/L

Evergreen Sample #	Client Sample ID	Chloride (mg/L)
X05056	56MP-2S	45.3
X05057	56MP-7S	32.8
X05060	MD56-MW4	24.9
X05063	MD75-MW5	12.3
X05066	MD75-MW1	6.27
X05067	75MP-5D	10.3
X05068	75MP-6D	12.2
X05069	MD75-MW2	12.6
X05071	75MP-8D	12.6
X05072	75MP-8S	12.5
X05072 dup	75MP-8S dup	12.5
Method blank (3-31-95)		<0.250

Quality Assurance

		Spike Amount (mg/L)	Sample Result (mg/L)	Spike Result (mg/L)	% Recovery
X05074	75MP-8S Matrix Spike	10.0	12.5	23.4	109
X05075	75MP-8S Matrix Spike Dup	10.0	12.5	22.9	104
	MS/MSD RPD				4.89
X05072/X05072 Dup	RPD				0.160

Analyst

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1044tm.25

EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303)425-6021

Anions

Date Sampled : 3/29,30/95
Date Received : 3/31/95
Date Prepared : 3/31/95
Date Analyzed : 3/31/95

Client Project ID. : 722450.21020 /MacDill AFB
Lab Project No. : 95-1044
Method : EPA 300.0
Matrix : Water
Detection Limit : 0.076 mg/L

Evergreen Sample #	Client Sample ID	Nitrite-N (mg/L)
X05056	56MP-2S	<0.076
X05057	56MP-7S	<0.076
X05060	MD56-MW4	<0.076
X05063	MD75-MW5	<0.076
X05066	MD75-MW1	<0.076
X05067	75MP-5D	<0.076
X05068	75MP-6D	<0.076
X05069	MD75-MW2	<0.076
X05071	75MP-8D	<0.076
X05072	75MP-8S	<0.076
X05072 dup	75MP-8S dup	<0.076
Method blank (3-31-95)		<0.076

Quality Assurance**

		Spike Amount (mg/L)	Sample Result (mg/L)	Spike Result (mg/L)	% Recovery
X05074	75MP-8S Matrix Spike	10.0	<0.250	10.2	102
X05075	75MP-8S Matrix Spike Dup	10.0	<0.250	9.86	98.6
	MS/MSD RPD				3.68
X05072/X05072 Dup	RPD				NC

** = Quality assurance results reported as Nitrite (NO_2).
NC = Not calculated because sample and/or duplication results below detection limit.

Analyst

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EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303)425-6021

Anions

Date Sampled : 3/29,30/95
Date Received : 3/31/95
Date Prepared : 3/31/95
Date Analyzed : 3/31/95

Client Project ID. : 722450.21020 /MacDill AFB
Lab Project No. : 95-1044
Method : EPA 300.0
Matrix : Water
Detection Limit : 0.056 mg/L

Evergreen Sample #	Client Sample ID	Nitrate-N (mg/L)
X05056	56MP-2S	<0.056
X05057	56MP-7S	<0.056
X05060	MD56-MW4	0.195
X05063	MD75-MW5	<0.056
X05066	MD75-MW1	<0.056
X05067	75MP-5D	<0.056
X05068	75MP-6D	<0.056
X05069	MD75-MW2	0.080
X05071	75MP-8D	0.060
X05072	75MP-8S	0.990
X05072 dup	75MP-8S dup	0.973
Method blank (3-31-95)		<0.056

Quality Assurance**

		Spike Amount (mg/L)	Sample Result (mg/L)	Spike Result (mg/L)	% Recovery
X05074	75MP-8S Matrix Spike	10.0	4.38	14.5	101
X05075	75MP-8S Matrix Spike Dup	10.0	4.38	13.6	91.9
	MS/MSD RPD				9.53
X05072/X05072 Dup	RPD				1.61

** = Quality assurance results reported as Nitrate (NO_3).

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4036 Youngfield St. Wheat Ridge, CO 80033
(303)425-6021

Anions

Date Sampled : 3/29,30/95
Date Received : 3/31/95
Date Prepared : 3/31/95
Date Analyzed : 3/31/95

Client Project ID. : 722450.21020 /MacDill AFB
Lab Project No. : 95-1044
Method : EPA 300.0
Matrix : Water
Detection Limit : 0.250 mg/L

Evergreen Sample #	Client Sample ID	Sulfate (mg/L)
X05056	56MP-2S	331
X05057	56MP-7S	108
X05060	MD56-MW4	104
X05063	MD75-MW5	27.8
X05066	MD75-MW1	15.2
X05067	75MP-5D	7.41
X05068	75MP-6D	2.16
X05069	MD75-MW2	25.8
X05071	75MP-8D	9.21
X05072	75MP-8S	28.4
X05072 dup	75MP-8S dup	28.5
Method blank (3-31-95)		<0.250

Quality Assurance

		Spike Amount (mg/L)	Sample Result (mg/L)	Spike Result (mg/L)	% Recovery
X05074	75MP-8S Matrix Spike	10.0	28.4	39.4	110
X05075	75MP-8S Matrix Spike Dup	10.0	28.4	39.3	109
	MS/MSD RPD				0.547
X05072/X05072 Dup	RPD				0.246

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EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303)425-6021

Miscellaneous Analyses

722450.21020

Date Sampled	: 3/29,30/95	Client Project ID.	: /MacDill AFB
Date Received	: 3/31/95	Lab Project No.	: 95-1044
Date Prepared	: 3/31/95	Matrix	: 5.00 $mgCaCO_3/L$
Date Analyzed	: 3/31/95	Method	: EPA 310.1

Evergreen Sample #	Client Sample ID	Matrix	Total Alkalinity ($mgCaCO_3/L$)
X05057	56MP-7S	Water	152
X05060	MD56-MW4	Water	166
X05063	MD75-MW5	Water	119
X05072	75MP-8S	Water	116
X05072 Dup	75MP-8S Dup	Water	117
X05073	75MP-28S	Water	117
X05081	MD75-MW11	Water	41.8
Method Blank (3/31/95)			<5.00

Quality Assurance

	True Value ($mgCaCO_3/L$)	Result ($mgCaCO_3/L$)	% Recovery
APG Minerals Reference Lot #13862	11.8	11.1	93.4

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1044cm.4

EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303)425-6021

Total Organic Carbon

722450-21020

Date Sampled : 3/29,30/95
Date Received : 3/31/95
Date Prepared : 4/3/95
Date Analyzed : 4/3/95

Client Project ID. : /MacDill AFB
Lab Project No. : 95-1044
Method : EPA 415.1
Detection Limit : 1.00 mgC/L

Evergreen Sample #	Client Sample ID	Matrix	mg C/Liter
X05057	56MP-7S	Water	20.0
X05060	MD56-MW4	Water	10.5
X05063	MD75-MW5	Water	7.42
X05072	75MP-8S	Water	5.18
X05072 dup	75MP-8S dup	Water	5.24
X05073	75MP-28S	Water	5.28
X05079	75MP-9S	Water	4.68
Method Blank 4/3/95			<1.00

Quality Assurance

	True Value (mg C/L)	Result (mg C/L)	% Recovery
Spex Demand Reference Lot 2-7 DEM	40.9	45.9	112

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1044tm.10

EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303) 425-6021

BTEX Data Report
Laboratory Control Sample (LCS)

LCS Number	: LCS041295	Dilution Factor	: 1.00
Date Extracted/Prepared	: 4/12/95	Method	: 602
Date Analyzed	: 4/12/95	Matrix	: Water
Spike Amount (ug/L)	: 20.0	Lab File No.	: BX1041 0

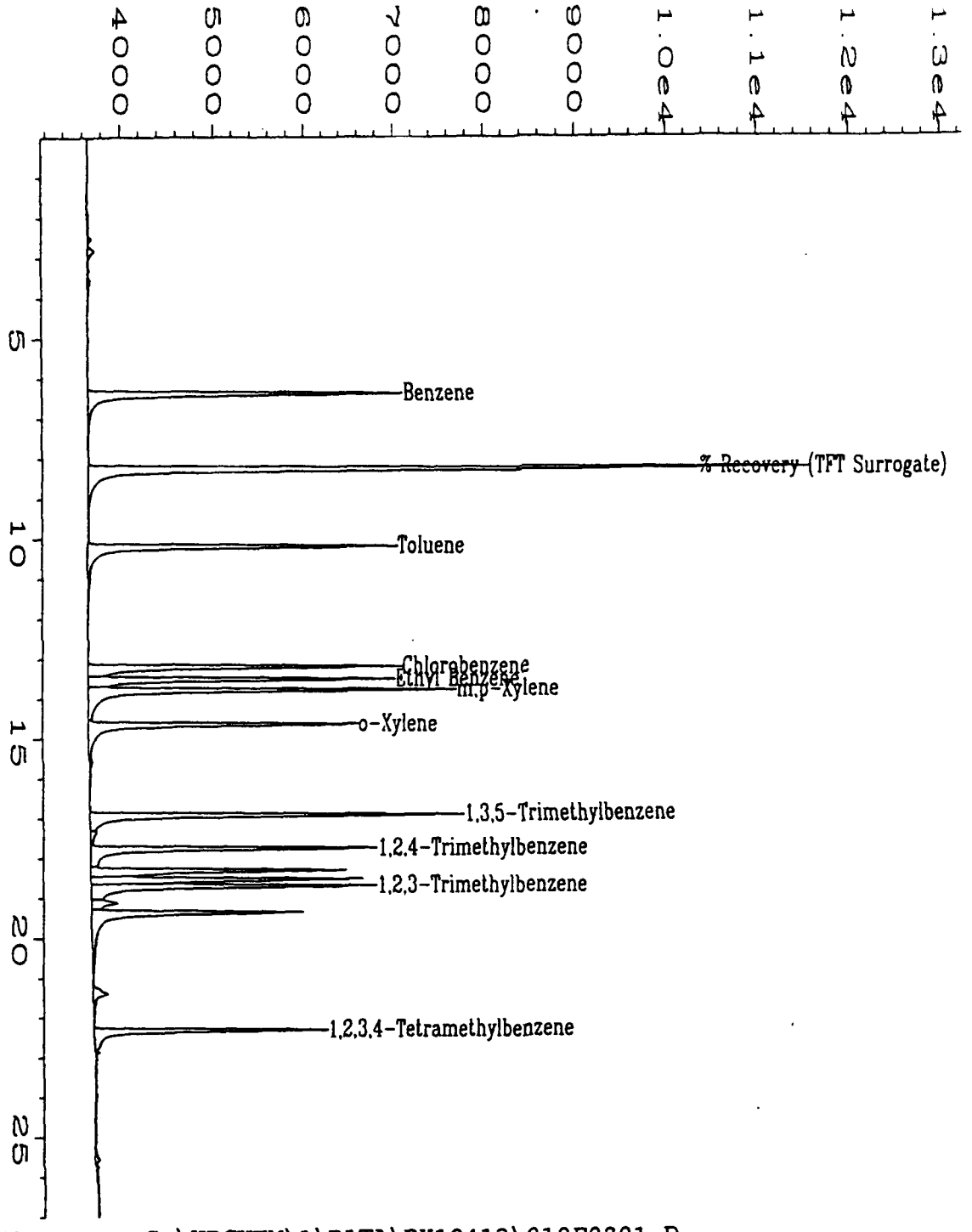
Compound Name	Cas Number	LCS Concentration ug/L	LCS % Recovery	QC Limit % Recovery
Benzene	71-43-2	16.5	82.5	71.0-119.0*
Toluene	108-88-3	16.5	82.5	73.0-111.0*
Chlorobenzene	108-90-7	17.4	87.0	64.0-119.0*
Ethyl Benzene	100-41-4	17.0	85.0	75.0-114.0*
m,p-Xylene	108-38-3 106-42-3	17.2	86.0	75.0-114.0*
o-Xylene	95-47-6	16.5	82.5	64.0-119.0*
1,3,5-Trimethylbenzene	108-67-8	16.3	81.5	50.0-150.0
1,2,4-Trimethylbenzene	95-63-6	17.3	86.5	50.0-150.0
1,2,3-Trimethylbenzene	526-73-8	21.5	107.5	50.0-150.0
1,2,3,4-Tetramethylbenzene	488-23-3	17.6	88.0	50.0-150.0
Surrogate Recovery (α,α,α-Trifluorotoluene):		97%	70%-130% (QC limits)	

* = Limits established 4/3/95 KSC

QUALIFIERS:
E = Extrapolated value
U = Compound analyzed for, but not detected.
B = Compound found in blank and sample. Compare blank and sample data.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit (RL).
NA = Not available/Not analyzed.

Analyst

Approved



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erator : S.W. Tyson
strument : BTEX1
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n Time Bar Code:
quired on : 12 Apr 95 07:21 AM
port Created on: 28 Apr 95 07:26 PM
st Recalib on : 28 APR 95 07:11 PM
ltiplier : 1

Page Number : 1
Vial Number : 10
Injection Number : 1
Sequence Line : 8
Instrument Method: BX10408.MTH
Analysis Method : BX10412B.MTH
Sample Amount : 0
ISTD Amount :

EVERGREEN ANALYTICAL, INC.
4036 Youngfield St. Wheat Ridge, CO 80033
(303) 425-6021

BTEX Data Report
Laboratory Control Sample (LCS)

LCS Number	: LCS041395	Dilution Factor	: 1.00
Date Extracted/Prepared	: 4/13/95	Method	: 602
Date Analyzed	: 4/13/95	Matrix	: Water
Spike Amount (ug/L)	: 20.0	Lab File No.	: BX2041308

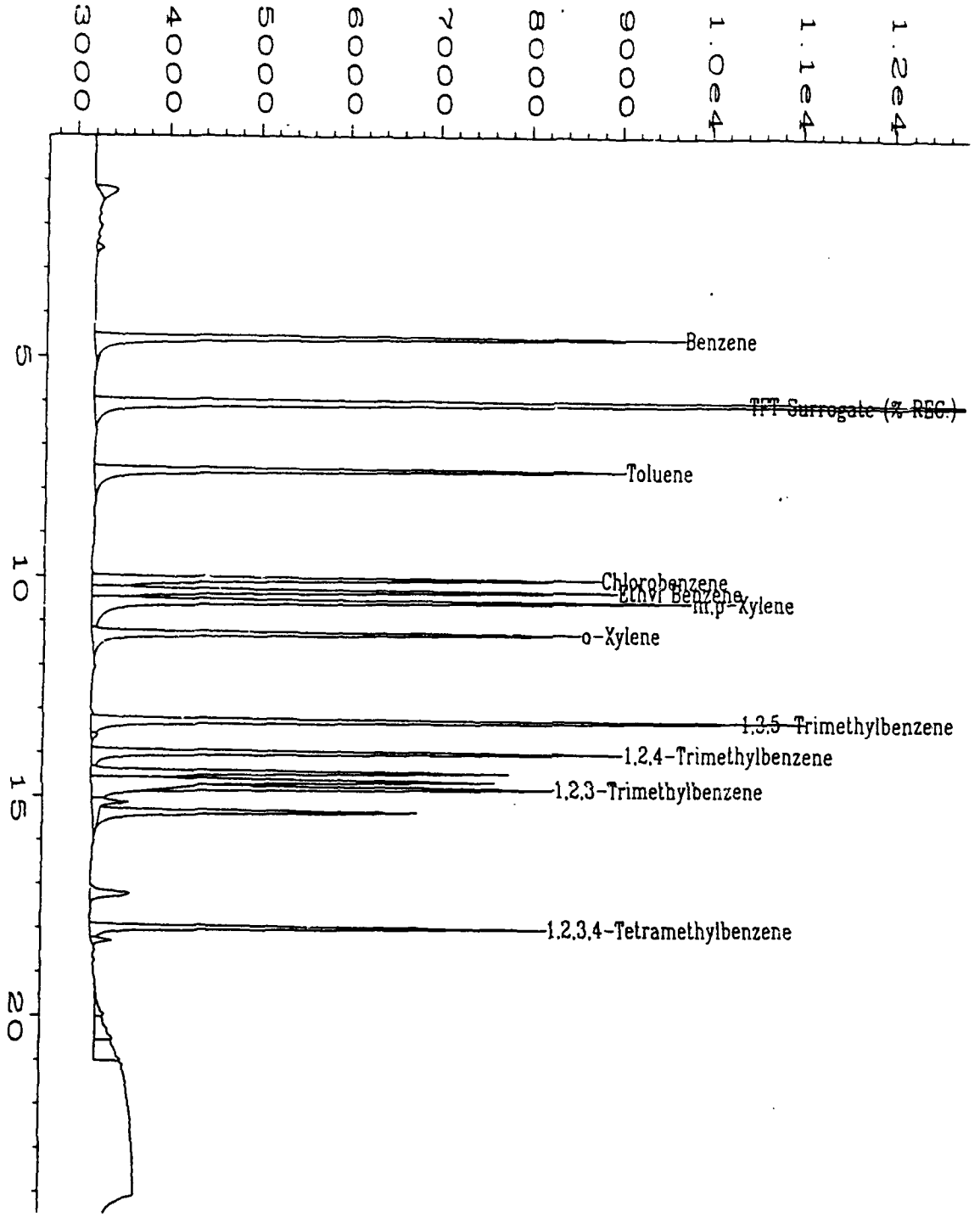
Compound Name	Cas Number	LCS Concentration ug/L	LCS % Recovery	QC Limit* % Recovery
Benzene	71-43-2	18.0	90.0%	71.0%-119.0%
Toluene	108-88-3	18.7	93.5%	73.0%-111.0%
Chlorobenzene	108-90-7	19.0	95.0%	64.0%-119.0%
Ethyl Benzene	100-41-4	19.3	96.5%	75.0%-114.0%
m,p-Xylene	108-38-3 106-42-3	20.1	101%	75.0%-114.0%
o-Xylene	95-47-6	18.9	94.5%	64.0%-119.0%
1,3,5-Trimethylbenzene	108-67-8	19.7	98.5%	68.0%-101.0%
1,2,4-Trimethylbenzene	95-63-6	20.3	102%	61.0%-88.0%
1,2,3-Trimethylbenzene	526-73-8	15.1	76%	63.0%-101.0%
1,2,3,4-Tetramethylbenzene	488-23-3	19.7	98.5%	58.0%-102.0%
Surrogate Recovery (α,α,α-Trifluorotoluene):		101%	70%-130% (QC limits)	

* = Limits established 4/3/95 KSC

QUALIFIERS:
E = Extrapolated value
U = Compound analyzed for, but not detected.
B = Compound found in blank and sample. Compare blank and sample data.
J = Indicates an estimated value when the compound is detected, but is below the Reporting Limit (RL).
NA = Not available/Not analyzed.

K. Cone
Analyst

Approved



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le Name	: LCS041395	Injection Number	: 1
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ired on	: 13 Apr 95 03:20 AM	Instrument Method	: BX20413.MTH
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iplier	: 1	ISTD Amount	:

EVERGREEN ANALYTICAL, INC.
4036 Youngfield, Wheat Ridge, CO 80033
(303) 425-6021

TOTAL VOLATILE HYDROCARBONS (TVH-GASOLINE)

Date Sampled	: 3/29,30/95	Client Project Number	: 722450.21020/MACDILL
Date Received	: 3/31/95	Lab Project Number	: 95-1044
Date Prepared	: 4/11,13/95	Matrix	: Water
Date Analyzed	: 4/12,13/95	Method Number	: 5030/Mod.8015

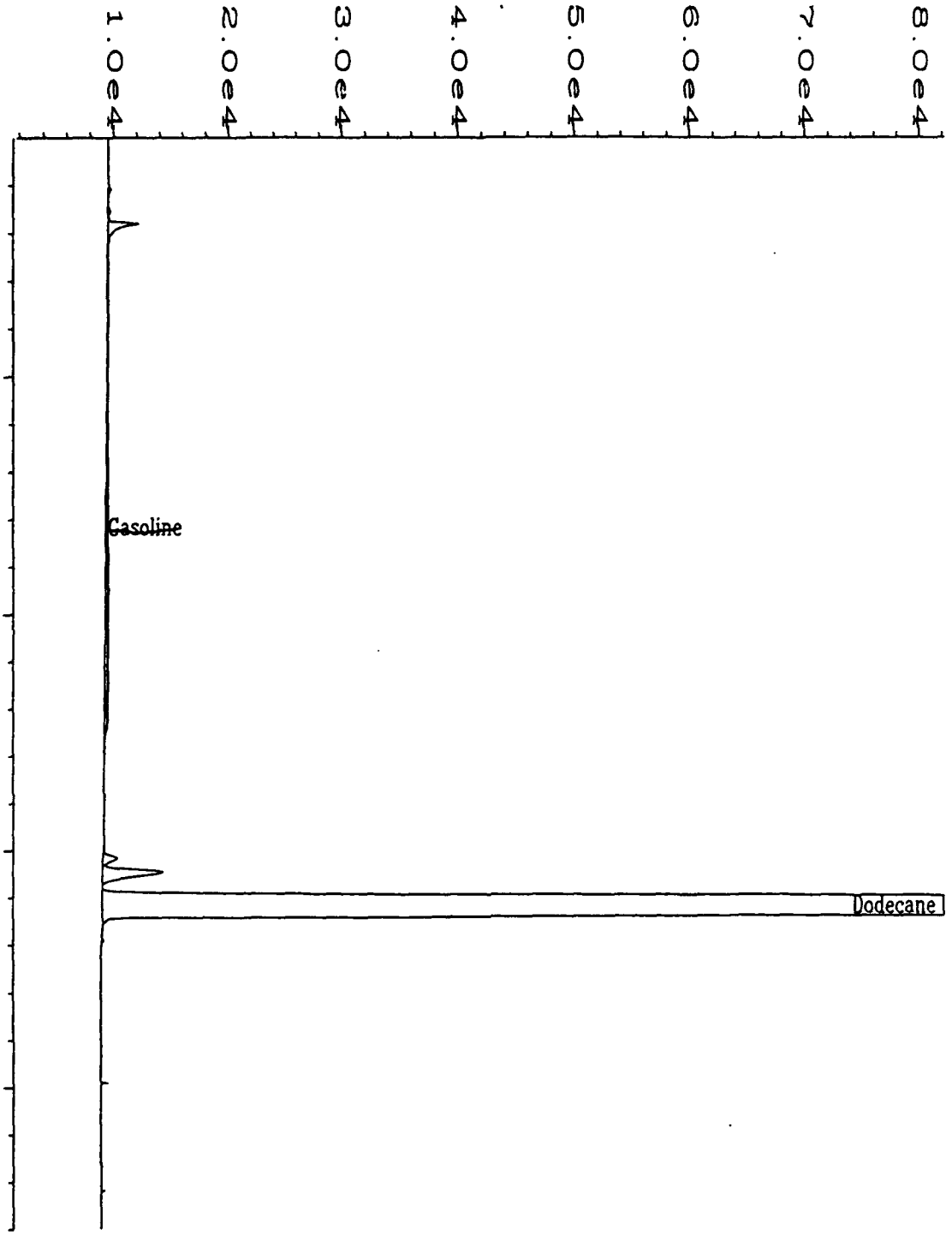
Evergreen Sample #	Client Sample #	Surrogate Recovery	TVH mg/L	RL mg/L
MB041295	METHOD BLANK	100%	U	0.1
MB041395	METHOD BLANK	100%	U	0.1
X05056	56MP-2S	100%	U	0.1
X05057	56MP-7S	96%	U	0.1
X05057 DUP	56MP-7S	97%	U	0.1
X05060	MD56-MW4	98%	U	0.1
X05063	MD75-MW5	93%	U	0.1
X05066	MD75-MW1	89%	U	0.1
X05067	75MP-5D	95%	U	0.1
X05068	75MP-6D	92%	0.1	0.1
X05068 DUP	75MP-6D	92%	0.1	0.1
X05069	MD75-MW2	88%	U	0.1
X05071	75MP-8D	84%	U	0.1
X05072	75MP-8S	85%	U	0.1
X05072 DUP	75MP-8S	85%	U	0.1
X05073	75MP-28S	96%	U	0.1
X05078	75MP-9D	99%	U	0.1
X05079	75MP-9S	99%	U	0.1
X05080	MD75-MW13	73%	U	0.1
X05081	MD75-MW11	97%	U	0.1
X05082	MD75-MW10	95%	0.5	0.1
X05083	MD75-MW9	96%	1.2	0.1

QUALIFIERS
U = TVH analyzed for but not detected.
B = TVH found in blank.
E = Extrapolated value.
RL = Reporting Limit.

Analyst

Approved

TVH1044.XLS



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Time Bar Code:		Sequence Line	: 1
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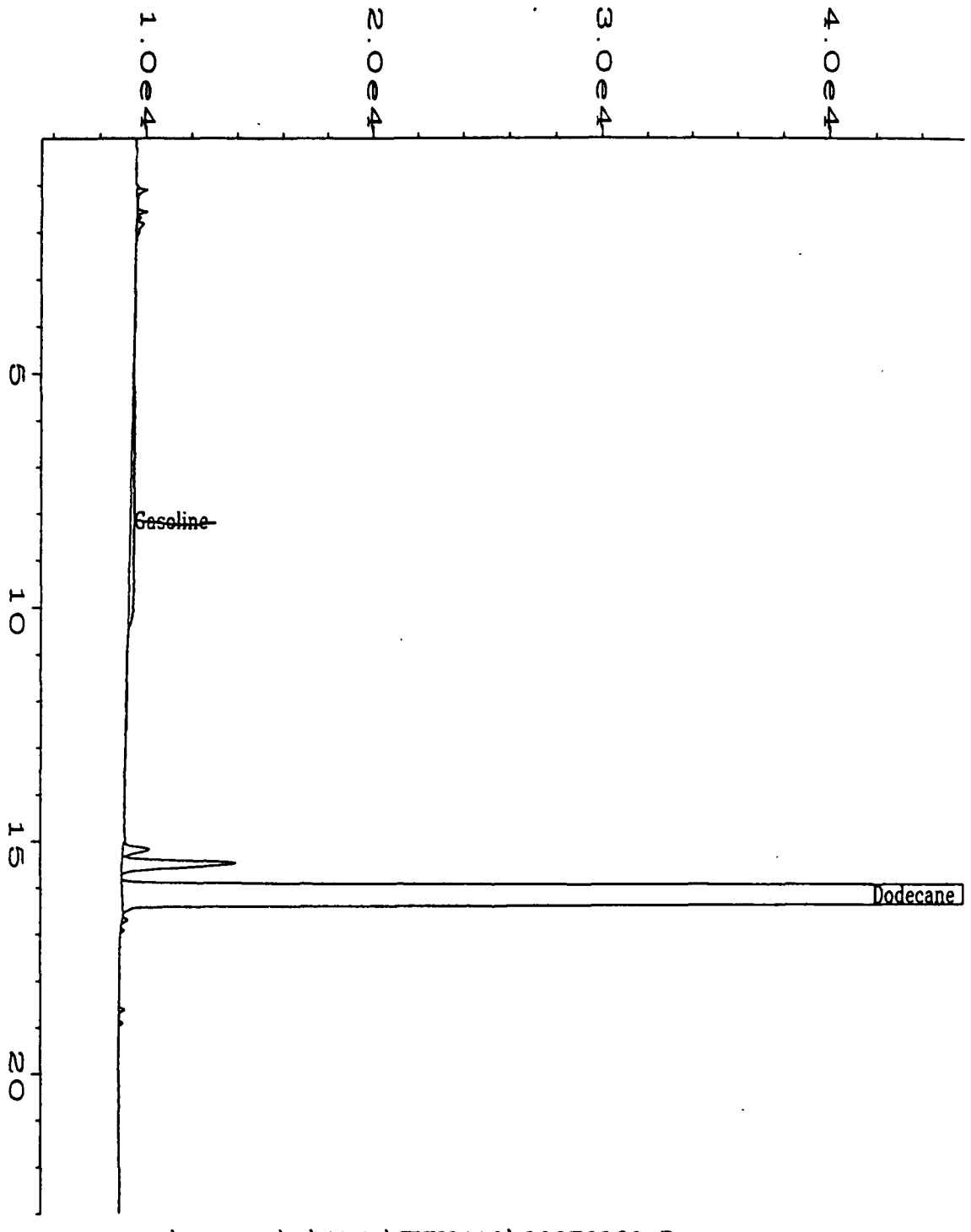
iplier	: 1	ISTD Amount	:

- 4/21/95



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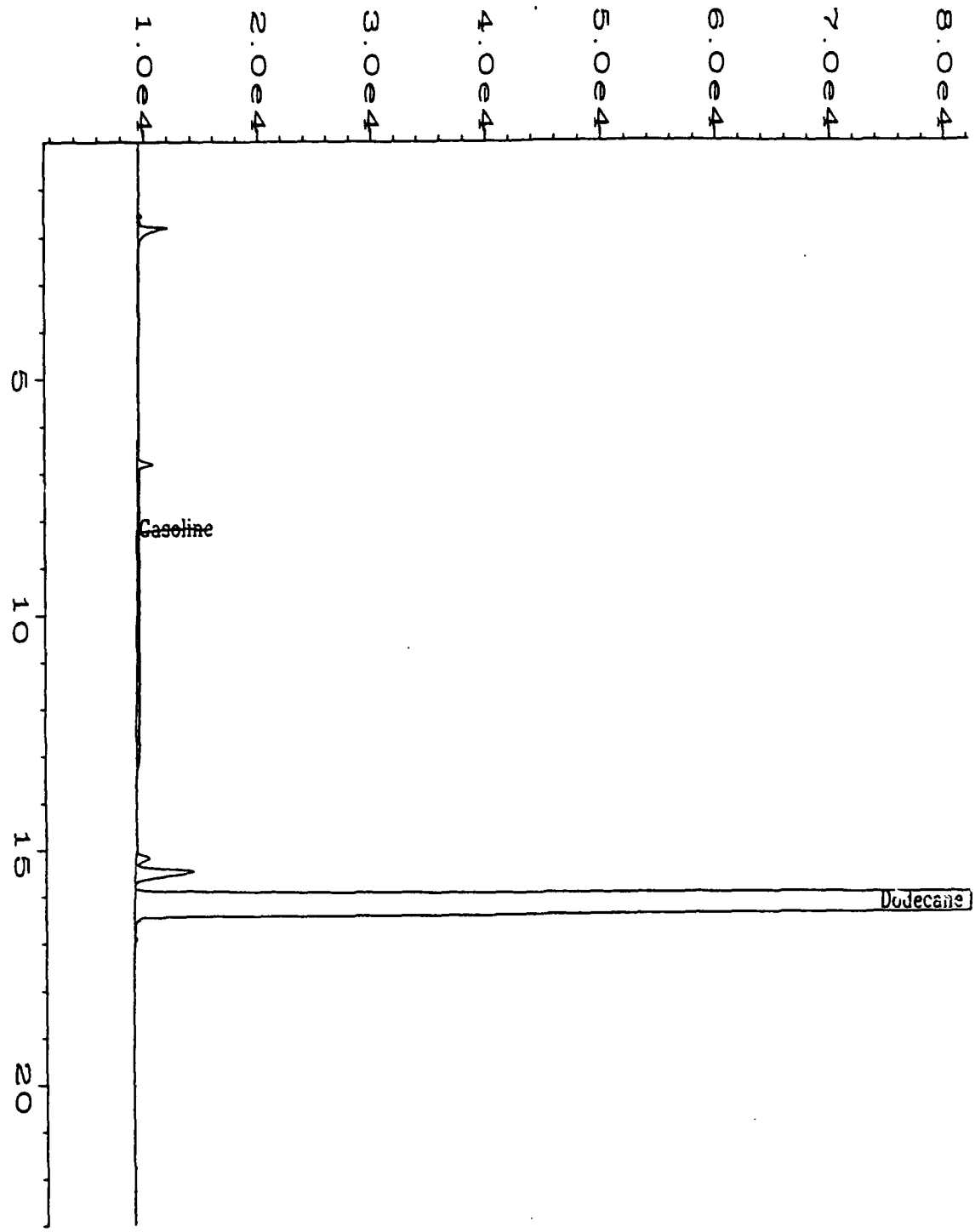
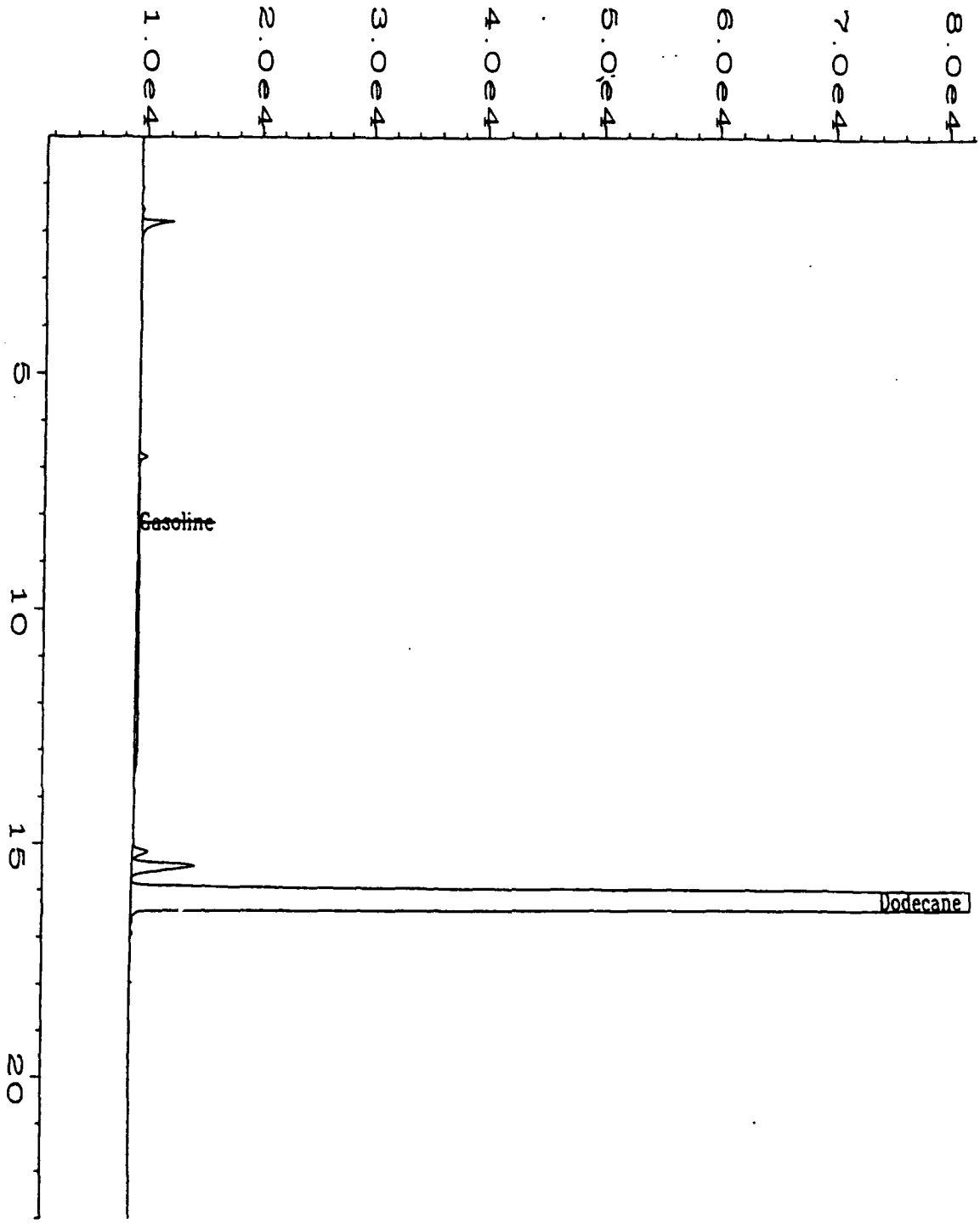
Instrument	: TVH	Vial Number	: 9
Sample Name	: MB041395	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 1
Acquired on	: 13 Apr 95 03:00 PM	Instrument Method	: TVH1BASE.MTH
Report Created on	: 13 Apr 95 03:25 PM	Analysis Method	: TVH0413.MTH
Last Recalib on	: 13 Apr 95 02:21 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:

pm 4/21/95



a File Name	: C:\HPCHEM\1\DATA\tvh0412\010F0101.D		
rator	: Dawn N. Guildner	Page Number	: 1
trument	: TVH	Vial Number	: 10
ple Name	: X05056;1;5	Injection Number	: 1
Time Bar Code	:	Sequence Line	: 1
uired on	: 12 Apr 95 05:25 AM	Instrument Method	: TVH1BASE.MTH
rt Created on	: 12 Apr 95 10:04 AM	Analysis Method	: TVH0412.MTH
Recalib on	: 12 APR 95 10:00 AM	Sample Amount	: 0
iplier	: 1	ISTD Amount	:
ple Info	: PROJECT # 95-1044 CLIENT # 56MP-2S WATER		

~ 4/21/95



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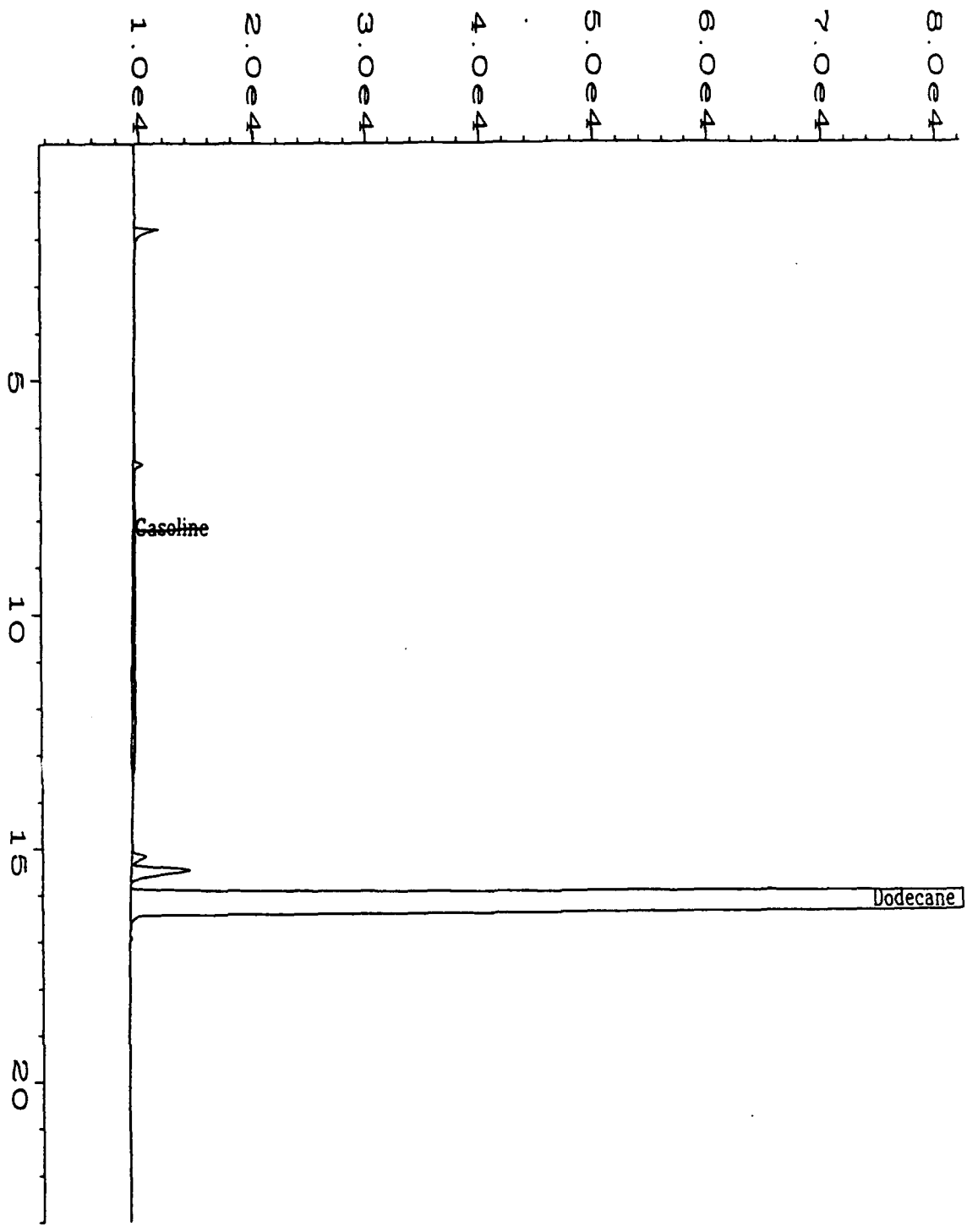
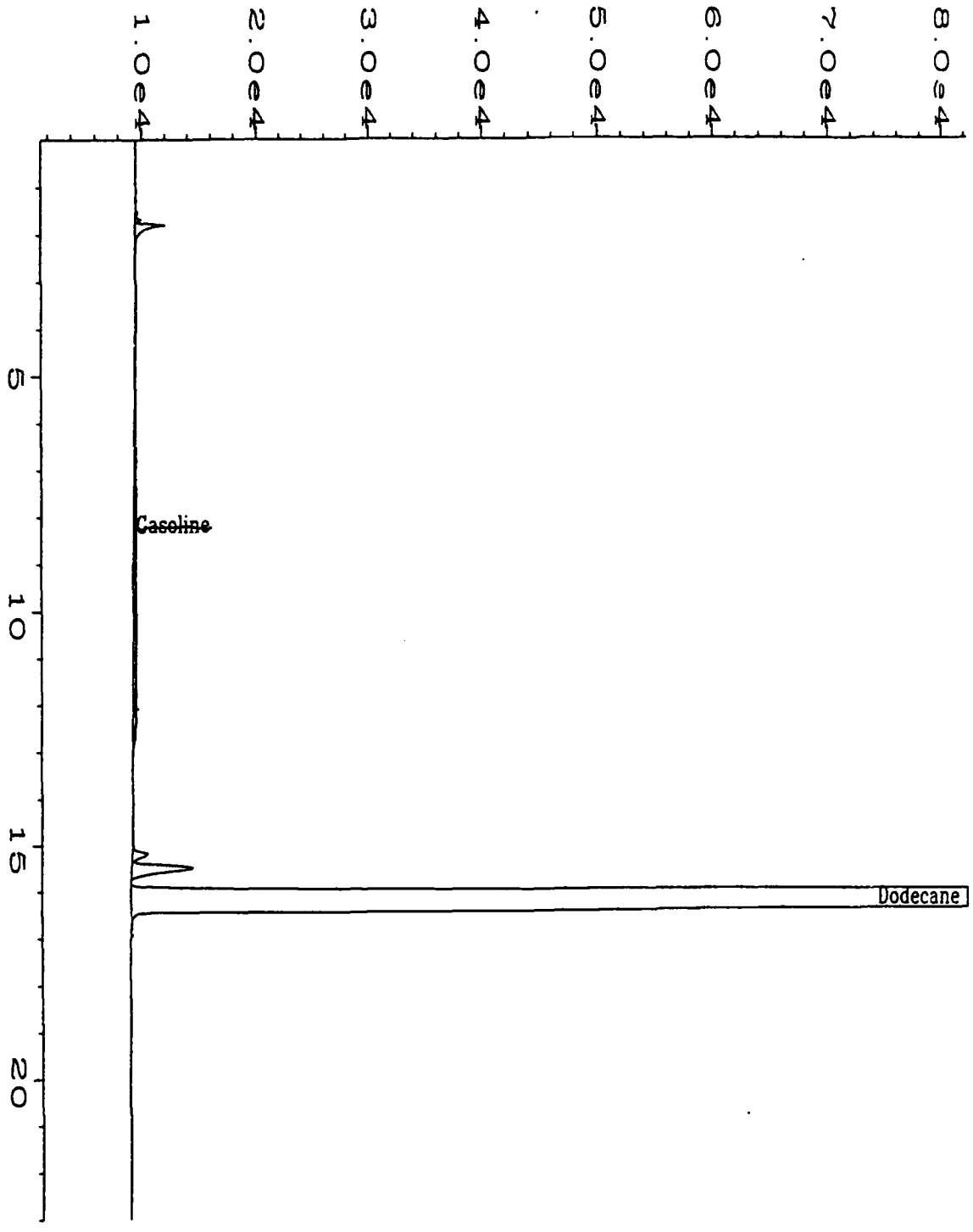
Operator	: Dawn N. Guildner	Page Number	: 1
Instrument	: TVH	Vial Number	: 13
Sample Name	: X05057;1;5	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 1
Acquired on	: 12 Apr 95 07:13 AM	Instrument Method	: TVH1BASE.MTH
Report Created on	: 12 Apr 95 10:05 AM	Analysis Method	: TVH0412.MTH
Last Recalib on	: 12 APR 95 10:00 AM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:
Sample Info	: PROJECT # 95-1044 CLIENT # 56MP-75 WATER		

pm 4/21/95



a File Name	: C:\HPCHEM\1\DATA\tvh0412\014F0101.D		
rator	: Dawn N. Guildner	Page Number	: 1
trument	: TVH	Vial Number	: 14
ple Name	: X05057 DUP	Injection Number	: 1
Time Bar Code	:	Sequence Line	: 1
ired on	: 12 Apr 95 07:49 AM	Instrument Method	: TVH1BASE.MTH
ort Created on	: 12 Apr 95 10:05 AM	Analysis Method	: TVH0412.MTH
t Recalib on	: 12 APR 95 10:00 AM	Sample Amount	: 0
tiplier	: 1	ISTD Amount	:

4/21/95



Data File Name	: C:\HPCHEM\1\DATA\tvh0412\015F0101.D		
Operator	: Dawn N. Guildner	Page Number	: 1
Instrument	: TVH	Vial Number	: 15
Sample Name	: X05060;1;5	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 1
Acquired on	: 12 Apr 95 08:25 AM	Instrument Method	: TVH1BASE.MTH
Report Created on	: 12 Apr 95 10:05 AM	Analysis Method	: TVH0412.MTH
Last Recalib on	: 12 APR 95 10:00 AM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:
Sample Info	: PROJECT # 95-1044 CLIENT # MD56-MW4 WATER		

Pm 4/21/95

External Standard Report

ta File Name : C:\HPCHEM\1\DATA\BX10417\020F0101.D
erator : C.J. Cook
strument : BTEX1
mple Name : X05083;10;0.500
n Time Bar Code:
quired on : 17 Apr 95 07:18 PM
port Created on: 17 Apr 95 07:45 PM
st Recalib on : 10 APR 95 02:22 PM
ltiplier : 10
mple Info : Project#: 95-1044 Client#: MD75-MW9 Water

Page Number : 1
Vial Number : 20
Injection Number : 1
Sequence Line : 1
Instrument Method: BX10417B.MTH
Analysis Method : BX10417B.MTH
Sample Amount : 0
ISTD Amount :

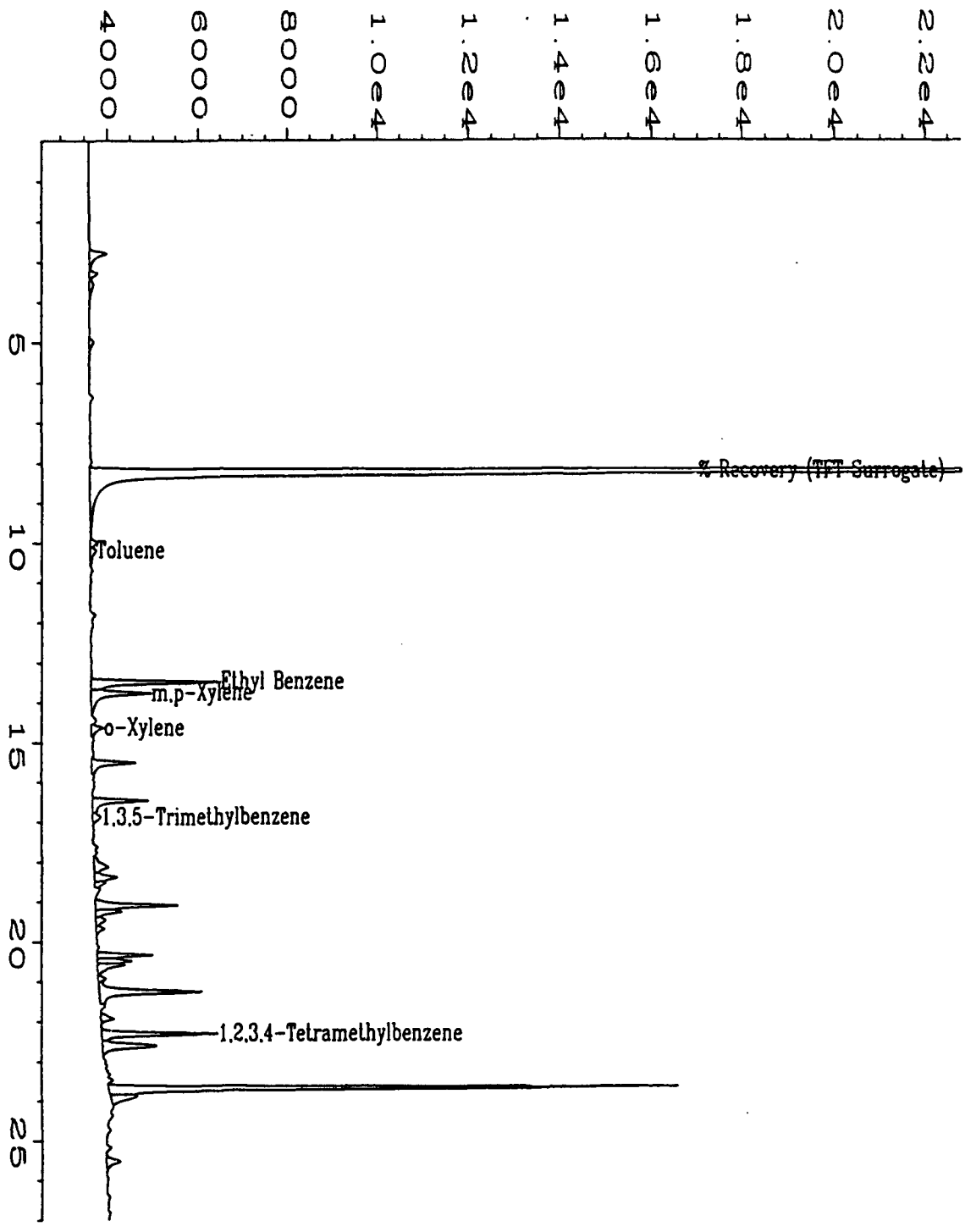
past holding time

g. 1 in C:\HPCHEM\1\DATA\BX10417\020F0101.D

t Time	Area	Type	Width	Ref#	ug/L	Name
6.390	* not found *			1		Benzene
8.234	233142	VV	0.107	1-R	758.365	% Recovery (TFT Surrogate) 76%
10.176	1840	VV	0.184	1	2.160	Toluene
13.196	* not found *			1		Chlorobenzene
13.474	17563	VV	0.093	1	24.449	Ethyl Benzene
13.753	10754	VV	0.117	1	12.135	m,p-Xylene
14.619	2304	VV	0.126	1	2.989	o-Xylene
16.869	1878	VV	0.160	1	2.100	1,3,5-Trimethylbenzene
17.775	* not found *			1		1,2,4-Trimethylbenzene
13.722	* not found *			1		1,2,3-Trimethylbenzene
22.296	14570	PV	0.088	1	29.889	1,2,3,4-Tetramethylbenzene

Time Reference Peak	Expected RT	Actual RT	Difference
2	8.275	8.234	-0.041

t all calibrated peaks were found



)ata File Name : D:\1\DATA\BX10417\020F0101.D
)perator : C.J. Cook
:nstrument : BTEX1
;ample Name : X05083;10;0.500
!un Time Bar Code:
. iired on : 17 Apr 95 07:18 PM
. ort Created on: 01 May 95 12:43 PM
;ast Recalib on : 17 APR 95 07:07 PM
fultiplier : 1

Page Number : 1
Vial Number : 20
Injection Number : 1
Sequence Line : 1
Instrument Method: BX10417B.MTH
Analysis Method : BX10417B.MTH
Sample Amount : 0
ISTD Amount :

External Standard Report

ta File Name	: C:\HPCHEM\2\DATA\BX20413\038R0201.D		
erator	: SW Tyson	Page Number	: 1
strument	: BTEX2	Vial Number	: 38
mple Name	: X05083;1;5	Injection Number	: 1
n Time Bar Code:		Sequence Line	: 2
quired on	: 14 Apr 95 02:04 AM	Instrument Method:	BX20413A.MTH
port Created on:	14 Apr 95 11:59 AM	Analysis Method	: BX20413B.MTH
st Recalib on	: 14 APR 95 00:39 AM	Sample Amount	: 0
ltiplier	: 1	ISTD Amount	:

RPe10

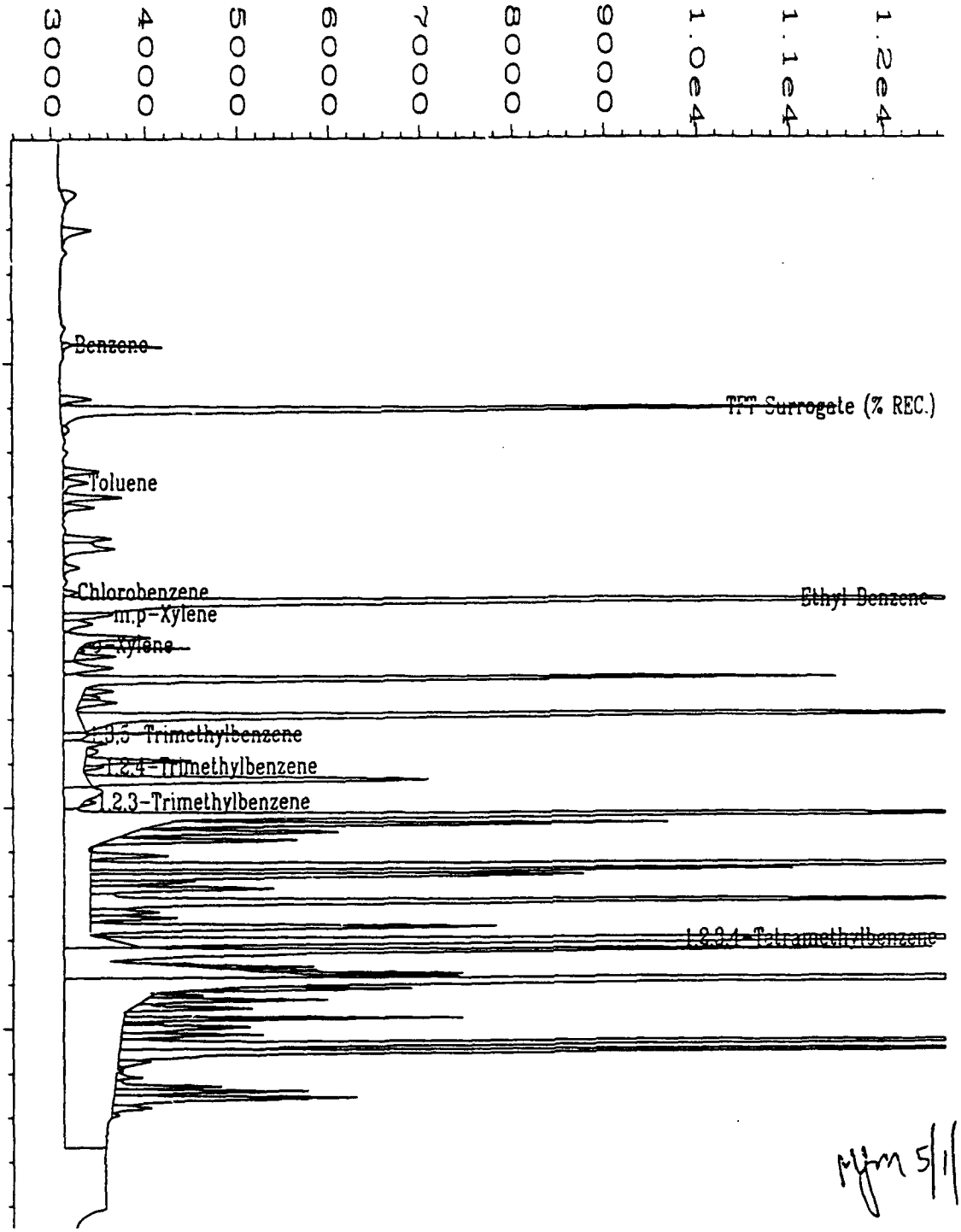
g. 2 in C:\HPCHEM\2\DATA\BX20413\038R0201.D

t Time	Area	Type	Width	Ref#	ug/L	Name
4.533	480	BB	0.089	1	0.380	Benzene
5.980	39337	VV	0.092	1-R	89.767	TFT Surrogate (% REC.) =90%
7.601	1433	VV	0.126	1	1.272	Toluene =1.3
10.047	493	PV	0.081	1	0.498	Chlorobenzene ~~=~~ 0.5
10.262	63371	VV	0.087	1	61.300	Ethyl Benzene =61.3
10.524	2462	VV	0.124	1	2.173	m,p-Xylene =2.2
11.217	1039	VV	0.089	1	1.106	o-Xylene =1.1
13.245	* not found *			1		1,3,5-Trimethylbenzene
13.964	1953	VV	0.096	1	2.083	1,2,4-Trimethylbenzene =2.1
14.774	2145	VV	0.129	1	2.687	1,2,3-Trimethylbenzene=2.7
17.938	99666	VV	0.086	1	132.716	1,2,3,4-Tetramethylbenzene =13>

Time Reference Peak	Expected RT	Actual RT	Difference
2	6.002	5.980	-0.022

t all calibrated peaks were found

past holding time



mjm 5/1/95

ta File Name : C:\HPCHEM\2\DATA\BX20413\025R0701.D
erator : SW Tyson
strument : BTEX2
mple Name : X05083;1;5
n Time Bar Code:
uired on : 13 Apr 95 04:13 PM
rt Created on: 13 Apr 95 05:54 PM
st Recalib on : 13 APR 95 02:16 AM
ltiplier : 1

Page Number : 1
Vial Number : 25
Injection Number : 1
Sequence Line : 7
Instrument Method: BX20413.MTH
Analysis Method : BX20413.MTH
Sample Amount : 0
ISTD Amount :

MD75-MW9

APPENDIX D

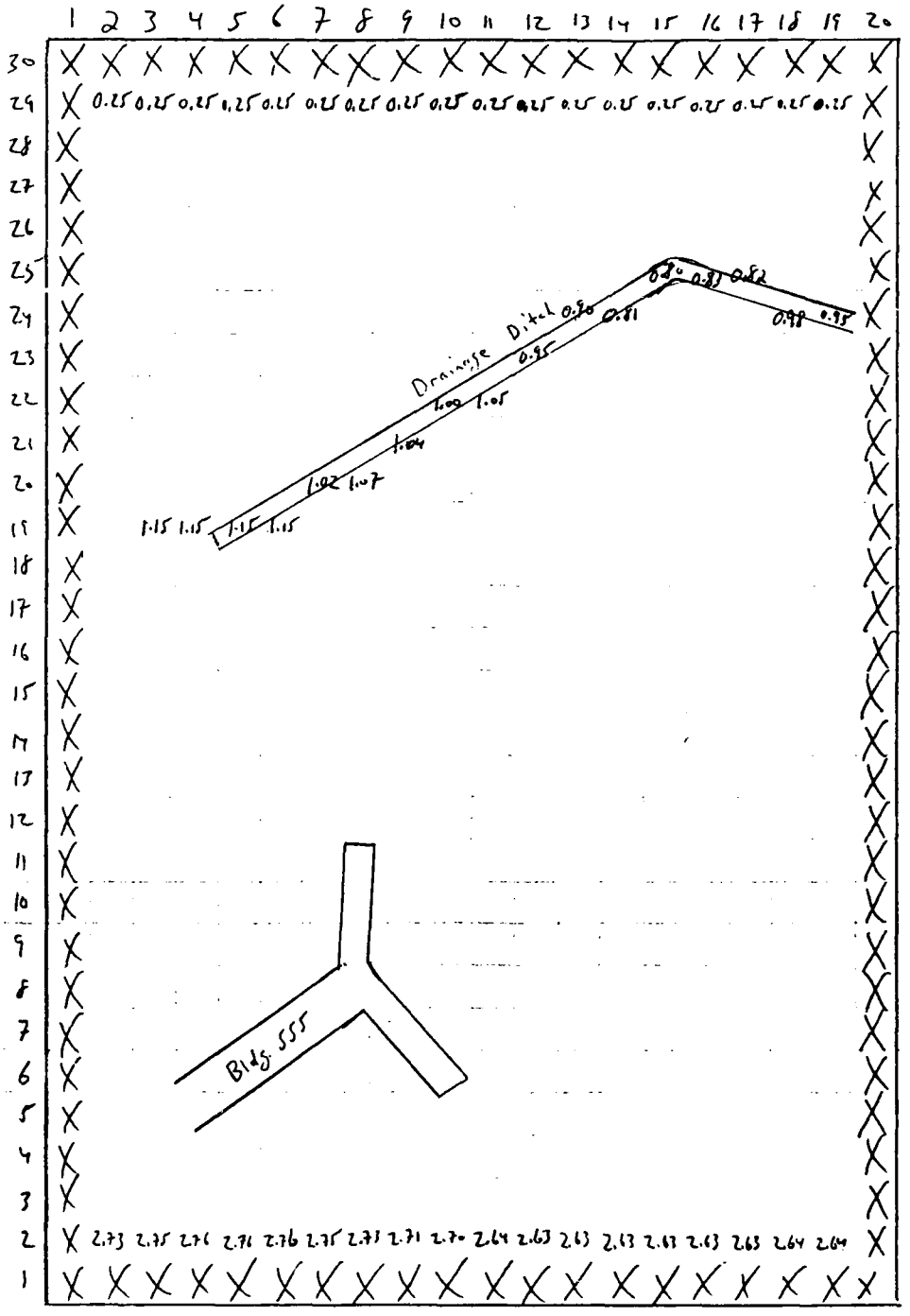
MODEL INPUT PARAMETERS AND RELATED CALCULATIONS

ES ENGINEERING-SCIENCE, INC.

Client AFCEE / MacDill AFB | Job No. 722450.2050 | Sheet 1 of 1

Subject Model Grid w/ Boundary Conditions | By JAH | Date

Checked | Rev.



X = No-flow Cell

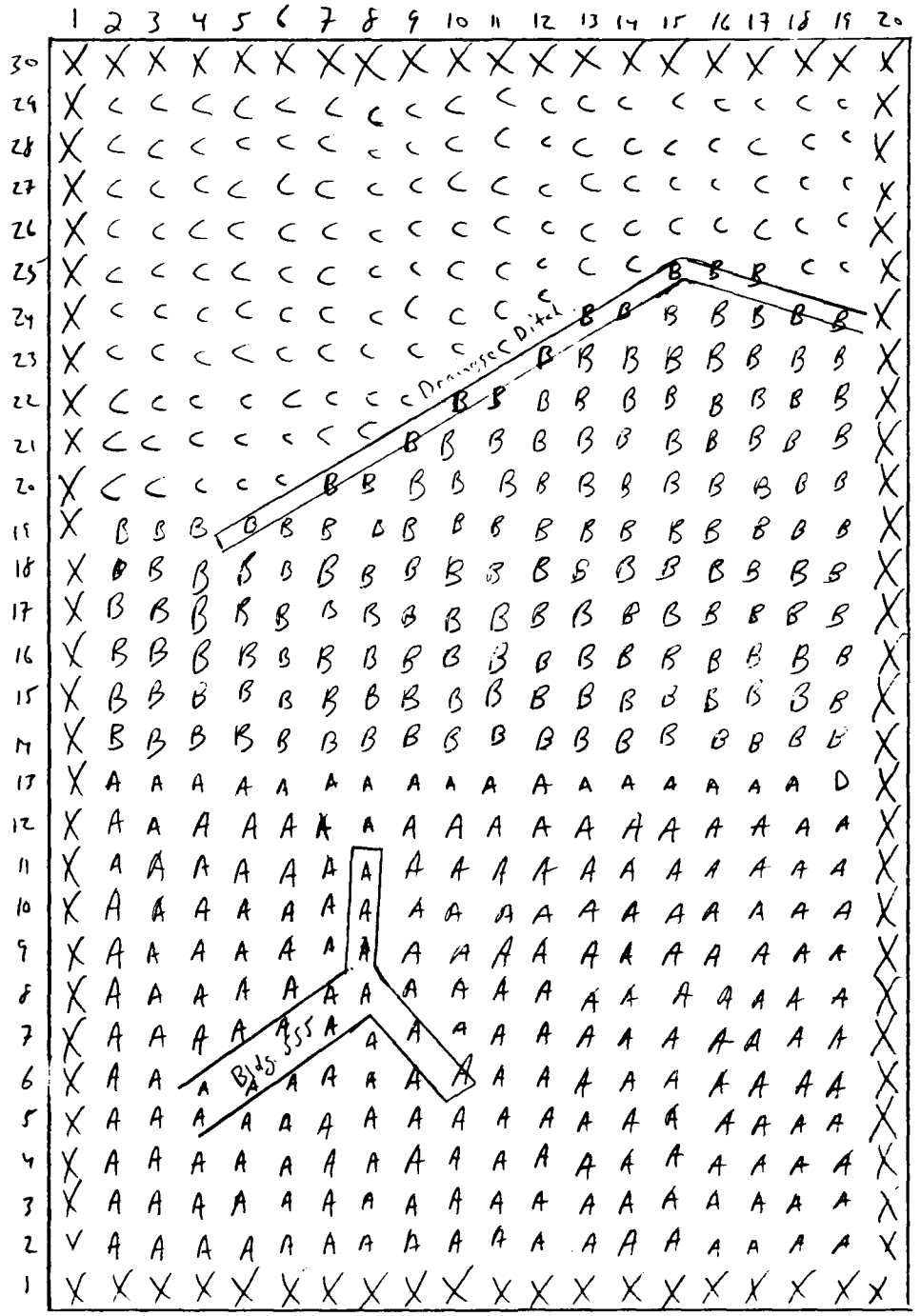
1.05 = Constant Head Cell with Assigned Head Value

ES ENGINEERING-SCIENCE, INC.

Client AFCEE/ MacDill AFB | Job No. 7C2450.2101A | Sheet 1 of 1

Subject Model Grid with Calibrated Transmissivity Array | By JRH | Date

Checked | Rev.



$A = 3.5 \times 10^{-3}$ ft²/sec

$B = 1.3 \times 10^{-3}$ ft²/sec

$C = 2.7 \times 10^{-3}$ ft²/sec

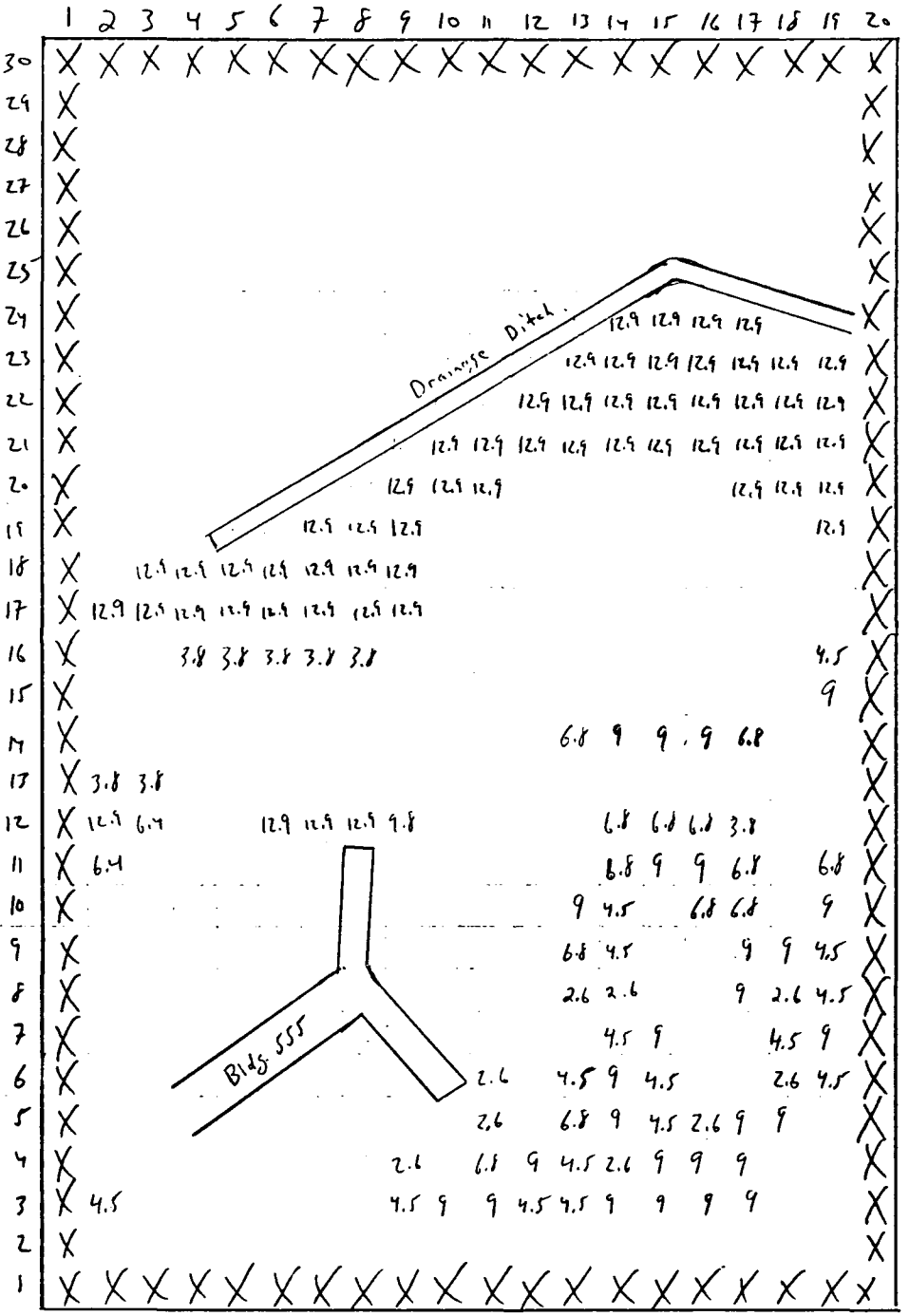
$D = 3.0 \times 10^{-3}$ ft²/sec

ES ENGINEERING-SCIENCE, INC.

Client AFLEG MacDill AFB | Job No. 722450.2050 | Sheet 1 of 1

Subject Model Grid with Recharge Rates | By JAH | Date

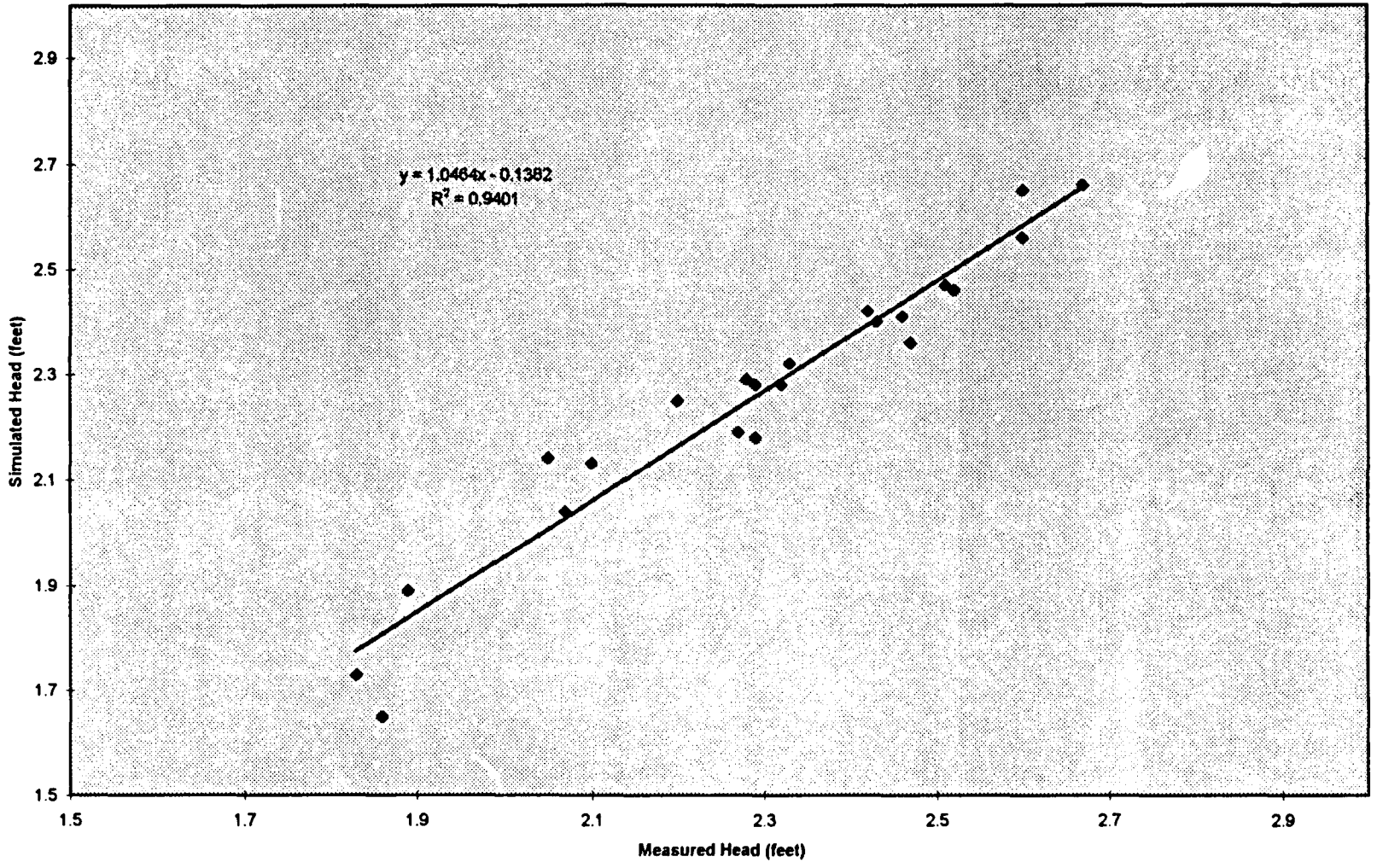
Checked | Rev.



Note: Recharge rates were shown in inches/year; rates were entered into the model as ft/second.

RMS Error Calculations for Calibrated Flow Model					
MacDill AFB, Site 56					
Well	Cell Location	Measured Head	Simulated Head	Hm-Hs	(Hm-Hs)2
	x,y	Hm	Hs		
MD56-MW01	12,14	2.2	2.25	-0.05	0.0025
MD56-MW02	(3,6) (3,5) (4,6) (4,5)	2.67	2.66	0.01	1E-04
MD56-MW03	out of modeled area				
MD56-MW04	3,10	2.6	2.65	-0.05	0.0025
MD56-MW05	12,6	2.27	2.19	0.08	0.0064
MD56-MW06	(9,11) (9,12) (8,11) (8,12)	2.43	2.4	0.03	0.0009
MD56-MW07	10,11	2.33	2.32	0.01	0.0001
MD56-MW08	7,10	2.52	2.46	0.06	0.0036
MD56-MW09	8,13	2.42	2.42	0	0
MD56-MW10	(11,12) (11,13)	2.32	2.28	0.04	0.0016
MD56-MW11	11,11	2.29	2.28	0.01	0.0001
MD32-MW01	17,10	1.86	1.65	0.21	0.0441
MD32-MW03	14,16	2.05	2.14	-0.09	0.0081
MD32-MW06	16,15	1.89	1.89	0	0
MD32-MW07	17,13	1.83	1.73	0.1	0.01
MD32-MW10	(14,12) (15,12)	2.07	2.04	0.03	0.0009
56MP-1S	9,9	2.47	2.36	0.11	0.0121
56MP-2S	8,3	2.46	2.41	0.05	0.0025
56MP-3S	(13,9) (12,9)	2.29	2.18	0.11	0.0121
56MP-6S	14,14	2.1	2.13	-0.03	0.0009
56MP-7S	(7,14) (7,15)	2.51	2.47	0.04	0.0016
56MP-8S	(12,17) (11,17)	2.28	2.29	-0.01	0.0001
56MP-10S	5,10	2.6	2.56	0.04	0.0016
		Sum of Squares of Differences			0.1118
		Average of Squares of Differences			0.005082
		RMS (square root of average of squares of differences)			0.071287
		RMS as a percentage of the head drop			3.751941
		over the model domain (about 1.9 feet)			
I:\45021\tables\rms37A.xls					

Simulated Head vs. Measured Head, Calibrated Groundwater Flow Model, MacDill AFB Site 56



s:\hicks\Sheet1 Chart 1

8/23/95 4:09 PM

Derivation of values used to compute decay rate constants:

Dispersivity (α_x): The longitudinal dispersivity value of 25 feet used in the calibrated Bioplume II models was used.

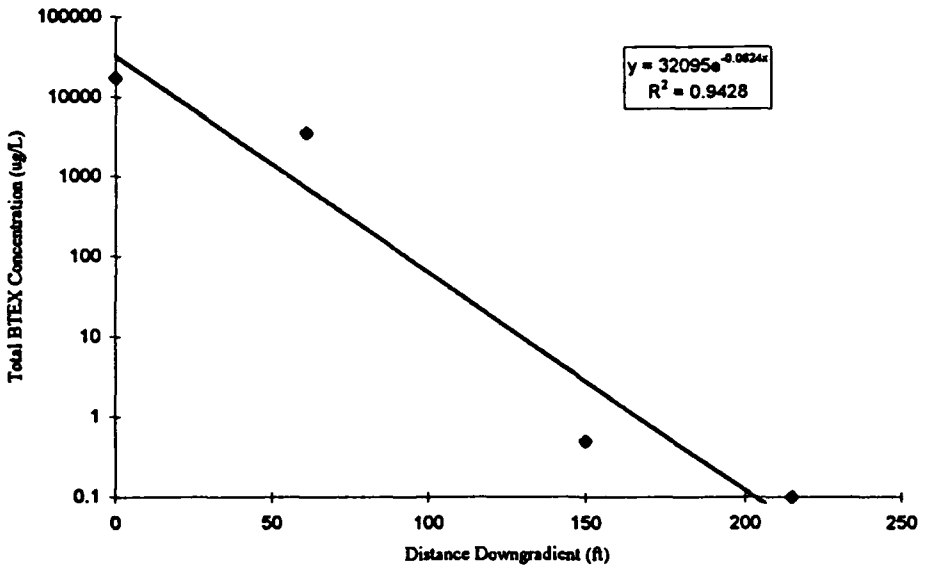
Contaminant Velocity (v_c): The average advective groundwater velocity between wells MD56-MW06 and MD32-MW04 was estimated to be 0.2 ft/day using the velocity equation presented in Section 3.5, a hydraulic conductivity value of 11.6 ft/day, an average hydraulic gradient of 0.0043 ft/ft, and an effective porosity of 0.25.

Using an average retardation coefficient for BTEX of 6.39 (derived from Table 5.3), the contaminant velocity equals 0.2/6.39 or 0.03 ft/day.

FIRST-ORDER RATE CONSTANT CALCULATION
USING THE METHOD OF BUSCHECK AND ALCANTAR (1995)
SITE 56
INTRINSIC REMEDIATION TS
MACDILL AFB, FLORIDA
(using BVWS data from Sept./Oct. 1994)

Point	Distance Downgradient	B, T, E, & X (µg/L) Mar-95
56MP-4S	0	17160
MD56-MW10	61	3514
MD32-MW10	150	0.5
MD32-MW7	215	0.1

PLOT OF TOTAL B, T, E, & X CONCENTRATION VERSUS DISTANCE



$\lambda = v_c/4\alpha_x([1+2\alpha_x(k/v_x)]^2-1)$

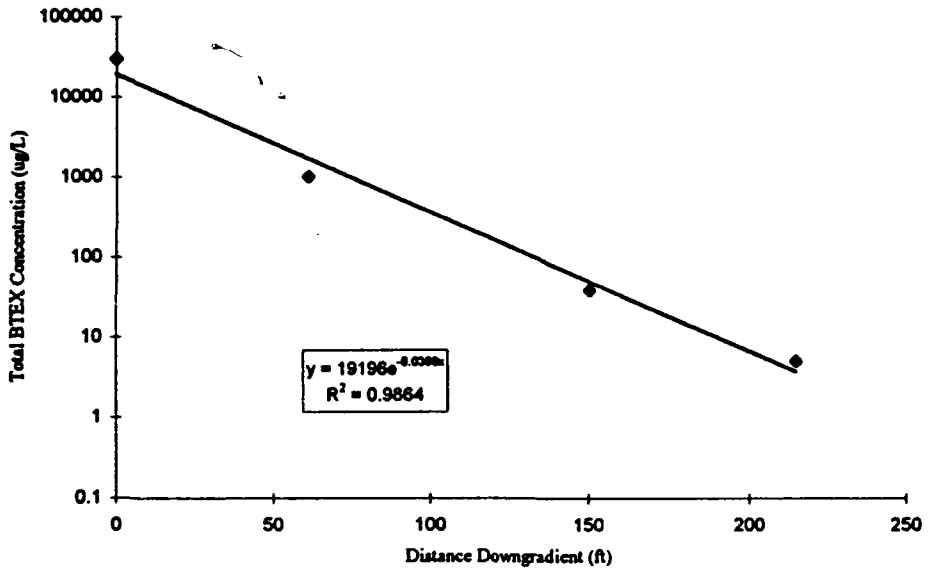
where v_c = 0.03
α_x = 25
k/v = 0.0624

therefore λ = 0.005

FIRST-ORDER RATE CONSTANT CALCULATION
USING THE METHOD OF BUSCHECK AND ALCANTAR (1995)
SITE 56
INTRINSIC REMEDIATION TS
MACDILL AFB, FLORIDA
(using March 1995 monitoring well data)

Point	Distance Downgradient	B, T, E, & X (µg/L) Mar-95
56MD-MW06	0	29622
56MD-MW10	61	1018
MD32-MW10	150	39
MD32-MW7	215	5

PLOT OF TOTAL B, T, E, & X CONCENTRATION VERSUS DISTANCE



$\lambda = v_c/4\alpha_x([1+2\alpha_x(k/v_x)]^2-1)$

where v_c = 0.03

α_x = 25

k/v = 0.0398

therefore λ = 0.002

PARSONS **Calculation Sheet**

Rev	By	Date	Ck	Date	Title
					Calculation of Biodegradation Rates using Conservative Tracers – Site 56, MacDill AFB
					Author JRH Sheet 1 Of 2

From Wiedemeier et al., 1996:

$$C_{i,corr} = C_{i-1,corr}\left(\frac{C_i}{C_{i-1}}\right)\left(\frac{1}{\left(1-\frac{R_c}{R_t}\left(1-\frac{T_i}{T_{i-1}}\right)\right)}\right)$$

where:

$C_{i,corr}$=corrected contaminant concentration at point *i*

$C_{i-1,corr}$=corrected contaminant concentration at point *i*-1. (If point *i*-1 is the first or most upgradient point, $C_{i-1,corr}$ is equivalent to the oberved contaminant concentration.)

C_i=observed contaminant concentration at point *i*

C_{i-1}=observed contaminant concentration at point *i*-1

T_i=observed tracer concentration at point *i*

T_{i-1}=observed tracer concentration at point *i*-1

Note: This assumes that $R_t/R_c + T_i/T_{i-1} > 1$.

R_t & R_c = Coefficients of retardation for the tracer & contaminant, respectively. (1.5 & 16.39, respectively)

Point	Measured BTEX (mg/L)	Measured Total TMB (mg/L)	TMB-Corrected BTEX (mg/L)
MO56-MW06	29,622	2,300	29,622
MO26-MW19	1,018	670	1,438
MO32-MW10	79	1	92
MO32-MW07	5	2	8
56MP-45	29,636	3,358	29,636
56MP-55	1,555	686	2,072
MO32-MW10	39	1	97
MO32-MW07	5	2	9

PARSONS

Calculation Sheet

Rev	By	Date	Ck	Date	Title	Decay Rate Calcs. – Site 56, MacDill AFB
					Author	JRH

Sheet 2 Of 2

Point	Measured BTEX (mg/L)	Measured TEMB (mg/L)	TEMB-Corrected BTEX (mg/L)
S6MP-4S	29,636	170	29,636
S6MP-5S	1,391	130	1,400
MW32-MW10	39	2	41
Σ-MW-7	5	1	5

CALCULATION OF RETARDATION COEFFICIENTS
SITE 56
INTRINSIC REMEDIATION TS
MACDILL AIR FORCE BASE, FLORIDA

Compound	K_{oc} (L/kg [a/])	Maximum Fraction Organic Carbon [b/]	Minimum Fraction Organic Carbon [b/]	Average Fraction Organic Carbon [b/]	Distribution Coefficient K_d (L/kg) Maximum [c1/]	Minimum [c2/]	Average [c3/]	Bulk Density (kg/L) [d/]	Effective Porosity [e/]	Coefficient of Retardation Maximum	Minimum	Average
Benzene	79	0.004	0.001	0.0028	0.316	0.079	0.221	1.70	0.25	3.15	1.54	2.50
Toluene	190	0.004	0.001	0.0028	0.760	0.190	0.532	1.70	0.25	6.17	2.29	4.62
Ethylbenzene	468	0.004	0.001	0.0028	1.872	0.468	1.310	1.70	0.25	13.73	4.18	9.91
m-xylene	405	0.004	0.001	0.0028	1.620	0.405	1.134	1.70	0.25	12.02	3.75	8.71
o-xylene	422	0.004	0.001	0.0028	1.688	0.422	1.182	1.70	0.25	12.48	3.87	9.03
p-xylene	357	0.004	0.001	0.0028	1.428	0.357	1.000	1.70	0.25	10.71	3.43	7.80
1,2,3-TMB	884	0.004	0.001	0.0028	3.536	0.884	2.475	1.70	0.25	25.04	7.01	17.83
1,2,4-TMB	772	0.004	0.001	0.0028	3.088	0.772	2.162	1.70	0.25	22.00	6.25	15.70
1,3,5-TMB	676	0.004	0.001	0.0028	2.704	0.676	1.893	1.70	0.25	19.39	5.60	13.87
1,2.4.5-TEMB	6166	0.004	0.001	0.0028	24.664	6.166	17.265	1.70	0.25	168.72	42.93	118.40

NOTES:

[a/] From technical protocol (Wiedemeier *et al.*, 1995) and Montgomery (1996) (for 1,2,4,5-TEMB)

[b/] From laboratory analyses of site soil samples

[c1/] K_d = Maximum Fraction Organic Carbon x K_{oc}

[c2/] K_d = Minimum Fraction Organic Carbon x K_{oc}

[c3/] K_d = Average Fraction Organic Carbon x K_{oc}

[d/] From laboratory analyses of moisture content, and assumed porosity and specific gravity.

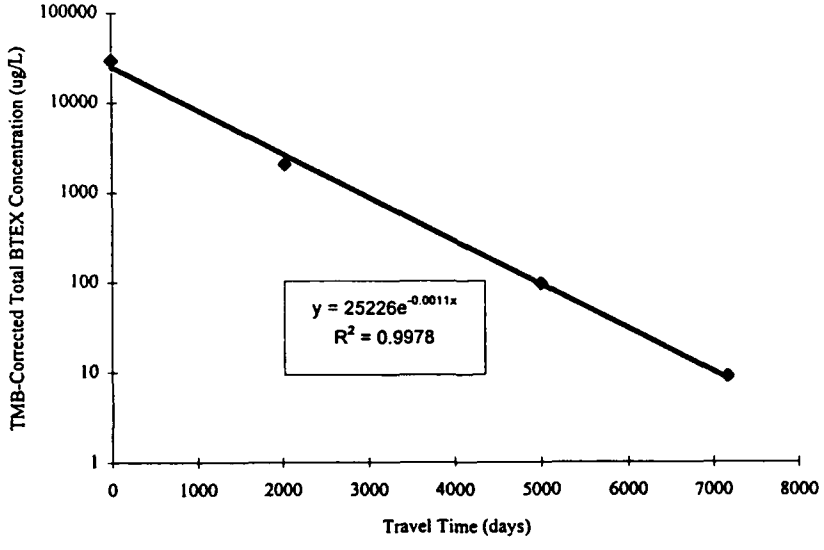
e/ Literature value.

FIRST-ORDER RATE CONSTANT CALCULATION
USING TMB AS A CONSERVATIVE TRACER
SITE 56
INTRINSIC REMEDIATION TS
MACDILL AFB, FLORIDA
(using monitoring wells and monitoring points)

Point	Distance Downgradient (ft)	Travel Time Between Upgradient and Downgradient Point (days)	Measured Total BTEX Concentration (µg/L)	Total Trimethylbenzene Concentration (µg/L)	Trimethylbenzene-Corrected Total BTEX Concentration (µg/L)
56MP-4S	0	0	29636	3580	29636
56MP-5S	61	2033	1395	686	2072
MD32-MW10	150	5000	39	1	97
MD32-MW07	215	7167	5	2	9

v_c = 0.03 ft/day (average for all BTEX compounds)

PLOT OF TMB-CORRECTED TOTAL BTEX CONCENTRATION VERSUS TIME



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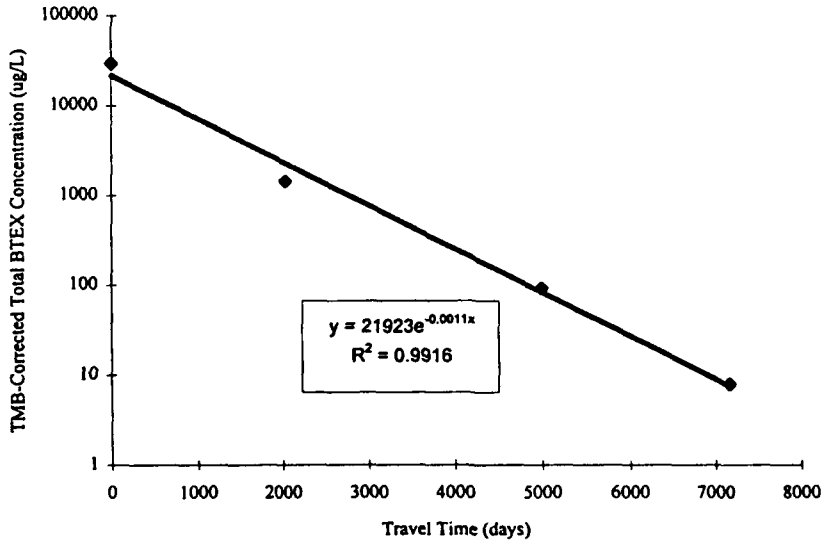
FIRST-ORDER RATE CONSTANT CALCULATION
USING TMB AS A CONSERVATIVE TRACER
SITE 56
INTRINSIC REMEDIATION TS
MACDILL AFB, FLORIDA
(using monitoring wells only)

Point	Distance Downgradient (ft)	Travel Time Between Upgradient and Downgradient Point (days)	Measured Total BTEX Concentration (µg/L)	Total Trimethylbenzene Concentration (µg/L)	Trimethylbenzene-Corrected Total BTEX Concentration (µg/L)
MD56-MW06	0	0	29622	2300	29622
MD56-MW10	61	2033	1018	640	1438
MD32-MW10	150	5000	39	1	92
MD32-MW07	215	7167	5	2	8

v_c = 0.03 ft/day (average for all BTEX compounds)

PLOT OF TMB-CORRECTED TOTAL BTEX CONCENTRATION VERSUS TIME

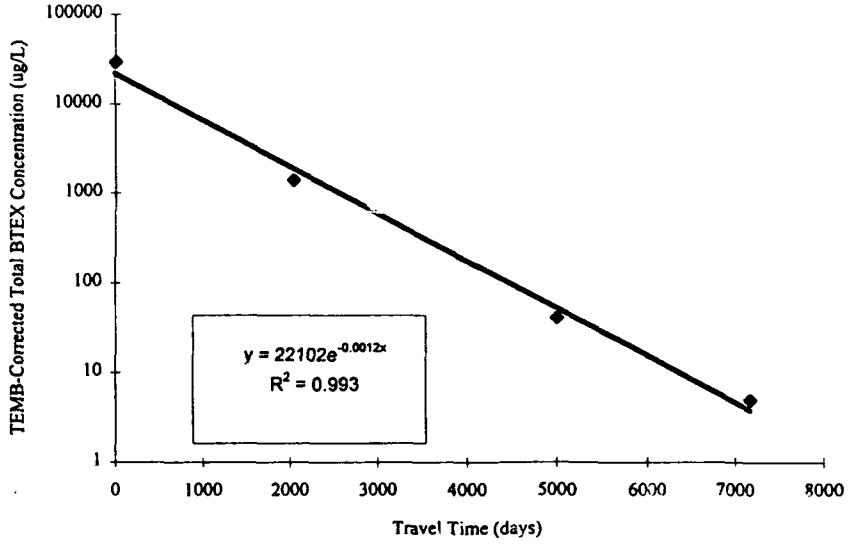


FIRST-ORDER RATE CONSTANT CALCULATION
USING TETRA-MB AS A CONSERVATIVE TRACER
SITE 56
INTRINSIC REMEDIATION TS
MACDILL AFB, FLORIDA
(using monitoring wells and monitoring points)

Point	Distance Downgradient (ft)	Travel Time Between Upgradient and Downgradient Point (days)	Measured Total BTEX Concentration (µg/L)	Total Tetramethylbenzene Concentration (µg/L)	Tetramethylbenzene Corrected Total BTEX Concentration (µg/L)
56MP-4S	0	0	29636	140	29636
56MP-5S	61	2033	1395	130	1400
MD32-MW10	150	5000	39	2	41
MD32-MW07	215	7167	5	1	5

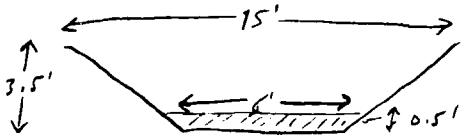
v_c = 0.03 ft/day (average for all BTEX compounds)

PLOT OF TMB-CORRECTED TOTAL BTEX CONCENTRATION VERSUS TIME



Site 56 Ditch Measurements

15 ft wide (total)
3.5 ft deep
0.5' Water depth
6.0' Water width



Assume 250' of drainage ditch is impacted by the discharging hydrocarbons. The impacted water volume is:

$$6\ ft \times 0.5' \times 250\ ft = 750\ ft^3 = \text{dilution volume}$$

Based on Bioplume II results, max. BTEX entering ditch at $t = 7$ years = 266 ug/L, then concentrations decrease. Assume worst case average of 266 ug/L entering ditch along entire 25' length. (Actual BTEX entering ditch should be less because 266 ug/L was only for one 25' model grid cell).

Worst Case Benzene Loading to Ditch

Assume benzene is 75% of BTEX, or $(0.75)(266\ ug/L) = 200\ ug/L$

If the discharge occurs over a 250' x 3' cross section of the ditch for 1 month:

$Q = KiA$ where K = hydraulic conductivity (ft/day)
i = hydraulic gradient (ft/ft)
A = cross sectional area of discharge (ft^2)

$Q = (15\ ft/day)(0.008\ ft/ft)(250' \times 3')$

$= 90\ ft^3/day = 2{,}700\ ft^3/month$

2,700 ft^3/month containing 200 mg/L benzene equals the following mass of benzene:

2,700 ft^3 = 76442 liters
200 mg/L = 0.2 mg/L

76,422 liters × 0.2 mg/L = 15,284 mg = 0.03 lb benzene/month

Pond dilution:

$$\frac{0.03 \text{ lb benzene/month}}{750\ ft^3} = 0.00004 \frac{lb}{ft^3}$$

$$0.00004 \frac{lb}{ft^3} \times \frac{1 \text{ mg}}{2.2046 \times 10^{-6} \text{ lb}} \times \frac{1\ ft^3}{28.32 \text{ liters}} = 0.64 \text{ mg/L}$$
$$= 640 \text{ µg/L}$$

This is overly conservative because it assumes no flow in the ditch — the benzene accumulates in the same 750 ft^3 of water instead of being continuously flushed downstream. Also, volatilization not accounted for.

Estimated water flow rate = 0.175 ft/sec on July 21, 1995 (after hard rain)

Flow velocity × cross sectional channel area = volumetric flow rate
0.175 ft/sec × (6 ft × 0.5 ft) = 0.525 ft^3/sec
= 1,360,800 ft^3/month

∴ In reality, 0.03 lb benzene per month will discharge into 1,360,800 ft^3 of water

Redoing the dilution calculations:

$$\frac{0.03 \text{ lb benzene/month}}{1,360,800 \text{ ft}^3} = 2.2 \times 10^{-8} \frac{\text{lb}}{\text{ft}^3}$$

$$2.2 \times 10^{-8} \frac{\text{lb}}{\text{ft}^3} \times \frac{1 \text{ g}}{2.2046 \times 10^{-6} \text{ lb}} \times \frac{1 \text{ ft}^3}{28.32 \text{ l}} = 0.00035 \text{ mg/l}$$

$$= 0.35 \text{ mg/l}$$

Because flow rate in ditch varies and may be less during dry periods, the estimated range of benzene concentrations in the ditch is 0.35 mg/l to 640 mg/l. The 640 value is absolute worst case, and is overly conservative.

VOLATILIZATION OF BENZENE

Fick's law modified for surface waters is:

$C = C_0 e^{-K_L t/z}$, where

C = Concentration at a particular time (g/cm^3)
C_0 = initial concentration (g/cm^3) — Assume 2.66×10^{-7} g/cm^3
K_L = volatilization rate constant
z = mean depth of water (cm) — Assume 0.5 ft or ~15 cm
t = time elapsed — Assume 1 day (86,400 sec)

$1/K_L = 1/K_l + \frac{1}{H K_g / RT}$ where K_l = liquid phase exchange coefficient ($\frac{cm}{s}$)
K_g = gas phase exchange coefficient ($\frac{cm}{s}$)
H = Henry's Constant (atm m^3/mole)
R = 8.2×10^{-5} atm-m^3/mole-k°
T = Absolute Temp. ($^\circ$K)

For benzene, $H = 5.5 \times 10^{-3}$ atm·m^3/mole

ENGINEERING-SCIENCE, INC.

Client AFCEE - MacDill AFB | Job No. 722450.2105 | Sheet 4 of 4
Subject Site 56 dilution & volatilization | By JRH | Date 7/29/95
Calculations | Checked | Rev.

Use avg wind velocity of 5 mph
Assume T = 72°F (295°K) = average annual temp. per BVWS (1995)
k_l = 27 cm/hr or 0.0075 cm/sec
k_g = 2000 cm/hr or 0.55 cm/sec

$$1/k_L = \frac{1}{0.0075} + \left[\frac{5.54\times10^{-3}(0.55)}{8.12\times10^{-5}(295)}\right]^{-1}$$

$$1/k_L = 133 + 8.0$$

$$k_L = 0.0071$$

Half Life ($t_{1/2}$) = $0.69\ ^{2}/k_L$

$$= 0.69\ \frac{15\text{ cm}}{0.0071} = 1458 \text{ seconds} = 0.40 \text{ hour half life for benzene @ } 72°F$$

∴ For benzene concentration of 640 mg/L in surface water:

After	Concentration is
0.4 hr	320 mg/L
0.8 hr	160 mg/L
1.2 hr	80 mg/L
1.6 hr	40 mg/L
2.0 hr	20 mg/L
2.4 hr	10 mg/L
2.8 hr	5 mg/L
3.2 hr	2.5 mg/L
3.6 hr	1.25 mg/L
4.0 hr	0.6 mg/L

In 4 hr, < 1 mg/L of benzene would remain under worst-case scenario. In ~1.3 hr, concentrations will decrease below the surface water standard of 71.28 mg/L (Chapter 62-302, FAC)

At 0.175 ft/second, the water would flow 819 ft in 1.3 hours.

ES ENGINEERING-SCIENCE, INC.

Client AFCEE - MacDill AFB | Job No. 722450.21050 | Sheet 1 of 3
Subject Contaminant Leaching Calculations - Saturated Water Flush | By JRH | Date 8/1/95
Checked GPV 8/28/95 | Rev.

Knowns:

a) Linear GW velocity = ~ 0.2 ft/day = 0.06 m/day
b) porosity = ~ 0.30
c) soil bulk density = ~1.7 g/cm^3
d) Distribution coefficients, (K_d)

benzene	0.221
toluene	0.532
ethylbenzene	1.310
xylenes	1.105 (average of m, o, & p xylenes)

e) Starting concentrations are as follows:

Groundwater
- Low (benzene) 7,600 mg/L
- Low (toluene) 12,722 mg/L
- Low (ethylbenzene) 1,600 mg/L
- Low (xylenes) 7,700 mg/L

Assumptions:

a) **10 %** of equilibrium will be reached with each flush. A value of 100% was not selected because of limited contact time and because some contaminant mass will not be in contact with flowing pore water with each flush. Choosing a value less than 100% is also more conservative.

b) Simulated volume = 1 m^3

$$\text{mass of soil} = \left(1.7 \frac{g}{cm^3}\right)\left(\frac{10^6 cm^3}{m^3}\right)\left(\frac{1 kg}{1000 g}\right) = 1{,}700 \frac{kg}{m^3}$$

$$\text{mass of water} = \left(1 \frac{g}{cm^3}\right)\left(\frac{0.3 cm^3 H_2O}{cm^3 \text{ aquifer}}\right) = \frac{0.3 g}{cm^3} = 300 \frac{kg}{m^3}$$

c) New volume of H_2O will pass through soil mass approximately 20 times per year.

$$\frac{1}{v} = \frac{1}{0.06 m/day} = 17 day = \sim 0.05 year$$

Compute Pore Volumes Exchanged Per Day Using Larger Aquifer Volume:
(This should be more accurate than using a $1 m^3$ volume)
$Q = 4$ gpm $= 0.53$ cfm (Groundwater extraction rate)

The area of contaminated soil can be approximated by a circle with a diameter of 100 ft. Therefore, the volume of aquifer that we want to flush with fresh water is a cylinder with a diameter of 100 ft and a height of 10 feet.

The Volume of water in this Cylinder $= V = \pi r^2 l \times$ porosity
$= \pi (50 ft)^2 (10 ft) (0.30)$
$= 23,557 ft^3$
$= 1$ pore volume

Pore volumes exchanged per day at the perimeter of this Cylinder

$$\frac{0.53 \frac{ft^3}{min} \times 1440 \frac{min}{day}}{23,557 ft^3 / \text{pore volume}} = 0.032 \text{ pore volume/day}$$

$$= 11.8 \text{ pore volumes/year}$$

This is conservative, because the number of pore volume exchanges per year will increase as the groundwater moves closer to the extraction well. For example, at a radial distance of 25 ft from the extraction well:

$V = \pi (25')^2 (10) (0.30)$
$= 5889 ft^3$

And the number of pore volumes per year increases to 47

The remediation time decreases as you approach the extraction well.

Select an average rate of 29 pore volumes per year $= 0.08$/day
(= 1 pore volume every 13 days)

Equations:

a) $k_d = \frac{mg/kg}{mg/L} = \frac{\text{mass adsorbed to soil}}{\text{mass dissolved in GW}}$

$\therefore \quad mg/L = (mg/kg \cdot 0.10) / k_d \qquad$ (w/ efficiency factor)

b) $M_{s_{new}}$ = Mass of contaminant in $1\ m^3$ of aquifer
$M_{s_{old}}$ = " " " in soil
M_w = " " " in water

$M_{s_{new}} = M_{s_{old}} - M_w$

$mg/kg = (mg/kg - mg/L) \rightarrow$ need to correct for density

remember: $\frac{300\ l/m^3}{1700\ kg/m^3} = 0.18\ l/kg$

$\therefore \quad mg/kg\ (\text{remaining}) = \left(mg/kg\ \text{initial} - \left[(mg/L\ \text{leached})(0.18\ L/kg)\right]\right)$

The following spreadsheet shows these calculations for BTEX. Note that leaching efficiency was defined to get C_{os} from C_{ow}. These calculations are in reasonable agreement with site data.

PUMP-AND-TREAT CONTAMINANT REMOVAL EFFICIENCIES

SITE 56

INTRINSIC REMEDIATION TS

MACDILL AIR FORCE BASE, FLORIDA

Days	1m3 Pore Volume	Benzene Soil Concen.	Water Concen.	Toluene Soil Concen.	Water Concen.	Ethylbenzene Soil Concen.	Water Concen.	Total Xylenes Soil Concen.	Water Concen.
0	0	16796.0	7600.0	67681.0	12722.0	20960.0	1600.0	85085.0	7700.0
13	1	15428.0	6981.0	65391.1	12291.6	20672.0	1578.0	83699.0	7574.6
26	2	14171.4	6412.4	63178.6	11875.7	20388.0	1556.3	82335.6	7451.2
39	3	13017.2	5890.1	61041.0	11473.9	20107.8	1534.9	80994.4	7329.8
52	4	11957.0	5410.4	58975.7	11085.7	19831.5	1513.9	79675.0	7210.4
65	5	10983.1	4969.7	56980.3	10710.6	19559.0	1493.1	78377.1	7093.0
78	6	10088.5	4565.0	55052.4	10348.2	19290.3	1472.5	77100.4	6977.4
91	7	9266.9	4193.1	53189.7	9998.1	19025.2	1452.3	75844.5	6863.8
104	8	8512.1	3851.6	51390.0	9659.8	18763.8	1432.4	74609.0	6751.9
117	9	7818.8	3537.9	49651.3	9332.9	18506.0	1412.7	73393.6	6642.0
130	10	7182.0	3249.8	47971.3	9017.2	18251.7	1393.3	72198.1	6533.8
1859	143	0.1	0.0	493.0	92.7	2898.2	221.2	8125.9	735.4
1872	144	0.1	0.0	476.3	89.5	2858.4	218.2	7993.5	723.4
1885	145	0.1	0.0	460.2	86.5	2819.1	215.2	7863.3	711.6
1898	146	0.1	0.0	444.6	83.6	2780.4	212.2	7735.2	700.0
1911	147	0.1	0.0	429.6	80.7	2742.2	209.3	7609.2	688.6
1924	148	0.1	0.0	415.0	78.0	2704.5	206.5	7485.3	677.4
1937	149	0.1	0.0	401.0	75.4	2667.4	203.6	7363.4	666.4
1950	150	0.0	0.0	387.4	72.8	2630.7	200.8	7243.4	655.5
1963	151	0.0	0.0	374.3	70.4	2594.6	198.1	7125.4	644.8
3939	303	0.0	0.0	2.0	0.4	316.8	24.2	587.0	53.1
3952	304	0.0	0.0	1.9	0.4	312.4	23.8	577.4	52.3
3965	305	0.0	0.0	1.9	0.4	308.1	23.5	568.0	51.4

Shaded boxes show when total BTEX is less than 1,000 micrograms per liter.

I:\45021\tables\PUMP.XLS

APPENDIX E

MODEL INPUT AND OUTPUT FILES

APPENDIX F

REMEDIAL ALTERNATIVE COST CALCULATIONS

Alternative 1: Long-Term Monitoring and Institutional Controls

Standard Rate Schedule

Billing Category Cost Code/(Billing Category)	Billing Rate	Task 1 (hrs)	Install New LTM/POC Wells ($)	Task 2 (hrs)	Sampling ($)	Task 3 (hrs)	Reporting & PM ($)
Word Processor 88/(15)	$30	0	$0	0	$0	30	$900
CADD Operator 58/(25)	$47	4	$188	0	$0	30	$1,410
Technician 42/(50)	$40	5	$200	35	$1,400	20	$800
Staff Level 16/(65)	$57	20	$1,140	35	$1,995	40	$2,280
Project Level 12/(70)	$65	4	$260	4	$260	30	$1,950
Senior Level 10/(80)	$85	1	$85	0	$0	2	$170
Principal 02/(85)	$97	0	$0	0	$0	0	$0
Total Labor (hrs | $)		34	$1,873	74	$3,655	152	$7,510
ODCs							
Phone			$20		$10		$40
Photocopy			$10		$5		$100
Mail			$100		$200		$50
Computer			$100		$0		$400
CAD			$0		$0		$450
WP			$0		$0		$200
Travel			$200		$200		$0
Per Diem			$90		$200		$0
Eqpt. & Supplies			$300		$200		$0
Total ODCs			$820		$815		$1,240
Outside Services							
LTM/POC Well Installation Costs [a]			$6,700		$0		$0
Laboratory Fees [b]		Soils	$440	5 LTM, 3 POC,	$1,800		$0
Other: Maintain Institutional Controls			$0	3 SW, and 4qa/qc	$0		$5,000
Total Outside Services			$7,140		$1,800		$5,000

Proposal Estimate	Task 1	Task 2	Task 3
Labor	$1,873	$3,655	$7,510
ODC's	$820	$815	$1,240
Outside Services	$7,140	$1,800	$5,000
Total by Task	$9,833	$6,270	$13,750

Total Labor	$13,038
Total ODCs	$2,875
Total Outside Services	$13,940
Total Project	$29,853

Task 1: Install New LTM/POC Wells

Task 2: Sampling per Event

Task 3: Reporting & Proper Sampling Event.

[a] 4 Wells, 60ft @ $70/ft, $2000mob, $500 soil handling

b/ 8 primary groundwater samples, 3 primary surface water samples, 4 QC Samples/ analysis for aromatics (8020) & lead (7421)

MacDill AFB Backup Calculations--Site 56

Alternative 1 : Long-term Monitoring

Misc calculations

Number of LTM wells:		
Number of wells:	4	
Depth each:	15	ft

Cost calculations

Description	Unit	Qty.	Unit Price	Subtotal	Total	Source (If applicable)
Well Installation					$ 6,700	
Mobilization	ea	1	$ 2,000	$ 2,000		
Well Installation	ln ft	60	$ 70	$ 4,200		
Soil Disposal	drum	5	$ 100	$ 500		

Present Worth Analysis Annual Adjustment Factor = 5%

Alternative 1: Intrinsic Remediation with Institutional Controls and Long-Term Groundwater Monitoring	years	Present Worth ($)	Cost ($) at Year Indicated Year: 1	2	3	4	5	6	55	56
Maintain Institutional Controls	56	$93,493	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000
Long-term Monitoring										
Install New Wells	1	$9,365	$9,833	$0	$0	$0	$0	$0	$0	$0
Groundwater Sampling	56	$61,453	$6,270	$5,956	$5,658	$5,375	$5,107	$4,851	$393	$373
Reporting/Project Mgmt	56	$85,766	$8,750	$8,313	$7,897	$7,502	$7,127	$6,771	$548	$521
Subtotal Present Worth ($)		$250,076	Note: only odd years are summed to accout for biannual sampling.							

For GW Sampling and Reporting/PM

Total Present Worth Cost ($): $250,076

ES ENGINEERING-SCIENCE, INC.

Client AFCEE - MacDill AFB | Job No. 722450.21050 | Sheet 1 of 2
Subject Site 56 Alternative 2 Costs | By JRH | Date 7/29/95
Checked RLM 8-18-95 | Rev.

Assumptions:
- 80-ft long horizontal bioventing / SVE well
- Power available at Bldg 522 at Site 32
- Well installed in 3½' deep trench
- 4 vapor monitoring points installed
- Base provides daily 10-minute check during SVE operation

CAPITAL COSTS

Trench Construction a/ 280' @ $70/ft	$19,600
Well Installation	$ 2,000
Blower, Blower House, manifold, piping, Safety	$ 2,500
Monitoring points (4)	$ 1,000
½ Internal Combustion Engine for SVE ($6000/month rental x 3 month) + $1,000 for supplemental fuel	$19,000
System Installation Oversight	
Labor 1 pers x 150 hr x $60/hr	$ 9,000
ODCs	$ 2,000
SVE System Optimization	
Labor 1 pers x 50 hr x $60/hr	$3,000
1 pers x 40 hr x $50/hr (local trainee)	$2,000
ODCs	$2,500
Soil Gas Sampling & Analysis During SVE Operation	
Labor 1 pers x 100 hr x $50/hr	$5,000
Analytical (BTEX) 15 BTEX @ $90	$1,350
Misc. ODCs	$1,000
TOTAL	$69,950 Round to $70,000

a/ includes backfill, repaving

ANNUAL COSTS

Extended Testing (performed annually) (See attached spreadsheet)	$15,435
Weekly System Checks (by local person)	
Labor (4 hr/wk x 52 wk/yr x $50/hr)	$10,400
ODCs	$ 25
Total	$25,860

Present Worth Costs For Alternative 2 — Assume inflation = 5%/yr

① PW = Capital Costs + (Annual Costs x Present Worth Factor)

$$PWF(3\text{ years}) = \frac{(1+0.05)^3 - 1}{(0.05)(1+.05)^3} = 2.71$$ For SVE/bioventing System

$$PW_{(SVE/bioventing)} = \$70,000 + (2.71)(25,860) = \underline{\$140,080}$$

② For LTM/Institutional Controls (14 years)

$$PWF(14\text{ years}) = \frac{(1+0.05)^{14} - 1}{(0.05)(1+0.05)^{14}} = 9.90$$

$$PW = \$9,833 + (9.90 \times 6,270) + (9.90 \times 17,750)$$
$$= \underline{\$208,031}$$

TOTAL PW = $140,080 + $208,031 = **$348,111**

Alternative 2

Option One
Extended Testing of Existing Bioventing Systems, Cost Per Site
Title I A Services (For Work Completed in 1994 - 1997)

20-Jul-94
c:\biovent\option1.wk4

Task Description	Labor Hours					Total Hours	Total Cost
Task 1: Administration	6	6	6	6	8	32	$824.34
Task 2: Extended Testing	2	8	60	20	15	105	$2,339.66
Task 3: Letter Report Preparation	4	12	8	8	10	42	$1,033.00
Total Labor Hours	12	26	74	34	33	179	
Labor Hourly Rates (CY 1996)	$43.75	$30.02	$23.39	$17.83	$16.80		
Total Labor Costs	$525.00	$780.52	$1,730.86	$606.22	$554.40		$4,197.00

A Direct Labor Cost	$4,197.00
B Home Office Overhead Including Fringe 139.61%	$5,859.43
C Total Labor Cost	$10,056.43
D Other Direct Costs	$3,726.00
E Total C and D	$13,782.43
F Profit on Item E at 11.99%	$1,652.51
Total Cost (CONUS)	$15,434.95
Total Cost (AK/HI/Johnston Atoll)	$19,758.88

MacDill AFB, Site 56 pg. 1 of 2

Computed by: JRH 8/9/95
Checked by RKM 8/13/95

Summary of Alternative 3 Costs:

Capital Costs

Design & Install Recovery System (from attached spreadsheet)	$56,363
SVE/Bioventing System Installation (from Alternative 2)	$70,000
Install new LTM/poc wells (from Alternative 1)	$9,633
Water Discharge Permitting	$5,000

Annual Costs

Bioventing/GW Extraction System O&M (from attached spreadsheet)	$24,464	3 yrs
GW Extraction System O&M (from attached spreadsheet)	$20,299	2 yrs
Monthly & Annual Reports - Bioventing & GW Extr. (from attached spreadsheet)	$10,310	3 yrs
Monthly & Annual Reports - GW Extr. (from attached spreadsheet)	$8,470	2 yrs
Extended (Annual) Testing of Bioventing System performance (from Alternative 2)	$15,435	3 yrs
LTM (from Alternative 1)	$6,270	10 yrs
LTM Reporting & PM (Alternative 1)	$13,750	10 yrs

Present Worth Costs (inflation = 5% annually)

PW = Capital Costs + [(Annual Costs) x (Present Worth Factor)]

$$PWF\ 5\ years = \frac{(1+.05)^5 - 1}{(.05)(1+.05)^5} = 4.33$$

PWF 10 yrs = 7.72
PWF 3 yrs = 2.72
PWF 2 yrs = 1.86

MacDill AFB, Site 56
Alternative 3

Computed by: JRH 8/4/95
Check by AAM 8/11/95

$$PW = 5{,}000 + 56{,}363 + 70{,}000 + 9{,}833 + 2.72(24{,}464) + 2.72(10{,}310)$$
$$+ 2.72(15{,}435) + 7.72(6{,}270) + 7.72(13{,}750)$$
$$+ 1.86(20{,}299) + 1.86(8{,}470)$$
$$= \boxed{\$485{,}829.}$$

MacDill AFB Backup Calculations--Site 56

Alternative 3: Groundwater Extraction System

Misc calculations

Number of groundwater extraction wells:		
Number of wells:	2	
Depth each:	15	ft
Trench Volume/Area		
Width:	12	in
Depth:	2	ft
Length:	300	ft
Volume:	600	cf
	22	cy
Surface Area:	300	sf
	33	sy

Cost calculations

Description	Unit	Qty.	Unit Price	Subtotal	Total	Source (If applicable)
Well Installation					$ 3,400	
Mobilization	ea	1	$ 1,000	1,000		
Well Installation	ln ft	30	$ 70	2,100		
Soil Disposal	drum	3	$ 100	$ 300		
Equipment Costs					$ 18,000	
Pumps	ea	2	$ 1,500	$ 3,000		
Air Stripper	ea	1	$ 10,000	$ 10,000		
Pump Electronics	ea	2	$ 2,500	$ 5,000		
System Installation					$ 12,749	
Mob/Demob	ea	1	$ 1,000	$ 1,000		
Trenchinga/	cy	10	$ 5.05	$ 51		Means 022 254 0050
Pipe laying	ln ft	300	$ 13.05	$ 3,915		Means 151 701 0550/026 686 2800
Backfill	cy	10	$ 17.20	$ 172		Means 022 204 0600
Compaction	cy	10	$ 5.10	$ 51		Means 022 204 0600
Pavement Base	sy	10	$ 5.25	$ 53		Means 022 308 0100
Reseeding	sy	-	$ 1.91	$ -		Means 029 304 0310
Piping	lf	100	$ 9.30	$ 930		Means 151 551 1880
Mechanical	man hr	20	$ 38.83	$ 777		Means Q-1 crew
Electrical	ls	1	$ 5,000	$ 5,000		
Slab	cy	2	$ 97.00	$ 194		Means 033 130 4700
Building	ea	-	$ 2,000	$ -		
Contingency	%	5%	$ 12,142	$ 607		
Product Hauling /Disposal	load	-	$ -	$ -		Assumed to be free-of-charge

a/ assume piping layed in trench excavated for SVE/bioventing system

Alternative 3: Groundwater Extraction

ndard Rate Schedule (costs inclusive of both bioventing and groundwater extraction systems)

ling Category Cost Code/(Billing Category)	Billing Rate	Task 1 (hrs)	Design & Install Recovey System ($)	System Monitoring/ Task 2 (hrs)	Maintenance ($)	Task 3 (hrs)	Monthly & Annual Reports ($)
Word Processor 88/(15)	$30	50	$1,500	0	$0	25	$750
CADD Operator 58/(25)	$47	60	$2,820	0	$0	10	$470
Technician 42/(50)	$40	60	$2,400	170	$6,800	0	$0
Staff Level 16/(65)	$57	140	$7,980	175	$9,975	140	$7,980
Project Level 12/(70)	$65	80	$5,200	20	$1,300	10	$650
Senior Level 10/(80)	$85	8	$680	0	$0	2	$170
Principal 02/(85)	$97	2	$194	0	$0	0	$0
Total Labor (hrs | $)		400	$20,774	365	$18,075	187	$10,020
ODCs							
Phone			$100		$100		$10
Photocopy			$100		$20		$100
Mail			$100		$120		$40
Computer			$200		$20		$40
CAD			$240		$0		$60
WP			$100		$0		$40
Travel a/			$0		$2,000		$0
Eqpt. & Supplies			$0		$1,500		$0
Total ODCs			$840		$3,760		$290
utside Services							
Well Installation			$3,400		$0		$0
Recovery System Installation			$12,749		$0		$0
Equipment Costs			$18,000		$0		$0
Product Hauling/Disposal			$0		$0		$0
Electrical Costs			$0		$229		$0
Laboratory Fees b/			$600		$2,400		$0
Other			$0		$0		$0
Total Outside Services			$34,749		$2,629		$0

Estimate	Task 1	Task 2	Task 3
Labor	$20,774	$18,075	$10,020
ODC's	$840	$3,760	$290
Outside Services	$34,749	$2,629	$0
Total by Task	$56,363	$24,464	$10,310

Total Labor	$48,869
Total ODCs	$4,890
Total Outside Services	$37,377
Total Project	$91,136

a/ 1 roundtrip from Denver @ $1,000; 52 local trips @ $10; 5 days per diem @ $90.

b/ 2 BTEX/month x 12 months @ $90 each + misc.

sk 1: LNAPL Recovery System Design and Construction
k 2: Monthly Site Time and Travel Costs (per year)
Task 3: Report Preparation

Alternative 3: Groundwater Extraction

ıdard Rate Schedule (costs inclusive of groundwater extraction system only)

ıing Category Cost Code/(Billing Category)	Billing Rate	Task 1 (hrs)	Design & Install Recovery System ($)	Task 2 (hrs)	System Monitoring/ Maintenance ($)	Task 3 (hrs)	Monthly & Annual Reports ($)
Word Processor 88/(15)	$30	0	$0	0	$0	20	$600
CADD Operator 58/(25)	$47	0	$0	0	$0	8	$376
Technician 42/(50)	$40	0	$0	130	$5,200	0	$0
Staff Level 16/(65)	$57	0	$0	130	$7,410	112	$6,384
Project Level 12/(70)	$65	0	$0	20	$1,300	10	$650
Senior Level 10/(80)	$85	0	$0	0	$0	2	$170
Principal 02/(85)	$97	0	$0	0	$0	0	$0
Total Labor (hrs|$)		0	$0	280	$13,910	152	$8,180
ODCs							
Phone			$0		$100		$10
Photocopy			$0		$20		$100
Mail			$0		$120		$40
Computer			$0		$20		$40
CAD			$0		$0		$60
WP			$0		$0		$40
Travel a/			$0		$2,000		$0
Eqpt. & Supplies			$0		$1,500		$0
Total ODCs			$0		$3,760		$290
ıtside Services							
Well Installation			$0		$0		$0
Recovery System Installation			$0		$0		$0
Equipment Costs			$0		$0		$0
Product Hauling/Disposal			$0		$0		$0
Electrical Costs			$0		$229		$0
Laboratory Fees b/			$0		$2,400		$0
Other			$0		$0		$0
Total Outside Services			$0		$2,629		$0

Estimate	Task 1	Task 2	Task 3
Labor	$0	$13,910	$8,180
ODC's	$0	$3,760	$290
Outside Services	$0	$2,629	$0
Total by Task	$0	$20,299	$8,470

Total Labor	$22,090
Total ODCs	$4,050
Total Outside Services	$2,629
Total Project	$28,769

a/ 1 roundtrip from Denver @ $1,000; 52 local trips @ $10; 5 days per diem @ $90.

b/ 2 BTEX/month x 12 months @ $90 each + misc.

ık 1: LNAPL Recovery System Design and Construction
k 2: Monthly Site Time and Travel Costs (per year)
Task 3: Report Preparation

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QuickFlow
Analytical Model of 2D Ground-Water Flow

Developed by

James O. Rumbaugh, III

(c) 1991 Geraghty & Miller, Inc.

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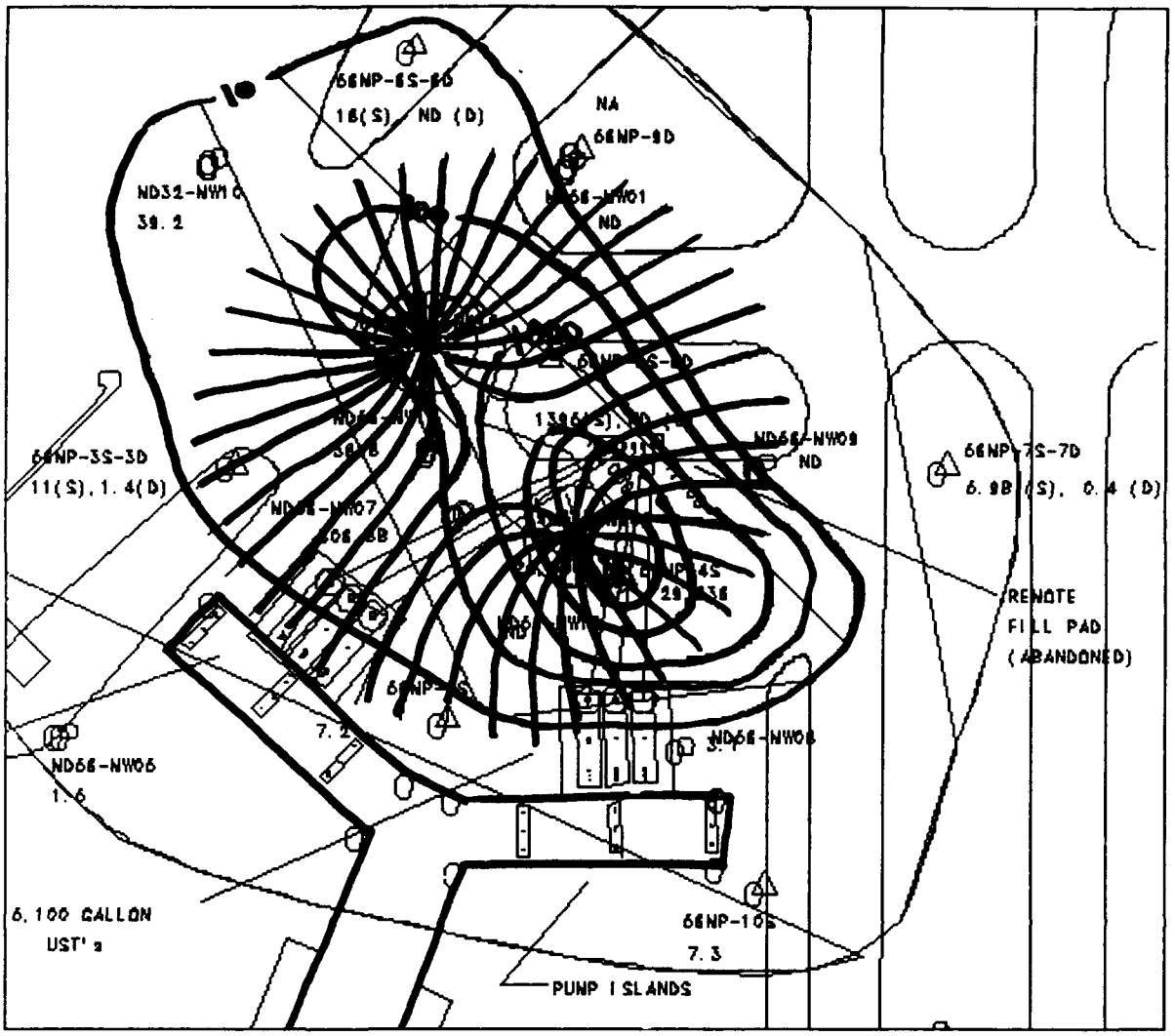
Date: 8/23/1995
Time: 17:35:49.36

Input File: 56-1.qfl
Map File : btexflow.map

Aquifer Properties

.... Steady-State Flow Model ....

Permeability.....= 20.000000 [L/T] (ft/day)
Porosity.....= 0.250000
Elevation of Aquifer Top....= 2.400000 (ft msl)
Elevation of Aquifer Bottom.= -7.600000 (ft msl)
Uniform Regional Gradient...= 0.002000
Angle of Uniform Gradient...= 138.609695
Recharge.....= 0.000000



Two-well groundwater extraction system showing particle traces (streamlines) and total BTEx isopletls.

56-1.QFL