Texaco Inc.

Universal City California

Final Remedial Investigation Report, Texaco Fillmore Facility

ENSR Consulting and Engineering

June 1991

Document Number 6608-047-900

Final Remedial Investigation Report, Texaco Fillmore Facility

ENSR Document No. 6600-047-900
June 1991

Prepared for

Texaco Inc.
Universal City, California

ENSR Consulting and Engineering
1220 Avenida Acaso
Camarillo, California 93012

Environment and
Product Safety
Department
Western Regional Office

Texaco Inc

10 Universal City Plaza
Universal City CA 91608-1097
818 505 2636
818 505 2833 Fax

June 27, 1991

Mr. Michael M. Montgomery
U.S. EPA - Region IX
Hazardous Waste Management Division
Superfund Branch/Enforcement Response Section
75 Hawthorne Street
San Francisco, CA 94105

Re: Texaco Fillmore Site

Dear Mr. Montgomery:

Enclosed is the report entitled "Remedial Investigation Report, Texaco Fillmore Site".

We believe the information contained in this document meets the suggestions you have provided in addition to the requirements of the various CERCLA guidance documents.

Sincerely,

Glenn R. Anderson
Environmental Associate

GRA:tw
Attachments

cc: Terry Foreman, CH2M Hill
Amancio Sycip, CADHS-LA
Jim Ross, LARWQCB

A:GRA62601

CONTENTS

1.0 INTRODUCTION 1-1
1.1 Purpose of Report 1-1
1.2 Project Background 1-1
1.3 Potential Source Areas 1-5
1.4 Previous Investigations 1-7
1.5 RI Goals and Objectives 1-8
1.5.1 Subsurface Soils 1-8
1.5.2 Groundwater 1-9
1.5.3 Surface Soils 1-9
1.5.4 Surface Water/Stream Sediment 1-9
1.5.5 Air 1-9
1.6 Scope of RI Activities 1-10
1.6.1 Subsurface Soils 1-10
1.6.2 Groundwater 1-10
1.6.3 Surface Soils 1-11
1.6.4 Surface Water/Stream Sediments 1-11
1.6.5 Air 1-12
1.7 Report Organization 1-12

2.0 STUDY AREA INVESTIGATION 2-1
2.1 Facility Setting 2-1
2.2 Scope of Field Activities 2-2
2.2.1 Subsurface Soils 2-2
2.2.1.1 Borehole Drilling 2-2
2.2.1.2 Soil Gas Investigation 2-4
2.2.2 Groundwater Investigation 2-4
2.2.2.1 Monitoring Well Drilling and Installation 2-10
2.2.2.2 Water Level Measurements 2-12
2.2.2.3 Groundwater Sampling 2-16
2.2.2.4 Aquifer Characteristics 2-19
2.2.2.5 Slug Tests 2-19
2.2.2.6 Network Sampling 2-20
2.2.2.7 Private Well Investigation 2-20
2.2.3 Surface Soils 2-23
2.2.4 Surface Water and Stream Sediment Investigation 2-25

CONTENTS
(Cont'd)

2.2.4.1 Presampling Reconnaissance 2-25
2.2.4.2 Surface Water Sampling 2-26
2.2.4.3 Stream Sediment Sampling 2-27
2.2.5 Ambient Air 2-29
2.2.5.1 Meteorological Sampling 2-29
2.2.5.2 Directional Sampling 2-30
2.2.5.3 Integrated Surface Sampling 2-31
2.3 Field Procedures 2-31
2.3.1 Health and Safety Requirements 2-31
2.3.1.1 Worker Protection 2-32
2.3.1.2 Health and Safety Monitoring Equipment 2-32
2.3.1.3 Community Monitoring 2-33
2.3.2 Decontamination of Drilling and Sampling Equipment 2-33
2.3.3 Borehole and Well Drilling Procedures 2-34
2.3.3.1 Drilling Methods 2-34
2.3.3.2 Borehole Termination 2-34
2.3.4 Subsurface Soil Sampling Procedures 2-35
2.3.4.1 Lithologic Logging 2-36
2.3.4.2 Ambient Temperature Headspace Monitoring 2-36
2.3.4.3 pH 2-36
2.3.5 Groundwater Sampling Procedures 2-36
2.3.6 Surface Soil Sampling Procedures 2-37
2.3.7 Surface Water/Stream Sediment Sampling Procedures 2-37
2.3.8 Ambient Air Sampling Procedures 2-37
2.3.8.1 PM_{10} Samplers 2-37
2.3.8.2 Volatile Organic Sampling Array 2-38
2.3.9 Sample Documentation 2-38
2.3.9.1 Field Logbook 2-38
2.3.9.2 Labels and Seals 2-39
2.3.9.3 Chain of Custody 2-39
2.3.9.4 Hazardous Materials Disposal 2-39

3.0 PHYSICAL CHARACTERISTICS OF THE STUDY AREA 3-1
3.1 Surface Soils 3-1
3.2 Geology 3-1

CONTENTS
(Cont'd)

3.2.1 Regional Geology . . . 3-2
3.2.1.1 Stratigraphy . . . 3-2
3.2.1.2 Structure . . . 3-8
3.2.1.3 Possible Impacts of the Area Geology on the Texaco Facility . . . 3-11
3.2.2 Facility Stratigraphy . . . 3-11
3.2.2.1 Depositional Setting . . . 3-11
3.2.2.2 Sediment Textures . . . 3-12
3.2.2.3 Soil Units . . . 3-12
3.2.2.4 Summary . . . 3-14
3.3 Hydrogeology . . . 3-16
3.3.1 Regional Hydrogeology . . . 3-16
3.3.2 Facility Hydrologic Units . . . 3-21
3.3.2.1 Perched Zone . . . 3-21
3.3.2.2 Aquifer 1 . . . 3-22
3.3.2.3 Aquifer 2 . . . 3-23
3.3.3 Hydrogeologic Properties . . . 3-24
3.3.3.1 General Discussion . . . 3-24
3.3.3.2 Aquifer Characteristics . . . 3-25
3.3.4 Groundwater Levels . . . 3-26
3.3.4.1 Perched Zone . . . 3-30
3.3.4.2 Aquifer 1 . . . 3-30
3.3.4.3 Aquifer 2 . . . 3-31
3.3.5 Aquifer Relationships . . . 3-31
3.3.5.1 Presence of Two Aquifers . . . 3-31
3.3.5.2 Connection of Aquifers . . . 3-33
3.3.5.3 Location of Aquifer Connection . . . 3-33
3.3.5.4 Vertical Transport Pressures . . . 3-34

4.0 RESULTS OF FACILITY CHEMICAL CHARACTERIZATION . . . 4-1
4.1 Subsurface Soil . . . 4-1
4.1.1 Chemical Analyses . . . 4-1
4.1.1.1 Laboratory Screening Analyses . . . 4-2
4.1.1.2 TCLP Analyses . . . 4-2
4.1.1.3 Total Organic Analyses . . . 4-2

CONTENTS
(Cont'd)

4.1.2 Data Discussion and Presentation 4-5
4.1.3 Total Petroleum Hydrocarbons 4-6
4.1.4 Volatile Organic Compounds (VOCs) 4-13
4.1.4.1 Total VOC Analyses 4-13
4.1.4.2 TCLP VOC Analyses 4-22
4.1.5 Semivolatile Organic Compounds (SVOCs) 4-52
4.1.5.1 Total SVOC Analyses 4-52
4.1.5.2 TCLP SVOC Analyses 4-60
4.1.6 Inorganic Compounds (Metals) 4-74
4.1.6.1 Site Background Levels 4-74
4.1.6.2 Published Regional Background Levels 4-75
4.1.6.3 Arsenic 4-77
4.1.6.4 Barium 4-88
4.1.6.5 Cadmium 4-121
4.1.6.6 Chromium 4-134
4.1.6.7 Lead 4-157
4.1.6.8 Copper 4-182
4.1.6.9 Nickel 4-182
4.1.6.10 Vanadium 4-182
4.1.6.11 Organic Lead 4-214
4.1.7 pH 4-214
4.1.8 Summary 4-214
4.2 Groundwater 4-230
4.2.1 Chemical Analyses 4-230
4.2.2 Perched Zone Wells Analytical Results 4-232
4.2.2.1 TPH Analyses 4-232
4.2.2.2 VOC Analyses 4-232
4.2.2.3 SVOC Analyses 4-234
4.2.2.4 Inorganic Analyses 4-234
4.2.3 Aquifer 1 Wells Analytical Results 4-234
4.2.3.1 TPH Analyses 4-234
4.2.3.2 VOC Analyses 4-251
4.2.3.3 SVOC Analyses 4-252
4.2.3.4 Inorganic Analyses (metals) 4-252
4.2.4 Aquifer 2 Analytical Results 4-252

CONTENTS
(Cont'd)

4.2.4.1 TPH Analyses 4-261
4.2.4.2 VOC Analyses 4-261
4.2.4.3 SVOC Analyses 4-261
4.2.4.4 Inorganic Analyses (metals) 4-262
4.2.5 Private Well Water Analyses 4-262
4.2.6 Historic Groundwater Quality Data 4-262
4.2.6.1 Regional Water Quality 4-262
4.2.6.2 Site Water Quality 4-262
4.2.7 Offsite Contamination - Ultramar Station 751 4-315
4.2.7.1 Groundwater Elevation and Gradients 4-315
4.2.7.2 Groundwater Analyses Results 4-316
4.2.7.3 Soil Analyses Results 4-316
4.2.8 Summary and Conclusions 4-316
4.2.8.1 Perched Zone 4-328
4.2.8.2 Aquifer 1 4-328
4.2.8.3 Aquifer 2 4-330
4.3 Surface Soil Chemical Analysis Results 4-330
4.3.1 Results of Surface Soil Chemical Analysis 4-330
4.3.1.1 Chemical Analyses 4-340
4.3.1.2 Inorganic Analyses (metals) 4-340
4.3.2 Results of Surface Soil Sieve Analysis 4-341
4.3.3 Summary and Conclusions 4-343
4.4 Soil Gas 4-343
4.4.1 Summary of Soil Gas Survey Field Sampling Results 4-344
4.4.2 Summary of Air Well Sampling Results 4-344
4.4.3 Relationship of Soil Gas Survey Results to Other Media 4-344
4.4.4 Comparison of Soil Gas Measurements and Surface Soil Sampling Results 4-345
4.4.5 Comparison of Soil Gas Measurements and Subsurface Soil Sampling Results 4-346
4.4.6 Comparison of Soil Gas Measurements and Air Well Sampling Results 4-346
4.4.7 Conclusions 4-352
4.5 Surface Water/Stream Sediments 4-352
4.5.1 Chemical Analysis 4-352

CONTENTS
(Cont'd)

4.5.2 Results of Surface Water Analyses 4-353
4.5.2.1 Organic Compounds 4-353
4.5.2.2 Metals 4-353
4.5.3 Results of Stream Sediment Chemical Analyses 4-355
4.5.3.1 Organic Compounds 4-355
4.5.3.2 Metals 4-357
4.5.4 Summary and Conclusions 4-357
4.6 Ambient Air 4-358
4.6.1 Chemical Analysis Results 4-358
4.6.2 Semivolatile Analysis 4-358
4.6.3 Volatile Analysis 4-358
4.6.4 Integrated Surface Sampling 4-371
4.7 Data Validation 4-371
4.7.1 Overall Precision and Accuracy 4-376
4.7.2 Completeness 4-376
4.7.3 Laboratory Errata 4-379
4.8 Summary of Nature and Extent of Chemical Constituents 4-380
4.8.1 VOCs 4-380
4.8.2 Semivolatiles 4-383
4.8.3 Metals 4-384
4.8.4 Conclusions 4-385

5.0 CHEMICAL CONSTITUENT FATE AND TRANSPORT 5-1
5.1 Introduction 5-1
5.2 Persistence 5-1
5.3 Migration 5-2
5.4 Potential Sources 5-4
5.5 Potential Migration Pathways 5-6
5.5.1 Main Waste Pit Plume 5-7
5.5.2 Southern Plume 5-8

CONTENTS
(Cont'd)

6.0 SUMMARY AND RECOMMENDATIONS 6-1
6.1 Nature and Extent of Chemical Constituents 6-1
6.2 Summary of Fate and Transport of Chemical Constituents 6-3
6.3 Summary of Risk Assessment 6-4
6.4 Summary of Recommendations 6-5

APPENDICES

A LABORATORY RESULTS
B SOIL BORING LOGS
C MONITORING WELL CONSTRUCTION DIAGRAMS
D METEOROLOGICAL AUDIT
E METEOROLOGICAL DATA
F AIR SAMPLING CALIBRATION DATA
G SEMI-LOG PLOT AND TIME DRAWDOWN MEASUREMENTS
H ULTRAMAR HISTORICAL BTEX DATA
I TRIHYDRO SOIL GAS SURVEY DATA
J DATA VALIDATION REPORTS
K LABORATORY ERRATA

LIST OF TABLES

1-1	Historical Refinery Waste Streams	1-6
2-1	Borehole Drilling and Sampling Summary - Phase I	2-5
2-2	Borehole Drilling and Sampling Summary - Phase II	2-9
2-3	Well Installation and Development Data Summary	2-13
2-4	Summary of August 1990 Monitoring Well Sampling	2-14
2-5	Summary of September - October 1990 Monitoring Well Sampling	2-15
2-6	Summary of January 1991 Monitoring Well Sampling	2-17
2-7	Summary of May 1991 Monitoring Well Sampling	2-18
2-8	Summary of Private Wells Included in Network Sampling	2-22
3-1	Age Correlation Chart	3-5
3-2	Local Stratigraphic Column	3-6
3-3	Perched Water Encounters	3-23
3-4	Historical Groundwater Surface Elevations - Monitoring Wells MW-6S and MW-10P	3-27
3-5	Groundwater Surface Elevations (in feet above msl)	3-28
3-6	Aquifer Comparison Data at Monitoring Well Locations 22 and 25	3-32
3-7	Hydrogeologic Parameters	3-35
4-1	Analytical Methods for Subsurface Soil Samples	4-3
4-2	Toxicity Characteristic Leaching Procedure (TCLP) Threshold Level for Subsurface Soil Investigation	4-4
4-3	Total Petroleum Hydrocarbons Concentrations - Subsurface Soil	4-7
4-4	Samples Selected for TCLP Organic Analysis	4-14
4-5	EPA 8240 Volatile Analysis - Subsurface Soil	4-17
4-6	TCLP Benzene - Subsurface Soil	4-23
4-7	TCLP EDB - Subsurface Soil	4-31
4-8	TCLP Ethylbenzene - Subsurface Soil	4-36
4-9	TCLP Toluene - Subsurface Soil	4-41
4-10	TCLP Xylenes - Subsurface Soil	4-46
4-11	TCLP EPA 8240 Volatile Analysis - All Regions	4-53
4-12	TCLP Tentatively Identified Volatile Organic Compounds (TIC) - Subsurface Soil	4-54
4-13	EPA 8270 Semivolatile Analysis - Subsurface Soil - All Regions	4-59
4-14	TCLP 2,4-Dimethylphenol - Subsurface Soil	4-61
4-15	TCLP EPA 8270 Semivolatile Analysis - Main Waste Pit Region	4-66
4-16	TCLP Tentatively Identified Semivolatile Organic Compounds (TIC) - Subsurface Soil	4-69

LIST OF TABLES
(Cont'd)

4-17	Background Samples Results - Subsurface Soil	4-76
4-18	Total Arsenic - Subsurface Soil	4-78
4-19	Samples Selected for TCLP Arsenic Analysis	4-85
4-20	TCLP Arsenic - Subsurface Soil	4-89
4-21	Total Barium - Subsurface Soil	4-94
4-22	Samples Selected for TCLP Barium Analysis	4-102
4-23	TCLP Barium - Subsurface Soil	4-105
4-24	Total Cadmium - Subsurface Soil	4-123
4-25	Samples Selected for TCLP Cadmium Analysis	4-131
4-26	TCLP Cadmium - Subsurface Soil	4-135
4-27	Total Chromium - Subsurface Soil	4-150
4-28	Samples Selected for TCLP Chromium Analysis	4-158
4-29	TCLP Chromium - Subsurface Soil	4-161
4-30	Total Lead - Subsurface Soil	4-166
4-31	Samples Selected for TCLP Lead Analysis	4-173
4-32	TCLP Lead - Subsurface Soil	4-176
4-33	Total Copper - Subsurface Soil	4-183
4-34	TCLP Copper - Subsurface Soil	4-190
4-35	Total Nickel - Subsurface Soil	4-195
4-36	TCLP Nickel - Subsurface Soil	4-202
4-37	Total Vanadium - Subsurface Soil	4-207
4-38	TCLP Vanadium - Subsurface Soil	4-215
4-39	Total Organic Lead - Subsurface Soil	4-220
4-40	pH - Subsurface Soil	4-225
4-41	Distribution and Sampling Chronology of Texaco Fillmore Site - Active Monitoring Well Network During RI	4-231
4-42	Groundwater Chemical Analyses for MW-10P (Perched Zone)	4-233
4-43	Groundwater Chemical Analyses for MW-6S (Aquifer 1)	4-235
4-44	Groundwater Chemical Analyses for MW-8S (Aquifer 1)	4-236
4-45	Groundwater Chemical Analyses for MW-11S (Aquifer 1)	4-237
4-46	Groundwater Chemical Analyses for MW-18S (Aquifer 1)	4-238
4-47	Groundwater Chemical Analyses for MW-19S (Aquifer 1)	4-239
4-48	Groundwater Chemical Analyses for MW-20S (Aquifer 1)	4-240
4-49	Groundwater Chemical Analyses for MW-21S (Aquifer 1)	4-241
4-50	Groundwater Chemical Analyses for MW-22S (Aquifer 1)	4-242

LIST OF TABLES
(Cont'd)

4-51	Groundwater Chemical Analyses for MW-25S (Aquifer 1)	4-243
4-52	Groundwater Chemical Analyses for MW-26S (Aquifer 1)	4-244
4-53	Groundwater Chemical Analyses for MW-27S (Aquifer 1)	4-245
4-54	Groundwater Chemical Analyses for MW-28S (Aquifer 1)	4-246
4-55	Groundwater Chemical Analyses for MW-29S (Aquifer 1)	4-247
4-56	Groundwater Chemical Analyses for MW-30S (Aquifer 1)	4-248
4-57	Groundwater Chemical Analyses for MW-32S (Aquifer 1)	4-249
4-58	Groundwater Chemical Analyses for MW-34S (Aquifer 1)	4-250
4-59	Groundwater Chemical Analyses for MW-16D (Aquifer 2)	4-253
4-60	Groundwater Chemical Analyses for MW-22D (Aquifer 2)	4-254
4-61	Groundwater Chemical Analyses for MW-23D (Aquifer 2)	4-255
4-62	Groundwater Chemical Analyses for MW-24D (Aquifer 2)	4-256
4-63	Groundwater Chemical Analyses for MW-25D (Aquifer 2)	4-257
4-64	Groundwater Chemical Analyses for MW-29D (Aquifer 2)	4-258
4-65	Groundwater Chemical Analyses for MW-31D (Aquifer 2)	4-259
4-66	Groundwater Chemical Analyses for MW-33D (Aquifer 2)	4-260
4-67	Private Well Laboratory Analysis Results	4-263
4-68	Historical Volatile Organics Groundwater Analytical Data (Aquifer 1)	4-265
4-69	Inorganic Groundwater Quality Data - January 1986 to May 1990	4-274
4-70	Groundwater Chemical Analyses for Ultramar MW-9 (Aquifer 1)	4-317
4-71	Groundwater Chemical Analyses for Ultramar MW-10 (Aquifer)	4-318
4-72	Average Benzene Concentrations for Aquifer 1 Monitoring Wells 1987-1990	4-329
4-73	Surface Soil Sample Laboratory Results - Areas of No Past Acitvity - Background	4-331
4-74	Surface Soil Sample Laboratory Results - Areas of Suspected Past Activity	4-333
4-75	Surface Soil Sample Laboratory Results for Metals - Known Waste Disposal Areas	4-336
4-76	Surface Soil Sample Sieve Results (PM_{10} - ASTM 422	4-342
4-77	Surface Water Analytical Results - Pole Creek - March 2 and 5, 1991	4-354
4-78	Creek Sediment Analytical Results - Pole Creek - July 24, 1990	4-356
4-79	Ambient Concentrations - Metals	4-359
4-80	Ambient Concentrations - Metals Blank Values	4-360
4-81	Ambient Concentrations - Semivolatiles	4-361
4-82	Ambient Concentrations - Semivolatiles Blank Values	4-364
4-83	Ambient Concentrations - VOC/GCMS	4-367

LIST OF TABLES
(Cont'd)

4-84	Ambient Concentrations - VOC/GCMS Blank Values	4-369
4-85	Ambient Concentrations - Semivolatile Values	4-372
4-86	Ambient Concentrations - VOC/GCMS Values	4-374
4-87	Percent of Samples that Underwent Duplicate and MS/MSD Analyses	4-377
4-88	Percent Completeness of Organic Indicator Compounds	4-378
4-89	Multimedia Matrix of Organic Compounds	4-381
5-1	Half-Lifes of Benzene and Other Selected Alkyl Benzene Compounds in Various Media	5-3

LIST OF FIGURES

1-1 Location Map, Fillmore Facility 1-2
1-2 City of Fillmore Site Location and Topographic Map 1-3
2-1 Dual Wall Reverse-Circulation Method 2-3
2-2 Schematic Monitoring Well Completion Diagram 2-11
2-3 Private Wells Selected for Sampling 2-21
2-4 Stream Sediment Sample Location 2-28
3-1 Oil and Tar Sand Location Map 3-3
3-2 Regional Structure Map 3-7
3-3 Local Structural Map 3-10
3-4 Groundwater Basin Water Levels 3-17
3-5 Historical Groundwater Surface Elevations Near the Texaco Fillmore Facility 3-18
3-6 Historical Rainfall Records for Santa Clara River Drainage 3-19
4-1 Total Petroleum Hydrocarbons - Subsurface Soil - Main Waste Pit Region 4-11
4-2 Total Petroleum Hydrocarbons - Subsurface Soil - Excluding Main Waste Pit Region 4-12
4-3 Distribution of Samples Selected for TCLP Organic Analysis by Waste Pit 4-15
4-4 Distribution of Samples Selected for TCLP Organic Analysis for All Pits 4-16
4-5 TCLP Benzene - Subsurface Soil - Main Waste Pit Region 4-29
4-6 TCLP Benzene - Subsurface Soil - Excluding Main Waste Pit Region 4-30
4-7 TCLP Xylenes - Subsurface Soil 4-51
4-8 Total Arsenic - Subsurface Soil - Main Waste Pit Region 4-83
4-9 Total Arsenic - Subsurface Soil - Excluding Main Waste Pit Region 4-84
4-10 Distribution of Samples Selected for TCLP Arsenic Analysis by Waste Pit 4-86
4-11 Distribution of Samples Selected for TCLP Arsenic Analysis for All Pits 4-87
4-12 Total Barium - Subsurface Soil - Main Waste Pit Region 4-99
4-13 Total Barium - Subsurface Soil - Excluding Main Waste Pit Region 4-100
4-14 Total Barium Concentration 4-101
4-15 Distribution of Samples Selected for TCLP Barium Analysis by Waste Pit 4-103
4-16 Distribution of Samples Selected for TCLP Barium Analysis for All Pits 4-104
4-17 TCLP Barium - Subsurface Soil - Main Waste Pit 4-110
4-18 TCLP Barium - Subsurface Soil - Main Waste Pit 4-111
4-19 TCLP Barium - Subsurface Soil - Main Waste Pit 4-112
4-20 TCLP Barium - Subsurface Soil - Main Waste Pit 4-113
4-21 TCLP Barium - Subsurface Soil - Excluding Main Waste Pit Region 4-114
4-22 TCLP Barium - Subsurface Soil - Excluding Main Waste Pit Region 4-115
4-23 TCLP Barium - Subsurface Soil - Excluding Main Waste Pit Region 4-116

LIST OF FIGURES
(Cont'd)

4-24	TCLP Barium - Subsurface Soil - Excluding Main Waste Pit Region	4-117
4-25	TCLP Barium - Subsurface Soil - Excluding Main Waste Pit Region	4-118
4-26	TCLP Barium - Subsurface Soil - Excluding Main Waste Pit Region	4-119
4-27	TCLP Barium Concentration	4-120
4-28	Total Barium versus Barium TCLP - All Regions	4-122
4-29	Total Cadmium - Subsurface Soil - Main Waste Pit Region	4-128
4-30	Total Cadmium - Subsurface Soils - Excluding Main Waste Pit Region	4-129
4-31	Total Cadmium Concentrations	4-130
4-32	Distribution of Samples Selected for TCLP Cadmium Analysis by Waste Pit	4-132
4-33	Distribution of Samples Selected for TCLP Cadmium Analysis for All Pits	4-133
4-34	TCLP Cadmium - Subsurface Soil - Main Waste Pit Region	4-140
4-35	TCLP Cadmium - Subsurface Soil - Main Waste Pit Region	4-141
4-36	TCLP Cadmium - Subsurface Soil - Main Waste Pit Region	4-142
4-37	TCLP Cadmium - Subsurface Soil - Main Waste Pit Region	4-143
4-38	TCLP Cadmium - Subsurface Soil - Excluding Main Waste Pit Region	4-144
4-39	TCLP Cadmium - Subsurface Soil - Excluding Main Waste Pit Region	4-145
4-40	TCLP Cadmium - Subsurface Soil - Excluding Main Waste Pit Region	4-146
4-41	TCLP Cadmium - Subsurface Soil - Excluding Main Waste Pit Region	4-147
4-42	TCLP Cadmium Concentrations	4-148
4-43	Total Cadmium versus Cadmium TCLP - All Regions	4-149
4-44	Total Chromium - Subsurface Soil - Main Waste Pit Region	4-155
4-45	Total Chromium - Subsurface Soil - Excluding Main Waste Pit Region	4-156
4-46	Distribution of Samples Selectged for TCLP Chromium Analysis by Waste Pit	4-159
4-47	Distribution of Samples Selected for TCLP Chromium Analysis for All Pits	4-160
4-48	Total Lead - Subsurface Soil - Main Waste Pit Region	4-171
4-49	Total Lead - Subsurface Soil - Excluding Main Waste Pit Region	4-172
4-50	Distribution of Samples Selected for TCLP Lead Analysis by Waste Pit	4-174
4-51	Distribution of Samples Selected for TCLP Lead Analysis for All Pits	4-175
4-52	TCLP Lead - Subsurface Soil - Excluding Main Waste Pit Region	4-181
4-53	Total Copper - Subsurface Soil - Main Waste Pit Region	4-188
4-54	Total Copper - Subsurface Soil - Excluding Main Waste Pit Region	4-189
4-55	Total Nickel - Subsurface Soil - Main Waste Pit Region	4-200
4-56	Total Nickel - Subsurface Soil - Excluding Main Waste Pit Region	4-201
4-57	Total Vanadium - Subsurface Soil - Main Waste Pit Region	4-212
4-58	Total Vanadium - Subsurface Soil - Excluding Main Waste Pit Region	4-213

LIST OF FIGURES
(Cont'd)

4-59	Benzene Concentrations for MW-10P (Perched Zone)	4-277
4-60	Benzene Concentrations for MW-13P (Perched Zone)	4-278
4-61	Benzene Concentrations for MW-1S (Aquifer 1)	4-279
4-62	Benzene Concentrations for MW-2S (Aquifer 1)	4-280
4-63	Benzene Concentrations for MW-3S (Aquifer 1)	4-281
4-64	Benzene Concentrations for MW-4S (Aquifer 1)	4-282
4-65	Benzene Concentrations for MW-6S (Aquifer 1)	4-283
4-66	Benzene Concentrations for MW-7S (Aquifer 1)	4-284
4-67	Benzene Concentrations in MW-8S (Aquifer 1)	4-285
4-68	Benzene Concentrations for MW-9S (Aquifer 1)	4-286
4-69	Benzene Concentrations for MW-11S (Aquifer 1)	4-287
4-70	Benzene Concentrations for MW-12S (Aquifer 1)	4-288
4-71	Benzene Concentrations for MW-14S (Aquifer 1)	4-289
4-72	Benzene Concentrations for MW-15S (Aquifer 1)	4-290
4-73	Benzene Concentrations for MW-17S (Aquifer 1)	4-291
4-74	Benzene Concentrations for MW-18S (Aquifer 1)	4-292
4-75	Benzene Concentrations in MW-19S (Aquifer 1)	4-293
4-76	Benzene Concentrations for MW-20S (Aquifer 1)	4-294
4-77	Benzene Concentrations for MW-21S (Aquifer 1)	4-295
4-78	Benzene Concentrations for MW-22S (Aquifer 1)	4-296
4-79	Benzene Concentrations in MW-25S (Aquifer 1)	4-297
4-80	Benzene Concentrations in MW-26S (Aquifer 1)	4-298
4-81	Benzene Concentrations in MW-27S (Aquifer 1)	4-299
4-82	Benzene Concentrations in MW-28S (Aquifer 1)	4-300
4-83	Benzene Concentrations in MW-29S (Aquifer 1)	4-301
4-84	Benzene Concentrations in MW-30S (Aquifer 1)	4-302
4-85	Benzene Concentrations in MW-32S (Aquifer 1)	4-303
4-86	Benzene Concentrations for MW-34S (Aquifer 1)	4-304
4-87	Benzene Concentrations for MW-P-2S (Aquifer 1)	4-305
4-88	Benzene Concentrations for MW-5D (Aquifer 2)	4-306
4-89	Benzene Concentrations for MW-16D (Aquifer 2)	4-307
4-90	Benzene Concentrations for MW-22D (Aquifer 2)	4-308
4-91	Benzene Concentrations for MW-23D (Aquifer 2)	4-309
4-92	Benzene Concentrations for MW-24D (Aquifer 2)	4-310
4-93	Benzene Concentrations for MW-25D (Aquifer 2)	4-311

LIST OF FIGURES
(Cont'd)

4-94	Benzene Concentrations for MW-29D (Aquifer 2)	4-312
4-95	Benzene Concentrations for MW-31D (Aquifer 2)	4-313
4-96	Benzene Concentrations for MW-33D (Aquifer 2)	4-314
4-97	Benzene Concentrations for ULT-MW-2 (Aquifer 1)	4-319
4-98	Benzene Concentrations for ULT-MW-3 (Aquifer 1)	4-320
4-99	Benzene Concentrations for ULTM-MW-5 (Aquifer 1)	4-321
4-100	Benzene Concentrations for ULT-MW-7 (Aquifer 1)	4-322
4-101	Benzene Concentrations for ULT-MW-7 (Aquifer 1)	4-323
4-102	Benzene Concentrations for ULT-MW-8 (Aquifer 1)	4-324
4-103	Benzene Concentrations for ULTM-MW-9 (Aquifer 1)	4-325
4-104	Benzene Concentrations for ULTM-MW-10 (Aquifer 1)	4-326
4-105	Benzene Concentrations for ULTM-MW-11 (Aquifer 1)	4-327
4-106	Surface Soil vs. Soil Gas Data - CLP-Volatiles Concentration	4-347
4-107	Surface Soil vs. Soil Gas Data - CLP-BTEX Conc. vs. VOCs as Benzene	4-348
4-108	Soil Gas Boreholes vs. Soil Gas Data - Average BTEX Conc. in Soil Samples from First 20 Feet of Soil Gas Boreholes	4-349
4-109	Subsurface Boreholes vs. Soil Gas Data - Average TPH Conc., First 20 Feet of Borehole	4-350
4-110	Relationship Between Phase I Soil Gas Measurements and Phase II Air Well Results	4-351
5-1	Schematic Conceptual Model	5-5

LIST OF PLATES

1-1 Historical Map
2-1 Site Topography and Surface Run-off Map
2-2 Water Monitoring Wells and Soil Boreholes Locations
2-3 Surface Soil Sampling Location Map
2-4 Surface Water Sample Location Map
3-1 Structure Contours of Top of the Upper Fine Grained Unit
3-2 Structure Contours of Top of the Lower Fine Grained Unit
3-3 Structure Contours of Bottom of the Lower Fine Grained Unit
3-4 Geologic Cross Sections
3-5 Monitoring Wells Location and Elevation
3-6 Approximate Areas of Perched Zone Water
3-7 Aquifer 1 Saturated Thickness Map
3-8 August 1990 Aquifer 1 Groundwater Surface Elevation Map
3-9 September 1990 Aquifer 1 Groundwater Surface Elevation Map
3-10 January 1991 Aquifer 1 Groundwater Surface Elevation Map
3-11 May 1991 Aquifer 1 Groundwater Surface Elevation Map
3-12 August 1990 Aquifer 2 Groundwater Surface Elevation Map
3-13 September 1990 Aquifer 2 Groundwater Surface Elevation Map
3-14 January 1991 Aquifer 2 Groundwater Surface Elevation Map
3-15 May 1991 Aquifer 2 Groundwater Surface Elevation Map
4-1 September-October 1990 Aquifer 2 Benzene Plume
4-2 January 1991 Aquifer 2 Benzene Plume
4-3 May 1991 Aquifer 2 Benzene Plume
4-4 September-October 1990 Aquifer 1 Benzene Plume
4-5 January 1991 Benzene Plume
4-6 May 1991 Benzene Plume
4-7 Average Benzene Concentration (1986-1990), Aquifer 1 Monitoring Wells
4-8 Soil Gas Survey Locations and Organic Vapor Contour Map

1.0 INTRODUCTION

1.1 Purpose of Report

This report describes the objectives, field methods, results, and conclusions of the Remedial Investigation (RI) for the Texaco Fillmore Facility [also known as Pacific Coast Pipelines (PCPL) Site], located in Fillmore, California. The RI was conducted by ENSR Consulting and Engineering under contract to Texaco Inc.

1.2 Project Background

The Texaco Fillmore facility is located at 67 East Telegraph Road in Ventura County, east of the incorporated areas of the City of Fillmore, California (see Figures 1-1 and 1-2). Between 1910 and 1920, a refinery began operations at the facility and was shut down in February 1950. Following closure, a majority of the facility was dismantled and the remainder converted to a crude oil pumping station.

Texaco has conducted soil and groundwater characterization and remediation activities at the Fillmore facility since 1983. A main waste pit and several other unlined refinery waste disposal areas have been identified onsite, and about 33,000 cubic yards of waste material and degraded soils were removed from these areas. In 1989, the Environmental Protection Agency (EPA) included the facility on the National Priorities List (NPL). The National Contingency Plan (NCP) sets forth procedures and standards for cleanup of CERCLA hazardous waste sites. While reserving its objections to the applicability of CERCLA here, Texaco agreed to conduct this investigation pursuant to the Remedial Investigation/Feasibility Study (RI/FS) process under the NCP.

Pursuant to an EPA Consent Order of November 15, 1989, and the scope of work established in the Texaco Fillmore Facility RI/FS Work Plan dated September 29, 1989 (ENSR Document No. 6600-023-130), Texaco awarded a contract to ENSR to perform the following tasks as part of the RI phase:

- Site Background Summary Report (ENSR Document No. 6600-035-110 dated March 1990). Preparation of a comprehensive review and compilation of historical operations and available data on the local physiological setting and the nature and extent of the alleged problem.

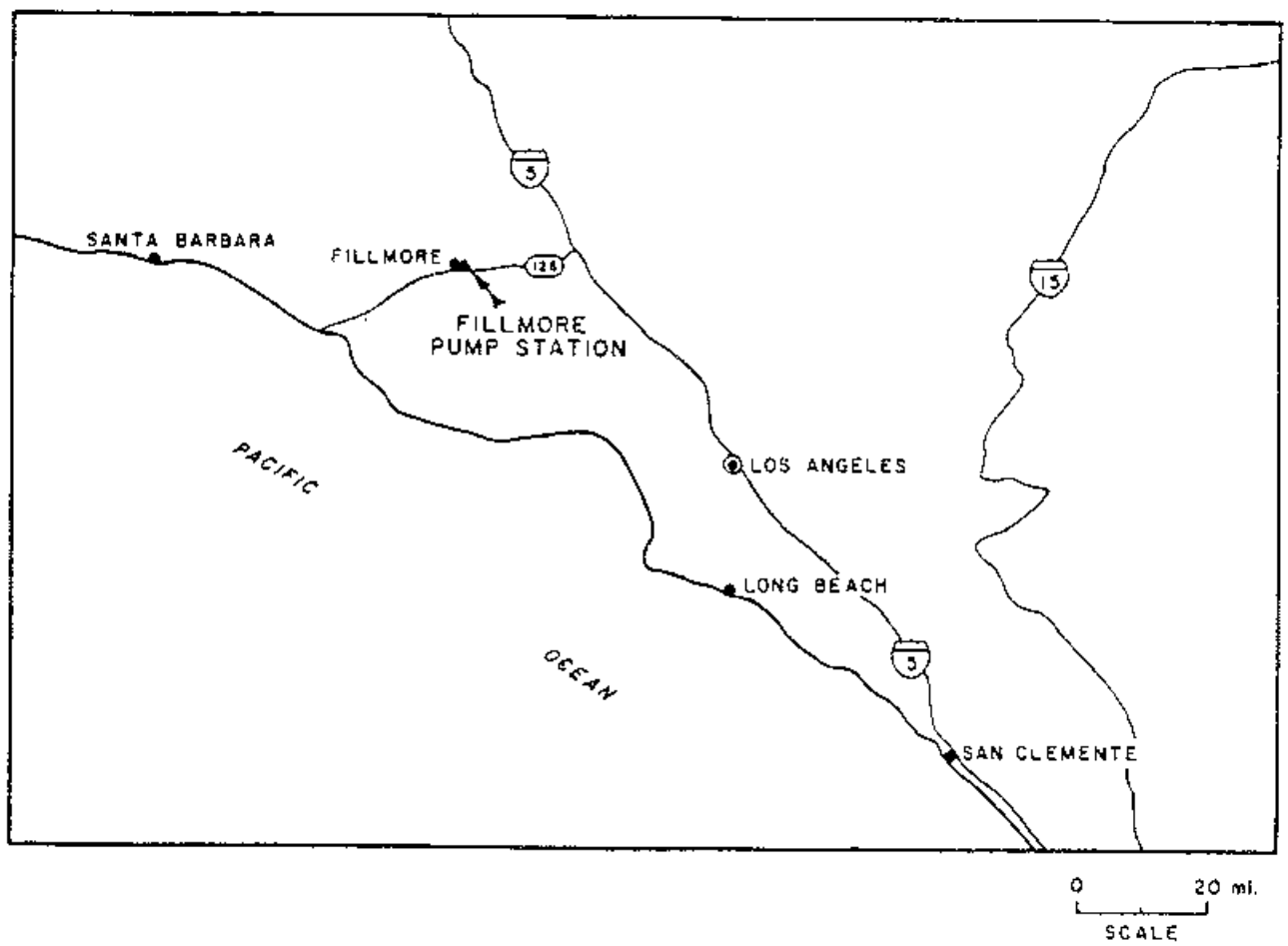


Figure 1-1. Location Map, Fillmore Facility

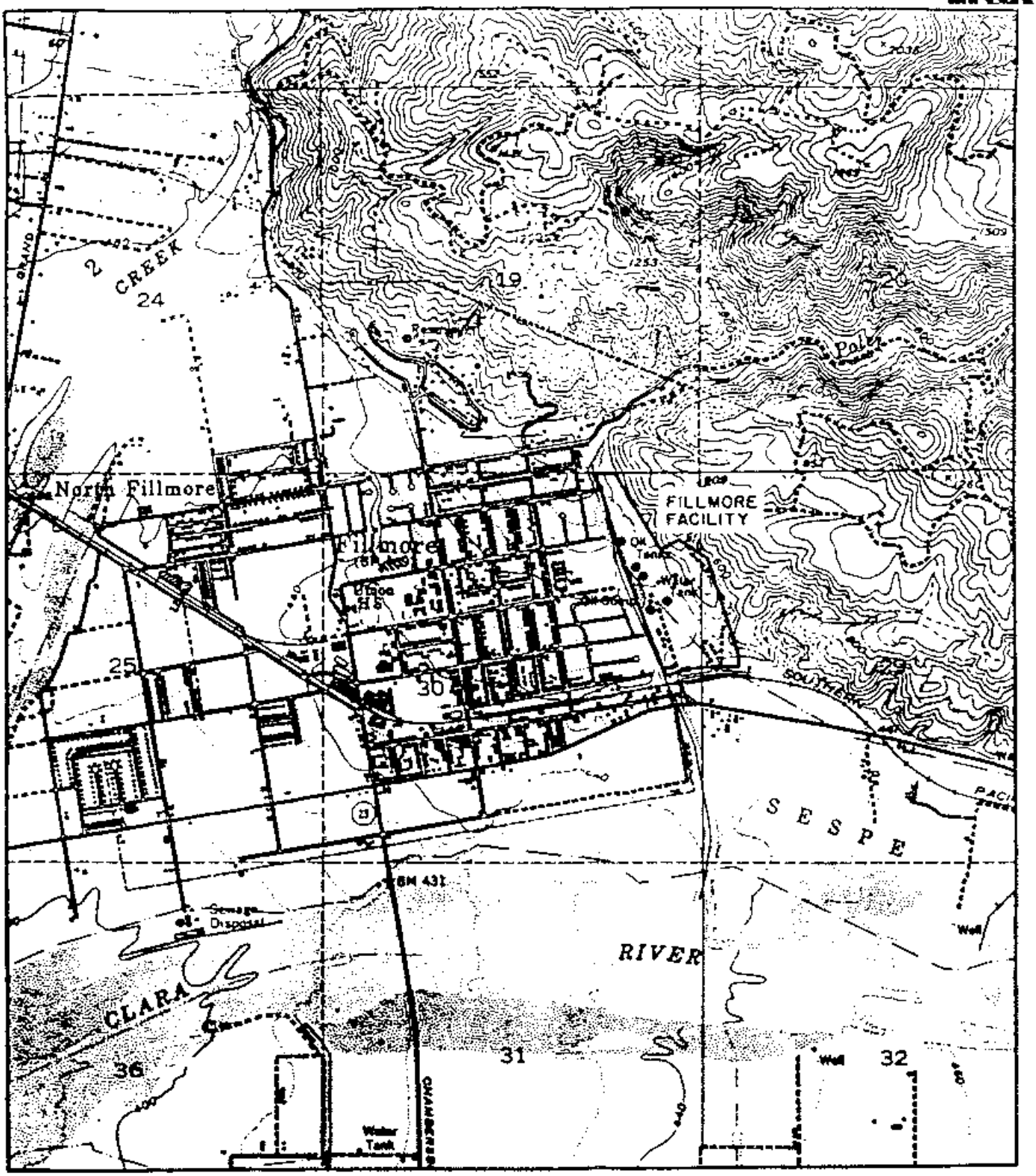


FIGURE 1-2. City of Fillmore Site Location and Topographic Map

0 2000 ft.
SCALE

- Quality Assurance Project Plan (QAPP) (ENSR Document No. 6600-035-130 dated July 1990).

- Field Sampling Plans (FSP) for investigation of each of the following media:

  - Subsurface Soils (ENSR Document No. 6600-035-160)
  - Soil Gas (ENSR Document No. 6600-035-122)
  - Groundwater (ENSR Document No. 6600-035-120)
  - Surface Soils (ENSR Document No. 6600-035-124)
  - Surface Water/Stream Sediments (ENSR Document No. 6600-035-150)
  - Air (ENSR Document No. 6600-035-125)

- Health and Safety Plan (HSP) (ENSR Document No. 6600-035-140)

- Monthly progress reports.

The EPA approved the final QAPP and FSPs in July 1990. Upon EPA approval, Texaco authorized ENSR to proceed with implementing all of the FSPs, except for the soil gas investigation to be conducted by TriHydro Corporation of Laramie, Wyoming. Site RI activities began on July 22, 1990 and continued through May 3, 1991. All projected objectives for the subsurface soil, groundwater, surface soil, stream sediment, air, and soil gas investigations were completed by May 1991 with the exception of laboratory tests of subsurface soil samples for moisture content, permeability, grain size distribution, and nitrogen, phosphorous and potassium. These tests, programmed for Phase II of the subsurface soil sampling program, which was canceled based on the low levels of subsurface soil degradation encountered in the Phase I samples, were primarily intended for site remediation purposes. The need for this data will be re-evaluated based on the results of the baseline risk assessment being conducted by the EPA and addressed in the feasibility study phase of the project.

A number of conference calls and two Technical Steering Committee meetings involving EPA, Texaco Inc., ENSR, TriHydro Corporation, and CH2M Hill (EPA's consultant) took place during the planning and field activity periods. These conference calls and meetings were used to define the original scope of the investigations, monitor progress, review new findings, and agree on the direction of additional work (e.g., discuss the number and location of proposed additional monitoring wells).

The "Draft Remedial Investigation (RI) Report" (ENSR Document No. 6600-047-900) was submitted to the EPA on January 15, 1991, as was agreed to in Administrative Consent Order

No. 90-03. A Technical Steering Committee meeting with EPA, Ventura County Environmental Health Department, Texaco Inc., and ENSR was then held on January 23, 1991 at the County Government Center in Ventura, to discuss the results of field activities and laboratory analyses presented in the Draft RI and the status of Phase II groundwater monitoring activities triggered by Phase I results.

ENSR received EPA comments on the Draft RI Report on March 5, 1991. A meeting was held at EPA Region IX in San Francisco on March 8, 1991 to review and discuss the EPA comments. The meeting was attended by EPA, CH2M Hill, Texaco Inc., and ENSR.

This final RI report incorporates all of the EPA comments, as well as the results of the following post Draft RI Report activities:

- First quarter (January 1991) and second quarter (May 1991) groundwater sampling of the Texaco Fillmore monitoring well network which includes all Phase II monitoring wells, as well as two wells from the Ultramar gas station (May 1991 only) southwest of the site.
- Surface water sampling at the Pole Creek concrete-lined channel conducted during a period of heavy rainfall in the area in March 1991.
- Validation of all CLP QA/QC data based on EPA functional guidelines and input from EPA and CH2M Hill.

Data presented in the final RI reflects data validation per EPA Functional Guidelines, as well as additional quality assurance checks. For this reason, data presented in the final RI supercedes all data presented in the above previously issued reports.

The Final RI Report does not reflect the results of the U.S. EPA Region IX Baseline Risk Assessment for the site, as it is being conducted independently of the RI and will be published as a separate EPA document.

1.3 Potential Source Areas

Little information is available concerning historic activities at the refinery. The 1923 Annual Report of Ventura Consolidated Oil Fields, a predecessor to Texaco at the Fillmore facility, shows that the Fillmore facility processed approximately 1.7 million barrels per year (4,725 barrels per day) during 1922 and 1923. The 1927 Annual Report of CALPET, the immediate predecessor to Texaco at the Fillmore site, states that the Fillmore refinery was "completely equipped for the manufacture of lubricating oils and paraffin wax." Wax plant operations may have been phased out after Texaco's purchase of the plant in 1928 because Texaco had this

production capability at their Port Arthur, Texas refinery. Prior wax plant operations probably did not involve the use of solvents since such use was not common until post-1940.

The refinery was characterized as a single topping plant with some upgrading for thermal cracking of gas oils. Primary products were gasoline (possibly leaded regular and super), diesel, and fuel oil. Texaco likely added or revamped the thermal cracking capacity shortly after acquisition. Drawings for the steam still, absorber, stabilizer, caustic treater, and polymerization units are all dated in the early 1940s. These units may have been added by Texaco in response to the war effort. All other units appear to date from the days of the Ventura Refining Company. Units identified as components of the refinery included: crude pressurization pipe still No. 1, continuous agitators, a depropanizer, a steam still, an absorption and stabilizing unit, a caustic treater, and the wax plant, plus a cooling tower, boiler, and oil storage tanks.

Texaco determined the existence of hazardous waste onsite in 1982. Miscellaneous refinery wastes are believed to have consisted primarily of tank bottoms, filter clays, and sludge generated during routine operations at the refinery between the 1920s and 1950. Table 1-1 provides a listing of wastes believed to have been generated from the various units at the refinery.

TABLE 1-1

Historical Refinery Probable Waste Streams

Unit	Waste Stream
Hydrogen sulfide fractionator	Wastewater containing H_2S
Crude pressurization pipe still No. 1	Cleaning sludge, wastewater
Continuous agitators	Acid sludge
Depropanizer	Cleaning sludge containing hexavalent chromium
Steam still	Wastewater
Absorption and stabilizing unit	Cleaning sludge
Caustic treater	Cleaning sludge
Cooling treater	Blowdown, potential chromate concentration
Boiler	Blowdown, dissolved solids
Tanks	Tank bottoms, oily material, acid sludge

Plate 1-1 shows the locations of the units at the facility during operation of the refinery. Wastes from these units were disposed of onsite in a large pit (approximately 600 feet by 100 feet) located on the western border of the property, and in eight smaller unlined sumps and pits located throughout the facility. Plate 1-1 also shows the location of the waste pits in relation to the refinery process units. Following the closure of the refinery in 1950, a majority of the facility was dismantled. Since closure of the refinery to the present time, the facility has operated only as a crude oil pumping station. It is believed that the waste disposal areas onsite have not been active since 1950.

In addition to the waste pits, other potential sources of organic constituents which may have contributed to releases to the soil and groundwater beneath the site include:

- Former loading rack area, pipelines, aboveground tanks, or other refinery equipment or process operation units.

- Existing pipelines, aboveground tanks, or other product transfer equipment.

- Offsite (non-Texaco) sources, including the commercial activity area on the south side of Highway 126 to the southwest of the facility, the auto salvage/service activities to the southwest of the facility, and the Ultramar service station to the south/southwest.

- Naturally occurring constituents which are augmenting the presence of hydrocarbons.

1.4 Previous Investigations

Investigations of potential soil and groundwater contamination at the Texaco Fillmore facility began in 1983 and have continued to the present. The specific reference, scope, and results of these investigations are documented in detail in the Site Background Summary Report, and that information is not duplicated in this report. However, all relevant historical data have been considered in forming the conclusions and recommendations in this report. No evidence of previous investigations were found concerning the impact of the Fillmore facility on stream water or sediments in Pole Creek.

1.5 RI Goals and Objectives

As stated in the Texaco Fillmore facility RI/FS Work Plan, the overall goals of the RI were to determine fully the nature and extent of any remaining degradation and the potential threat posed to public health or welfare or the environment that may be caused by the actual or potential release of any chemical constituents remaining at the facility. The ultimate goal of the FS is to select the most cost-effective remedial alternative, if any, which mitigates any threat consistent with the NCP.

The RI's primary objectives were to characterize the hydrogeology of the facility and assess the impacts of past operations and waste disposal practices, if any, on the quality of air, soils, and groundwater in the immediate area of the facility. The specific objectives for each of the media investigated are outlined below.

1.5.1 Subsurface Soils

- Characterize the geology of the subsurface, including stratigraphy, structure, and physical characteristics of lithologic units.
- Evaluate the existence, nature, and the lateral and vertical extent of chemical constituents in the subsurface soil below known or suspected waste disposal areas.
- Develop data to support evaluation and design of remedial actions.
- Evaluate background levels of naturally occurring metals of concern in subsurface soils from areas not affected by past or present activities at the facility.
- Evaluate the possibility of additional suspected disposal areas of chemical constituent sources existing at the facility.
- Confirm and validate results of previous soil gas studies.
- Evaluate potential chemical constituent migration and exposure pathways, if any, and determine remedial action objectives.

1.5.2 Groundwater

- Assess the existence, nature, and the lateral and vertical extent of chemical constituents in the groundwater in the vicinity of the facility.

- Build a groundwater monitoring well network to detect current and future movement of any existing groundwater-borne chemical constituents in the perched zone and main aquifer, and to assess the necessity for any future remedial actions.

- Characterize hydrogeologic units, groundwater elevations, flow directions and velocities, and likely chemical constituent migration pathways.

- Conduct aquifer tests or slug tests to obtain data on the properties of hydrogeologic units.

1.5.3 Surface Soils

- Characterize the predominant lithology of surface soils.

- Evaluate physical parameters (i.e., grain size distribution) and assess the potential for wind erosion and soil particle mobility.

- Determine and evaluate the presence and levels of constituents of concern (i.e., metals and volatile and semivolatile organics) throughout the facility.

1.5.4 Surface Water/Stream Sediment

- Characterize the hydrologic flow regime in Pole Creek.

- Evaluate the potential impact on surface water/stream sediments in Pole Creek of chemical constituents potentially originating from the Texaco Fillmore facility.

1.5.5 Air

Characterize the presence of selected airborne compounds in ambient air at the Texaco Fillmore facility and its vicinity.

1.6 Scope of RI Activities

The original scope of the RI investigation was clearly established in each of the media-specific FSPs prepared by ENSR Consulting and Engineering in July 1990 (see Section 1.2). The actual scope of each media investigation was consistent with the FSP objectives and included the tasks listed below.

1.6.1 Subsurface Soils

- Performed continuous coring of 11 Phase I boreholes, two in the Main Waste Pit (MWP) down to groundwater, and one in each small pit (nine total) down to a minimum depth of 40 feet.

- Drilled 78 boreholes ranging from 40 to 161 feet and collected soil samples at every 5 feet during drilling for lithologic description; conducted field measurement of soil headspace volatile organics, pH, and visual indicators; and conducted organic and inorganic laboratory chemical analysis screening.

- Determined the leachability of organic and metal constituents in subsurface soils through toxic characteristics leaching procedures (TCLP) tests on the highest 20 percent of samples analyzed in the screening phase.

- Conducted a soil gas investigation to identify possible chemical constituent sources, if any, support subsurface soil and groundwater investigation decisions, and validate previous soil gas studies.

- Evaluated the relationship between soil gas survey results and surface soil, subsurface soil, and groundwater laboratory analysis results from the RI activities.

All projected subsurface soil drilling and sampling and soil gas survey activities were completed by December 1990.

1.6.2 Groundwater

- Conducted drilling, installation, and development of 11 Phase I monitoring wells ranging in depth from 70 to 165 feet.

- Conducted drilling, installation, and development of nine Phase II monitoring wells ranging in depth from 100 to 160 feet, based on Phase I results.

- Measured water levels in all wells to estimate groundwater gradients and aquifer identities.

- Performed sampling and chemical analysis of groundwater in the Phase I and Phase II monitoring wells, selected private water wells in the vicinity, and the Ultramar gas station monitoring wells. Samples were analyzed for petroleum hydrocarbons, volatile organics, semivolatile organics, and selected metals.

- Performed slug tests on Phase I wells to begin estimating aquifer characteristics.

- Evaluated water chemistry results to determine the nature and extent of chemical constituents in the groundwater underneath the site.

All projected monitoring well construction and development and slug tests were completed by December 1990. Quarterly groundwater monitoring was instituted and continues to be conducted.

1.6.3 Surface Soils

- Collected and analyzed 32 random samples (through a sampling grid overlying the facility) to determine the presence of analytes of concern in known, suspect, and background areas at the facility.

- Performed grain size distribution (PM_{10}) on all 32 samples.

1.6.4 Surface Water/Stream Sediments

- Collected four stream sediment samples (two upstream and two downstream of facility) to examine potential chemical constituent runoff from the facility.

- Collected surface water sampling from seven locations along the Pole Creek drainage basin, upstream, adjacent and downstream of Texaco Fillmore facility.

1.6.5 Air

- Collected meteorological (met) data and conducted integrated surface sampling (ISS).

- Collected and analyzed collocated ambient air samples from locations up- and downwind of the MWP.

All the projected sampling and analysis activities for the surface soil, surface water/stream sediments, and air investigations were completed. The need for additional work in these areas will be determined from the results of the EPA Baseline Risk Assessment.

1.7 Report Organization

The organization of this report is consistent with the format recommended in EPA Guidance for CERCLA Remedial Investigations/Feasibility Studies, October 1988.

Section 2.0 of this report describes the field and ancillary activities and procedures performed during the data collection process, including drilling, monitoring well installation, surveying, permitting, health and safety monitoring, field screening, sample collection and documentation, and quality control. The scope of drilling, sampling locations, and sampling strategy implemented from the FSPs are also summarized in this section.

Section 3.0 discusses the physical characteristics of the facility's subsurface, including local and regional geology, hydrogeology, stratigraphy, structure, and history of depositional settings. This section presents the results of the field activities and literature search regarding the hydrologic characteristics of the facility. It presents the regional hydrogeology and recent hydrologic history. The shallow hydrologic units [shallower than 360 feet above mean sea level (msl)] are discussed and groundwater elevations in these units are presented. This section also addresses the influence of fractures associated with folding, faults, and fault zones as conduits for fluid migration, and the possibility of naturally occurring levels of hydrocarbons in the area. Finally, the results of slug tests performed on Phase I monitoring wells and aquifer characteristics determined from these tests are presented.

Section 4.0 presents the results of chemical analyses for Phases I and II of the RI. For sub-surface soil analysis, all relevant organic and inorganic screen and toxicity characteristic leaching procedure (TCLP) analytical data are tabulated and presented. Emphasis is placed on evaluating naturally occurring levels of metal constituents of concern locally and regionally, in order to assist in determining appropriate remediation levels, if any, of

introduced materials onsite. Groundwater analyses are tabulated and integrated with previous groundwater analyses, as well as analysis from the neighboring Ultramar gas station to the south, to form as complete a picture as possible of groundwater quality in the area. Laboratory reports for data collected during this RI that have been provided in the individual media draft report and monthly status reports are not provided as part of this report. However, laboratory reports for the resampled surface soil, the surface water, and the January 1991 and May 1991 groundwater sampling events, not previously submitted, are provided in Appendix A.

Section 5.0 evaluates the potential sources and the fate and transport of constituents detected during the RI based on the data collected. This chapter also presents information concerning the persistence and migration of the chemical constituents detected at the facility and provides a conceptual model of constituent migration pathways for the site.

Section 6.0 summarizes the findings, conclusions, and recommendations resulting from the investigation based on an evaluation of the data collected during the RI. The conclusions and recommendations presented in the report do not reflect, and could be affected by, the results of the EPA Baseline Risk Assessment for the Fillmore site.

2.0 STUDY AREA INVESTIGATION

This section briefly describes the facility's physical setting and summarizes the field activities and procedures for drilling and sampling of boreholes; installing, developing, and sampling of monitoring wells; and sampling of surface soils, surface water and stream sediment, and ambient air. The field procedures for the soil gas investigation are described in the soil gas investigation report prepared by TriHydro Corporation and are not reproduced in this report.

2.1 Facility Setting

The Texaco Fillmore facility is located just east of the city of Fillmore and has been the location of petroleum industry activities since the 1910s. The facility, approximately 20 acres situated northeast of the intersection of Highway 126 and Pole Creek, is surrounded by areas of mixed use. Adjacent to the subject facility and to the north and east is vacant land with some agricultural use. Industrial and residential properties are located to the south of the facility. To the southwest is a gasoline service station operated by Ultramar, and along the western boundary are residential homes and a secondary school.

The facility lies between the Topa Topa mountains to the northwest and the Fillmore Groundwater Basin to the southwest, at elevations ranging from 480 to 625 feet above mean sea level. The facility slopes generally to the south and west toward the Santa Clara River and is bordered on the west by Pole Creek, the only natural surface water drainage system in the immediate vicinity of the facility. The average topographic gradient is above 0.05 foot per foot. The relatively flat western portion of the facility appears to overlie floodplain deposits and colluvium common to the Fillmore Basin sediments. In contrast, the eastern portion of the facility is assumed to be largely based on Miocene oil-bearing sediments representing the upper plate of the San Cayetano Thrust Fault. Detailed topography is superimposed on a present facility map included as Plate 2-1.

Surface water runoff at the facility flows in a southerly direction. The runoff is either channeled along graded roads for collection in bermed storage tank areas or in the Main Waste Pit (MWP) excavation, or it flows into Pole Creek either directly over the ground's surface or through drainage pipes. Predominant surface water flow direction patterns are also illustrated in Plate 2-1. The facility's main surface water feature is Pole Creek on the western boundary, which drains to the south from the Topa Topa Mountains into the Santa Clara River. Pole Creek's concrete-lined channel extends approximately 1,200 feet north (upstream) of Tank #8 and about 500 feet south (downstream) of Highway 126.

2.2 Scope of Field Activities

The scope of field activities conducted during the facility investigation adhered to the scope of work approved by the EPA and established in each of the six media-specific FSPs, unless otherwise indicated in this section.

2.2.1 Subsurface Soils

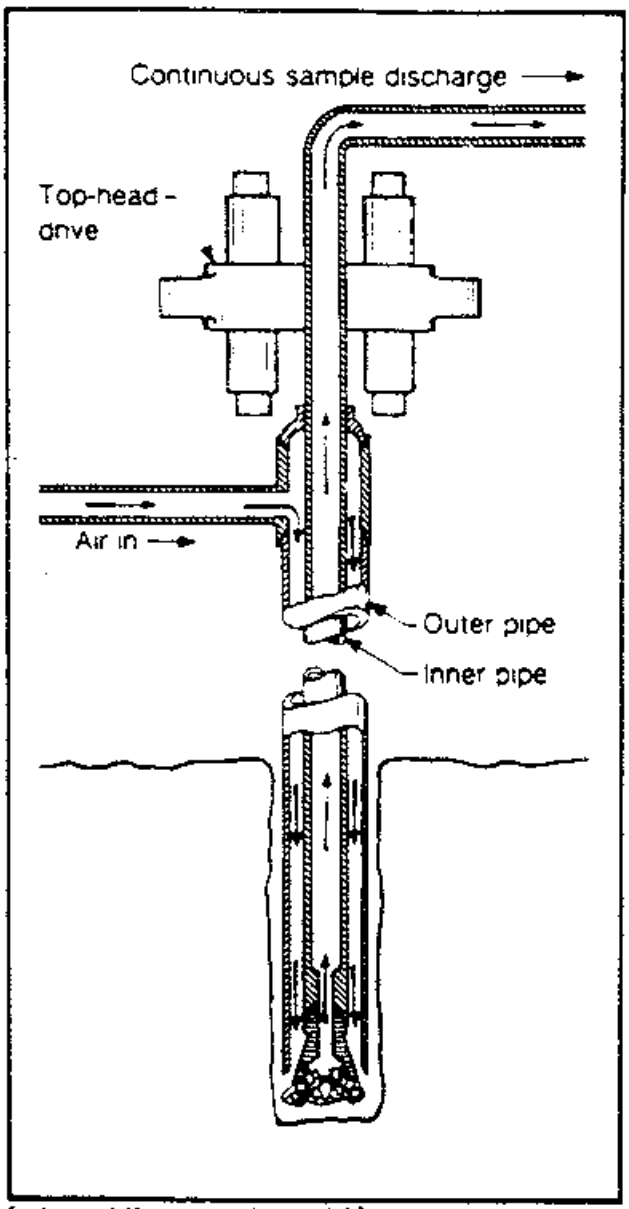
The subsurface soils investigation included soil borings and sampling at the following known and suspected areas of soil degradation (see Plate 2-2 for locations):

- Former main waste disposal pit
- Eight small waste disposal areas
- Possible surface impoundment area west of waste disposal area 3
- Soil gas area in the south-central portion of the facility identified by TriHydro Corporation in 1987

2.2.1.1 Borehole Drilling

ENSR subcontracted with Layne Environmental Services, Inc. to drill, install, and develop 20 monitoring wells under ENSR's supervision. There were 78 boreholes drilled at the facility from July to December 1990, consisting of 67 original exploratory boreholes, 20 of which were converted into monitoring wells, and 11 resampling exploratory boreholes due to missed sample holding times by the laboratory. All boreholes were drilled using either a dual-tube/percussion hammer (Figure 2-1) or hollow-stem auger drilling technique. The outside tube in the dual-tube technique facilitates penetration of unconsolidated formations by holding the sediments away from the drill pipe while having the capability of cutting through boulders and gravel. This was the preferred method because it allowed detection of perched water zones. The rest of the boreholes were drilled using hollow stem auger drilling rigs. Boreholes ranged in depth from 40 to 161 feet.

Eleven boreholes, two at the MWP and one at each small waste pit, were continuously cored to obtain a continuous description of the subsurface lithology as specified in the FSP. Continuous-core borehole samples were collected with a 24-inch split-spoon sampler void of brass sleeves. Undisturbed drive samples were collected at 5-foot intervals using a 24-inch-long stainless steel split-spoon sampler equipped with eight 3-inch long brass



(after Aller et al. 1989)

Figure 2-1

Dual Wall Reverse-Circulation Method

(shown with rotary bit - may also be used with drive hammer)

sleeves. From three to seven sleeves were preserved for laboratory analysis depending on recovery. Logging was accomplished by alternating 3-foot coring and 2-foot driving intervals. Boring logs were developed by visually examining core and drive samples (if available). Cores were brought to the surface, positioned in a stratigraphically continuous sequence, labeled, and photographed by the rig geologist. Copies of all boring logs are included in Appendix B of this report.

The borehole numbers, locations, types, elevation and depth, soil samples collected, reason for termination, and EPA level of personnel protection used during the drilling of all Phase I and Phase II boreholes are summarized in Tables 2-1 and 2-2, respectively.

2.2.1.2 Soil Gas Investigation

A soil gas survey was conducted by TriHydro Corporation as part of the Texaco Fillmore RI. The survey consisted of 299 sampling points from two onsite traverses spanning previously identified areas of high soil gas in the southern portion of the facility. The sampling points were spaced on a 20 by 20-foot grid. Soil gas samples collected were injected into a portable gas chromatograph and analyzed for BTEX. In addition to the soil gas survey, TriHydro collected soil gas samples from five of the soil gas survey sampling points for chemical speciation of volatile organic compounds in the laboratory.

Field procedures for the soil gas RI/FS investigation are contained in the Texaco Fillmore Facility RI/FS Soil Gas FSP and are not duplicated in this report. The actual field procedures and modifications to FSP procedures are presented in detail in TriHydro's "Soil Gas RI/FS Investigation Report," dated September 7, 1990. All procedural modifications for conducting the soil gas survey were requested by TriHydro and approved by EPA prior to initiating any field activities. Four boreholes were also drilled to collect subsurface soil samples in the areas of highest soil gas.

2.2.2 Groundwater Investigation

The groundwater investigation included the installation of 20 groundwater monitoring wells, measurement of groundwater conditions, and sampling and analysis of groundwater from these wells, as well as from other monitoring and water supply wells in the vicinity of the site. The groundwater monitoring wells were installed to define the nature and extent of potentially hazardous chemical constituents in the groundwater below and around the Texaco Fillmore site. The wells were drilled and installed with the purpose of defining three encountered aquifers, as listed below.

Borehole Drilling and Sampling Summary
Phase I

Location	Borehole I.D. Number	Borehole Completion Date	Borehole Type[a]	Drilling Method[b]	Borehole Elevation	Borehole Depth (feet)	Soil Samples Collected and Analyzed	Reason for Termination[c]	EPA Levels of Protection	
									Startup	Upgrade/ Downgrade
Main Waste Pit	MWP-BH-1	07/25/90	A	HSA/DT	505.6	95	19	SGW		
	MWP-BH-2	07/31/90	A	HSA	505.9	55	11	PGW	D	C
	MWP-BH-3	07/30/90	C	DT	503.9	100	19	SGW	D	—
	MWP-BH-4	07/26/90	C	DT	505.4	95	20	SGW	D	—
	MWP-BH-5	07/07/90	C	DT	503.6	50	11	PGW	C	—
	MWP-BH-6	08/21/90	C	DT	504.3	95	20	SGW	D	—
	MWP-BH-7	08/16/90	C	DT	515.6	75	16	BD	D	—
	MWP-BH-8	08/02/90	C	DT	529.4	125	26	SGW	D	—
	MWP-BH-9	08/10/90	C	DT	504.5	95	20	SGW	D	C
	MWP-BH-10	07/17/90	C	DT	508.3	80	18	BD	D	—
	MWP-BH-11	08/08/90	C	DT	518.4	90	20	BD	D	C
	MWP-BH-12	08/23/90	C	DT	515.8	105	24	SGW	D	—
	MWP-BH-13	08/29/90	C	DT	516.9	75	16	BD	D	—
	MWP-BH-14	09/06/90	C	HSA/DT	529.0	85	19	BD	D	—
	MWP-BH-902	09/24/90	D	DT	505.9	45	4	EOB	D	—
	MWP-BH-904	09/25/90	D	DT	505.4	45	3	EOB	D	—
	MWP-BH-906	09/25/90	D	DT	504.3	55	3	EOB	D	—
	MWP-BH-907	09/26/90	D	DT	515.6	57	3	EOB	D	—
	MWP-BH-908	09/26/90	D	DT	529.4	47	3	EOB	D	—
	MW-21S	09/04/90	E	DT	502.23	114	5	SGW	D	—
	MW-24D	07/23/90	E	DT	533.44	165	1	OGW	D	—

See last page of Table 2-1 for footnotes.

TABLE 2-1 (cont.)

Location	Borehole I.D. Number	Borehole Completion Date	Borehole Type[a]	Drilling Method[b]	Borehole Elevation	Borehole Depth (feet)	Soil Samples Collected and Analyzed	Reason for Termination[c]	EPA Levels of Protection	
									Startup	Upgrade/ Downgrade
Pit 1	P1-BH-1	08/01/90	B	DT	561.8	40	9	BD	D	--
	P1-BH-2	08/01/90	C	DT	570.1	40	9	BD	D	--
Pit 2	P2-BH-1	08/13/90	B	HSA	531.3	60	15	PGW	D	C
	P2-BH-2	08/15/90	C	DT	531.7	65	15	PGW	C	--
Pit 3	P3-BH-1	08/14/90	B	HSA	490.3	45	10	PGW	C	--
	P3-BH-2	08/17/90	C	HSA	492.8	80	17	SGW/AR	C	--
	P3-BH-3	09/07/90	C	HSA	491.4	60	14	AR	D	--
	P3-BH-4	09/06/90	C	HSA	493.4	40	9	PGW	D	--
	P3-BH-902	09/28/90	D	DT	492.8	77	5	EOB	D	--
	P3-BH-904	10/01/90	D	HSA	493.4	40	3	EOB	D	--
	MW-26	07/24/90	E	DT	491.41	100	0	SGW	D	--
Pit 4	P4-BH-1	07/25/90	B	HSA	483.8	47	10	PGW	D	--
	P4-BH-2	07/26/90	C	HSA	484.4	55	11	PGW	D	--
	P4-BH-3	08/27/90	C	HSA	483.7	50	11	PGW	D	--
	P4-BH-4	08/29/90	C	HSA	485.9	50	11	PGW	D	--
	P4-BH-5	09/04/90	C	HSA	485.9	50	11	PGW	D	--
	P4-BH-6	09/05/90	C	HSA	484.1	50	11	PGW	D	--
Pit 5	P5-BH-1	07/29/90	C	HSA	524.9	90	20	AR	D	--
	P5-BH-2	07/27/90	B	HSA	526.6	40	9	BD	D	--
Pit 6	P6-BH-1	08/01/90	B	HSA	520.8	40	9	BD	D	--
	P6-BH-2	08/02/90	C	HSA	520.3	85	19	BD	D	--

See last page of Table 2-1 for footnotes.

TABLE 2-1 (cont.)

Location	Borehole I.D. Number	Borehole Completion Date	Borehole Type[a]	Drilling Method[b]	Borehole Elevation	Borehole Depth (feet)	Soil Samples Collected and Analyzed	Reason for Termination[c]	EPA Levels of Protection	
									Startup	Upgrade/ Downgrade
Pit 7	P7-BH-1	08/07/90	C	HSA	531.5	50	10	BD	D	C
	P7-BH-2	08/08/90	B	HSA	527.8	50	10	BD	C	D
	P7-BH-902	09/27/90	D	DT	529.8	10	3	EOB	D	--
Pit 8	P8-BH-1	08/13/90	C	DT	585.0	105	22	BD	D	--
	P8-BH-2	08/10/90	B	HSA	585.4	60	14	BD	D	--
Suspected Pit	SP-BH-1	08/15/90	B	HSA	488.8	60	18	SGW	D	--
	SP-BH-2	08/16/90	C	HSA	490.3	55	13	PGW	D	C
Soil Gas Area	SG-BH-1	08/23/90	C	DT	505.90	95	21	SGW	D	--
	SG-BH-2	08/24/90	C	HSA	502.1	80	18	AR	D	--
	SG-BH-3	08/23/90	C	HSA	498.7	75	17	AR	D	--
	SG-BH-4	08/22/90	C	HSA	499.4	80	18	AR	D	C
	SG-BH-901	09/24/90	D	DT	505.9	78	6	EOB	D	--
Orchard	MW-18S	09/06/90	E	DT	470.28	70	2	SGW	D	--
South End	MW-19S	08/20/90	E	DT	476.66	79	7	SGW	D	--
	MW-9019	10/01/90	D	HSA	478.66	60	4	EOB	D	--
Pole Creek and Main Street	MW-20S	08/27/90	E	DT	488.44	100	7	SGW	D	--
School	MW-22S	07/30/90	E	DT	521.96	139	17	SGW	D	--
	MW-22D	07/26/90	E	DT	521.89	161	0	DGW	D	--
	MW-23D	07/31/90	E	DT	524.88	142.5	16	DGW	D	--

See last page of Table 2-1 for footnotes.

TABLE 2-1 (cont.)

Location	Borehole I.D. Number	Borehole Completion Date	Borehole Type[a]	Drilling Method[b]	Borehole Elevation	Borehole Depth (feet)	Soil Samples Collected and Analyzed	Reason for Termination[c]	EPA Levels of Protection	
									Startup	Upgrade/ Downgrade
South of Tank 1	MW-25S	07/31/90	E	DT	502.8	103.5	10	SGW	D	—
	MW-25D	08/06/90	E	DT	502.34	139	20	DGW	D	—
	MW-9025	09/27/90	D	DT	502	78	3	EOB	D	—
Background	BG-BH-1	08/03/90	B	DT	—	20	4	EOB	D	—
	BG-BH-2	08/03/90	B	DT	—	20	4	EOB	D	—
	BG-BH-3	08/03/90	B	DT	—	20	4	EOB	D	—
	BG-BH-4	08/20/90	B	HSA	—	20	3	EOB	D	—
	BG-BH-5	08/20/90	B	DT	—	20	5	EOB	D	—

[a] **Borehole Types**
A = continuous core to groundwater
B = continuous core first 20 feet
C = noncontinuous core
D = resampling
E = monitoring well

[b] **Drilling Method**
HSA = hollow-stem auger
DT = dual tube

[c] **Reason for Termination**
BD = below degradation
AR = auger refusal
PGW = perched groundwater
SGW = shallow groundwater
DGW = deep groundwater
EOB = end of borehole per work plan

TABLE 2-2

Borehole Drilling and Sampling Summary
Phase II

Location	Borehole I.D. Number	Borehole Completion Date	Borehole Type[a]	Drilling Method[b]	Borehole Elevation	Borehole Depth (feet)	Soil Samples Collected and Analyzed	Reason for Termination[c]	EPA Levels of Protection	
									Startup	Upgrade/ Downgrade
Main Waste Pit	MW-27S	11/27/90	E	DT	531.00	135	N/A	SGW	D	—
	MW-28S	11/28/90	E	DT	513.80	120	N/A	SGW	D	—
	MW-32S	12/11/90	E	DT	513.30	126	N/A	SGW	D	—
	MW-33D	12/13/90	E	DT	514.50	158.5	N/A	DGW	D	—
Pit 3	MW-29S	11/30/90	E	DT	493.90	100	N/A	SGW	D	—
	MW-29D	11/29/90	E	DT	494.50	143	N/A	DGW	D	—
	MW-31D	12/12/90	E	DT	486.90	144	N/A	DGW	D	—
Residential Area	MW-34S	12/17/90	E	DT	491.90	115	N/A	SGW	D	—
Orchard	MW-30S	12/03/90	E	DT	482.70	85	N/A	SGW	D	—

[a] **Borehole Types**
A = continuous core to groundwater
B = continuous core first 20 feet
C = noncontinuous core
D = resampling
E = monitoring well

[b] **Drilling Method**
HSA = hollow-stem auger
DT = dual tube

[c] **Reason for Termination**
BD = below degradation
AR = auger refusal
PGW = perched groundwater
SGW = shallow groundwater
DGW = deep groundwater
EOB = end of borehole per work plan

- Perched Aquifer: a shallow zone of discontinuous groundwater
- Aquifer 1: an unconfined zone below the perched aquifer
- Aquifer 2: a confined (or partially confined) aquifer below Aquifer 1

Following well installation and development, groundwater samples were collected during four sampling events. The sampling events took place in August 1990, September to October 1990, January 1991, and April to May 1991. Each sampling event included the measurements of groundwater depth in the well. The following sections describe the procedures and results of the groundwater monitoring well installation, development, and sampling.

2.2.2.1 Monitoring Well Drilling and Installation

All wells were drilled using dual-tube reverse-circulation air drilling rigs (Figure 2-1) equipped with drive hammers. The outside tube facilitates penetration of unconsolidated formations by holding the sediments away from the drill pipe while having the capability of cutting through boulders and gravel. The wells were completed with 4-inch inner diameter, schedule 40 PVC casing and PVC screen with 0.020-inch slots. A typical well installation detail is seen in Figure 2-2. Well installation diagrams are included in Appendix C of this report. Typically, the well installation sequence proceeded as follows:

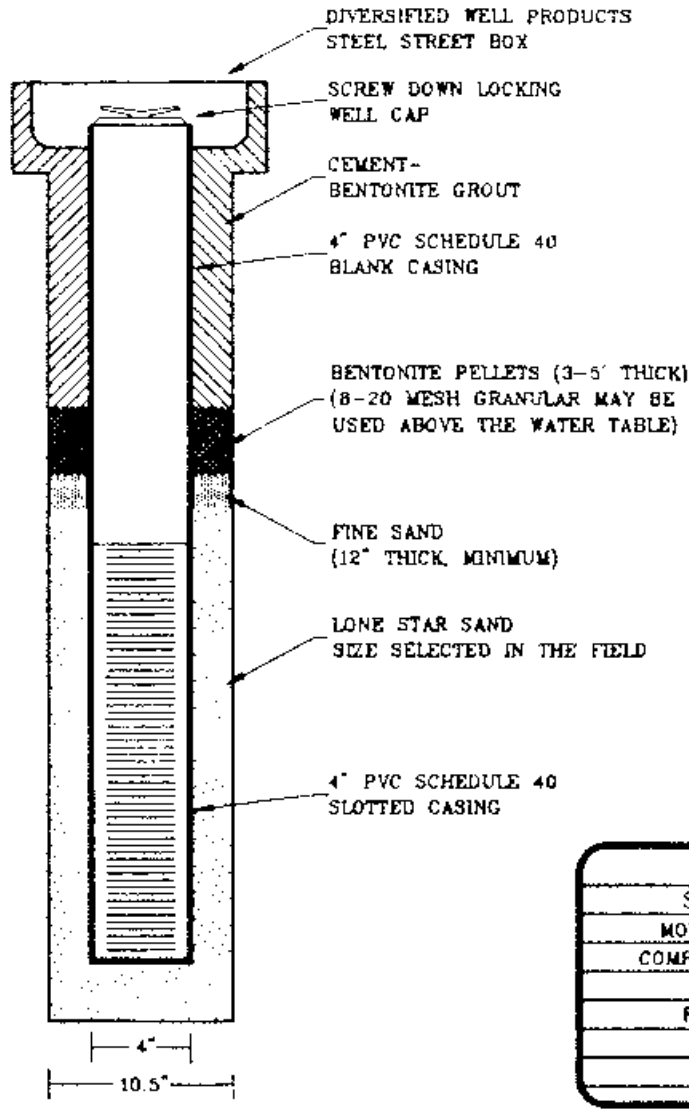
- The annulus of the well was filled from total depth to approximately five feet above the top of the screened interval with Monterey or Lonestar No. 3 sand to form the sand pack.

- A minimum of one foot of fine-grained sand was placed on top of the filter pack to prevent any penetration from the bentonite seal into the filter pack.

- A 3-foot bentonite seal was placed on the fine-grained sand.

- The annulus was filled from the bentonite seal to the surface by pumping in a four percent bentonite cement mix.

Wells screened in the deep aquifer (Aquifer 2) were sealed above the screened interval with approximately three feet of fine silica sand in place of a bentonite seal. Fine silica sand was used due to the difficulties in placing a bentonite seal more than 20 feet below the static water level.



ENSR

SCHEMATIC
MONITORING WELL
COMPLETION DIAGRAM

Figure 2-2

Each wellhead was fitted with a well cap upon which the well identification number was painted. The wellheads were covered with either steel protection casing or flush-mounted, traffic-rated steel boxes. Monitoring wells with protective casing aboveground were surrounded by four bollards for additional wellhead protection.

The drilling rigs were decontaminated by steam cleaning after each well installation to prevent any potential cross-contamination.

After well installation, all wells were developed with truck-mounted development rigs by surging, swabbing, bailing, and pumping until the water was determined free of fines by the rig geologist. Table 2-3 gives the following installation and development data: monitoring well identification number, date developed, screened interval, casing diameter, and volume of water removed during development.

2.2.2.2 Water Level Measurements

The depth to groundwater was measured during each of the four groundwater sampling events. The measurements were made to an accuracy of ±0.01 foot using a Solinst water level meter. Each measurement was made from the designated measuring point (notch) at the top of the well casing to groundwater. All monitoring wells were surveyed relative to the nearest USGS NGVD benchmark and an onsite fixed reference point. All field procedures employed for water level measurements adhered to the Field Sampling Plan for Hydrogeologic Remedial Investigation/Feasibility Study (ENSR Document No. 6600-035-120).

During the first groundwater sampling event, depth measurements were made for the six newly installed Phase I groundwater monitoring wells (Table 2-4). Additionally, the groundwater wells installed during previous investigations were checked for groundwater. For the wells containing groundwater, a depth measurement was recorded. For groundwater wells containing no groundwater, a record of the dry conditions was noted.

During the second groundwater sampling event, also referred to as the "Network Sampling Event," measurements of the depth to groundwater were recorded for all eleven Phase I wells and all pre-RI wells previously identified as containing groundwater (Table 2-5).

TABLE 2-3
WELL INSTALLATION AND DEVELOPMENT DATA SUMMARY

WELL ID NUMBER	DATE DEVELOPED	WELL ELEVATION (feet-MSL)		TOTAL WELL DEPTH (feet below grade)	SCREENED INTERVAL (feet-MSL)	VOLUME OF WATER REMOVED	
		TOP OF CASING	BOTTOM OF CASING			GALLONS	# OF WELL VOLUMES
Perched Zone							
MW-10P	2-21-86*	502.52	452.0	50.52	462-452	N/A	N/A
Aquifer 1							
MW-6S	7-2-86*	517.26	399.6	117.66	413-403	N/A	N/A
MW-8S	2-20-86**	484.32	412.1	72.22	439-409	N/A	N/A
MW-11S	2-21-86**	507.70	412.0	95.70	432-412	N/A	N/A
MW-18S	9-24-90	470.28	400.8	69.48	421-401	250	27
MW-19S	8-28-90	478.66	400.2	78.46	420-400	200	20
MW-20S	9-24-90	488.44	394.9	93.54	415-395	200	19
MW-21S	9-07-90	502.23	388.7	113.53	409-389	200	14
MW-22S	8-29-90	521.96	384.5	137.46	405-384	200	13
MW-25S	8-28-90	502.80	401.3	101.50	422-401	200	23
MW-26S	8-28-90	491.41	400.9	90.51	421-401	200	22
MW-27S	1-07-91	531.00	393.5	135.5	414-394	100	13
MW-28S	1-07-91	513.80	393.3	118.5	414-394	280	41
MW-29S	1-08-91	493.90	394.4	97.5	415-395	250	27
MW-30S	1-08-91	482.70	395.2	85.5	416-396	200	30
MW-32S	1-10-91	513.30	387.8	125.5	408-388	500	51
MW-34S	1-09-91	491.90	376.4	115.5	397-377	550	33
Aquifer 2							
MW-16D	1-13-88*	571.85	390.4	181.45	410-390	N/A	N/A
MW-22D	8-29-90	521.89	361.4	160.49	372-361	200	9
MW-23D	8-29-90	524.88	382.4	142.48	403-382	200	22
MW-24D	8-27-90	533.44	369.9	163.54	390-370	300	17
MW-25D	8-28-90	502.34	361.8	140.54	376-356	200	3
MW-29D	1-08-91	494.50	362.0	136.5	373-363	300	15
MW-31D	1-08-91	486.90	349.4	135.5	360-350	250	8
MW-33D	1-09-91	514.50	362.0	150.5	373-363	300	27

* Radian Corporation Well
** Geraghty & Miller Corporation Well

TABLE 2-4
SUMMARY OF AUGUST 1990 MONITORING
WELL SAMPLING

WELL ID NUMBER	SAMPLING DATE	TOTAL WELL DEPTH (feet)	WATER TABLE DEPTH (feet)	LENGTH OF WATER COLUMN (feet)	WELL VOLUME (gallons)	VOLUME PURGED (gallons)	NUMBER OF WELL VOLUMES PURGED
Aquifer 1							
MW-22S	08/29/90	137.50	114.82	22.68	14.65	200	14
MW-25S	08/30/90	101.50	89.23	12.27	7.93	200	25
MW-26S	08/28/90	90.50	77.53	12.97	8.38	200	24
Aquifer 2							
MW-23D	08/29/90	142.50	128.20	14.30	9.24	200	22
MW-24D	08/27/90	163.50	137.86	25.64	16.56	300	18
MW-25D	08/28/90	136.50	103.05	33.45	21.61	200	9

TABLE 2-5
SUMMARY OF SEPTEMBER-OCTOBER 1990 MONITORING
WELL SAMPLING

WELL ID NUMBER	SAMPLING DATE	TOTAL WELL DEPTH (feet)	WATER TABLE DEPTH (feet)	LENGTH OF WATER COLUMN (feet)	WELL VOLUME (gallons)	VOLUME PURGED (gallons)	NUMBER OF WELL VOLUMES PURGED
Perched Aquifer							
MW-10P	10/02/90	49.70	45.42	5.87	3.79	purged dry	--
Aquifer 1							
MW-6S	09/25/90	117.68	109.85	7.83	5.06	20	4
MW-8S	10/02/90	72.25	71.32	0.93	0.60	purged dry	--
MW-11S	10/02/90	89.66	88.57	1.09	0.70	purged dry	--
MW-18S	09/27/90	69.50	56.37	13.13	8.48	58	7
MW-19S	09/27/90	78.50	64.48	14.02	9.06	28	3
MW-20S	09/25/90	93.50	78.30	15.20	9.82	40	4
MW-21S	09/26/90	113.50	93.61	19.89	12.85	82	6
MW-22S	09/27/90	137.50	116.25	21.25	13.73	72	5
MW-25S	09/28/90	101.50	90.63	10.87	7.02	54	8
MW-26S	09/25/90	90.50	77.20	13.30	8.59	50	6
Aquifer 2							
MW-16D	10/02/90	181.45	178.73	2.72	1.76	13	7
MW-22D	09/27/90	160.50	127.75	32.75	21.16	110	5
MW-23D	09/27/90	142.50	129.32	13.18	8.51	54	6
MW-24D	09/25/90	163.50	138.21	25.29	16.34	67	4
MW-25D	09/28/90	136.50	104.48	32.02	20.68	102	5

The following wells were found to be dry during the first two groundwater sampling events.

MW-1	MW-4	MW-9	MW-14
MW-2	MW-5	MW-12	MW-17
MW-3	MW-7	MW-13	P-2

These wells have not been sampled, since they were identified as being dry. In addition, monitoring well MW-15 and piezometer P-1 could not be located at the site. Monitoring well MW-15 was last reported active by TriHydro in December 1988; it reportedly was vandalized, then plugged and abandoned in 1989. Piezometer P-1 was reported as dry by TriHydro as far back as 1987 and not reported at all since 1988.

The results of the third groundwater sampling event show the depth to groundwater increased for most wells during the period of August 1990 to January 1991 (Table 2-6). Conversely, the results of the fourth groundwater sampling event show the depth to groundwater decreased from the measurements recorded during the third groundwater sampling event (Table 2-7). This is consistent with the amount of rainfall that occurred in the area during the in-between-sampling periods.

During the third and fourth sampling events, groundwater monitoring wells MW-8S, MW-11S, and MW-16D were found to be dry. In addition, three monitoring wells from the Ultramar gas station southwest of the site were sounded (two of them were found to contain water) and sampled during the fourth sampling event.

2.2.2.3 Groundwater Sampling

Groundwater samples were collected during each of the four groundwater sampling events. Prior to the collection of groundwater samples, each groundwater well was purged by use of a Grundfos stainless steel submersible pump. Tables 2-4, 2-5, 2-6 and 2-7 present the volume of water purged from each well during each sampling event. The sampling methods and field procedures employed during each groundwater sampling event adhered to the Field Sampling Plan for Hydrogeologic Remedial Investigation/Feasibility Study (RI/FS) (ENSR Document No. 6600-035-120). The groundwater analytical test results from the four sampling events are discussed in Section 4.0 of this report.

All of the nondisposable equipment was decontaminated between the collection of samples from each well. Water from purging was collected in DoT-approved 55-gallon drums or a 500-gallon Baker tank.

TABLE 2-6
SUMMARY OF JANUARY 1991 MONITORING
WELL SAMPLING

WELL ID NUMBER	SAMPLING DATE	TOTAL WELL DEPTH (feet)	WATER TABLE DEPTH (feet)	LENGTH OF WATER COLUMN (feet)	WELL VOLUME (gallons)	VOLUME PURGED (gallons)	NUMBER OF WELL VOLUMES PURGED
Perched Aquifer							
MW-10P	01-16-91	49.70	46.55	3.15	2.03	10	5
Aquifer 1							
MW-6S	01-17-91	117.68	112.60	5.08	3.28	5	2
MW-8S	dry	72.25	dry	dry	dry	dry	dry
MW-11S	dry	89.66	dry	dry	dry	dry	dry
MW-18S	01-17-91	69.50	60.70	8.80	5.68	50	9
MW-19S	01-17-91	78.50	69.95	8.55	5.52	25	5
MW-20S	01-17-91	93.50	82.60	10.90	7.04	50	7
MW-21S	01-16-91	113.50	98.00	15.50	10.01	60	6
MW-22S	01-17-91	137.50	123.04	14.46	9.34	50	5
MW-25S	01-14-91	101.50	94.92	6.58	4.25	20	5
MW-26S	01-16-91	90.50	83.10	7.40	4.78	50	10
MW-27S	01-14-91	135.00	123.05	11.95	7.72	40	5
MW-28S	01-15-91	118.00	107.50	10.50	6.78	180	27
MW-29S	01-15-91	97.00	83.00	14.00	9.04	50	6
MW-30S	01-15-91	85.00	74.64	10.36	6.69	50	7
MW-32S	01-16-91	125.00	110.00	15.00	9.69	40	4
MW-34S	01-16-91	115.00	89.60	25.40	16.41	100	6
Aquifer 2							
MW-16D	dry	181.45	dry	dry	dry	dry	dry
MW-22D	01-17-91	160.50	132.50	28.00	18.09	90	5
MW-23D	01-17-91	142.50	133.37	9.13	5.90	40	7
MW-24D	01-15-91	163.50	142.80	20.70	13.37	60	4
MW-25D	01-16-91	136.50	107.15	29.35	18.96	70	4
MW-29D	01-15-91	130.00	98.23	31.77	20.52	200	10
MW-31D	01-15-91	135.00	91.93	43.07	27.82	100	4
MW-33D	01-15-91	150.00	121.94	28.06	18.13	80	4

TABLE 2-7
SUMMARY OF MAY 1991 MONITORING
WELL SAMPLING

WELL ID NUMBER	SAMPLING DATE	TOTAL WELL DEPTH (feet)	WATER TABLE DEPTH (feet)	LENGTH OF WATER COLUMN (feet)	WELL VOLUME (gallons)	VOLUME PURGED (gallons)	NUMBER OF WELL VOLUMES PURGED
Perched Aquifer							
MW-10P	04-30-91	49.70	43.53	5.87	3.79	14	4
Aquifer 1							
MW-6S	05-02-91	117.68	114.10	3.58	2.31	purged dry	2
MW-8S	dry	72.25	dry	dry	dry	dry	dry
MW-11S	dry	89.66	dry	dry	dry	dry	dry
MW-18S	05-03-91	69.50	56.47	13.03	8.42	60	7
MW-19S	05-01-91	78.50	67.05	11.45	7.40	30	4
MW-20S	05-01-91	93.50	80.78	12.72	8.22	45	5
MW-21S	05-03-91	113.50	97.27	16.23	10.48	50	5
MW-22S	05-02-91	137.50	124.08	13.42	8.67	35	4
MW-25S	04-30-91	101.50	93.77	7.73	4.99	25	5
MW-26S	05-01-91	90.50	81.10	9.40	6.07	70	12
MW-27S	04-30-91	135.00	126.18	8.82	5.70	30	5
MW-28S	05-01-91	118.00	107.49	10.51	6.79	60	9
MW-29S	04-30-91	97.00	82.87	14.13	9.13	40	4
MW-30S	05-03-91	85.00	70.28	14.72	9.51	50	5
MW-32S	05-01-91	125.00	109.84	15.16	9.79	55	6
MW-34S	05-01-91	115.00	88.36	26.64	17.21	90	5
Ultm-MW-9*	05-01-91	78.7	66.27	12.43	2.16	6	3
Ultm-MW-10*	05-01-91	72.2	57.66	14.54	2.53	8	3
Aquifer 2							
MW-16D	dry	181.45	dry	dry	dry	dry	dry
MW-22D	05-02-91	160.50	127.87	32.63	21.08	110	5
MW-23D	05-02-91	142.50	130.76	11.74	7.58	30	4
MW-24D	05-02-91	163.50	139.37	24.13	15.59	100	6
MW-25D	04-30-91	136.50	103.25	33.25	21.48	85	4
MW-29D	04-30-91	130.00	94.55	35.45	22.90	100	4
MW-31D	05-02-91	135.00	89.38	45.62	29.47	120	4
MW-33D	05-02-91	150.00	118.74	31.26	20.19	100	5

*Ultramar gas station wells included in May 1991 sampling event.

2.2.2.4 Aquifer Characteristics

During well development, two wells were pumped dry. Monitoring well MW-19B went dry four times, each time after about 60 gallons had been evacuated. Monitoring well MW-23D11 was dry for a brief time after approximately 75 gallons had been pumped out.
Three wells were pumped dry during purging of the wells before sampling. During the September-October 1990 sampling event, monitoring wells MW-8S, MW-10S, and MW-11S were dry after purging approximately 1.5 gallons, 4.0 gallons, and 0.7 gallon, respectively. During the May 1991 sampling event, monitoring well MW-6S was purged dry.

2.2.2.5 Slug Tests

Slug tests were performed during the Phase I activities on selected facility monitoring wells to establish the range of hydraulic conductivities and transmissivities of the facility aquifers. In addition, storage coefficients and other hydrogeologic characteristics were either calculated or estimated based on the results of the tests. Slug withdrawal tests were performed on the eleven Phase I wells. These wells included MW-18S, MW-19S, MW-20S, MW-21S, MW-22S, MW-22D, MW-23D, MW-24D, MW-25S, MW-25D, and MW-26S.

The slug tests were performed using a slug constructed of 2.5-diameter by 5-, 10-, or 15-foot-long PVC pipe sealed at both ends. An in-situ PTX161D-10 psig or 20 psig pressure transducer connected to a Hermit 1000B field datalogger was used to record the drawdown with time measurements. The slug tests were conducted in the following manner.

- Prior to beginning the test, all downhole equipment was decontaminated according to procedures discussed in the Quality Assurance Project Plan (ENSR Document No. 6600-035-130, dated June 1990).

- The initial water level in the monitoring well was measured.

- The pressure transducer was lowered into the well and allowed to rest one foot off the bottom of the well.

- Either a 5-, 10-, or 15-foot slug was used depending upon the height of the water column in the well and the length of the monitoring well screen. Before the slug was inserted, it was filled with deionized water and capped.

- The data recorder was turned on as the slug was lowered in the well and submerged below the initial water level.

- The water level was monitored with the data logger and allowed to equilibrate to its initial water level.

- As the slug was "instantaneously" withdrawn from the well, the data recorder was activated once again, starting the test.

- The test was terminated when the water in the well returned to the initial pretest level.

2.2.2.6 Network Sampling

Network sampling was completed from September 25 through early October 1990. The network consisted of all Texaco Phase I wells, previously installed wells, and selected private wells. This event was intended to provide data to compare water quality of Texaco facility wells with surrounding wells in the area. Samples were collected after measurement of the water levels. Analytical results are discussed in Section 4.0 of this report.

2.2.2.7 Private Well Investigation

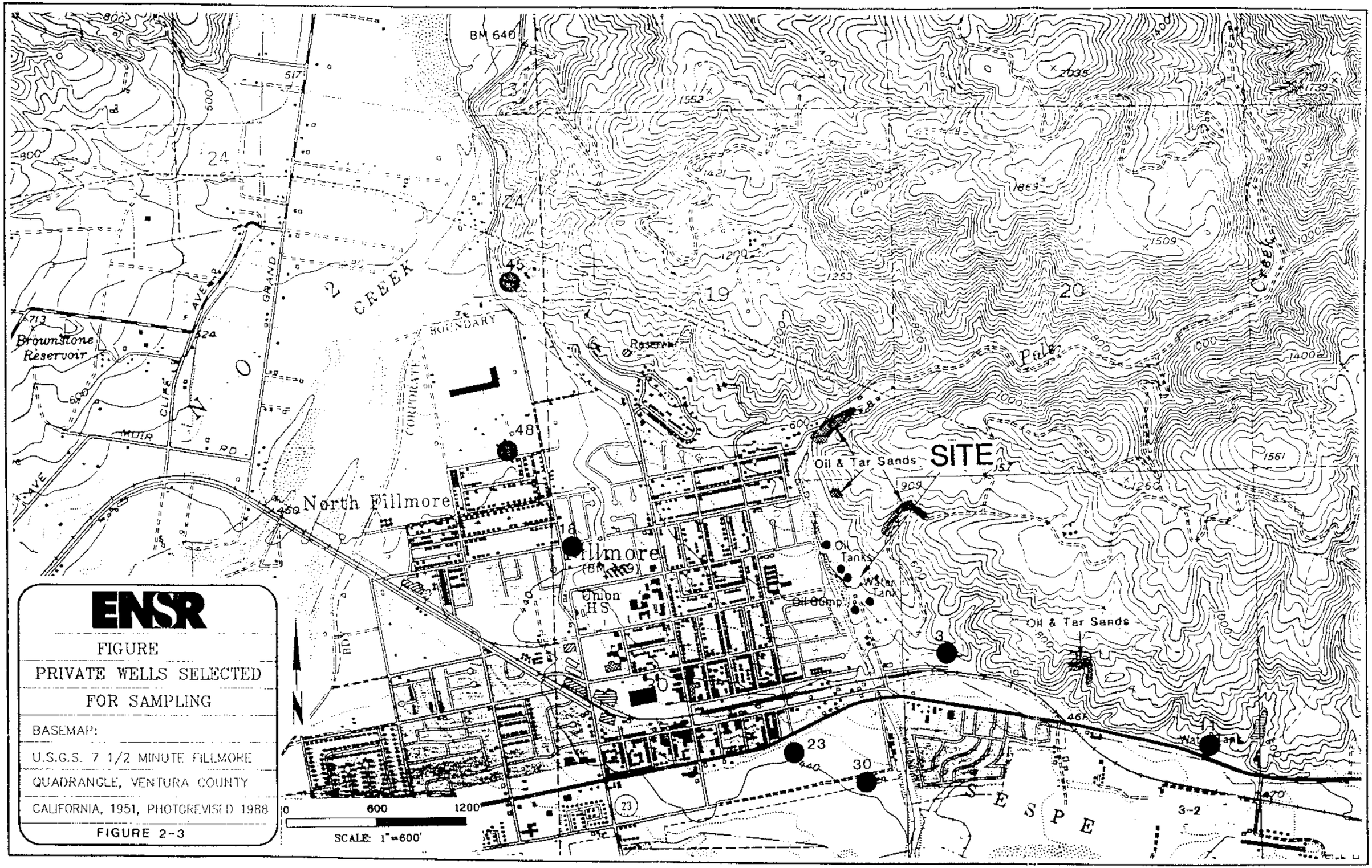
In order to accomplish the objectives of the network sampling at the Texaco Fillmore facility, an investigation was undertaken to update the water well data base compiled under previous studies (TriHydro 1988). It was originally planned to limit the network sampling to within ½-mile of the facility. This distance was expanded to a 1-mile radius when it became apparent that insufficient wells were available within the ½-mile limit.

After the water well data base was reviewed and updated, attempts were made to contact the owners of all water wells located within one mile of the facility. This effort resulted in:

- Permission to inspect and collect groundwater samples from four water wells within a ½-mile radius of the Texaco Fillmore facility.

- Permission to inspect and collect groundwater samples from 17 water wells within a radius of one-half to one mile from the facility.

From this group of wells, seven were selected for sampling based on availability and desired coverage of areas adjacent to the Texaco facility. Figure 2-3 shows the location of the private wells ultimately selected for sampling related to the facility, and Table 2-8 lists the sampling dates as well as the screened interval data for the wells.



ENSR

FIGURE

PRIVATE WELLS SELECTED FOR SAMPLING

BASEMAP:

U.S.G.S. 7 1/2 MINUTE FILLMORE QUADRANGLE, VENTURA COUNTY CALIFORNIA, 1951, PHOTOREVISED 1988

FIGURE 2-3

TABLE 2-8

Summary of Private Wells
Included in Network Sampling

Private Well Number	Date Sampled	Screened Depths (feet below ground surface)
3	10/03/90	unknown
11	12/12/90	174-204
18	10/04/90	60-134 186-208 260-281 374-380
23	10/03/90	160-232 345-355 404-434 446-479
30	12/12/90	173-190 200-212 245-262 265-300
45	10/18/90	240-502 pump at 160 feet
48	10/03/90	well total depth = 300 ft
Onsite Production Well	12/04/90	120-530

Wells selected and sampled in conjunction with the Network Sampling Event were determined to be pumped routinely. Sampling times were scheduled so that groundwater samples were collected during active pumping events, ensuring that samples representative of reservoir-quality water were collected. The wells sampled were primarily active irrigation and municipal water wells. These wells are usually constructed with an aboveground well pump housing situated over an enclosed casing. Downhole access for sounding and sampling purposes was generally not possible. Sampling notes for the wells are listed below.

Private Well No.	Sampling Notes
3	Well not purged due to frequent use; sampled from spigot; no filter system - water straight from well.
18	Well had been pumping for two days continuously immediately prior to sampling; samples collected from spigot; no filter system - water straight from well.
23	Allowed pump to purge well water, filling very large holding tank; tank water expended and as well purged additional water to recharge the holding tank, samples were collected from a spigot; no filter system - water straight from well.
45	Well used frequently; samples collected from spigot; no filter system - water straight from well.
48	Well used every day; samples collected from spigot; no filter system - water straight from well.

2.2.3 Surface Soils

The surface soil investigation involved establishing a reference grid consisting of 250-ft by 250-ft squares over the facility and collecting soil samples from 32 locations as follows:

ENSR subcontracted with Land and Sea Surveys of Ventura, California, to establish the reference grid. During the survey, it became obvious that the gridlines originally specified in the FSP were approximately 100 feet north of the ones determined in the field. This discrepancy required adjusting some of the sampling locations proposed in the FSP. The intersections of the gridlines were marked with permanent metal markers and stakes on which the grid coordinates were written. The actual grid is shown on Plate 2-3.

Exact sampling locations were determined in the field using the reference grid nodes, tanks, berms, pits, and other landmarks as reference points. Historical aerial photographs were reviewed to evaluate selected sample locations, particularly for background samples which fell predominantly on the hills and vegetated areas of the eastern part of the facility. (Past activities were largely concentrated on the relatively flat western part.)

Based on the shifting of the sampling grid and other facility conditions, the following sample location adjustments and observations were made:

- Background samples from grid squares 4, 8, and 19 were relocated to grid squares 2, 9, and 20 respectively, so that no more than one sample was collected from the same grid area.

- Waste pit samples were collected to avoid visible traces of bentonite from borehole grouting in waste pits where drilling had taken place.

- Samples from waste pits 5, 6, and 7 were collected after surface soil had been graded to accommodate the drilling rig.

- The background sample from grid square 36 was moved about 150 feet to the south within the same grid square after traces of a black tarry substance were observed at the location originally proposed in the FSP.

Surface soil sampling activities were performed in six separate events on August 2 (3 samples), 10 (8 samples), 12 (8 samples), 14 (8 samples), 16 (7 samples), and 17 (2 samples), 1990. Due to the 24-hour turnaround time required for hexavalent chromium analysis, the Enseco Laboratory in Ventura could not accept more than eight samples per day. All samples were collected from the top one inch of soil.

Split samples were collected during the initial August 3, 1990 event at three locations specified by CH2M Hill, the EPA's consultant onsite: two from the MWP and one from the former wax plant area. Because the reference grid, intended to be used for identifying sampling locations, had not been surveyed prior to the August 3 event, the three split samples were identified with the following sample identification numbers: TF-S-MWP-1-1, TF-S-MWP-2-1, and TF-S-WAXP-1-1.

2.2.4 Surface Water and Stream Sediment Investigation

2.2.4.1 Presampling Reconnaissance

On July 17 and 23, 1990, presampling reconnaissance trips were made to the general areas from which samples were expected to be collected. From the upstream end of the concrete channel, the streambed was explored for approximately 1,000 feet upstream into the Topa Topa mountains. The reconnaissance ended at this point because the stream channel was fenced off and two large dogs discouraged trespassing. At approximately 900 feet upstream, two stagnant pools of water were observed. The sill between the two pools appeared to be a grey shale formation outcropping into the dry streambed and about five feet up the sides of the stream channel. There appeared to be small natural petroleum seeps at two points in the shale bed. To examine the possibility of nonnatural origins for these occurrences, the tarlike material was cleaned away on the July 17 visit. On July 23, additional tarlike material had seeped out as a result of the hot weather. The downstream pool had a sheen on the surface during both visits, as would be expected from one of the seeps directly above the pool edge. The source of the water in the two pools could not be clearly determined. No flow had been recorded in the stream for more than 12 months, and adjacent to the pools were two residences with landscape irrigation systems and septic tanks. It is estimated that these two residences are approximately 10 to 20 feet higher in elevation than the pool surfaces.

Based on these reconnaissance visits, it was decided not to sample the water in the pools, but to sample the sediment in the streambed immediately adjacent to and upstream of the beginning of the concrete lining of the streambed.

At the downstream end of the concrete channel in Pole Creek, the unlined channel did not appear completely natural. The unlined channel bed was apparently artificially aligned with the lined portion, but no concrete had been applied due to its proximity to the Santa Clara River channel area. Unpaved roads were positioned on both banks of Pole Creek at this point. On the east side, a restricted access road under the jurisdiction of the Ventura County Flood Control District started at Highway 126 and extended well beyond the concrete portion of the channel. On the west side, a less well-maintained private road also started at Highway 126 and continued past the concrete portion. Downstream of the concrete channel end, slumping of the channel banks was common and a modest amount of trash and other man-made debris was observed in the streambed. Just upstream of the concrete channel end, a thin layer of stream sediment (up to 3 inches thick) extended about 75 feet from the end of the concrete.

The above observations indicated that the best place to sample stream sediments was from the thin layer just inside the lower end of the concrete portion of the channel. These sediments seemed less likely to have suffered contamination from the debris and roadside slumping and were more likely to indicate effects only from upstream.

ENSR and CH2M Hill jointly made sampling location decisions at both the upstream and downstream ends of the concrete channel.

2.2.4.2 Surface Water Sampling

Initially, surface water sampling was not possible due to the absence of water in Pole Creek. Due to a period of heavy rainfall in the latter part of February 1991, surface water samples were collected during early March 1991. The stream water samples were collected upstream, adjacent to, and downstream of the facility. Downstream for this report is defined as the area receiving runoff downstream of and adjacent to the facility. Local surface drainage is toward the south, southwest, and Pole Creek. Attempts were made to sample direct runoff from the facility into Pole Creek, but none was observed. Therefore, we cannot confirm that the analytical results presented in Chapter 4.0 are representative of the Texaco Fillmore site.

Surface water in the Pole Creek concrete-lined channel was sampled at seven locations as specified in the Field Sampling Plan for Surface Water and Stream Sediment Remedial Investigation/Feasibility Study (RI/FS) (ENSR Document 6600-035-150), and shown on Plate 2-4.

The sampling occurred on March 2 and 5, 1991, as soon as possible after the heaviest of the rains had passed through the area. The first sampling day occurred on a weekend, which precluded analysis of the samples collected for hexavalent chromium due to the required 24-hour holding time required for the method. Continued rainfall later in the week allowed resampling of the Pole Creek channel for the hexavalent chromium analysis.

The March 2, 1991 sampling was conducted during the afternoon. Samples were collected by placing the sample containers—two 1-liter amber glass bottles, two 250-ml amber glass bottles, and two 40-ml glass vials—beneath the surface of the water until they were properly filled. At sampling points B, E, and F, the stream had become too shallow at the time of sampling to collect samples in the way previously described. At these locations, previously decontaminated plastic tubs were filled with stream water and the samples were then retrieved from the plastic tub. The plastic tubs were dedicated for each sampling location and did not have to be decontaminated in the field.

Collocated samples were collected from locations B, E, F, and G located near the facility's stormwater drainage pipes which drain into the Pole Creek channel. However, it should be noted that no runoff into the channel from the pipes or other areas of the site was observed during sampling.

Continuing rains allowed resampling of the Pole Creek channel on the morning of March 5, 1991 for hexavalent chromium analysis. These samples were collected at approximately the same locations as the samples collected on March 2, 1991, except for locations C and D. A sample was not collected from location D due to the presence of two large Caterpillar bulldozers that were removing sediment and debris from the channel floor.

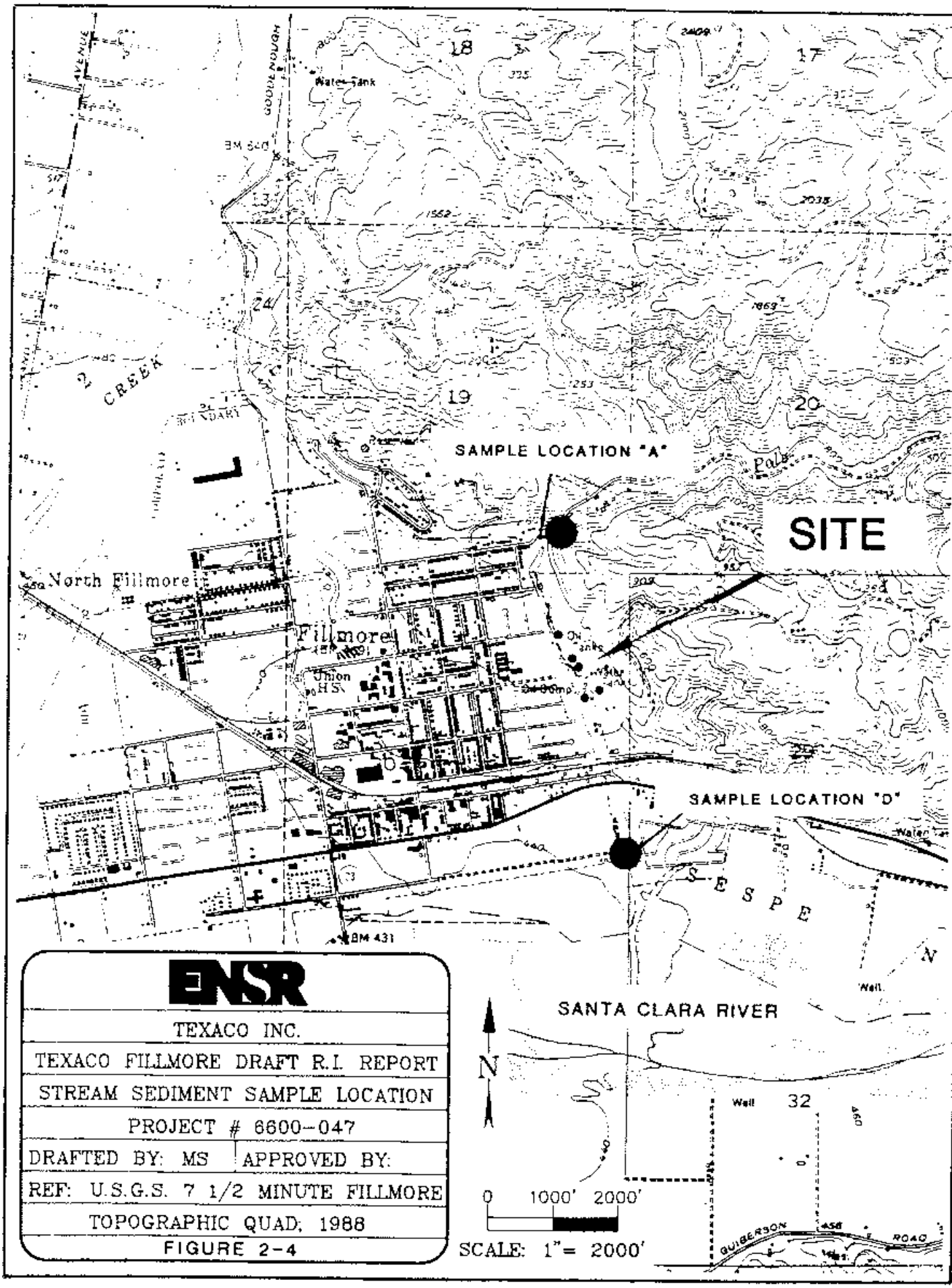
The stream water sampling during this second sampling event was conducted by use of a 5-gallon plastic bucket that was decontaminated prior to collecting each sample. Collocated samples for semivolatile organic analysis were collected at sample locations A and B due to the presence of a sheen in the bucket observed by the field geologist during sampling.

Laboratory labels and chain-of-custody labels were placed on all samples collected and the samples were refrigerated at 4°C and delivered to the laboratory for analysis. Chain-of-custody records prepared for each of the sampling days accompanied the samples to the laboratory.

2.2.4.3 Stream Sediment Sampling

Sediments were sampled at the two locations specified in the Field Sampling Plan for Surface Water and Stream Sediment Remedial Investigation/Feasibility Study (RI/FS) (ENSR Document No. 6600-035-150). These locations were selected as described above under Section 2.2.4.1, Presampling Reconnaissance.

The sediment samples were collected on July 24, 1990. The sampling team consisted of representatives from ENSR, EPA, and CH2M Hill. Two samples were initially collected at the downstream end of the concrete-lined channel (Figure 2-4, Site D) with a previously decontaminated trowel at a location approximately 50 feet upstream of the end of the concrete portion of the channel. The sediments at this point were about 2 inches thick. The samples were placed in brass sample sleeves 6 inches long by 2 inches in diameter, their ends sealed with Teflon and covered with plastic caps. They were then wrapped in aluminum foil, labeled, sealed in polyethylene bags, and refrigerated for delivery to a laboratory. The representative from CH2M Hill took collocated samples from the same location for laboratory analysis.



ENSR

TEXACO INC.
TEXACO FILLMORE DRAFT R.I. REPORT
STREAM SEDIMENT SAMPLE LOCATION
PROJECT # 6600-047
DRAFTED BY: MS | APPROVED BY:
REF: U.S.G.S. 7 1/2 MINUTE FILLMORE
TOPOGRAPHIC QUAD, 1988
FIGURE 2-4

Two additional samples were collected at the upstream end of the concrete channel (Figure 2-4, Site A). EPA and CH2M Hill planned no collocated samples for this location and did not accompany the ENSR sampling team. These two samples were taken approximately 10 feet upstream of the concrete channel end, and sandbags were located there to prevent erosion at the lip of the concrete. As before, a previously decontaminated trowel was used to collect the sample from the upper three inches of the streambed. Sample handling and preservation protocol was as described above.

A chain-of-custody record was prepared and submitted to the laboratory with the four samples.

2.2.5 Ambient Air

The air investigation involved the following field activities:

- Meteorological (met) sampling to support directional ambient air quality and integrated surface sampling activities.
- Directional ambient air quality sampling upwind and downwind of suspected source areas.
- Integrated surface sampling (ISS) over the MWP.

The met sampling program was performed as described in the FSP, although the exact location of the met tower and the samplers was amended to comply with EPA and ENSR ambient sampling standard operating procedures.

2.2.5.1 Meteorological Sampling

A met tower was installed primarily to provide wind direction and speed data necessary to drive the directional sampling array, and to ensure that integrated surface samples were collected within the constraints of the CARB's (California Air Resources Board) Technical Guidelines for Active Solid Waste Disposal Sites, 1987.

Met data were taken at the onsite met station for a 30-day period prior to the directional sampling and analyzed for site-specific flow behavior. In addition, ENSR reviewed 1988-1989 wind data for the Fillmore area from the Ventura County Air Pollution Control District's nearby Piru monitoring station. The wind roses for the 2-year Piru data set and the onsite data set are presented in the Air Sampling Program Results report (ENSR Document No.

6600-047-500). The ENSR met tower at the Texaco Fillmore facility was audited by AeroVironment in Santa Barbara, California. A copy of the audit report is provided in Appendix D of this report.

Onsite winds were found to flow at moderate speed in a primarily west-southwest direction from mid-morning to mid-evening, and relatively light and variable in a predominant north to southeast direction during the night and early morning. The data were reported in chart form, rather than summarized in a wind rose for ease of interpretation, in the ASPR.

Aspirated temperature, relative humidity, and solar radiation sensors could not be secured from equipment suppliers in the short time frame prior to the directional sampling program (all other facility activities had to be shut down to ensure undisturbed sampling). Therefore, these data were obtained from the Ventura County APCD's Air Pollution Monitoring Station in Piru, California, located approximately five miles east of the Texaco Fillmore facility; these data are considered representative of the temperature, relative humidity, and solar radiation at the Fillmore facility. All met data are provided as Appendix E of this report.

2.2.5.2 Directional Sampling

Directional sampling was conducted as outlined in the FSP, except for one modification to the standard operating procedures for PUF sampler operation: the semivolatile high-volume samplers were wiped cleaned without using an organic solution (EPA and ENSR SOPs require methanol and hexane, respectively, for PUF sampler preparation and calibration) in order to avoid biased results from the volatile sampler located within five feet of the semivolatile sampler.

Volatile and semivolatile organic directional samplers were located immediately west (upwind) and east (downwind) of the MWP. Collocated samplers were placed at both locations to validate the integrity of the data and to provide for EPA's decision not to collect split samples from this event. A third sampler was located further downwind of the MWP, near the area of highest soil gas concentrations detected by TriHydro Corporation's soil gas investigation, in response to EPA recommendations. The samplers were programmed to take samples during daytime winds flowing in a northwest to south/southeast direction, since these winds were from a relatively narrow sector and persisted in a steady fashion for 10 hours or more on most days.

The samplers were programmed to start sampling when the 5-minute average wind speed was between 1 and 10 mph, and to turn off if the average speed exceeded 15 mph. The lower limit is intended to circumvent wind speeds below the minimum response threshold of the direction sensor to prevent the vane from indicating a constant wind direction when the

wind is actually highly variable. The upper speed limit is intended to avoid excessive atmospheric dilution during sampling.

Calibrations for all samplers appear in Appendix F of this report.

2.2.5.3 Integrated Surface Sampling

The ISS was performed in the MWP as stated in the FSP with the following exceptions:

- Duplicate samples for both volatile and semivolatile organics were taken immediately after each was first sampled, rather than after sampling both as specified in the FSP (i.e., two volatile samples were drawn first and then two semivolatile samples). This procedural change was made because it would have taken approximately 60 minutes to modify the ISS pump system from drawing air into a Tedlar bag to drawing air into an XAD cartridge, thus extending the ISS into the mid-morning when wind speeds would likely exceed the maximum conditions specified by the ARB.

- The ISS was conducted concurrent with, rather than before, the directional sampling. The FSP specified using the results of the ISS to limit the number of analytes in the directional sampling. However, laboratory results could not be available within the short time period (about 10 working days) between the two events. Furthermore, the ISS has relatively higher detection levels than directional sampling and was not considered adequate to be used for limiting the analysis of the directional sampling.

Ms. Sharon A. Jones, Hazardous Waste Engineer with the CH2MHill Santa Ana office, was onsite on Friday August 31, 1990, during the ISS program to audit this air sampling program.

2.3 Field Procedures

The field procedures used in the facility investigation followed the EPA-approved protocols established in each of the six media-specific FSPs and the Site Health and Safety Plan, unless otherwise indicated in this section.

2.3.1 Health and Safety Requirements

Daily activities were overseen by Mark Landgaard, Industrial Hygienist, of Envirohealth, Inc., Long Beach, California. A health and safety briefing was conducted daily before work began. Attendance was mandatory for all workers involved with the project and was recorded in the Workers Logbook. All personnel involved in field activities were required to present proof of

completion of a 40-hour health and safety training, and their records were kept onsite for the duration of the project.

2.3.1.1 Worker Protection

Field activities were primarily conducted in EPA Level D personal protection clothing, except for some drilling activities which required an upgrade to Level C. Boreholes requiring upgrade to Level C are identified in Tables 2-1 and 2-2. The protective equipment and clothing required for Levels C and D are described in detail in the FSPs. The minimum protection required for facility field activities included Tyvek coveralls, neoprene gloves, steel-toed rubber boots, and a hard hat. Workers operating or steam cleaning the drill rigs were also required to wear safety goggles and, in the case of the dual-tube drilling rigs, hearing protection.

All drilling activities were conducted inside a 50-foot work zone equipped with a fire extinguisher, first aid kit, and eyewash station. Workers leaving the work zone were required to remove their Tyvek coveralls and decontaminate their boots and hands in designated wash areas. No food or drink was allowed within the work zone. A support zone was located outside and upwind of every work zone.

2.3.1.2 Health and Safety Monitoring Equipment

The Site Health and Safety Plan (ENSR Document No. 6600-035-140) specifies the types of health and safety monitoring equipment required for the investigation and the monitoring frequency and action levels associated with each piece of equipment. All drilling activities were monitored with organic vapor analyzers (OVA), lower explosive limit (LEL) meters, and H_2S meters. The equipment was calibrated daily prior to initiating work and as necessary throughout the day. Calibration of each piece of equipment was recorded in dedicated logbooks. LEL and H_2S were monitored continuously, while organic vapor readings were collected every 15 minutes. Readings were recorded in a Personal Exposure Monitoring Field Logbook. A benzene Dräger tube was broken when OVA readings exceeded 10 units, in order to determine the presence or absence of benzene.

A Reuter-Stokes RSS-217 Heat Stress Monitor was used to monitor ambient air temperature during drilling. Extreme temperatures often exceeding 100°F made worker heat stress a critical factor during the initial phase of the investigation, requiring drilling crews to take 15-minute breaks every hour.

2.3.1.3 Community Monitoring

A portable gas chromatograph (GC) was used to measure benzene concentrations when OVA measurements indicated sustained levels above 10 units in the breathing space of rig workers. Portable GC benzene levels never exceeded the 1 ppm action level specified in the Site Health and Safety Plan for community monitoring. While not required, community monitoring was performed with the portable GC 50 feet downwind from the drill rig, and with a photoionization detector along Pole Creek, during drilling of boreholes in close proximity to the residential neighborhoods.

2.3.2 Decontamination of Drilling and Sampling Equipment

Drilling and sampling equipment was decontaminated prior to and between use, in accordance with the procedures specified in the FSPs. Each drill rig, drill pipe, auger flight, and all other support trucks and equipment, were steam-cleaned with high-pressure and high-temperature water before and after each borehole sampling. All well screens and casings were also steam-cleaned prior to installation. Decontamination procedures were carried out within the confines of a concrete truck wash pad onsite. Water used in cleaning the rigs was collected in a sump and pumped into storage tanks located inside the bermed wash pad area for proper disposal.

The split-spoon sampler was decontaminated between every sampling event. Decontamination involved immersion in a nonphosphate soap (Alconox) solution, followed by scrub brushing and a double distilled water rinse. The following procedure was followed for decontamination of brass sleeves, bailers, spades, and other sampling equipment:

- Wash and scrub with nonphosphate detergent
- Rinse with tapwater
- Rinse with 10 percent HNO_3
- Rinse with deionized/distilled water
- Rinse with isopropyl alcohol water
- Two rinses with deionized/distilled water
- Air dry

All cleaned brass sleeves were wrapped in plastic bags and sealed until used for sampling.

2.3.3 Borehole and Well Drilling Procedures

ENSR issued a subcontract to Layne Environmental, Inc. to perform the borehole and monitoring well drilling and the well installation and development activities. Drilling activities were conducted under the supervision of a California-registered geologist in accordance with California Regional Water Quality Control Board (RWQCB) standards.

ENSR also subcontracted with Land and Sea Surveyors from Ventura, California, to survey all borehole and well locations upon completion. Boreholes and well locations were surveyed using an x-y-z coordinate system.

2.3.3.1 Drilling Methods

All boreholes and wells were drilled using an AP 1000 percussion-hammer drill rig or a CME-75 auger drill rig, depending on drilling conditions. The percussion hammer drill rig used a 9-inch outer diameter dual-wall drive pipe which was advanced through the soil by a diesel-powered pile-drive hammer. With this method of drilling, soils were brought to the surface by forcing compressed air down the annulus between the inner and outer drive pipe. Soil cuttings were carried up the center of the inner drive pipe and collected in 4-yard soil bins at the surface. This drilling technique offered a high-quality method of drilling and sampling in the difficult drilling environments encountered at the facility. It provided rapid penetration through difficult subsurface formations such as coarse gravel and cobble formations, while providing a temporary casing for the borehole. The use of compressed air to carry soil to the surface ensured that no contaminants were added to the borehole during drilling.

The majority of deep boreholes (90 to 150 feet) were advanced using the AP 1000 percussion-hammer drill rig. However, a significant number of shallower boreholes (40 to 80 feet) were drilled with a CME-75 auger rig. The auger rig proved important in drilling locations where topography, surface conditions, or surface obstructions prevented access to the larger percussion rig. The CME-75 auger rig utilized 6⅝-inch outer diameter by 3¼-inch inner diameter hollow-stem augers. Soil cuttings brought up by the augers during drilling were shoveled into 4-yard soil bins.

2.3.3.2 Borehole Termination

Boreholes not converted into monitoring wells were abandoned in accordance with appropriate Ventura County regulations. The onsite geologist acted as the inspector for all borehole abandonment activities. Inspection documents with information including total

depth drilled, borehole locations, grouting materials, and methods used have been filed with the County of Ventura Water Resource Department.

Abandoned boreholes were plugged with an expansive grout mixture of 95 percent Portland cement and 5 percent bentonite. Pure bentonite grout was not used because hydrocarbon liquids destroy its sealing qualities. The cement grout was mixed using a gasoline-powered "mud pump" and injected through a grout hose into the borehole. The cement-to-water ratio of the grout was approximately three 95-pound bags of cement to 15 gallons of water. Boreholes were filled with cement grout to within three feet of the ground surface. The remaining three feet was filled with uncontaminated native soil to allow for future grading of the facility without damage to the cement plugs.

Extreme caution was taken to ensure that no cross-contamination occurred as the result of piercing a significant perched zone (e.g., red clay marker bed) during borehole drilling and installation of monitoring wells. When a significant fine-grained unit was encountered by a borehole not earmarked for a well, the field geologist was responsible for deciding if the borehole should be advanced below the fine-grain unit. Boreholes that encountered perched water and were not to be converted into wells were terminated and abandoned as described above without penetrating the confining layer below the perched water.

2.3.4 Subsurface Soil Sampling Procedures

Subsurface soil samples for laboratory analysis were collected at 5-foot intervals beginning at a depth of five feet below grade and continuing until the total depth of the borehole was reached. A 2.5-inch inner diameter, 24-inch-long stainless steel split-spoon sampler equipped with eight 3-inch-long brass sleeves was used for sample recovery. Samples were obtained using the standard penetration test (SPT) to determine the consistency or degree of compactness within the deposits. The sampler was driven using a 140-pound hammer with a vertical drop of 30 inches. The number of hammer blows required for every six inches of penetration was recorded on the field boring log.

Upon retrieval of the sampler, the split-spoon was opened and from three to seven sleeves preserved for laboratory analysis depending on recovery. Soil samples designated for analysis were immediately sealed at both ends with Teflon sheeting, capped with polyethylene caps, wrapped in aluminum foil, labeled, placed into a sealable polyethylene bag, and placed in an ice chest maintained at approximately 4°C with blue ice. After completion of the borehole, all samples were inventoried, cross-checked against the original borelogs, and transferred to a freezer maintained in the field to await pickup by the laboratory.

2.3.4.1 Lithologic Logging

All boreholes were logged by a qualified geologist. An experienced onsite geologist analyzed the drill cuttings for physical parameters, including color, texture, odor, relative moisture content, lithology, and the presence of hydrocarbon staining, liquids, or odors. Soil color was determined using a Geological Society of America Rock Color Chart. Physical characteristics were recorded within the boring logs (Appendix B).

Additional samples were collected at the discretion of the project geologist when circumstances required.

A number of boreholes were continuously cored, allowing a continuous stratigraphic record to be recorded. Boreholes that were continuously cored were done so by driving a split-spoon sampler void of brass sleeves ahead of the drill bit. Coring in this manner was accomplished in 2-foot intervals, alternating drilling and coring. Cores were brought to the surface, positioned in a stratigraphically continuous sequence, labeled, and photographed by the rig geologist.

2.3.4.2 Ambient Temperature Headspace Monitoring

One sleeve from each sampling event was analyzed for soil gas using the ambient temperature headspace methodology (ATHM). About one-half of the soil was removed from the sleeve to create a vacant headspace of approximately 200 millimeters over the remaining soil (about 300 grams), and the sleeve was sealed at each end with aluminum foil. Samples were stored out of the sun at room temperature and the headspace monitored with a flame ionization detector (FID) after 15 to 30 minutes, to obtain a reading of potential total volatile organic compounds. The reading was recorded in the borelog.

2.3.4.3 pH

Approximately five grams of soil from each sampling event were added to 5 cc of deionized water in a volatile organic analysis (VOA) vial to measure soil pH in the field. The VOA vial was shaken for 30 seconds to form a solution, and pH paper with a range of 0 to 14 was used to measure the pH of the solution. The reading was recorded in the boring log.

2.3.5 Groundwater Sampling Procedures

Groundwater samples were collected during four sampling events. Refer to Section 2.2.2 for a discussion of groundwater sampling procedures.

2.3.6 Surface Soil Sampling Procedures

Surface soil samples were collected with stainless steel spades. The soil was scraped directly off the surface and placed in one large (±1 liter) and three small (±250 milliliter) precleaned glass jars. One of the small jars was as tightly packed as possible in order to preserve the volatiles for the organic analysis. The other two small jars were used for the metal and hexavalent chromium analyses. The samples from the large jar were used for sieve analysis and lithologic descriptions. In some areas, where the surface was covered with highly coarse gravel, the gravel was carefully moved aside prior to sampling. For every single sample, the sampling depth did not exceed one inch.

2.3.7 Surface Water/Stream Sediment Sampling Procedures

Refer to Section 2.2.4.2 for a discussion on surface water sampling procedures.

Stream sediment samples were collected with a previously decontaminated trowel. The samples were placed in brass sample sleeves six inches long by two inches in diameter, their ends sealed with Teflon and covered with plastic caps. They were then wrapped in aluminum foil, labeled, sealed in polyethylene bags, and refrigerated for delivery to a laboratory.

2.3.8 Ambient Air Sampling Procedures

2.3.8.1 PM_{10} Samplers

A Wedding PM_{10} sampler or its equivalent was deployed at each selected monitoring location. Prior to deployment, each sampler received a five-point flow rate calibration at ENSR's Air Quality Laboratory in Camarillo, California, using a Reference Flow Device (ReF) whose calibration is traceable to NIST. The inlet of the sampler was approximately two to three meters above ground. Prior to field operation, the samplers received another five-point field calibration using a certified ReF device.

Sampling periods for the directional samplers occurred over 24 hours on three separate days. The flow rate was verified daily by a field engineer. Flow rates were verified using a mercurial manometer's delta pressure, reading inches, and applying the field-generated calibration curve constants.

Particulate matter was collected on 8.5-inch by 11-inch prefired and preweighed quartz filters. Individual filters were identified with a unique seven-digit code. Filters were loaded at the beginning of each sampling period using gloved hands and tweezers to avoid contamination.

The exposed filter was removed, employing the same precautions, and folded with the exposed side in, slipped into a protected sleeve, and wrapped in aluminum foil All sampling data were entered on a data sheet that accompanied the exposed filter, along with a completed chain-of-custody form. All siting, calibration, operation, and maintenance procedures were designed to meet or exceed the guidelines established in the Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II, Ambient Air Measurements, specifically Section 2.11.

2.3.8.2 Volatile Organic Sampling Array

The sampling procedure describes the collection of VOCs in ambient air by collection in Tedlar bags. Ambient air was introduced into the Tedlar bags at a measured flow rate through the use of sampling pumps.

One sampler was deployed at all monitoring sites except the collocated site, which had two samplers. Installation, calibration, operation, and maintenance followed the ENSR Technical Instruction Document No. 2622-022 (Appendix B of the Quality Assurance Project Plan, ENSR Document No. 6600-035-130).

2.3.9 Sample Documentation

The procedures described below were followed during sampling and analytical activities to provide sample documentation and chain-of-custody control during all transfers of samples.

2.3.9.1 Field Logbooks

Sampling activities were recorded in dedicated logbooks with indelible ink and entries included the following information:

- Project number
- Sampling date and time
- Name of sampler
- Borehole number and location
- Borehole depth
- Type of sampler
- Field indicator parameter test results
- Number of samples
- Sample storage procedures

The person taking the sample entered the time and date in the field logbook and then signed the page.

2.3.9.2 Labels and Seals

Each sample container was labeled with the project name, sample date, depth of sample, sample identification code, and preservation method. Sample labels were generated at the facility with a desktop computer and printed on a dot matrix printer.

2.3.9.3 Chain of Custody

A chain-of-custody (COC) record was initiated at the time of sampling for all samples collected and submitted to the laboratory for analysis. The COC contained the sample ID number, date and time of sampling, number of containers per sample, name and dated signature of the sampler, and the analytical methods requested for each sample according to the QAPP. Standardized COC forms were used for tracking samples. The COC accompanied all samples at all times. A copy of each COC was retained by field personnel at the time of relinquishing the samples. Copies of the COC forms were returned by the laboratory with the results of the sample analyses.

2.3.9.4 Hazardous Materials Disposal

Soil cuttings from both the percussion-hammer rig and the hollow-stem auger rig were collected in 4-yard soil bins as the cuttings were generated. Upon completion of each borehole, the soil bin was covered with visqueen in order to prevent volatilization of any hydrocarbons present. The bins were transported by forklift to a designated soil storage area. At approximately 2-week intervals, Offshore Crane emptied the 4-yard bins into roll-off soil bins stored in a designated area of the facility.

All spent personal protective equipment and surplus sampling containers used during drilling and decontamination procedures were placed in DoT-approved 55-gallon drums. All bins and drums were properly labeled and stored for disposal by Texaco, Inc. per applicable regulations.

3.0 PHYSICAL CHARACTERISTICS OF THE STUDY AREA

3.1 Surface Soils

Surficial soils located in the areas of investigation at the Fillmore facility are similar in many respects to subsurface soils encountered at that facility. The general soil profile consists of gravelly, silty sands containing a trace (<5 percent) to little (<12 percent) clay. Under the Unified Soil Classification System, the classifications which best describe the surface soil are GM — silty-gravels or gravel, and sand-silt mixtures; and SM — silty sands or sand-silt mixtures. The proportions of each constituent vary with respect to topographic control, as does the amount of organic material present.

Surficial soil color varies little across the facility and is mainly a function of the percentage of fines and organic material. Dusky to moderate brown soil is characteristic of the presence of finer material with organic matter. Moderate brown soils often grade to light brown and dark, yellowish orange, which generally represents the coarser material. Mixtures of grain size and organic material often create different shades of brown.

The topography of the subject facility represents an area of substantial relief over a short distance. Large hills representing the upper plate of the San Cayetano Thrust Fault bound the east and slope to the drainage at Pole Creek to the west. This topography exerts control over the surficial material such that in the areas of higher elevation, more organic material is present and grain size decreases. Areas of topographically lower elevation generally contain a greater fraction of coarse grain sizes.

The soil samples for particle size distribution analysis were sent to the Earth Technology Corporation in Huntington Beach, California. The analysis followed the ASTM D422 methodology as specified in the Field Sampling Plan (FSP). Results of the ASTM D422 analysis are provided in Appendix A, Laboratory Reports.

3.2 Geology

The geologic aspects of this remedial investigation (RI) are particularly relevant since the facility, which is being investigated for potential petroleum-related chemical constituents, is located in an area where naturally occurring petroleum-bearing sediments and rocks are predominant.

To better understand these phenomena, the investigation of the facility's geology included a literature search and consultations with expert petroleum geologists from the producing area around the facility (Mr. Gregory Cavette and Mr. Marvin Katz of Texaco USA).

3.2.1 Regional Geology

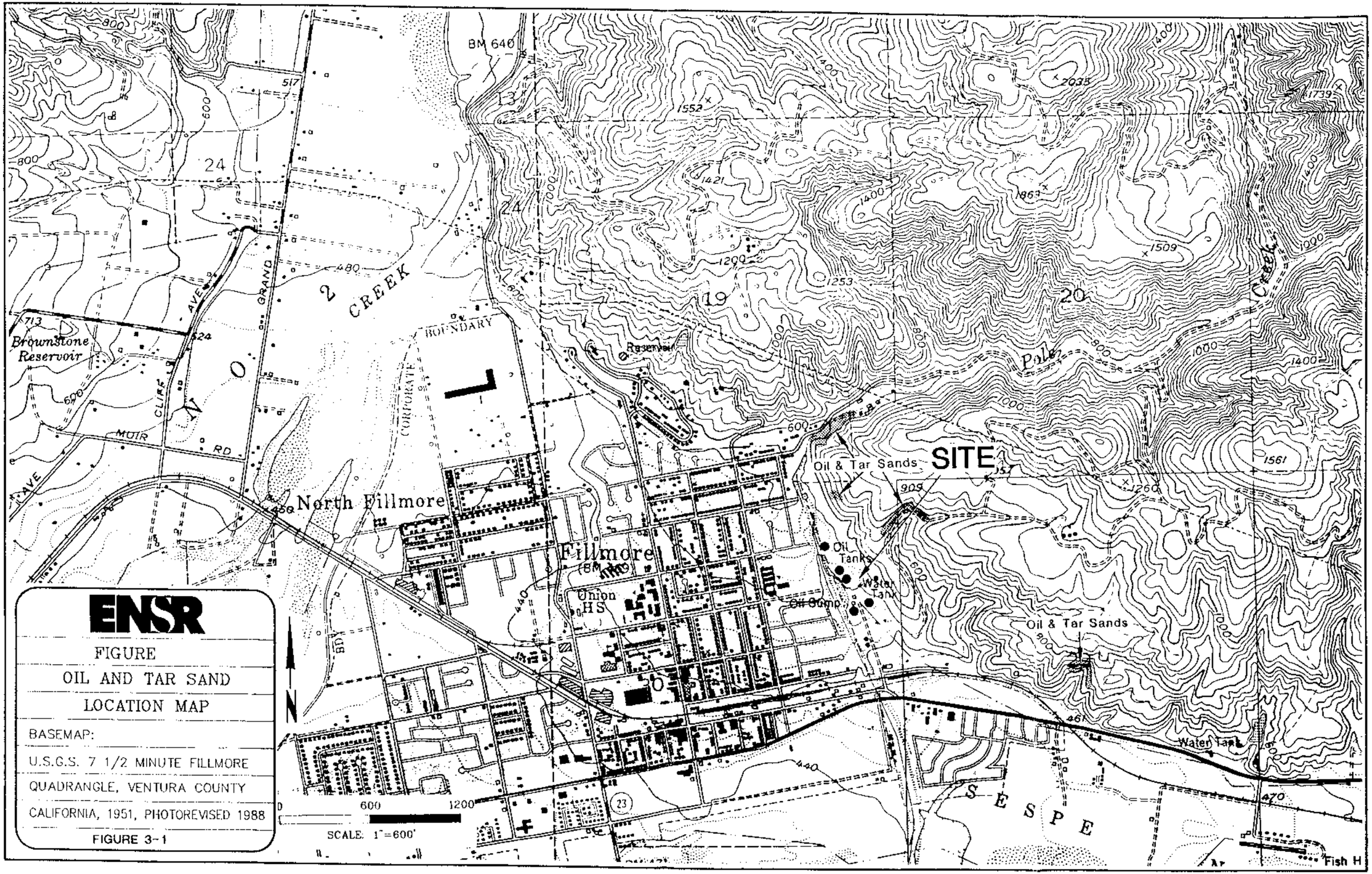
The Texaco Fillmore facility is located on the southern edge of the Topa Topa Mountains in a tectonically active area that includes both potential faulting and mountain building. The San Cayetano Thrust Fault that crosses the Texaco facility is associated with areas of significant oil seeps. Pleistocene movement on the fault has been documented. Holocene and Historical movement are believed to have occurred (Keller, et al. 1982, Tectonic Geomorphology of the Ventura, Ojai, and Santa Paula areas, Western Transverse Ranges, California, Neotectonics in Southern California, Guidebook). Fractures associated with folding and fault zones can act as either seals or conduits for the migration of fluids.

The facility is surrounded by oil and gas fields such as the Sespe Field on the north, which contains the Tar Creek and Little Sespe production areas; Fillmore Field at the town of Fillmore; Bardsdale and Shiells Canyon on the south; Hopper Canyon on the east; and Timber Canyon on the west (Munger Map Book 1987, California-Alaska Oil and Gas Fields). All of these fields have been producing since the late 1800s and early 1900s (Conservation Committee of California Oil Producers 1988, Annual Review of California Oil and Gas Production 1987). Approximately three-fourths of the producing wells in Ventura County are within a 6-mile radius of the town of Fillmore (Fillmore Historical Society 1989, Fillmore, 1888-1988).

Oil-containing oil and tar sands and shales that extend across the facility have been identified. Outcrops are located to the north, at the mouth of Pole Creek Canyon; to the southeast, north of Highway 126; and on the facility itself, in the hill forming the eastern boundary (Figure 3-1).

3.2.1.1 Stratigraphy

Identification of faults and unconformities, both of which may act as either conduits or seals for fluid migration, depends upon an ability to identify the rock strata involved. This identification is based on both the order of deposition of the rock units, from oldest to youngest, and lithology (physical characteristics such as mineralogic composition, grain size, and color). With this knowledge it can be determined if any strata are out of order or missing as a result of either faulting, unconformities, or both. In addition, the strata normally encountered in a river valley such as the facility area also provide conduits and seals in relation to fluid migration potential.



ENSR

FIGURE

OIL AND TAR SAND

LOCATION MAP

BASEMAP:

U.S.G.S. 7 1/2 MINUTE FILLMORE

QUADRANGLE, VENTURA COUNTY

CALIFORNIA, 1951, PHOTOREVISED 1988

FIGURE 3-1

Nomenclature and Age

The 1990 Geologic Map of the Fillmore Quadrangle (Dibblee) identifies the rock strata in the area of Texaco's property as Monterey Formation from Luisian through Delmontian (Mid through Late Miocene) in age (Tables 3-1 and 3-2). The same strata have also been identified as Modelo Formation (I. Cemen 1977, Geology of the Sespe-Piru Creek Area, Ventura County, California) of Luisian through Delmontian in age. The Modelo Formation type section is located approximately five miles to the east in the Piru area (Figure 3-2). The name Modelo is commonly used in this area by the oil industry for strata of this age. The Sespe Creek area has served as a general boundary, with the name Monterey Formation used for strata of this age to the west, and Modelo Formation for strata to the east.

The Monterey and the Modelo have been described as lithologically very similar. They are both sequences of sand-rich strata alternating with shale-rich strata that are typically siliceous, often diatomaceous, and commonly contain oil seeps. Monterey shales commonly contain abundant organics resulting in a black or dark grey color on fresh surfaces, although the weathered surface is often white.

Regional Stratigraphy

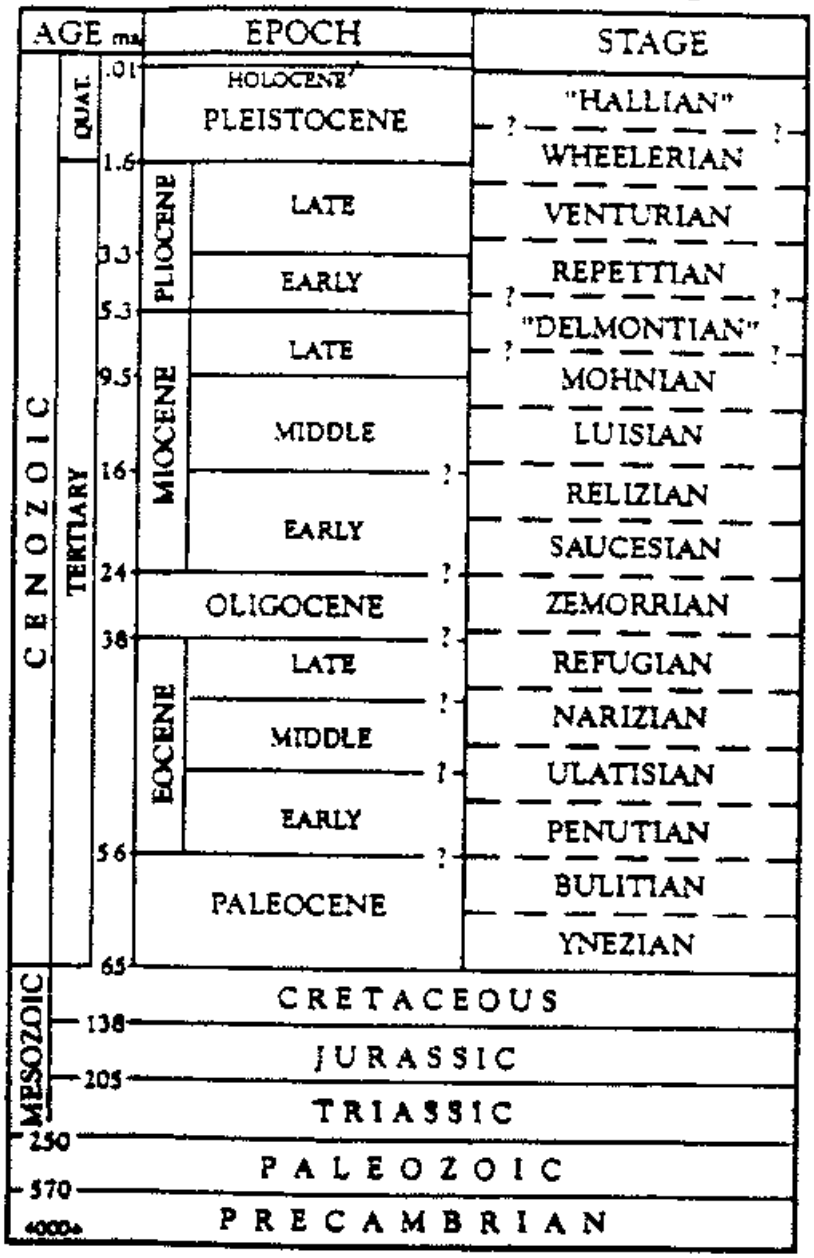
The oldest exposed strata in the region are middle to late Eocene sandstones and shales. In order of age from oldest to youngest, they are the Matilija Sandstone, a marine unit with interbeds of shale; the Cozy Dell Shale, a marine unit with sandstone interbeds; and the Coldwater Sandstone, a late Eocene (Narizan Stage) unit with shale interbeds and some fossiliferous beds (Dibblee 1990).

The next stratigraphic unit, the Oligocene Sespe Formation, follows an unconformity. It represents a period of lowered sea level and terrestrial deposition. This interval was followed by a sea level rise and deposition in the Miocene of the marine Vaqueros Sandstone, Rincon Shale, Monterey Formation (also Modelo Formation), and Sisquoc Shale (Dibblee 1990).

Marine deposition continued in the Pliocene and early Pleistocene. Formations representing this period are the Pico and the Las Posas Sand. The Saugus Formation of this time interval overlies the Los Posas Sand. It is nonmarine and contains reworked material, including rounded quartzite and granitic rocks, and is unconformable over its underlying strata (Dibblee 1990).

TABLE 3-1

AGE CORRELATION CHART



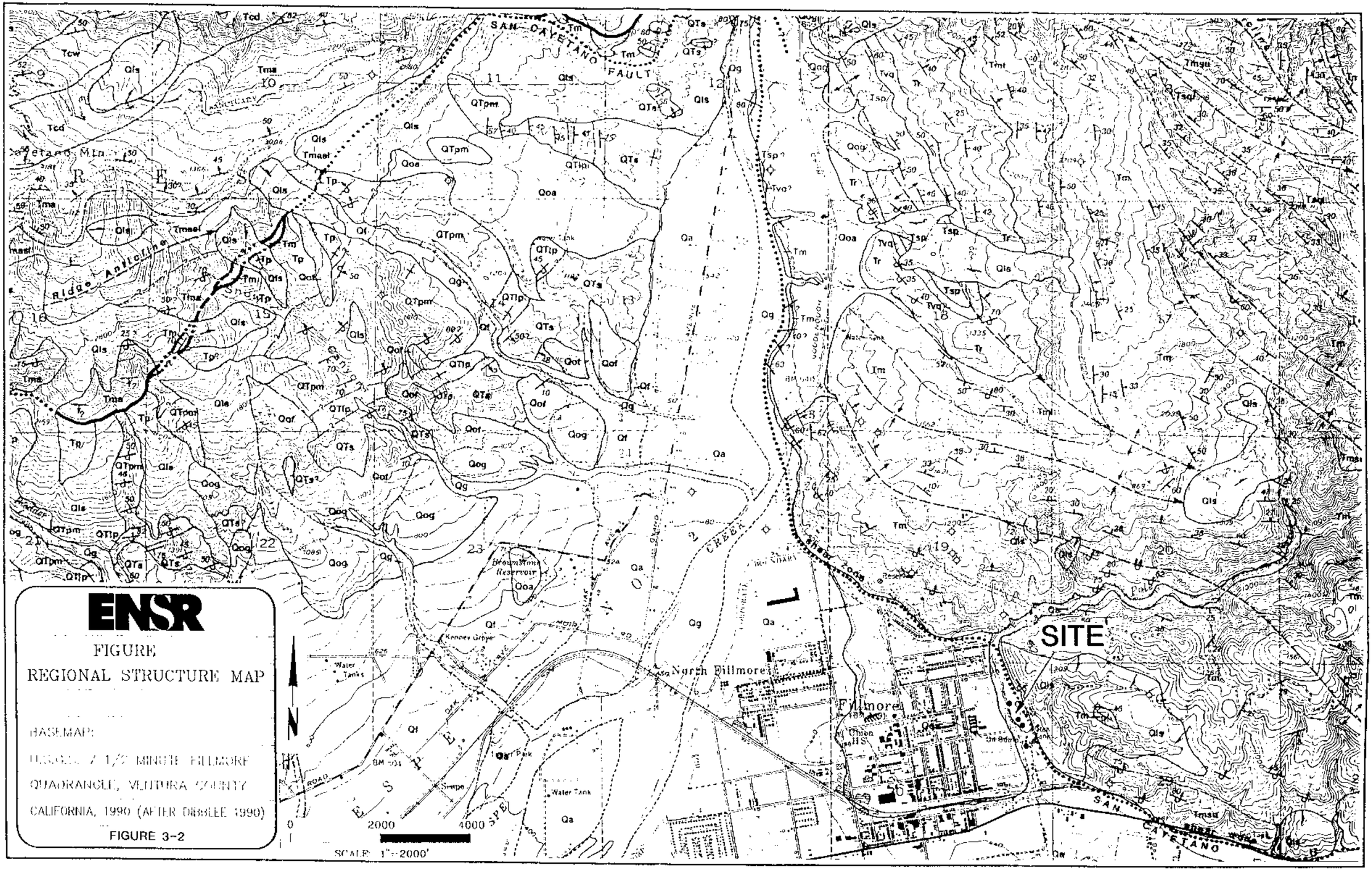
Radiometric ages, in millions of years (ma) are from current geological literature. Time relationships between California provincial microfaunal stages and epochs are subject to continued revision and refinement, as indicated by dashed and/or queried lines. (Stage boundaries are adapted mostly from Micropaleo Consultants, Inc., 1989.) Partitions between epochs and stages are diagrammatic and not to scale.

(after Dibblee 1990)

TABLE 3-2

Local Stratigraphic Column

System	Series	Formation	Description
Quaternary	Recent	Landslide Talus Alluvium	Large blocks, replicas of parent formation, and unconsolidated slope debris
	Pleistocene	Terrace	Cobbles, gravel, sand and silt
Tertiary	Miocene	Monterey/Modelo	Shale multicolored, calcareous, carbonaceous, siliceous, diatomaceous, chart and mudstone interbeds. Bitumen in fractures and shales. Sandy light grey to buff, massive thick bedded, coarse to fine grained, angular to subrounded, interstratified quartz pebble conglomerates. Thin interbeds of shale and silt stone.
		Rincon	Shale and mudstones, bluish-black to chocolate brown, numerous dolomitic concretionary layers.
		Vaqueros	Sandstone, greenish grey to buff, interbeds of calcareous shales, siltstone, numerous oyster reefs.
	Oligocene	Sespe	Sandstone, reddish-brown to buff, massive to bedded, includes shales, pebble lenses, and discontinuous basal conglomerate.
	Eocene	Coldwater	Sandstone, greenish-grey to white, interbedded with red, pink and green shale and siltstone, numerous oyster reefs.
		Cozy Dell	Shale, dark to reddish-grey, massive to thin bedded, indurated, micaceous, spheroidal fracture, gypsum in fractures, numerous thin sandstone interbeds.



ENSR

FIGURE

REGIONAL STRUCTURE MAP

BASEMAP:

U.S.G.S. 7 1/2 MINUTE FILLMORE QUADRANGLE, VENTURA COUNTY CALIFORNIA, 1990 (AFTER DIBBLEE 1990)

FIGURE 3-2

LEGEND

af / Qg / Qf / Qa

SURFICIAL SEDIMENTS

af *artificial fill*

Qg *stream channel deposits, mostly gravel and sand*

Qf *alluvial fan boulder-cobble gravel*

Qa *alluvium: unconsolidated floodplain deposits of silt, sand and gravel*

Qls

LANDSLIDE AND TALUS DEBRIS

includes slopewash of sandstone detritus

Qoa / Qog / Qof

OLDER DISSECTED SURFICIAL SEDIMENTS

dissected remnants of slightly indurated brown, alluvial boulder-cobble gravel, composed of sandstone detritus, in sandy to silty matrix

Qoa *youngest, lowest gravel terraces*

Qog *intermediate, higher gravel terraces*

Qof *oldest, highest, gravel terraces*

QTs

SAUGUS FORMATION

nonmarine; Pleistocene, possibly in part latest Pliocene age

QTs *weakly consolidated brown alluvial cobble-boulder conglomerate of poorly sorted subrounded to subangular detritus of mostly sandstone, and minor rounded detritus of shale (Tm), quartzite, andesitic porphyry and granitic rocks; crudely bedded to massive; locally includes thin lenses of brown sandstone*

QTlp

LAS POSAS SAND

marine regressive; latest Pliocene(?) to early Pleistocene age

QTlp *mostly tan to light brown friable fine grained sandstone and sandy siltstone, commonly with shell fragments; includes lenses of pebble-cobble conglomerate of mostly sandstone detritus; grades upward into QTs and downward into QTpm*

QTpm / Tp

PICO FORMATION

marine; Pliocene and Pleistocene age

QTpm *Mudpit Claystone Member, massive to poorly bedded, soft, crumbly gray claystone or mudstone, bluish grey where unweathered; early Pleistocene and possibly late Pliocene age*

Tp *Pico Formation: vaguely bedded, soft, crumbly grey claystone and siltstone, bluish-gray where unweathered; includes strata of tan, semi-friable, bedded sandstone; mostly Pliocene age*

Tsqu / Tsql

SISQUOC SHALE

(Santa Margarita Formation of Bailey and Jahns, 1954; Weber et al, 1973; included in Modelo Formation by Kew; 1924)

marine; late Miocene age (Delmontian - Mohnian Stages)

Tsqu *upper part; light gray silty clay shale,*

Tsql *lower part; light gray clay shale, and semi-siliceous and diatomaceous shale*

Tmsu / Tm / Tml / Tmss

MONTEREY FORMATION

(Modelo Formation of Kew, 1924)

marine biogenic; primarily middle and late Miocene age

Tmsu *upper sandstone member; tan, semi-friable, thick bedded arkosic sandstone*

Tm *upper shale unit: white-weathering, thin bedded, hard, platy to brittle siliceous shale; Mohnian Stage*

Tmss *lower sandstone member; similar to Tmsu*

Tml *lower shale unit: white-weathering, soft, fissile to punky thin-bedded shale and interbedded harder siliceous shale and thin hard dolomitic strata; Uzian to uppermost Saucesian Stage*

Tr

RINCON SHALE

marine; primarily early Miocene age (Saucesian and upper Zemorrian Stages)

Tr *poorly bedded gray clay shale and siltstone; contains occasional gray dolomitic concretions*

Tts

TOPANGA SANDSTONE

(Vaqueros Formation of Kew, 1924; Weber and others, 1973)

marine; late Oligocene(?) to early Miocene age (Saucesian Stage)

Tts *light gray to tan, semi-friable vaguely bedded arkosic sandstone; exposed south of Oak Ridge Fault*

Tvq

VAQUEROS SANDSTONE

shallow marine transgressive; Oligocene to earliest Miocene(?) age (Zemorrian Stage)

Tvq *massive to poorly bedded, light gray to tan, fine-grained sandstone, locally calcareous*

Tsp

SESPE FORMATION

nonmarine; predominantly Oligocene age

Tsp *in northern area, mostly hard maroon-red, bedded sandstone, and lesser amounts of interbedded red claystone; lowest part is thick bedded hard sandstone and conglomerate with pebbles of granitic rocks, andesitic porphyries and quartzite; southeast of Fillmore, mostly tan, friable sandstone with thin interbeds of red claystone*

Tcww / Tcw

COLDWATER SANDSTONE

marine regressive; late Eocene age (Narizian Stage)

Tcww *white semi-friable sandstone; locally pebbly*

Tcw *tan, hard sandstone; includes thin interbeds of gray siltstone and clay shale*

Tcd

COZY DELL SHALE

marine; late Eocene age (Narizian Stage)

Tcd *dark gray, argillaceous to silty micaceous shale with many thin gray to tan sandstone strata*

Tma / Tmasl

MATILIJA SANDSTONE

marine; middle to late(?) Eocene age

Tma *hard, gray to tan, thick bedded, arkosic sandstone with thin partings and interbeds of gray micaceous shale; much fractured*

Tmasl *hard sandstone similar to Tma, but with many interbeds of hard gray micaceous shale; much fractured*

SYMBOLS

(not all symbols present on each map)

FORMATION CONTACT *dashed where inferred or indefinite*

MEMBER CONTACT *between units of a formation*

CONTACT BETWEEN SURFICIAL SEDIMENTS *located only approximately in places*

U / D / 25 / ?

FAULT

Dashed where indefinite or inferred, dotted where concealed, queried where existence is doubtful. Parallel arrows indicate inferred relative lateral movement. Relative vertical movement is shown by U/D (and U=upthrown side, D=downthrown side). Short arrow indicates dip of fault plane. Sawteeth are on upper plate of low angle thrust fault

ANTICLINE / **SYNCLINE**

arrow on axis indicates direction of plunge, dotted where concealed by surficial sediments

horizontal / 18 inclined / 20 inclined (approx.) / vertical / 80 overturned / 75 inclined and vertical metamorphic or igneous rock foliation

STRIKE AND DIP OF STRATIFIED ROCKS

DIRECTION OF LANDSLIDE MOVEMENT / **SANDSTONE MARKER BED** / **CONGLOMERATE MARKER BED**

MICROFOSSIL LOCALITY / **TAR SEEP** / **SPRING** / **ABANDONED EXPLORATORY OIL (OR GAS) WELL**

FIGURE 3-2 (cont.)

Younger Pleistocene sediments unconformably overlie the marine strata and the Saugus Formation. They consist of reworked material usually found as a succession of terraces. The oldest terrace will normally be the highest topographically, and the youngest terrace, the lowest topographically (Dibblee 1990).

Local Stratigraphy

Preliminary mapping in the area of the Texaco facility has identified the presence of shales with white weathered surfaces and black fresh surfaces. They are interbedded with sands that are usually grey or white on weathered surfaces and black or dark grey on fresh surfaces. Several areas of oil and tar sands have also been located (Figure 3-1). The northernmost of these areas is located on the floor and south wall of the mouth of Pole Creek Canyon (the southeast quadrant, Section 19, T4N, R19W). Proceeding to the south, an outcrop has been found on Texaco's facility. It is located on the western side of the hill that forms the northeasterly facility boundary (the northeast quadrant, Section 30, T4N, R19E). The third location is found in road cuts on the eastern side of the same hill (Sections 30 and 29, T4N, R19W). The most southerly of the areas is in a canyon north of the crossing of Highway 126 and the railroad track (Section 29, T4N, R19E).

Dibblee (1990) considers these rocks to be middle and upper Monterey. Mapping by Texaco exploration geologists identified them as middle and upper Modelo. Preliminary mapping could not confirm the stratigraphic position of the oil and tar sands associated with the facility due to the local structural complexities resulting from folding and movement on the San Cayetano Fault.

3.2.1.2 Structure

The Texaco facility is located at the juncture between the Santa Clara River Basin and the Topa Topa Mountains north of the basin. Oak Ridge forms the southern boundary of the basin. In this area of the Santa Clara Basin, the Topa Topa Mountains are fronted by the San Cayetano Thrust Fault and Oak Ridge by the Oak Ridge Fault.

Regional Structure

Structurally, the region northwest, north, and northeast of the facility is complexly folded into a series of synclines and anticlines with associated faults exposed in the Topa Topa Mountains (Figure 3-2). West of Sespe Creek, the synclines and anticlines generally trend southwest to northeast, while on the east side of Sespe Creek the structural trend changes direction and is from northwest to southeast. The anticlines and synclines have been

mapped (Dibblee 1990) as all plunging in an easterly direction and most in a southeasterly direction.

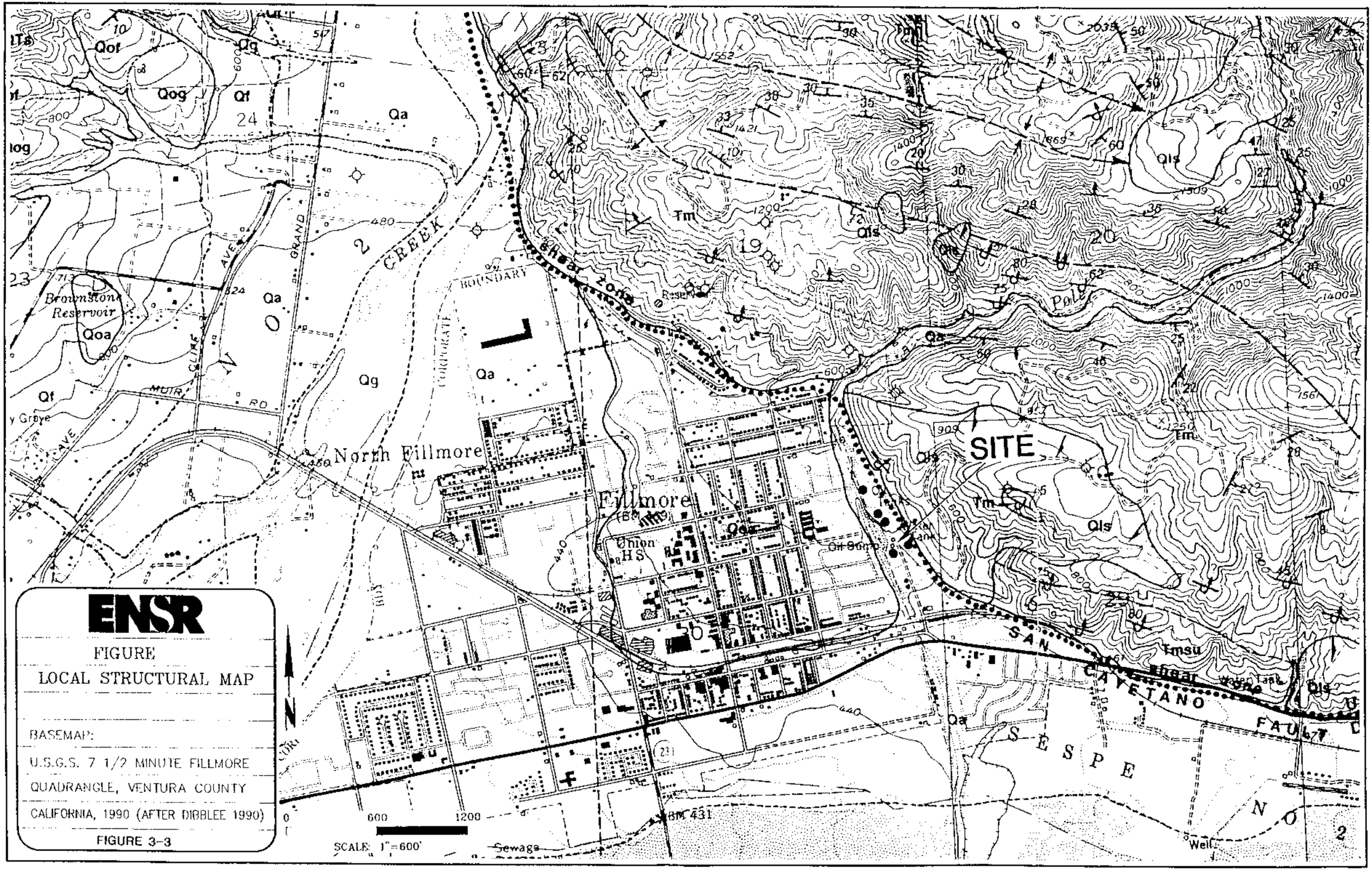
The Pine Mountain Syncline, Coldwater Anticline, and Bear Heaven Syncline have all been mapped as continuous from the west side of Sespe Creek to the east side. The Pine Mountain Syncline and Coldwater Anticline follow the regional structural trend on both sides of Sespe Creek. The Bear Heaven Syncline departs from the regional trend west of the Sespe, trending slightly south of due east but bends to the southeast after crossing Sespe Creek, joining the regional trend and plunge.

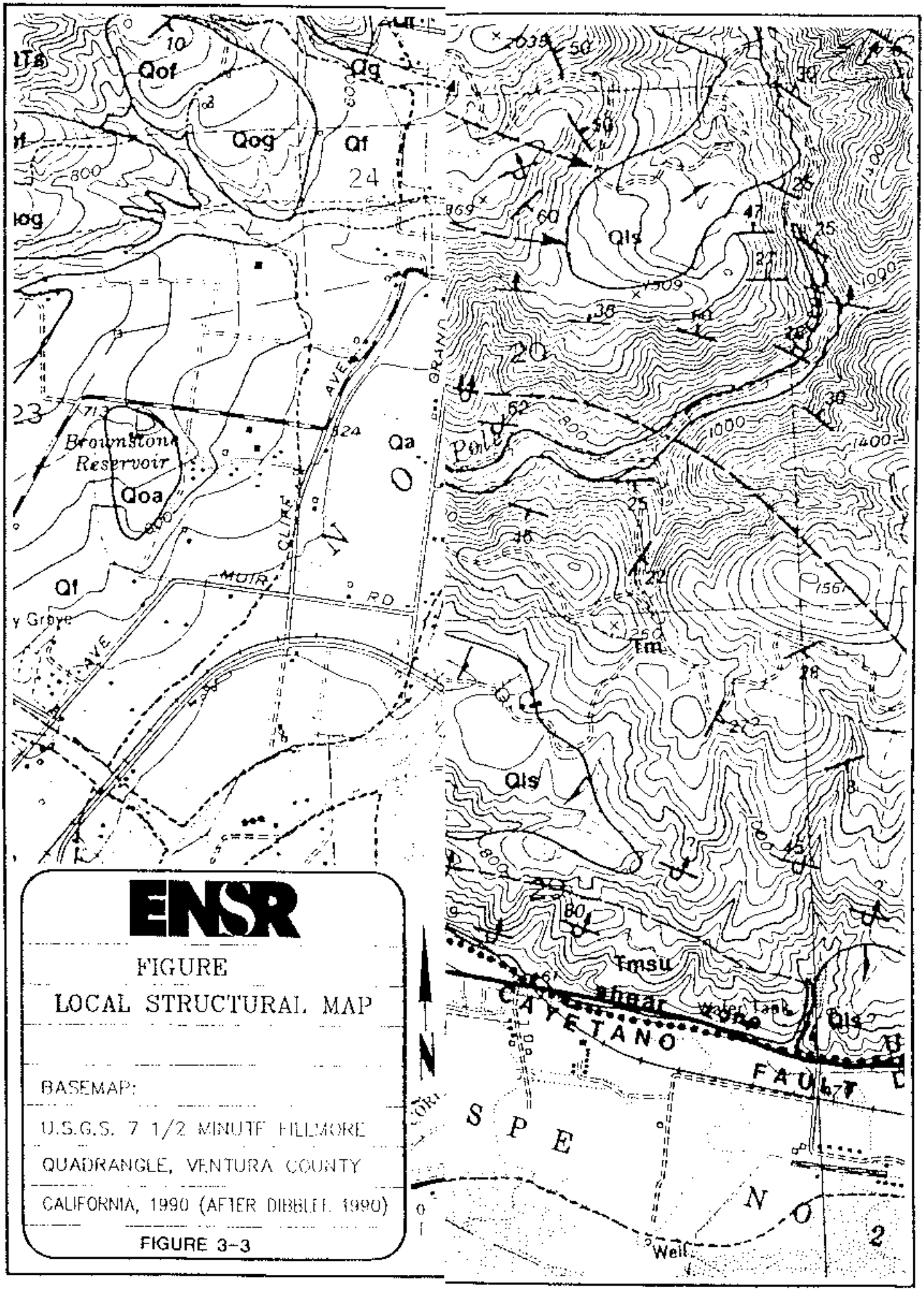
West of Sespe Creek, the San Cayetano Fault has thrust the Middle Eocene Matilija Sandstone over the considerably younger Pliocene Pico Formation (Dibblee 1990, Figure 3-2). At the mouth of Sespe Creek Canyon, an outcrop has been identified as Pleistocene Saugus Formation at an altitude of about 90 degrees (Yeats, et al., 1982).

East of Sespe Creek, the structure at the front of the San Cayetano becomes less clear. In the northern portion of this area, the beds generally are overturned to the west toward Sespe Creek and dip in an easterly direction. Progressing southward, the beds are generally overturned to the south and the dip direction is to the north. The oldest and structurally highest formation in this area is the predominantly Oligocene Sespe (Dibblee 1990). The Sespe overlies beds identified as Monterey, which are located along the stream bank on the east side of Sespe Creek. At the southern portion of this area, the oldest exposed formation is mapped as Miocene Monterey (Dibblee 1990).

Local Structure

The mountains directly north of Pole Creek contain the area where the dip direction swings from easterly to northerly. Along the north side of Pole Creek, as mapped by Dibblee (1990) (Figure 3-3), the beds are overturned to the south and dip north. Immediately south of Pole Creek, this same section is dipping south by as much as 50 degrees. The dip then changes to the southeast (dip greater than 20 degrees) before abruptly changing to slightly east of north. Along the southern margin of the hills, the beds are overturned with northeast dips of 75 and 80 degrees and are interpreted (Dibblee 1990) to be older Monterey over younger Monterey.


ENSR
FIGURE
LOCAL STRUCTURAL MAP
BASEMAP:
U.S.G.S. 7 1/2 MINUTE FILLMORE
QUADRANGLE, VENTURA COUNTY
CALIFORNIA, 1990 (AFTER DIBBLEE 1990)
FIGURE 3-3
SITE
North Fillmore
Fillmore
Brownstone Reservoir
Union HS
Oil Sump
Water Tank
SAN CAYETANO FAULT
SESPE NO 2
Shear Zone
CREEK
BOUNDARY
CORPORATE
MUIR RD
GRAND AVE
CLIFF AVE
Qa
Qg
Qf
Qog
Qof
Qoa
Qls
Tm
Tmsu
Well
Sewage
BM 431
0
600
1200
SCALE: 1"=600'



ENSR

FIGURE
LOCAL STRUCTURAL MAP

BASEMAP:

U.S.G.S. 7 1/2 MINUTE FILLMORE QUADRANGLE, VENTURA COUNTY CALIFORNIA, 1990 (AFTER DIBBLEE, 1990)

FIGURE 3-3

The structural geology of the Texaco facility is rendered more complex for several additional reasons.

- Faulting must be interpreted based on the preserved remnants of lithologically similar units.
- The fault zone at the base of the upper plate of the San Cayetano thrust has been mapped as cutting the surface of the ground adjacent to the hills on both the east side and the west side of the facility, under the town of Fillmore.
- Several types of faulting appear to be present in this area, including thrusting and associated decollement, flexural-slip, and bending-moment faults.
- There is incomplete identification of the stratigraphic position of the beds that are present in the exposed nearby outcrops.

3.2.1.3 Possible Impacts of the Area Geology on the Texaco Facility

The following possible impacts are seen as particularly significant for this facility.

- The presence of naturally occurring hydrocarbons must be considered to avoid over- or under-designing remedial systems.
- Conduits for fluid migration or seals preventing migration may be provided by fractures associated with folding, faults, and fault zones. Similar conditions may also be caused by variations in stratigraphy such as changes in depositional environments.

3.2.2 Facility Stratigraphy

3.2.2.1 Depositional Setting

The Texaco facility is located at the confluence of three major drainages: the Santa Clara River, Sespe Creek, and Pole Creek. Pole Creek empties directly into the facility and the facility is included within its flood plain. The area also contains the shear zone of the San Cayetano Thrust Fault. The upper plate of this fault is characterized by a rapid change in relief immediately to the east of the facility and the shear zone contains crushed, pulverized, sedimentary rocks.

As location and topography would indicate, soil stratigraphy in this area is largely the product of fluvial processes and to a lesser degree the result of colluvial (landslide) deposition. Fluvial processes include both erosion and deposition. These depositional processes may commonly include the dynamics of debris flow, sheet flooding, and channelized flow originating from the adjacent drainages.

The surrounding area provides an abundant supply of sediment from the proximal sedimentary rocks and contains little vegetation to stabilize stream banks. The material available for deposition includes the weathering products of conglomerates, sandstones, siltstones, mudstones, shales, and diatomaceous earth.

3.2.2.2 Sediment Textures

The term soil is intended to include all unconsolidated deposits encountered in the borings. The size, shape, and arrangement of materials that make up the soil at this facility are consistent with the textural parameters commonly encountered in the previously described depositional setting. Included here are coarse alluvial deposits formed at the edge of sharply elevated tracts in places where streams emerge from their canyons or valleys. This material merges with colluvium and other alluvial deposits which floor a larger alluvial basin. As a result, the sediments tend to be coarse and poorly sorted, and commonly display a lack of stratification. Sediment size ranges from clay to pebbles 50 mm in diameter, displaying shapes generally subangular to subrounded. Brecciated sediments also occur. Although the irregular arrangement of sediments contributes to a general absence of stratification, certain soil units have been identified.

3.2.2.3 Soil Units

Shallow Fine-Grained Unit

The most correlative single soil unit identified at this facility is recognized by its uniform depth, fine-grained texture, high degree of sorting, and characteristic color. This fine-grained unit occurs at a depth ranging from 40 to 60 feet below grade in virtually all locations drilled at the facility. It is composed of approximately 75 percent silt, 10 to 15 percent very fine to medium sand, and 10 to 15 percent clay-sized particles. The clay fraction varies and may give rise to horizontal changes in permeability. A trace of gravel appears in some locations. The majority of the recognizable clastic constituents are quartz and lithic fragments of chert. Its most diagnostic color is dark, yellowish brown; however, frequently it takes on a reddish hue. This unit is approximately one to five feet thick.

Locations where this unit has been described include MW-16D to the extreme north, a series of wells and borings near the Main Waste Pit (MWP), and MW-19S to the extreme south. This unit has acted as a vertical barrier to water migration in scattered locations, serving as a confining layer at the base of perched water in a number of boreholes and at least one well (MW-10P).

In Plate 3-1, a map can be seen which displays the structure base contours of the elevation of the top of the shallow fine-grained unit. It can be seen to roughly parallel the surface of the main operating area of the facility as it drops about 70 feet in elevation from north to south. Also in this map it is possible to visualize a relict stream channel or similar depression in the area of the MWP.

Deep Fine-Grained Unit

Another soil horizon with properties similar to the shallow fine-grained unit appears at a depth of approximately 135 to 140 feet below grade. This unit has been described as far north as MW-22D, -23D, and -24D extending south as far as MW-25; placing it in a central location with respect to the facility. Soil descriptions from previous work indicate a comparable unit as far north as MW-16D, occurring at a similar depth when adjusted for topographic differences.

Soil descriptions from these deep wells characterize this horizon as being 80 to 90 percent silt and clay and up to 15 percent sand-size particles, with a trace of gravel. As with the shallow fine-grained unit, the majority of the recognizable clastic constituents are subangular to subrounded quartz and lithic fragments. Its color has been described as grayish red to dark, yellowish brown. This unit is found to be up to about 20 feet thick

The textural properties and fine-grained composition of this unit appear to make it an impediment to fluid migration. It serves as a substantial confining layer to aquifers penetrated in at least eight deep monitoring wells (MW-16D, -22D, -23D, -24D, -25D, -29D, -31D and -33D). In each of these wells, groundwater was initially encountered at an elevation near 380 to 385 feet above mean sea level (msl). Subsequently, the water rose in the wells to approximately 395 feet above msl.

Much less control is available to map structure contours of this unit than for the shallow fine-grained unit. As a result, Plates 3-2 and 3-3, which show elevation contours of the top and bottom of the deep fine-grained unit, are much less precise and must be recognized as estimates only. Taking this limitation into account, it can still be seen that in the vicinity of MW-22D and MW-24D, this unit appears to be about 20 feet thick. It thins to the south at

MW-33D, thickens somewhat at MW-25D, and appears to be one to three feet thick at MW-29D and MW-31D, the most southerly data points.

Brecciated Gravel

Angular, moderately sorted, gravel-sized (2 to 4 mm) accumulations of clastic material occur in limited subsurface locations at the Texaco facility. This brecciated gravel was encountered in monitoring wells MW-22D, MW-23D, and MW-24D with possible correlations extending north to MW-16. It occurs at two discrete depths 115 and 150 feet. When found at 150 feet, it has often preceded an aquifer (capillary fringe).

The source of this brecciated sediment is unknown; however, the proximity to a fault zone and elevated topography suggest cataclastic fragmentation or slope instability may have supplied the material.

Well Sorted Quartz Sands

The subsurface soil profile at the Texaco facility is largely dominated by very poorly sorted sediments illustrating a wide compositional range. In a number of locations, however, a distinct unit of very well-sorted sand-sized material has been described. This horizon was encountered in pit numbers 4, 5, 6, and 7 at approximately 40 feet below grade and may be correlative to a lithologically similar unit in the MWP at a depth of approximately 40 feet below grade. This unit was approximately one foot thick.

The soil consists of very well-sorted fine to medium sand and silt. Predominately composed of quartz grains, its color is a distinctive yellowish gray to pale orange, becoming a more medium gray when subjected to degradation.

3.2.2.4 Summary

To illustrate the vertical relationships of the major shallow stratigraphic units on the facility, a number of cross sections were drawn up. These six cross sections are shown on Plate 3-4, along with a location map and a legend of the symbols. The cross sections were constructed from boring logs of the Phase I and Phase II drilling taking place during July, August, September, and December 1990. Correlations between borings were made by the geologists who had performed the actual field logging and drilling supervision. In all appropriate borings, the first encounter of groundwater is illustrated. Some pertinent details on each profile are listed below:

- **Profile A-A'**. This profile is oriented parallel to the long axis of the facility (NW to SE) along the east side of the facility. The boreholes covered were of limited depth since little or no contamination was indicated by field screening during the drilling of this area.

- **Profile B-B'**. This profile is also oriented parallel to the long axis of the facility. However, it is along the west side and was placed to pass through many of the former waste pits expected to be of most interest to this remedial investigation.

- **Profile C-C'**. This profile is perpendicular to the long axis of the facility and was constructed to examine the possibility of tying together the long axis profiles, A-A' and B-B'. The San Cayetano Thrust Fault base is placed in an estimated position on this profile based on the work of Diblee (1990) and on the lack of correlation between borings on either side of its estimated location.

- **Profiles D-D' and E-E'**. These profiles intersect B-B' at 30- to 45-degree angles to cover the central area of the facility and provide support for conclusions which might be drawn from B-B'.

- **Profile F-F'**. This profile is perpendicular to the long axis of the facility and is located at the southern end.

Several points of geologic and hydrologic interest are illustrated by examination of these profiles.

- Water levels encountered in boreholes and monitoring wells below the shallow fine grained unit pinch out as the upper surface of the deep fine-grained unit rises toward the north.

- Perched water seems to occur in local low points on the upper surface of the shallow fine-grained unit.

- The deep fine-grained unit gets thinner as it progresses from north to south on the facility.

- All of the borings on profile A-A' appear to be on the upper plate of the San Cayetano Thrust system and may be in a slump block created by that thrusting. No correlations appear reasonable with other borings to the west.

3.3 Hydrogeology

3.3.1 Regional Hydrogeology

The Texaco Fillmore facility lies at the eastern end of the Fillmore groundwater basin as shown in Figure 3-4. This basin, the Piru Basin, and the Santa Clara River valley sediments form one large connected groundwater system, as also shown in Figure 3-4. The groundwater elevation gradient is generally down toward the west with local variations reflecting irregularities in the basin sides. At the Texaco facility, the basin suddenly widens and the regional gradient is bent toward the northwest on the north side of the Santa Clara River valley. In the vicinity of the facility, the gradient is estimated to be an approximate 35-ft per mile (0.66-foot per 100 feet) drop toward the west.

Groundwater in the vicinity of the facility is used extensively for irrigation and domestic use as documented in previous reports about the facility. Due to this extensive use, the aquifers in the valley are an important resource and as such receive careful attention from the Ventura County Public Works Agency (VCPWA). In Figure 3-4, a well is shown just south of the Texaco facility. This well (No. 04N19W30R01S) is about 1,000 feet from the facility and has been monitored for water surface elevations since 1950. It is used for agricultural purposes, and the screened intervals are reported to be from 173 to 300 feet below the surface. In Figure 3-5, the record of water surface elevation is presented from 1950 to 1985 from the VCPWA Quadrennial Report of Hydrologic Data 1981-1984. Two apparently different time intervals can be distinguished in these data: 1950 to 1967 and 1967 to 1985. In the period before 1967, variations in groundwater surface elevation ranged to 50 feet, from a low of approximately 366 feet to a high of approximately 415 feet above msl. To avoid this type of large variation in groundwater surface elevation and the resulting problems to agricultural users, the water from Lake Piru was discharged over time in a manner designed to maintain more stable water table levels. In the period between 1968 and 1985, this was considered to be relatively successful.

The cycles in groundwater levels in the facility vicinity displayed in Figure 3-5 can be seen to be related to rainfall cycles for the Santa Clara River drainage as shown in Figure 3-6. This figure is reproduced from the VCPWA Quadrennial Report of Hydrologic Data 1985-1988 and presents the annual precipitation for a station in the area as well as a cumulative deviation from the mean value of the annual precipitation. This cumulative deviation curve represents a trend which could be expected to influence groundwater levels. Not included in these data from the VCPWA are the data from 1989 and most of 1990. Rainfall in these two years has been very low and conditions since 1986 have been considered as severe drought. Water levels in Lake Piru have been lowered to the point that water is no longer released in an

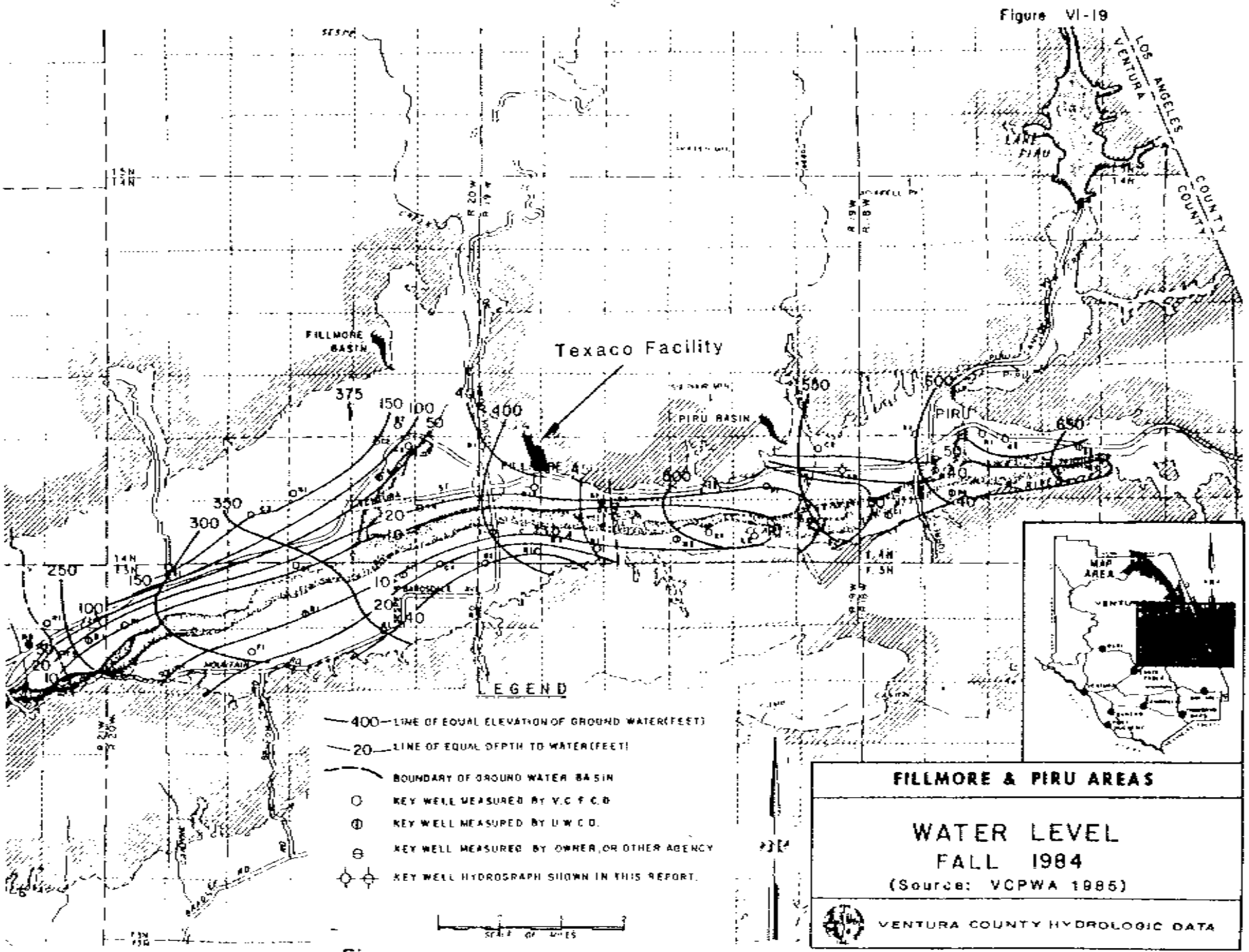


Figure 3-4 Groundwater Basin Water Levels

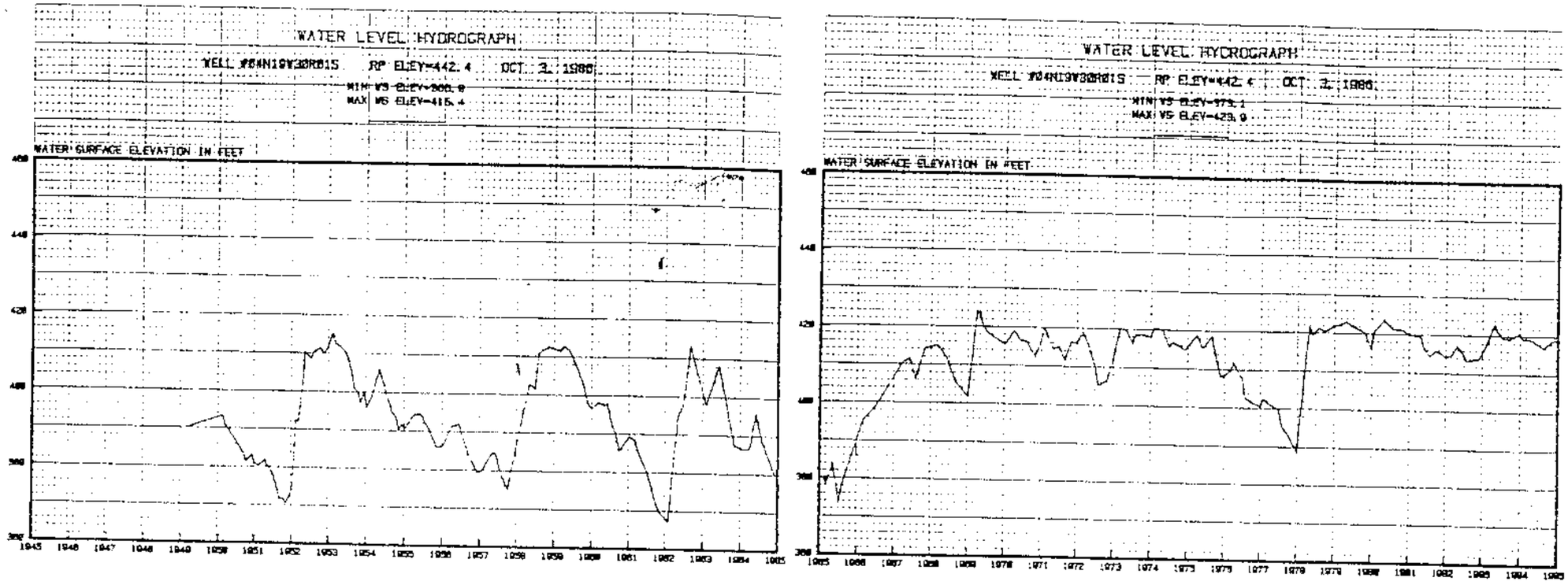
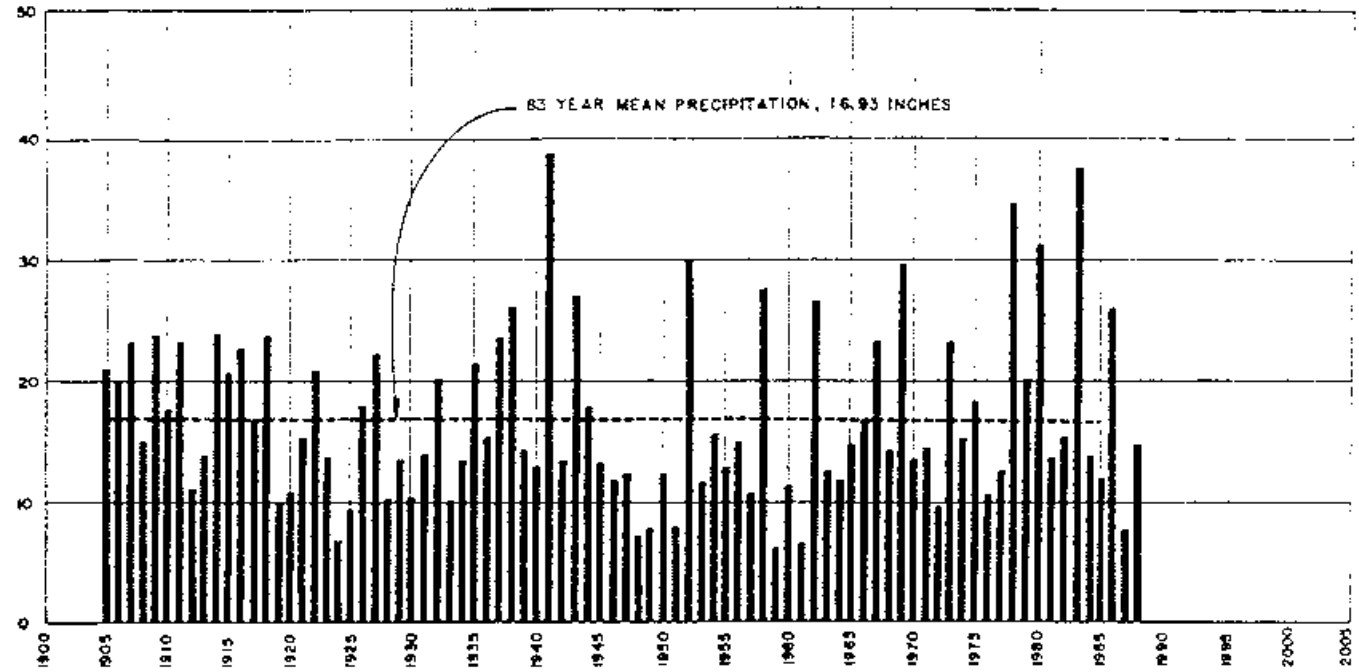
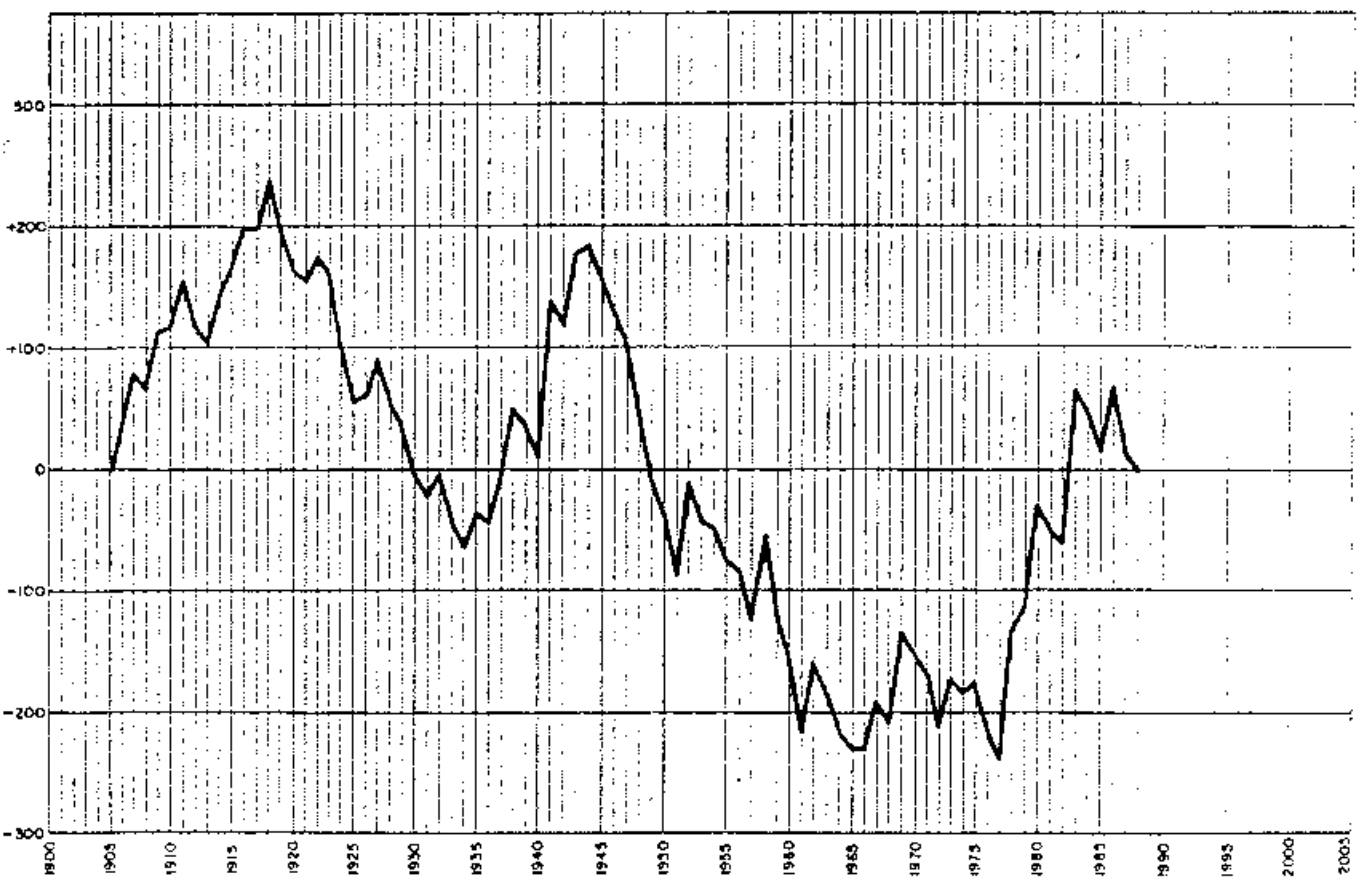


Figure 3-5 Historic Groundwater Surface Elevations Near the Texaco Fillmore Facility

(Source: VCPWA 1985)





REPRESENTATIVE PRECIPITATION CHARACTERISTICS
SANTA CLARA RIVER DRAINAGE , LIMONERIA RANCH, Nº 18

Figure 11-13

Figure 3-6 Historic Rainfall Records for Santa Clara River Drainage
(After VCPWA 1980)

attempt to continue groundwater level regulation. Groundwater surface levels in the area have been dropping since 1986 and facility data during that period are presented in Section 3.3.4, which reflects this effect.

Since the Texaco facility at Fillmore has been in place for more than 70 years, it is of significance to examine the potential for groundwater gradient variation in the past. This can be done in a regional sense for the period after 1950, but data generally are not available for the area prior to that time.

Three wells were found in the area with good water level measurements going back to at least 1950. These wells are part of the Ventura County Flood Control Department program of measuring and recording "key well" data. Listed below are the well numbers and locations of the three wells:

(A) Well #04N19W25K02S - About 5 miles due east of the Texaco facility and 1.5 miles southwest of Piru

(B) Well #04N19W30R01S - One thousand feet south of the Texaco facility (see Figure 3-5 for water level history)

(C) Well #03N21W15K02S - On the southwest side of Santa Paula and 11 miles west-southwest of the Texaco facility

For ease of discussion, these wells will be referred to as A, B, and C.

Wells A and B show considerable variation in water levels during wet and dry periods with apparent cycles of 4 to 6 years (see Figure 3-5). Well A levels have varied 130 feet during the last 40 years, while Well B has varied 60 feet. However, their variations are almost exactly in phase with no lag from one to the other. For example, when Well B rose 40 feet in early 1952 (see Figure 3-5), Well A rose 90 feet, but at virtually the same time. The difference in water level elevations between these two wells has varied between 70 and 150 feet with Well A always the higher. This results in an average water level gradient of 0.30 to 0.61 foot per hundred feet down toward the west.

Well C does not exhibit the 4 to 6 year cycles of A and B, but rather varies on an annual cycle. During the last 40 years, its water level range has been 40 feet. The difference in water level between B and C has varied between 145 and 265 feet with B always the higher. This has resulted in an average water level gradient of 0.25 to 0.46 foot per hundred feet down toward the west.

In summary, the picture presented in Figure 3-4 of general groundwater gradients in the region being down to the west and down to slightly north of west at the Texaco facility has probably not changed in 40 years. Even the known occurrence of wells within one mile of the facility pumping at the rate of 1,000 acre-feet per month do not appear to have significantly affected the general gradients.

Any water in the perched zone within the facility boundaries is unlikely to have been the relic result of high groundwater from the lower aquifers. As Figure 3-5 illustrates, groundwater levels near the facility in 1985 were close to their highs of the last 40 years. At this time, water level measurements at the facility (Radian 1986) showed that the perched zone was 20 to 50 feet higher than the water table aquifer surface.

3.3.2 Facility Hydrologic Units

Drilling at the Texaco facility in Fillmore for Phase I monitoring wells did not penetrate below 360 feet above msl. For reference, the ground surface elevation at the well locations varies from 470 to 535 feet above msl, as shown in Plate 3-5. At this elevation of 360 feet and above, three possible hydrologic units were identified. From the surface down they consist of the following:

- A perched zone generally shallower than 450 feet above msl
- Aquifer 1, found between 390 and 430 feet above msl
- Aquifer 2, found usually below 380 feet above msl

The hydrogeologic units are defined more by their less permeable beds, which serve as bases and confinements, than by their aquifer lithology. The actual aquifers are the typical sediments described for the facility. They tend to be coarse and poorly sorted and commonly display a lack of stratification.

The perched zone is separated from Aquifer 1 by an unsaturated permeable zone. Aquifer 1 and Aquifer 2 are distinguished from each other by static water levels which differ by 12 to 14 feet.

3.3.2.1 Perched Zone

The perched zone at this facility is not a continuous aquifer; rather it is a number of moist areas or isolated shallow saturated zones above a thin but locally effective aquitard. This aquitard is referred to in this report as the shallow fine-grained unit. In previous work, it was referred to as the "red clay layer," and was considered to be a significant marker bed. During the Phase I drilling of monitoring wells and soil borings, this unit appeared more commonly

as a silt with up to 15 percent clay. The clay percentage varied from place to place on the facility, and this variation may play an important part in determining the occurrence of perched water. Where the clay percentage was very small or zero, the unit may not have served as an effective aquitard. Also, where the top of the unit formed a local depression, perched water may have collected. To examine this facet more carefully, a structure base map has been prepared (Plate 3-1) which shows the upper surface of this shallow fine-grained unit. The map will permit better visualization of the location and thickness of the perched water.

The perched zone itself consists of a variety of lithologies. The single common lithologic characteristic the zone possesses is that it is coarser grained and presumed more permeable than the shallow fine-grained unit which it overlies. Its lithologies range from sandy silts to gravels and they are generally poorly sorted.

From August through October 1990, only one monitoring well (MW-10D) remained supplied with water from this perched zone; MW-13D, previously reported completed in this zone, has gone dry. However, a number of soil borings drilled during this period did encounter water at the perched zone levels. These borings are listed in Table 3-3 and approximate areas of these encounters with perched groundwater are overlain on the contour map describing the top of the shallow fine-grained unit and shown in Plate 3-6.

3.3.2.2 Aquifer 1

The base of this aquifer is formed by the unit designated as the deep fine-grained unit. This unit is generally characterized as containing 80 to 90 percent silt and clay. Its thickness is commonly about 20 feet.

The aquifer lithology varies from gravels in the southern part of the facility to sands in the area of MW-22. Sands are the most common component with variations from silty sands to gravelly sands vertically and horizontally. North of MW-22D, this aquifer appears to end with a change in lithology above the deep fine-grained unit. In MW-23D and MW-24D (which do not seem to encounter Aquifer 1), at elevations of 395 to 415 feet above msl we see fine-grained soils rather than the sands and gravels to the south. This suggests that the northern extent of Aquifer 1 is possibly determined by the cut bank side of a stream or river deposit. Prior to the aquifer sediments being deposited, a river or stream eroded into older fine-grained sediments. The northern bank of this stream or river was located between MW-22D to the south and MW-23D to the north. Subsequently, coarser sediments were deposited in this channel forming the more permeable deposits for Aquifer 1. An alternative possibility is

that as the top of the deep fine-grained unit slopes upward to the north, Aquifer 1 pinches out.

TABLE 3-3

Perched Water Encounters

Location	Boring or Well	I. D.	Depth to Water (feet)	Water Thickness (feet)
East Side of Facility	Well	MW-10P	45.42	4 (est.)
Main Waste Pit - South End	Boring	MWP-BH-2	52.5	1 - 2 (est.)
Main Waste Pit - South End	Boring	MWP-BH-5	50	1 (est.)
Pit 2 (north end of Main Waste Pit)	Boring	P2-BH-1	61.2	1 - 3 (est)
Pit 2 (north end of Main Waste Pit)	Boring	P2-BH-2	64.6	1 (est.)
Pit 3 (500 feet north of RR tracks)	Boring	P3-BH-1	43.4	Unknown
Pit 4 (150 feet north of RR tracks)	Boring	P4-BH-1	47	Unknown
Pit 4 (150 feet north of RR tracks)	Boring	P4-BH-2	50	2 (est)
Suspected Pit (Pole Creek near Pit 4)	Boring	SP-BH-2	55	Unknown

Note: Estimates of perched water thickness were based on suspected height above shallow fine grained unit.

By subtracting the elevation of the top of the deep fine-grained unit from the water table elevations, a map was constructed of the saturated thickness of Aquifer 1 (Plate 3-7).

3.3.2.3 Aquifer 2

Aquifer 2 appears to be confined beneath the deep fine-grained unit, which is described above. In the seven monitoring wells which partially penetrate Aquifer 2, groundwater was initially encountered near an elevation of 380 feet above msl. It later rose in each boring to approximately 395 feet in elevation.

In the aquifer sediments below 380 feet of elevation, sands and gravelly sands seemed to characterize the aquifer. In MW-22D, MW-29D, MW-31D, and MW-33D, at elevations of about 355 feet above msl, a fine-grained layer of unknown thickness and extent was encountered which appear to form the bottom limit of Aquifer 2.

3.3.3 Hydrogeologic Properties

3.3.3.1 General Discussion

In the FSP for Hydrogeologic RI/FS, an examination of the characteristics of the aquifers underlying the facility with slug tests and one or more pump tests was planned. Slug tests on MW-18S, MW-19S, MW-20S, MW-21S, MW-22S, MW-25S, MW-26S, MW-22D, and MW-25D were conducted in October 1990. The scope and resulting data, as well as aquifer properties calculated from these tests, are discussed in Section 3.3.3.2.

Pump tests were not performed during the RI phase of this project. The purpose of conducting pump tests during the RI is usually to help define the extent of contamination when it may not be possible or practical to define it directly by enveloping the plume with enough monitoring wells. In the case of the Fillmore site, with the exception of the area near the southwest corner of the facility, the extent of the constituents of concern (i.e., BTEX) above MCL in groundwater is quite well established by the existing data.

While pump tests may not significantly contribute to a better understanding of the extent of groundwater degradation at this site, such tests would still be valuable and even necessary to assess of the feasibility of any groundwater remediation strategy and to design a cost-effective and reliable remediation system. Therefore, one or more pump tests and additional wells design to evaluate the hydrogeological properties of the site are still planned to be conducted during the FS or remedial design phase of the project.

Prior to performing slug tests on the facility wells, some information on aquifer properties was obtained from the development and sampling data. For all of the 11 Phase I wells (MW-18S, MW-19S, MW-20S, MW-21S, MW-22S, MW-22D, MW-23D, MW-24D, MW-25S, MW-25D, and MW-26-S) it was common to remove 150 to 300 gallons from each well during development and sampling at a maximum rate of 10 gallons per minute (gpm). At this pumping rate, one well in each of the aquifers went temporarily dry. In Aquifer 1, MW-19S went dry four times after about 60 gallons were pumped at 10 gpm. Each time after a brief wait, the well recharged. In Aquifer 2, MW-23D went dry after 75 gallons were removed at 10 gpm, but then produced at that rate for another 75 gallons after about a minute's recovery without giving indication of going dry again.

These sustained rates suggest that 10-gpm production rates are reasonable for most of the new monitoring wells but local variations exist. Several of the older wells went dry quickly, but that was expected since they had less of their screened intervals remaining in the water table. In all cases, recharge to prepumping or sampling levels was achieved.

3.3.3.2 Aquifer Characteristics

A sediment horizon referred to as the deep fine-grained unit appears at a depth of approximately 135 to 140 feet below grade. This deep fine-grained unit functions as a lower confining layer to an unconfined aquifer above it and an upper confining layer to a lower aquifer. In effect, it makes the lower aquifer a semiconfined aquifer. Like the upper fine-grained unit, it is homogenous and semipermeable, comprising mostly silt and clay-sized particles. The thickness of this unit varies from 10 to 20 feet across the facility.

At the time of the aquifer characteristics testing with "slug tests," the Phase II wells had not been installed. Therefore, the discussion in this section only concerns wells MW-18S, -19S, -20S, -22S, -25S, -26S, -22D, and -25D.

Monitoring wells MW-18S, MW-19S, MW-20S, MW-21S, MW-22S, MW-25S, and MW-26S all penetrated and were screened in the upper unconfined aquifer above the lower fine grained unit. MW-22D, MW-23D, MW-24D, and MW-25D penetrated this lower unit. However, only MW-22D and MW-25D were screened completely in the semiconfined aquifer. MW-23D and MW-24D were screened with a part of their screen within the lower confining unit, separating the upper unconfined aquifer from the lower semiconfined aquifer. This occurred because these two wells were the first to encounter Aquifer 2 in Phase II and their screened interval was determined by the Field Sampling Plan criteria for Aquifer 1.

Both upper unconfined aquifer and semiconfined aquifer are composed of gravely, silty sands. However, the percentages of each constituent do change with respect to one another across the facility.

The slug test data from the Phase I wells screened in the unconfined aquifer were solved for hydraulic conductivity using the analytical solution of Bower and Rice (1976). This solution allows for the determination of hydraulic conductivity of unconfined aquifers with partially penetrating wells. The method assumes (1) drawdown of the water table around the well is negligible, (2) flow above the water table (in the capillary fringe) can be ignored, (3) head losses as water enters the well are negligible, and (4) the aquifer is homogenous and isotropic. The analytical method allows for the determination of hydraulic conductivity based upon the geometry of the well and the results of the time drawdown measurements. It should be noted that the elevation of the groundwater was within the elevation of the screened intervals for all unconfined wells during the tests. Because of this, during the test the groundwater level rose in the screened open section of the well and within the gravel pack surrounding it. Therefore, when solving the equations, the effective total free water surface area in the well and sand pack were used.

The slug test data from the Phase I wells screened in the lower aquifer (MW-22D and MW-25D) were solved for transmissivity and storage coefficients using the analytical solutions of Cooper et al. (1967). This solution allows for the determination of a transmissivity and the storage coefficient of confined aquifers with completely penetrating wells. This analytical method assumes (1) the aquifer is infinite in areal extent, homogenous, isotropic, and of uniform thickness; (2) the aquifer is confined; (3) the well fully penetrates the aquifer; (4) flow is unsteady; (5) water is released instantaneously from storage with decline of hydraulic head; (6) the slug is withdrawn from the well instantaneously; (7) flow to the well is horizontal; and (8) the diameter of the test well is very small so that storage in the well can be neglected. It should be noted that MW-25D did not completely penetrate the entire aquifer.

Two wells were partially screened in the upper confining layer of MW-23D and MW-24D. These wells both receive groundwater from the upward infiltration of groundwater from the lower semiconfined aquifer as determined during the installation of these wells. For this reason these wells are not analyzed.

3.3.4 Groundwater Levels

As shown in Figure 3-5 and discussed in Section 3.3.1, the groundwater levels in the vicinity of the facility were at or near historic highs, at least until 1985. However, since 1986 the amount of rainfall had dropped (as seen in Figure 3-6), and levels at Lake Piru were so low that releases into the Piru and Fillmore Basins had been stopped. By 1985, groundwater monitoring wells were present at the Texaco Fillmore facility and water level records were maintained. Of the early monitoring wells, few escaped drying up during the period from 1989 to 1990. However, MW-6S is centrally located on the facility and had water in it as of October 1990. Therefore, it is used in Table 3-4 to illustrate the effect of recent dry times on the groundwater levels of Aquifer 1 at the facility. MW-10P is included in Table 3-4 to illustrate the independence of the "perched zone" from Aquifer 1 and regional influences.

As can be seen from MW-6S, a dramatic drop in water surface elevation seems to have taken place after mid-1989. The drop of almost two feet in a one-month period from August to September 1990 is representative of most Aquifer 1 wells on the facility, as can be seen in Table 3-5.

In Table 3-5, each well has an indication of which hydrologic unit it appears to be screened over. MW-10P is the only well responding to perched zone water elevations. With only one well remaining in this unit, an elevation map cannot be constructed with any accuracy, but using the data from Table 3-3, a map of the areas where perched water is likely to be encountered can be presented (see Plate 3-5). The other wells are divided between Aquifer 1

TABLE 3-4

Historical Groundwater Surface Elevations
Monitoring Wells MW-6S and MW-10P

Date Measured	Monitoring Well MW-6S (elevation in feet above msl)	Monitoring Well MW-10P (elevation in feet above msl)
March 1986	430.75	460.41
July 1987	426.75	458.46
February 1988	426.93	459.52
November 1988	424.42	458.75
February 1989	424.14	459.48
May 1989	424.81	460.17
February 1990	414.10	458.44
August 1990	409.51	457.12
Late September 1990	407.41	457.10

NOT JAN 91 prior to Augu 404.66 adjusted to remov 455.97 easuring
ion discrepa 403.16 458.99
MAY 91 409.06 453.02
8/13/91 410.05 457.65
11/14/91 417.43 457.55
2/18/92 422.52 459.91
4/7/92

TABLE 3-5

Groundwater Surface Elevations (in feet above msl)

Monitoring Well I.D.	Hydrologic Unit	Elevation August 1990	Elevation Sept/Oct 1990	Elevation January 1991	Elevation May 1991
P-2	Aquifer 1	412.62	<410 (Dry)	Dry	Dry
MW-6S	Aquifer 1	409.51	407.41	404.66	403.16
MW-8S	Aquifer 1	415.37	413.00	Dry	Dry
MW-10P	Perched Zone	457.12	457.10	455.97	458.99
MW-11S	Aquifer 1	415.50	413.13	Dry	Dry
MW-16D	Aquifer 2	396.00	393.12	Dry	Dry
MW-18S	Aquifer 1	Not Installed	413.91	409.58	413.81
MW-19S	Aquifer 1	415.32	414.18	408.71	411.61
MW-20S	Aquifer 1	Not Installed	410.10	405.84	407.66
MW-21S	Aquifer 1	Not Installed	408.62	404.23	404.96
MW-22D	Aquifer 2	395.23	394.14	389.39	394.02
MW-22S	Aquifer 1	407.14	405.71	398.92	397.88
MW-23D	Aquifer 2	396.68	395.56	391.51	394.12
MW-24D	Aquifer 2	395.58	395.23	390.64	394.07
MW-25D	Aquifer 2	399.29	397.86	395.19	399.09
MW-25S	Aquifer 1	413.57	412.17	407.88	409.03
MW-26S	Aquifer 1	413.88	414.21	408.31	410.31
MW-27S	Aquifer 1	Not Installed	Not Installed	407.95	404.82
MW-28S	Aquifer 1	Not Installed	Not Installed	406.30	406.31
MW-29D	Aquifer 2	Not Installed	Not Installed	396.27	399.95
MW-29S	Aquifer 1	Not Installed	Not Installed	410.90	411.03

TABLE 3-5

Groundwater Surface Elevations (in feet above msl)

Monitoring Well I.D.	Hydrologic Unit	Elevation August 1990	Elevation Sept/Oct 1990	Elevation January 1991	Elevation May 1991
MW-30S	Aquifer 1	Not Installed	Not Installed	408.06	412.42
MW-31D	Aquifer 2	Not Installed	Not Installed	394.97	397.52
MW-32S	Aquifer 1	Not Installed	Not Installed	403.30	403.46
MW-33D	Aquifer 2	Not Installed	Not Installed	392.56	395.76
MW-34S	Aquifer 1	Not Installed	Not Installed	402.30	403.54

and Aquifer 2. Dropping water table levels have caused a number of wells onsite to dry up, reducing the dataset which can be used for groundwater surface elevation maps. Data from Table 3-5 have been used to construct groundwater surface elevation maps for Aquifers 1 and 2 representing the four sampling events: August 1990, September-October 1990, January 1991, and May 1991. These maps are seen in Plate 3-8 (Aquifer 1, August 1990), Plate 3-9 (Aquifer 1, September-October 1990), Plate 3-10 (Aquifer 1, January 1991), Plate 3-11 (Aquifer 1, May 1991), Plate 3-12 (Aquifer 2, August 1990), Plate 3-13 (Aquifer 2, September-October 1990), Plate 3-14 (Aquifer 2, January 1991), and Plate 3-15 (Aquifer 2, May 1991). These maps provide reasonable representations of the data and take into account regional hydrologic considerations.

3.3.4.1 Perched Zone

Plate 3-5 suggests a scattered occurrence of groundwater perched on the shallow fine-grained unit. No indication is given of an extensive aquifer which might provide a pathway for contaminants around or off the facility. Within this unit, the area around MW-10P might be unique. It appears to have the greatest thickness of water, and Table 3-4 shows its levels to be very stable through time. MW-10P is located downgradient of a modest gulch or canyon which contains runoff from irrigated avocado orchards upgradient. It is possible that the area around MW-10P is receiving subsurface drainage from the irrigation of these orchards.

3.3.4.2 Aquifer 1

Plates 3-8, 3-9, 3-10, and 3-11 suggest a westerly or northwesterly dipping gradient for the surface of Aquifer 1. In Plate 3-9, there is more data in the southern end of the facility and the picture becomes more confused in that area. A possibility for this erratic data is the location of a production well used to irrigate the avocado orchards mentioned previously. Data presented on this well in a previous report (TriHydro 1988) indicate that it is screened over three intervals from 483 to 752 feet below ground surface and its yield is approximately 60 acre-feet/month (500 gallons per minute). A recent telephone conversation with the maintenance manager of the facility suggests that the lower intervals of the screen may be sanded in and average production of the well is about 50 to 75 gpm.

A comparison between Plates 3-8 and 3-9 shows quite clearly that water levels are dropping significantly, even over a period of one month. From October 1990 to January 1991 (Plate 3-10) water levels on the site dropped three to five feet. From January to May 1991 (Plate 3-11) some wells rose and some fell.

Comparing the water level maps made after wells were installed in 1990 and 1991 with water level maps prior to that time suffers from two significant problems. First, prior to 1990, the array of wells did not indicate that wells such as MW-5D and MW-16D at the north end of the facility were measuring a different aquifer than the others. Second, all maps made from May 1987 until August 1990 had MW-17S located 350 feet farther north than its actual position.

With MW-5D and MW-16D presumed in the same aquifer as other wells, a strong northerly plunge to the groundwater surface was depicted. With MW-17S placed too far north, a reduced level of the same effect was produced in the southern portion of the facility. The total result was water level maps from 1985 to early 1990, suggesting a more northerly dip to the groundwater gradient than actually existed. A re-examination of the historical dataset suggests gradients for the entire period with directions similar, but slightly more northerly than those measured in late 1990.

3.3.4.3 Aquifer 2

With only four and five wells providing data for Plates 3-12 and 3-13, interpretation of contour placement is subjective. More data is available after Phase II installations for Plates 3-14 and 3-15. However, the general gradient dipping to the northwest is very apparent. Also, lower water levels in this confined aquifer, showing a drop in water elevation, are obvious from the later measurements.

3.3.5 Aquifer Relationships

The well clusters at monitoring well locations allow us to understand several points of relationship between Aquifer 1 and Aquifer 2. Table 3-6 summarizes relevant data for monitoring well locations 22 and 25.

With these data, several points need to be addressed, as follows.

3.3.5.1 Presence of Two Aquifers

At both locations 22 and 25, the deep and shallow wells are about 15 feet apart horizontally. In spite of this proximity, the static water levels in the wells at each location differ by 12 and 14 feet, respectively. When rising level slug tests were performed in MW-22S and MW-25S, no changes in levels were measured in the adjacent deep wells. In addition, at location 25 not only is one well degraded and one well not, but it is MW-25D that is degraded and MW-25S that is not. Finally, we note that in drilling the two deep wells at both locations, a fine-grained unit, which was not saturated, was encountered between the screened intervals.

TABLE 3-6

Aquifer Comparison Data
At Monitoring Well Locations 22 and 25

	MW-22S	22S Minus 22D (feet)	MW-22D	MW-25S	25S Minus 25D (feet)	MW-25D
Aquifer	1		2	1		2
Screened Interval (feet-msl)	385-405		362-372	402-422		366-376
Water Elevation (ft 8/90)	407.14		396.23	413.57		399.29
Water Elevation Difference (8/90)		11.9			14.28	
Water Elevation (ft 9/90)	405.71		394.14	412.17		397.86
Water Elevation Difference (9/90)		11.57			14.31	
Dry Layer Between Aquifers?*		Yes			Yes	
Slug Test Interactions Between Wells?		No			No	
Benzene Present Above msl	No		No	No		Yes

* A "dry layer" or unsaturated sediments between aquifers suggest that vertical movement of groundwater is not taking place at that location.

3.3.5.2 Connection of Aquifers

The most compelling evidence for connection between the aquifers is the relationship of the water levels in the deep and shallow wells with time. As shown in Table 3-6, water levels were measured twice in each well approximately one month apart. During this month, water levels dropped in all wells. At each location, the drop was similar for both the deep and shallow wells. The difference between deep and shallow wells remained almost constant. This is strong evidence that the aquifers are connected at some moderately distant location. Also, the presence of the chemical constituents in well MW-25D suggests that a pathway exists from the ground surface to Aquifer 2. It is likely that this pathway would go through Aquifer 1, which generally overlies Aquifer 2.

3.3.5.3 Location of Aquifer Connection

In the simplest case of connection between a water table, an unconfined aquifer, and a lower semiconfined aquifer, the water table aquifer effectively controls the static water level in both aquifers. In addition, for the simple case, this control is exercised at the location of connection. If the location of the connection was a relatively restricted spot, almost no gradient would be expected in the confined aquifer except for a slight drop in all directions away from the connection. In this case, the connection is downgradient of measuring wells in which the confined layer has a lower static water level and upgradient of measuring wells in which the confined layer has a higher static water level.

At the Fillmore facility, it is not quite so simple. Both the confined and unconfined aquifers exhibit gradients in roughly the same direction although at different rates. The confined aquifer has a lower gradient than the unconfined aquifer. Also, the direction of steepest gradient in each aquifer appears to be slightly different, with the confined aquifer gradient dipping more northerly than the unconfined aquifer. This relationship suggests, in a slightly less simple model, that the connection between the aquifers is one with significant linear extent (or at least not a restricted spot) and is diagonally downgradient from the facility to the southwest. If the gradients in both aquifers were constant, the distance to the connecting area could be calculated. However, they are not constant, and such a calculation would be stretching the simple model too far.

In addition to the possibility of a direct connection between the two aquifers at some point, there is also the probability that some transport may occur through the apparently less permeable layer between the aquifers. For the potential transport of contaminants from one aquifer to another, both could be significant or either one could dominate.

3.3.5.4 Vertical Transport Pressures

Data reported from the drilling of Phase II monitoring wells into Aquifer 2 in the southern portion of the facility suggests that the fine-grained unit separating the two aquifers thins in the south. Rather than the 10 to 20 feet of thickness at monitoring well locations 22 and 25, it appears that this layer is only about two feet thick in the south at MW-31D. However, it does not appear to pinch down to zero in any wells penetrating to the lower aquifer.

Since the separation is relatively thin in at least some areas, vertical driving pressures might transport water (and chemical constituents) between the aquifers. In the case of vertical motion, the driving force is not a simple pressure variation, but rather, the difference in pressure values from a normal hydrostatic pressure distribution. In a coarse sense, this variation is easy to measure — it is the difference in static water levels in wells screened at different elevations. These differences at monitoring well locations 22 and 25 are roughly 12 and 14 feet as shown in Table 3-6. To calculate a vertical gradient from such data, the interval of dissipation of this pressure difference must be known. If there is a dry layer between, the calculation is not appropriate. A more accurate evaluation of this driving force will be available after constant drawdown pump tests are performed later in the FS phase of the project.

While quantification of the vertical gradients are not possible yet, the implications are quite clear. The upper, unconfined aquifer at this facility will be inclined to leak into the lower, confined aquifer wherever leaky conditions prevail. It appears that these conditions are most likely in the southern section of the facility where low levels of chemical constituents are known to exist in the upper aquifer. Phase II wells were drilled and installed in the southern part of the facility to test this possibility. However, as sampling results in Section 4 will show, the chemical compounds in Aquifer 1 do not appear in Aquifer 2 except at MW-25D.

Table 3-7 presents the calculated results for hydraulic conductivities, transmissivities and storage coefficients. It also includes the screen length, estimated aquifer thickness, estimated saturated thickness, length of water column, and the analytical method used.

Semilog plots of time drawdown measurements are included in Appendix G of this report. Analysis of the plots for all wells, except MW-22S screened in the unconfined aquifer, exhibit two best-fit lines with separate slopes.

The early portion of the graph exhibits a steeper best-fit line due to dewatering of the highly permeable sandpack around the well. The later less-steep best-fit line is characteristic of the formation immediately surrounding the well. This line most likely represents the time when the water level in the sandpack has been drained to the water level in the well itself, and the flow becomes controlled by the aquifer hydraulic conductivity. This is the slope of the line used to calculate the hydraulic conductivities.

The hydraulic conductivities derived from the slug tests in the upper unconfined aquifer ranged from 0.45 feet per day in MW-19S to 61.0 feet per day in MW-25S and averaged 20.0 feet per day. MW-19S exhibited the lowest hydraulic conductivity of 0.45 foot per day, likely the result of the fine-grained nature of soils surrounding the screened interval. These hydraulic conductivity values are characteristic of soils comprised of fine to coarse sand with gravels or fluvial deposits similar to the lithologies encountered at this facility.

From the calculated hydraulic conductivities and saturated thickness of the aquifer, transmissivities were also determined for each well. These values are also presented in Table 3-7.

It is estimated, using the description of lithologies in the boring logs, that the specific yield of the unconfined aquifer ranges between 15 and 25 percent. An average groundwater gradient of the upper aquifer was also calculated as 0.007 from the groundwater contour maps shown in Plate 3-8. Based upon the calculated groundwater gradient of 0.007 and using an average hydraulic conductivity of 20 feet per day and an estimated specific yield ranging from 0.15 to 0.25, the average linear velocity of groundwater flow in the upper unconfined aquifer ranges from 0.56 feet per day to 0.93 feet per day.

During the tests of monitoring wells MW-22S and MW-25S, wells MW-22D and MW-25D, respectively, were monitored to observe any influence on these wells. No changes in water levels were detected.

Table 3-7 presents the calculated results for transmissivities, hydraulic conductivities, and storage coefficients for the lower semiconfined aquifer.

The transmissivities calculated were 663 square feet per day for MW-22D and 2,016 square feet per day for MW-25D. The calculated transmissivity for MW-25D is an order of magnitude greater than for MW-22D. This may be due to the fact that MW-25D does not fully penetrate the aquifer, and there is a vertical component of flow which increases the calculated transmissivity value.

The analytical solution used (Cooper et al. 1967) to solve for the transmissivities and storage coefficients is a curve-matching solution method. In principle, the storage coefficient can be determined from the value of the matched curves. However, in practice (since the slopes of the various curves are very similar), the determination of the storage coefficient by this method has questioned reliability and may differ by orders of magnitude. The two storage coefficients calculated were 2.4×10^{-7} for MW-22D and 1×10^{-10} for MW-25D. These are possibly low values, and the storage coefficient for MW-22D is probably the most accurate.

From the calculated transmissivities and the confined aquifer thickness, hydraulic conductivities were determined for each well (Table 3-7). A hydraulic conductivity of 15 feet per day was calculated for MW-22D and 10 feet per day for MW-25D.

4.0 RESULTS OF FACILITY CHEMICAL CHARACTERIZATION

This section discusses the results of the laboratory analyses conducted to determine the presence of chemical constituents of concern in each of the different media investigated. The data are used to characterize existence, nature, and extent of chemical constituents in subsurface soils and groundwater at the facility, to determine the potential for leaching of chemicals into the groundwater, and to asses the potential impact of past facility activities on surface soils, surface water and ambient air quality in the immediate area of the facility.

4.1 Subsurface Soil

As discussed in Section 2.0, the extent of subsurface soil sampling and analysis activities conducted during this investigation included the laboratory analysis of 785 samples from 78 exploratory boreholes drilled in the following areas:

- Main Waste Pit (MWP) area
- Eight known and one suspected small waste pits
- Soil gas area
- Background areas

The subsurface sampling program included samples collected during the construction of the 11 Phase I monitoring wells installed throughout and around the facility, when field indicators showed the presence of hydrocarbons in the subsurface soils. The program also included eleven boreholes that were redrilled and resampled after the laboratory reported exceeding the EPA required holding times for organic analyses in a number of samples from these boreholes. The redrilled boreholes were drilled right next to the original borehole they were intended to replace and are identified by a "90" added in front of the original borehole's ID number (e.g., MWP-BH-2 and MWP-BH-902).

4.1.1 Chemical Analyses

Chemical analyses conducted on subsurface soil samples to characterize the various areas of the site under investigation were selected based upon the chemical characteristics of wastes historically disposed of at the facility. These wastes consisted of petroleum hydrocarbons and other chemical constituents associated with the refinery operation, including volatile and semivolatile organic compounds and a number of metals. The chemical analyses used were

prescribed in the Subsurface Soils Field Sampling Plan (FSP) and the QAPP, and are presented in Table 4-1.

4.1.1.1 Laboratory Screening Analyses

All samples from the MWP area, small pits, and monitoring wells boreholes were analyzed for total extractable petroleum hydrocarbons (TPH) and total metals including arsenic, barium, cadmium, chromium and lead. In addition, two samples from each of these boreholes at shallow depths were analyzed for total copper, nickel, vanadium and organic lead. These laboratory screening analyses were used to screen soil samples with the highest degradation levels for subsequent TCLP extraction and analysis.

4.1.1.2 TCLP Analyses

All samples analyzed for TPH and total metal screening analyses were preserved under refrigeration and kept by the analytical laboratory. From 20 to 40 percent of the samples within the 50 percent highest TPH and total metal concentration were selected for TCLP extraction and analysis for volatile and semivolatile organics, EDB, and metals.
One or two samples from each borehole (5 percent of the number of samples collected in the borehole) drilled at the site were selected in the field based on the highest OVA reading and visible staining, split with CH2M Hill and submitted to the laboratory for full suite of TCLP analysis (volatile, semivolatile, EDB, and metals) and for pH measurement.

TCLP threshold levels were established in the FSP for 11 laboratory indicator parameters (i.e., five metals and five volatile and one semivolatile organic compounds). These indicator parameters were intended to automatically trigger Phase II boreholes if exceeded in Phase I samples. The designated indicator parameter and their TCLP threshold levels are presented in Table 4-2.

4.1.1.3 Total Organic Analyses

All samples collected from the four soil gas area boreholes were analyzed for total volatile organic compounds. In some instances, one or two samples from the waste pit and monitoring well boreholes were analyzed for total volatile and semivolatile organic compounds. Although these latter analyses were not required in the FSP, the data was intended to provide additional information on the nature and extent of organic compounds present in subsurface soils at the site, if any, and to identify any possible correlation with TPH results and with organic analysis results from other media.

TABLE 4-1

Analytical Methods for Subsurface Soil Samples

Locations	Analysis Methods	Constituents
• Waste Pit Boreholes	EPA 8015m Cal DHS	Total Extractable Petroleum Hydrocarbons (TEPH)
	EPA SW846 Total Metals	As, Ba, Cd, Cr, Pb, Ni, Cu, Ni, V
• Monitoring Well Boreholes	EPA 8240	Volatile Organics
(selected samples only)	EPA 8270	Semivolatile Organics
	EPA TCLP Extractions	
	EPA CLP	Volatile Organics
	EPA CLP	Semivolatile Organics (incl. phenol)
	EPA 504 Modified	EDB
	EPA CLP	As, Ba, Cd, Cr, Pb, Cu, Ni, V
	EPA CLP	Organic Lead
	EPA CLP	pH
Soil Gas Area Boreholes	All Samples	
	EPA CLP	Volatile Organics
	Selected Samples	
	EPA TCLP Extractions	
	EPA CLP	Volatile organics
	EPA CLP	Semivolatile organics (incl. phenol)
	EPA 504 Modified	EDB
	EPA CLP	As, Ba, Cd, Cr, Pb, Cu, Ni, V
	EPA CLP	Organic Lead
	EPA CLP	pH
Background Boreholes	EPA SW-846 Total Metals	As, Ba, Cd, Cr, Pb, Ni, Cu, V

TABLE 4-2

Toxicity Characteristic Leaching Procedure (TCLP)
Threshold Level for Subsurface Soil Investigation

Indicator Parameter	Regulatory Threshold		
	EPA LDRs (mg/l)	EPA MCL/CAL ACL mg/l	Threshold Levels [a] (mg/l)
Metals			
Arsenic	.004	.05	.05
Barium	1.0	–	1.0
Chromium	.20	.05	.20
Cadmium	.066	.01	.066
Lead	.18	.05	.18
Organics			
Benzene	.011	.001	.011
2,4-Dimethylphenol	.33	--	.33
Toluene	.33	.1	.33
Ethylbenzene	.053	.7	.7
EDB	16.00	0	16.00
Xylenes [b]	.15	.62	.62

[a] Highest of EPA LDR and EPA MCL/CAL ACL.
[b] Sum of three xylene isomers.
LDR = EPA land disposal restrictions standards for RCRA wastes
MCL = EPA maximum contaminant levels for drinking water.
ACL = alternate concentration levels (State-based).

4.1.2 Data Discussion and Presentation

The analytical results are discussed by the following groups or categories of chemical analyses:

- Total Petroleum Hydrocarbons (TPH)
- Volatile Organic Compounds (VOCs)
- Semivolatile Organic Compounds
- Metals
- pH

Exceedances of TCLP thresholds for laboratory indicator parameters specified in the FSP are discussed as applicable within the above groups. Because of the large amounts of analytical data involved, and to present an appropriate picture of the geographical distribution of boreholes throughout the facility, the data has been divided into four geographical regions described below.

- **Main Waste Pit Region:** This region located in the west-central portion of the facility consists of boreholes and monitoring wells in and around the Main Waste Pit, Waste Pit 2 boreholes, and monitoring well boreholes surrounding the Main Waste Pit. Data for these boreholes have been presented by elevation instead of depth. The excavation that was left after the previous soil moving activities made it impossible to compare a sample at a certain depth below grade inside the pit with another sample at the same depth outside the pit. The Soil Gas Area boreholes fall geographically within this region but their results are presented separately since the intent and the laboratory analyses for these boreholes were different. The MWP Region was subject to the most detailed investigation of all of the regions (50 percent of all boreholes were drilled in this region).

- **Southern Region:** This region encompasses boreholes and monitoring wells located in the southwestern portion of the facility and includes Pit 3, Pit 4, and the Suspected Pit (SP) along the Pole Creek Channel (also referred to as Pit 9).

- **Hills Region:** This region includes boreholes drilled in the area of small waste pits 5, 6, 7, and 8 located on the hills in the eastern side of the facility. These pits are arranged in a northwest to southwest straight line formation and separated from each other by several hundred feet.

- **Northern Region**: This region is remotely located on the north section of the facility and includes boreholes from Waste Pit 1 and from background areas in the vicinity.

These four regions, shown on Plate 2-2, do not represent or presuppose any significant patterns in chemical constituents unless otherwise noted. Plate 2-2 also shows the locations of all boreholes within each region.

4.1.3 Total Petroleum Hydrocarbons

TPH analysis by EPA Method 8015 reported as diesel was conducted for all samples from the MWP and nine other small waste pit boreholes, and from selected samples from monitoring well boreholes, as an indicator for the presence of organic compounds. Table 4-3 presents the results of TPH analysis for all samples analyzed in all four regions.

As shown in Table 4-3 the higher TPH concentrations are found in the MWP Region and the Southern Region. In addition, the higher TPH concentrations in all four regions predominate at shallow depths and decrease sharply at depths below 55 feet. Figure 4-1 illustrates this trend for the MWP region. At elevations between 455 and 520 feet, above MSL, TPH values range from nondetected (ND) to 8,000 mg/kg (with one sample at 13,000 mg/kg) while at lower elevations (between 380 and 450 feet) the TPH values range from ND to 2,000 mg/kg.

This trend is even more evident in Figure 4-2 for the other regions. Figure 4-2 shows a wider range (ND to 12,000 mg/kg) at shallow depths below grade (5 to 50 feet) and a sudden decrease of the range of TPH results (ND to 2,000 mg/kg) at greater depths (55 to 105 feet).

Figure 4-2 shows one outlier 13,000 mg/kg at 65 feet within borehole P3-BH-2. hydraulic This occurrence appears to be the result of hydraulic fluid that leaked from the drill rig into the borehole at that specific depth as noted on the soil boring log dated August 17, 1990. The results of samples taken 10 feet above and five feet below the 65-foot sample are extremely low (12 mg/kg and 29 mg/kg respectively) and appears to support this observation.

The highest TPH concentrations tend to be present silty and sandy soils with a percentage of gravel. All concentrations above 10,000 mg/kg were found in these soil types. Conversely clayey soils tended to have the lowest TPH concentrations.

In general, the TPH data shows a very good correlation with the OVA field screening results, with the highest TPH laboratory results corresponding to the highest OVA readings. Furthermore, both data sets exhibit almost identical trends in the geographical and vertical

TABLE 4-3

Total Petroleum Hydrocarbons Concentrations - Subsurface Soil

Main Waste Pit Region

Constituent	Total Petroleum Hydrocarbons C concentrations (mg/kg)																											
Locations	MAIN WASTE PIT																		PIT 2		MONITORING WELLS							
Borehole	BH-1	BH-2	BH-902	BH-3	BH-4	BH-904	BH-5	BH-6	BH-906	BH-7	BH-907	BH-8	BH-908	BH-9	BH-10	BH-11	BH-12	BH-13	BH-14	BH-1	BH-	MW21	MW22S	MW22D	MW23	MW24	MW25D	MW25S	MW902S
Elev. (ft)																													
525												ND(10)							ND(10)	17	ND(10)								
520												1000							ND(10)	ND(10)	ND(10)								
515												5100							ND(10)	ND(10)	ND(10)								
510										ND(10)		4700				ND(10)			ND(10)	ND(10)	ND(10)								
505										ND(10)		2500				ND(10)	ND(10)	ND (10)	1000	ND(10)	10								
500		130000		35000						ND(20)		20000	ND(25)		ND(10)	ND(10)	ND(10)	ND (10)	670	730	710								
495	320	2800		26000	990		ND(10)			ND(10)		1200		ND(10)	ND(10)	ND(10)	380	ND (10)	960	960	280				ND (10)				
490	780	7400	ND(5000)	41000	1900		690	ND(10)		ND(10)		41		ND(20)	ND(10)	ND(10)	2300	ND (10)	250	1500	220						2000		
485	2100	6100	ND(5000)	80	2100	ND(50)	ND(10)	360	ND(10)	ND(10)	ND(10)	610	ND(10)	1000	ND(10)	ND(10)	710	ND (10)	380	240	510						2600	1700	
480	1900	4400		5700	1200		ND(10)	ND(10)		ND(10)		690	ND(10)	430	ND(10)	63	5900	ND (10)	360	91	140								
475	38000	250	ND(5000)	3900	ND(10)		ND(10)	ND(10)		ND(10)		400	ND(10)	1100	ND(10)	150	2100	ND (10)	ND (10)	ND(10)	ND(10)		ND(10)		ND(10)		2500		
470	13000	790		3100	1800		ND(10)	ND(10)		ND(10)		410		ND(10)	ND(10)	300	3100		ND (10)	70	88						1100		
465	430	420		5100	500		2300	1300		ND(10)		620		20	ND(10)	87	490	ND (10)	1200	28	43						1900		
460	1800	1900		ND(10)	320		2900	1000		ND(10)		260		230	ND(10)	1000	130	95	410	ND(10)	160		ND(10)		30		1400	3600	
455	2700	670	1500	ND(5000)	ND(10)	ND(10)	2100	ND(10)		99	ND(10)	ND(10)		68	42	ND(10)	1300	ND (10)	ND (10)	ND(10)							1600		ND(50)
450	ND (10)	5300		ND(10)	ND(10)	7100	ND(10)	670		5300	ND(10)	ND(10)		2000	34	ND(10)	ND(10)	ND (10)	ND (10)				ND(10)				2400		
445	ND (10)				ND(10)			ND(10)	ND(10)	ND(10)				240	ND(10)	13	ND(10)	ND (10)	ND (10)				ND(10)		ND(10)		2500		
440	ND (10)			ND(10)	ND(10)			ND(10)	ND(10)	ND(10)		ND(10)		ND(10)	ND(10)	ND(10)	13	ND (10)	ND (10)				ND(10)		ND(10)		180		
435	ND (10)			ND(10)	ND(10)			ND(10)		ND(10)		ND(10)		ND(10)	ND(10)	ND(10)	ND(10)			ND (10)	ND(10)		ND(10)		ND(10)		1400	180	
430	ND (10)			ND(10)	ND(10)			150						ND(10)	ND(10)	ND(10)	53			ND (10)	ND(10)		ND(10)		ND(10)		60	840	
425	ND(10)			ND(10)	ND(10)			25				ND(10)		ND(10)			51			ND (10)	ND(10)		ND(10)		ND(10)		110	720	
420	120			ND(10)	60			47				ND(10)		ND(10)			750			ND (10)	ND(10)		ND(10)		ND(10)		80	ND(10)	
415	40			380	30			85				ND(10)		ND(10)			180				ND(10)		ND(10)		ND(10)		44	490	
410				ND(10)	ND(10)			ND(10)				ND(10)		25			610				ND(10)		ND(10)		ND(10)		1600		ND(50)
405												ND(10)					ND(10)				ND(10)		ND(10)		ND(10)		160	ND(10)	ND(50)
400												ND(10)									ND(10)		ND(10)		ND(10)		11		
395																					ND(10)		ND(10)						
																					ND(10)								

Detection limits are shown in parenthesis

TABLE 4-3 (cont.)

Total Petroleum Hydrocarbons Concentrations - Subsurface Soil

Southern Region

Constituent	Total Petroleum Hydrocarbons Concentrations (mg/kg)																		
Location	PIT 3						PIT 4						SUSPECT PIT		MONITORING WELLS				BKGND
Borehole	BH-1	BH-2	BH-902	BH-3	BH-4	BH-904	BH-1	BH-2	BH-3	BH-4	BH-5	BH-6	BH-1	BH-2	MW18	MW19	MW1909	MW20	BH-4
Depth (FT)																			
5	ND(10)	300		1300	ND(10)		80	50	500	ND (10)	ND(10)	ND (10)	ND(10)	ND(10)					
10	3200	2100		ND (10)	ND(10)		4700	3000	1100	ND (10)	ND(10)	10000	ND(10)	ND(10)					
15	5300	680	ND(250)	ND (10)	ND(10)		1900	3000	870	ND (10)	ND(10)	2900	1300	1600					
20	4900 3500	6500 1400		580	ND(10)		ND(10)	7300	60	13	ND(10)	3400	520	3700					
25	2900	2000		2500	430		ND(10)	10000	14	29	ND(10)	68	520	4800					
30	11000	70		910 4600	12		ND(10)	3500	460	1400	ND(10)	12	2900	12000					
35	410	2700	ND(500)	1900	ND(10) 2200	ND(120)	50	5200 1400	3000	1600 2100	ND(10) 1900	ND (10)	4500	4000		200			
40	52	1100		ND (10)	3100	ND(10)	1300	1600	1600	ND (10)	110	3100	5800 3700	2200 2000		190 740			
45	410	1900		ND (10) 120		ND(25)			2500			2200							
50		40 1500		24			ND(10) ND(10)	14	760	1300	5200	2300	5000 8900	2900	1500	40			
55		12		2000				ND(10)	ND(10)	ND (10)	13	41	ND(10)	4000 3500	860	2500	ND(25)		
60				1600									ND(10)	ND(10)		290	ND(10) ND(10)		
65		13000	ND(500)										660			140	ND(10)	270	
70		ND(500) 29											1200 560					ND(10) 130	
75		400	ND(50)										ND(10)					340	
80		320											ND(10)					ND(10) ND(10)	
85																		ND(10)	

Detection limits are shown in parenthesis

TABLE 4-3 (cont.)

Total Petroleum Hydrocarbons Concentrations - Subsurface Soil

Hill Region

Constituent	Total Petroleum Hydrocarbons Concentrations (mg/kg)									
Location	PIT5		PIT6		PIT7			PIT8		8G
Borehole	BH-1	BH-2	BH-1	BH-2	BH-1	BH-2	BH-902	BH-1	BH-2	BH-1
Depth (FT)										
5	ND(10)	ND(10)	ND(10)	ND(10)	ND(10)	2900	ND(10)	18	ND(10)	
					29					
10	460	ND(10)	ND(10)	ND(10)		ND(10)	ND(10)	60	ND(10)	
	340					44	ND(10)			
15	670	ND(10)	ND(10)	ND(10)	ND(10)	ND(10)		ND(10)	ND(10)	
20	6900	ND(10)	ND(10)	ND(10)	ND(10)	ND(10)		ND(10)	ND(10)	
			ND(10)							
25	770	ND(10)	ND(10)	ND(10)	ND(10)	ND(10)		78	ND(10)	
									ND(10)	
30	550	ND(10)		ND(10)	32	ND(10)		15	ND(10)	
		ND(10)								
35	430	ND(10)		ND(10)	ND(10)	ND(10)			ND(10)	
40	ND(10)	ND(10)		ND(10)	ND(10)	ND(10)		21	ND(10)	
45	ND(10)			ND(10)	ND(10)			ND(10)	ND(10)	
				ND(10)						
50	ND(10)			51	ND(10)	ND(10)		ND(10)	ND(10)	
55	ND(10)			ND(10)				ND(10)	ND(10)	
				ND(10)					ND(10)	
60	ND(10)			ND(10)				ND(10)	ND(10)	
	ND(10)									
65	ND(10)			ND(10)				ND(10)		
								ND(10)		
70	ND(10)			ND(10)				ND(10)		
75	ND(10)			ND(10)				ND(10)		
80	ND(10)			ND(10)				ND(10)		
85	29			ND(10)				ND(10)		
90	ND(10)							ND(10)		
								ND(10)		
95								ND(10)		
100								ND(10)		
105								ND(10)		

Detection limits are shown in parenthesis

TABLE 4-3 (cont.)

TPH Concentrations - Subsurface Soil

Northern Region

Constituent	TPH Concentrations (mg/kg)				
Location	PIT 1		BACKGROUND		
Borehole	BH-1	BH-2	BH-2	BH-3	BH-5
Depth (FT)					
5	40	ND(10)			
10	44	ND(10)			
		ND(10)			
15	ND(10)	ND(10)			
20	ND(10)	ND(10)			
25	ND(10)	ND(10)			
	ND(10)				
30	ND(10)	ND(10)			
35	ND(10)	ND(10)			
40	ND(10)	ND(10)			
45					
50					

Detection limits are shown in parenthesis

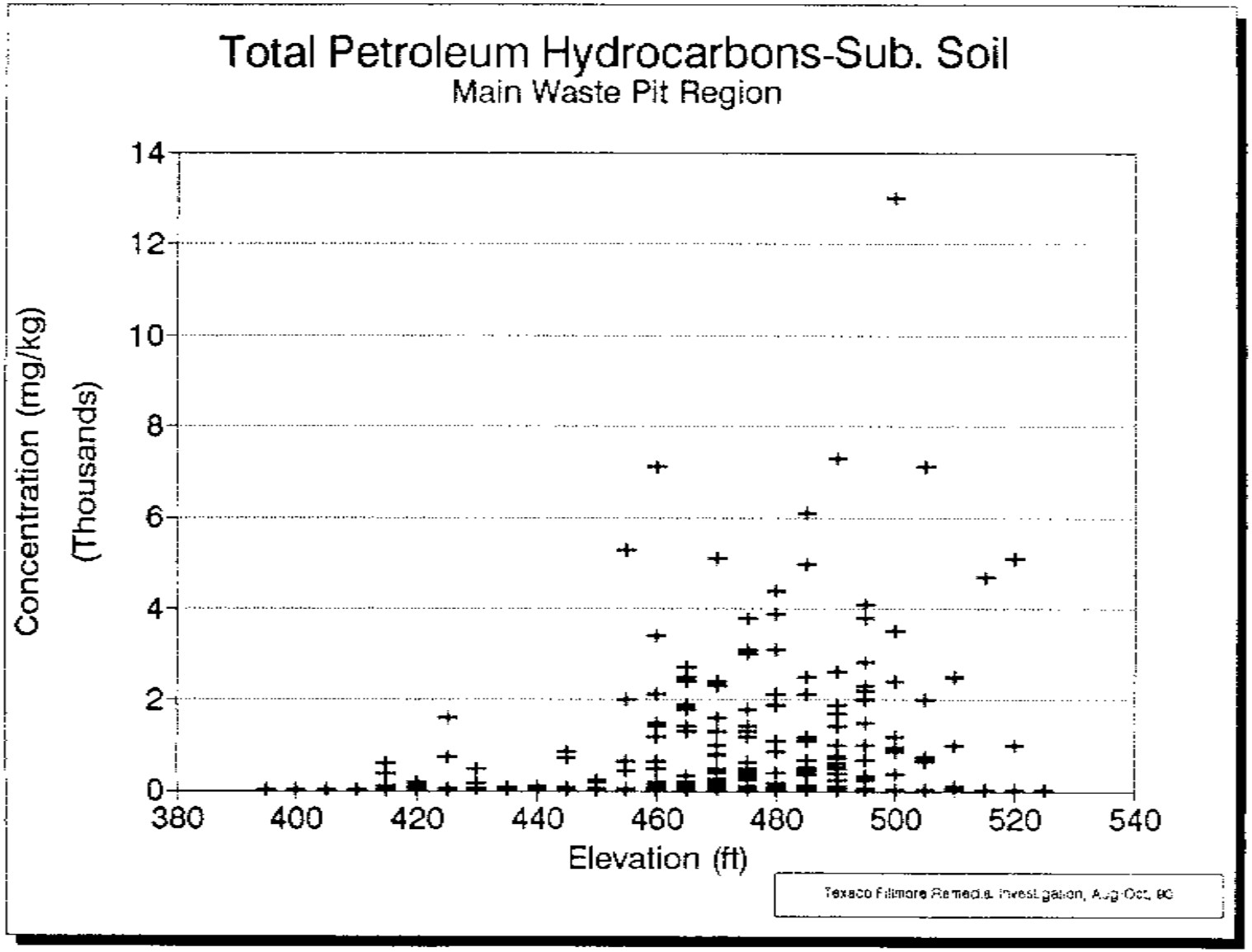

Total Petroleum Hydrocarbons-Sub. Soil
Main Waste Pit Region
Concentration (mg/kg)
(Thousands)
14
12
10
8
6
4
2
0
380
400
420
440
460
480
500
520
540
Elevation (ft)
Texaco Fillmore Remedial Investigation, Aug-Oct, 90

FIGURE 4-1

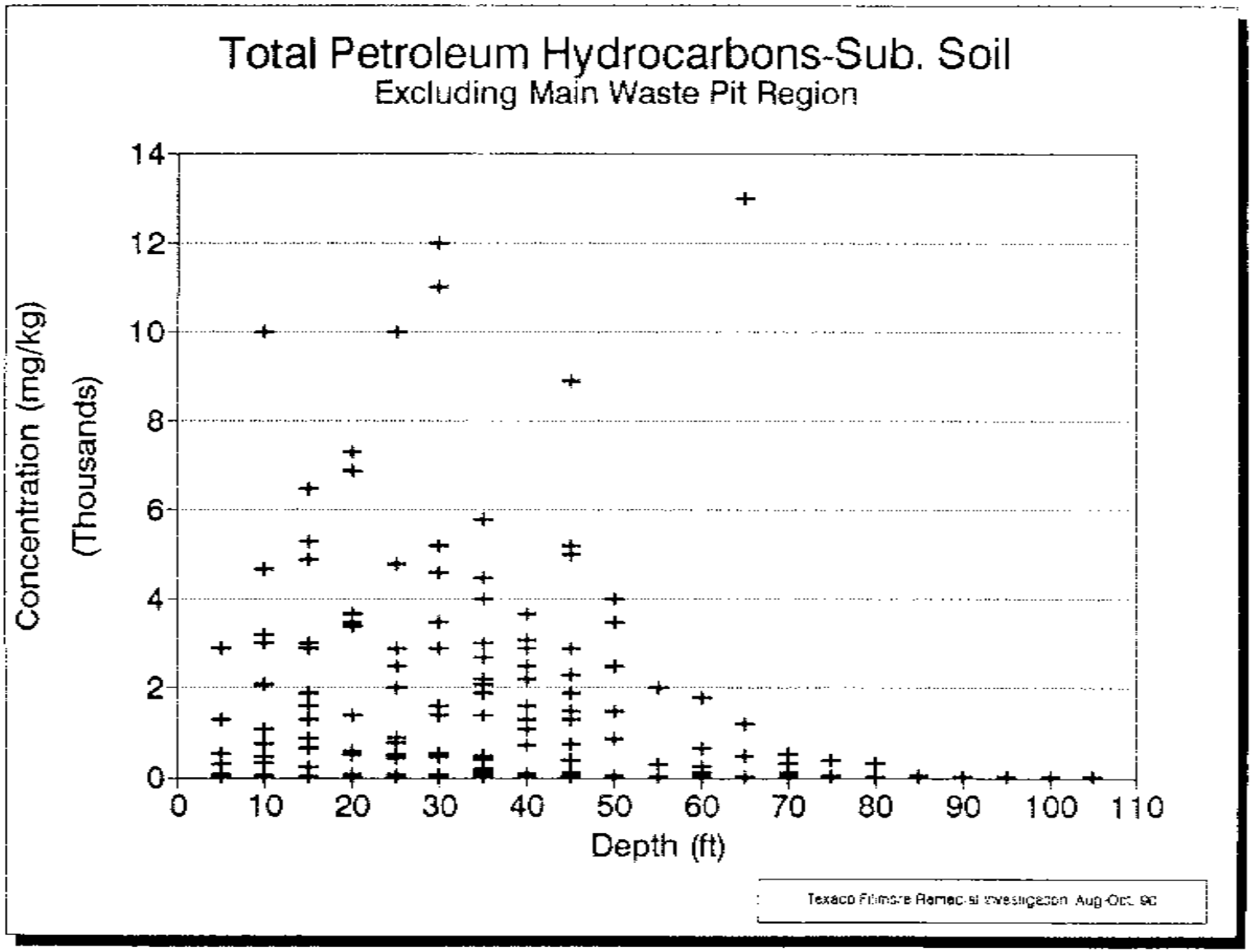

Total Petroleum Hydrocarbons-Sub. Soil
Excluding Main Waste Pit Region
Concentration (mg/kg)
(Thousands)
14
12
10
8
6
4
2
0
0
10
20
30
40
50
60
70
80
90
100
110
Depth (ft)
Texaco Fillmore Remedial Investigation Aug-Oct. 90

FIGURE 4-2

distribution of hydrocarbons in the subsurface. The highest TPH concentrations and OVA readings are found in the MWP Region and in waste pits 3, 4 and 9 (suspected pit) in the Southern Region. Also, as shown These levels are mostly present at depths ranging from 20 to 65 feet, decreasing sharply to low to nondetectable levels below this depth and away from the pits.

Based on the TPH and OVA results, approximately 20 percent of the samples with the highest concentrations were screened for TCLP organic analysis as discussed in the next section. Table 4-4 presents a breakdown of the number and distribution of samples selected for TCLP extraction and organic analysis. Figures 4-3 and 4-4 are plots of the distribution of that data by waste pit and for the entire site. The samples selected for TCLP analyses are indicated by a double box around the TPH value in Table 4-3.

4.1.4 Volatile Organic Compounds (VOCs)

This section presents the results of analyses by EPA methods 8240 (VOCs) and 504 Modified (EDB), performed on subsurface soil samples at the Texaco Fillmore site. The discussion is divided into Total and TCLP analyses.

4.1.4.1 Total VOC Analyses

Total VOC analyses were conducted in all samples collected from the four soil gas area boreholes. In addition, one or two samples from each of the waste pit and monitoring well boreholes, selected based on the highest OVA readings were also analyzed for Total VOCs. Table 4-5 provides a "hits only" list of VOCs detected in these samples.

Of the samples taken in the soil gas area, 35 samples had detected VOCs. The VOCs detected more than once in the soil gas area are benzene, ethylbenzene, toluene, total xylenes, and 2-butanone. Four VOCs were detected only once, vinyl acetate, 2-hexanone, trichloroethylene, and 1,2-dichloroethylene. Benzene was detected in five samples in the soil gas area, with three samples having benzene over the detection limit (60, 260 and 400 µg/kg, with the detection limit equal to 25 µg/kg). The remaining two samples have benzene results flagged as estimated, as the results were under the detection limit. In the soil gas area, benzene was detected in boreholes SG-BH-1 and SG-BH-901. Ethylbenzene was detected above the reporting limit in 9 samples collected in the soil gas area. The highest value found in the soil gas area was 6,800 µg/kg. Toluene was detected in 23 samples with 8 of the samples containing toluene over the detection limit. The two highest values detected in the soil gas area are 720 and 630 µg/kg from SG-BH-1 and SG-BH-901. However, in all but one sample, toluene was flagged as a common laboratory contaminant. Total xylenes were

Samples Selected for TCLP Organic Analysis (Based on Total Petroleum Hydrocarbon Results)

Waste Pit	BH #	Total # of Samples Collected	Median TPH Concentration*	TCLP Sample Selection Breakdown			
				Number of Samples Selected for TCLP Analysis		Number of Selected Samples Above Median TPH Concentration	
				#	% of Total	#	% of Total
Main Waste Pit	1	19	320.0	5	26.3	5	26.3
	2	11	2800.0	2	18.2	2	18.2
	902	4	500.0	4	100.0	0	0.0
	3	19	80.0	4	21.1	4	21.1
	4	20	20.0	1	5.0	1	5.0
	904	3	50.0	3	100.0	1	33.3
	5	11	10.0	2	18.2	2	18.2
	6	20	17.5	1	5.0	1	5.0
	906	3	10.0	3	100.0	1	33.3
	7	16	10.0	2	12.5	1	6.3
	907	3	120.0	3	100.0	1	33.3
	8	26	25.5	5	19.2	5	19.2
	908	3	10.0	3	100.0	1	33.3
	9	20	20.0	4	20.0	4	20.0
	10	18	10	1	5.6	0	0.0
	11	20	10	1	5.0	1	5.0
	12	24	175	7	29.2	5	20.8
	13	16	10	4	25.0	2	12.5
	14	19	10	5	26.3	4	21.1
	Total	275		60	21.8	41	14.9
Pit #1	1	9	10.0	3	33.3	2	22.2
	2	9	10.0	1	11.1	0	0.0
	Total	18		4	22.2	2	11.1
Pit #2	1	15	17.0	3	20.0	3	20.0
	2	15	410.0	5	33.3	5	33.3
	Total	30		8	26.7	8	26.7
Pit #3	1	10	3050	3	30.0	3	30.0
	2	17	1100	5	29.4	5	29.4
	902	5	500	5	100.0	0	0.0
	3	14	745	4	28.6	3	21.4
	4	9	10	2	22.2	2	22.2
	904	3	25	3	100.0	1	33.3
	Total	58		22	37.9	14	24.1
Pit #4	1	10	30	3	30.0	3	30.0
	2	11	3000	3	27.3	2	18.2
	3	11	760	4	36.4	3	27.3
	4	11	13	3	27.3	3	27.3
	5	11	10	2	18.2	2	18.2
	6	11	2200	3	27.3	2	18.2
	Total	65		18	27.7	15	23.1
Pit #5	1	20	10.0	3	15.0	3	15.0
	2	9	10.0	1	11.1	0	0.0
	Total	29		4	13.8	3	10.3
Pit #6	1	6	10.0	0	0.0	0	0.0
	2	19	10.0	0	0.0	0	0.0
	Total	25		0	0.0	0	0.0
Pit #7	1	10	10	3	30.0	2	20.0
	2	10	10	3	30.0	2	20.0
	902	3	10	3	100.0	0	0.0
	Total	20		6	30.0	4	20.0
Pit #8	1	22	10.0	6	27.3	5	22.7
	2	14	10.0	0	0.0	0	0.0
	Total	36		6	16.7	5	13.9
Pit #9 Suspected Pit	1	18	610.0	6	33.3	5	27.8
	2	13	2900.0	6	46.2	4	30.8
	Total	31		12	38.7	9	29.0

* Concentrations exceeded by 50% of samples.

Distribution of Samples Selected for TCLP Organic Analysis by Waste Pit

(Based on Total Petroleum Hydrocarbon Concentration)

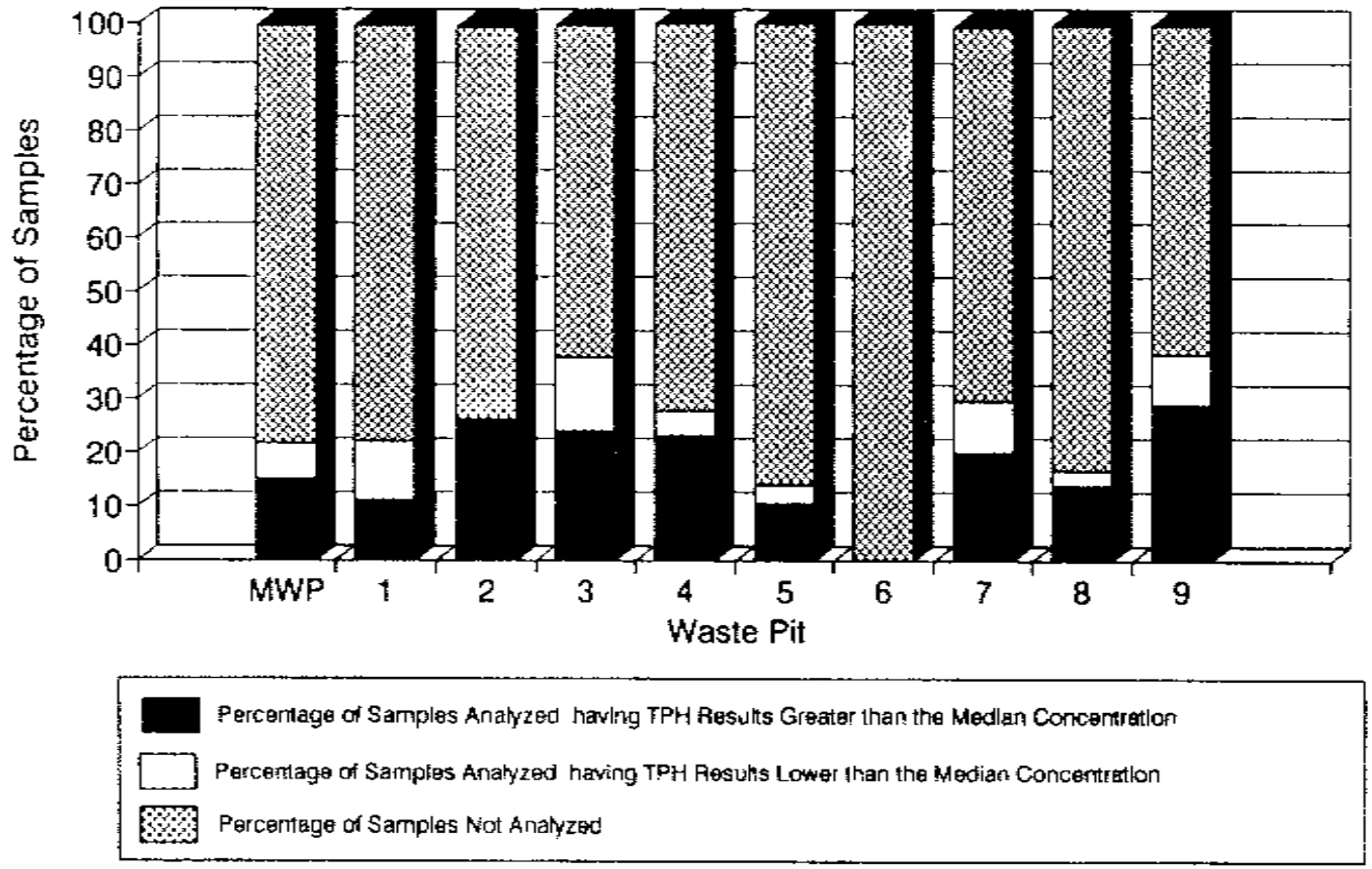


Figure 4-3

Texaco Fillmore Remedial Investigation June 1991

Distribution of Samples Selected for TCLP Organic Analysis for All Pits

(Based on Total Petroleum Hydrocarbon Concentration)

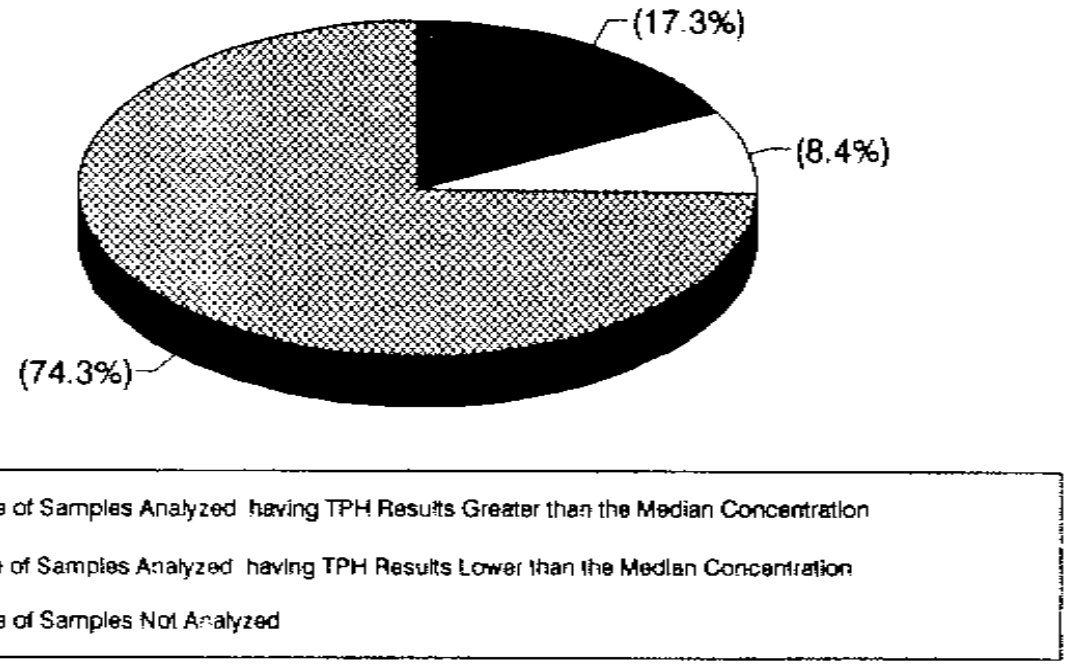


Figure 4-4

Texaco Fillmore Remedial Investigation June 1991

TABLE 4-5

EPA 8240 Volatile Analysis - Subsurface Soil
Main Waste Pit Region

MAIN WASTE PIT REGION						
Location	Depth (ft)	Constituent	Value	Units	RDL	Qualifier
MWP-BH10	40	Highest TIC	31	ug/kg		J
	40	Toluene	19	ug/kg	25	PJ
	50	Highest TIC	160	ug/kg		J
	50	Toluene	8.5	ug/kg	25	PJ
	75	Ethylbenzene	1.2	ug/kg	5	J
	75	Highest TIC	72	ug/kg		J
	75	Toluene	22	ug/kg	5	P
MWP-BH13	65	2-Butanone	5.7	ug/kg	10	PJ
	65	Benzene	1.3	ug/kg	5	J
	65	Ethylbenzene	52	ug/kg	5	
	65	Highest TIC	89	ug/kg		J
	65	Toluene	16	ug/kg	5	P
	65	Xylenes (TOTAL)	80	ug/kg	5	
MWP-BH14	60	Ethylbenzene	79	ug/kg	25	
	60	Highest TIC	120	ug/kg		J
	60	Toluene	9.4	ug/kg	25	PJ
	60	Xylenes (TOTAL)	81	ug/kg	25	

J : Estimated value

P : Possible Laboratory Contaminant

EPA 8240 Volatile Analysis - Subsurface Soil
Soil Gas Area

SOIL GAS AREA						
Location	Depth (ft)	Constituent	Value	Units	RDL	Qualifier
SG-BH1	5	Highest TIC	0	ug/kg		J
	5	Toluene	20	ug/kg	5	P
	10	Highest TIC	0	ug/kg		J
	10	Toluene	21	ug/kg	5	P
	15	Highest TIC	0	ug/kg		J
	15	Toluene	9	ug/kg	5	P
	20	Highest TIC	0	ug/kg		J
	20	Toluene	5.9	ug/kg	5	P
	25	2-Butanone	21	ug/kg	10	
	25	Highest TIC	0	ug/kg		J
	25	Toluene	42	ug/kg	5	
	30	Highest TIC	32	ug/kg		J
	30	Toluene	4.6	ug/kg	5	PJ
	35	1,2-Dichloroethylene	2.2	ug/kg	5	J
	35	Highest TIC	8	ug/kg		J
	35	Toluene	6.7	ug/kg	5	P
	40	Highest TIC	37	ug/kg		J
	40	Toluene	2.9	ug/kg	5	PJ

Texaco Fillmore Remedial Investigation, Aug.-Oct., 90

TABLE 4-5 (cont.)

EPA 8240 Volatile Analysis - Subsurface Soil
Soil Gas Area

SOIL GAS AREA (Cont.)						
Location	Depth (ft)	Constituent	Value	Units	RDL	Qualifier
SG-BH1	45	Benzene	60	ug/kg	25	
cont.	45	Ethylbenzene	97	ug/kg	25	
	45	Highest TIC	530	ug/kg		J
	45	Toluene	27	ug/kg	25	P
	45	Xylenes (TOTAL)	36	ug/kg	25	
	50	2-Butanone	680	ug/kg	1000	PJ
	50	2-Hexanone	270	ug/kg	1000	PBJ
	50	Ethylbenzene	370	ug/kg	500	J
	50	Highest TIC	4500	ug/kg		J
	55	Ethylbenzene	1800	ug/kg	500	
	55	Highest TIC	28000	ug/kg		J
	55	Toluene	630	ug/kg	500	P
	55	Xylenes (TOTAL)	8900	ug/kg	500	
	60	Ethylbenzene	110	ug/kg	500	J
	60	Highest TIC	2800	ug/kg		J
	60	Xylenes (TOTAL)	490	ug/kg	500	J
	60(dup)	Highest TIC	35000	ug/kg		J
	65	Ethylbenzene	220	ug/kg	1000	J
	65	Highest TIC	33000	ug/kg		J
	65	Xylenes (TOTAL)	2700	ug/kg	1000	
	70	2-Butanone	330	ug/kg	1000	PJ
	70	Ethylbenzene	210	ug/kg	500	J
	70	Highest TIC	2900	ug/kg		J
	70	Xylenes (TOTAL)	870	ug/kg	500	
	70(dup)	Ethylbenzene	620	ug/kg	500	
	70(dup)	Highest TIC	2000	ug/kg		J
	70(dup)	Toluene	160	ug/kg	500	PJ
	70(dup)	Xylenes (TOTAL)	2500	ug/kg	500	
	75	Ethylbenzene	210	ug/kg	500	J
	75	Highest TIC	1600	ug/kg		J
	75	Trichloroethylene	110	ug/kg	500	J
	75	Xylenes (TOTAL)	630	ug/kg	500	
	80	Highest TIC	5000	ug/kg		J
	80	Xylenes (TOTAL)	350	ug/kg	500	J
	85	Ethylbenzene	400	ug/kg	500	J
	85	Highest TIC	6500	ug/kg		J
	85	Xylenes (TOTAL)	710	ug/kg	500	
	90	Ethylbenzene	440	ug/kg	500	J
	90	Highest TIC	7200	ug/kg		J
	90	Xylenes (TOTAL)	790	ug/kg	500	
	95	Ethylbenzene	480	ug/kg	500	J
	95	Highest TIC	33000	ug/kg		J
	95	Toluene	250	ug/kg	500	PJ
	95	Xylenes (TOTAL)	660	ug/kg	500	

Texaco Fillmore Remedial Investigation, Aug.-Oct. 90

TABLE 4-5 (cont.)

EPA 8240 Volatile Analysis - Subsurface Soil
Soil Gas Area

SOIL GAS AREA (Cont.)						
Location	Depth (ft)	Constituent	Value	Units	RDL	Qualifier
SG-BH901	15	Highest TIC	1300	ug/kg		J
	15	Xylenes (TOTAL)	11	ug/kg	5	
	30	Highest TIC	29	ug/kg		J
	45	Benzene	260	ug/kg	25	
	45	Ethylbenzene	460	ug/kg	25	
	45	Highest TIC	1000	ug/kg		J
	45	Toluene	56	ug/kg	25	P
	45	Xylenes (TOTAL)	130	ug/kg	25	
	45(dup)	Ethylbenzene	1200	ug/kg	500	
	45(dup)	Highest TIC	7500	ug/kg		J
	45(dup)	Toluene	720	ug/kg	500	P
	45(dup)	Xylenes (TOTAL)	1600	ug/kg	500	
	60	Benzene	400	ug/kg	25	
	60	Ethylbenzene	640	ug/kg	25	
	60	Highest TIC	190	ug/kg		J
	60	Toluene	73	ug/kg	25	P
	60	Xylenes (TOTAL)	180	ug/kg	25	
	75	Benzene	14	ug/kg	25	J
	75	Ethylbenzene	91	ug/kg	25	
	75	Highest TIC	1800	ug/kg		J
	75	Toluene	37	ug/kg	25	P
	75	Xylenes (TOTAL)	290	ug/kg	25	
SG-BH3	5	Ethylbenzene	1200	ug/kg	2500	J
	5	Highest TIC	35000	ug/kg		J
	5	Xylenes (TOTAL)	600	ug/kg	2500	J
	10	Ethylbenzene	2300	ug/kg	2500	J
	10	Highest TIC	78000	ug/kg		J
	10	Toluene	560	ug/kg	2500	PJ
	10	Xylenes (TOTAL)	1600	ug/kg	2500	J
	15	Ethylbenzene	1700	ug/kg	2500	J
	15	Highest TIC	79000	ug/kg		J
	15	Toluene	580	ug/kg	2500	PJ
	15	Xylenes (TOTAL)	1800	ug/kg	2500	J
	20	Ethylbenzene	580	ug/kg	2500	J
	20	Highest TIC	110000	ug/kg		J
	20	Toluene	560	ug/kg	2500	PJ
	20	Xylenes (TOTAL)	1400	ug/kg	2500	J
	20(dup)	Benzene	620	ug/kg	2500	J
	20(dup)	Ethylbenzene	860	ug/kg	2500	J
	20(dup)	Highest TIC	200000	ug/kg		J
	20(dup)	Toluene	720	ug/kg	2500	PJ
	20(dup)	Xylenes (TOTAL)	1700	ug/kg	2500	J
	25	Highest TIC	180000	ug/kg		J
	25	Toluene	560	ug/kg	2500	PJ
	25	Xylenes (TOTAL)	620	ug/kg	2500	J

Texaco Fillmore Remedial Investigation, Aug.-Oct., 90

TABLE 4-5 (cont.)

EPA 8240 Volatile Analysis - Subsurface Soil
Soil Gas Area

SOIL GAS AREA (Cont.)						
Location	Depth (ft)	Constituent	Value	Units	RDL	Qualifier
SG-BH3	30	Highest TIC	30000	ug/kg		J
cont.	35	Ethylbenzene	3000	ug/kg	2500	
	35	Highest TIC	180000	ug/kg		J
	35	Toluene	600	ug/kg	2500	PJ
	35	Xylenes (TOTAL)	1700	ug/kg	2500	J
	35(dup)	Ethylbenzene	6800	ug/kg	2500	
	35(dup)	Highest TIC	310000	ug/kg		J
	35(dup)	Toluene	1200	ug/kg	2500	PJ
	35(dup)	Xylenes (TOTAL)	5000	ug/kg	2500	
	45	Ethylbenzene	1400	ug/kg	2500	J
	45	Highest TIC	52000	ug/kg		J
	50	Highest TIC	18000	ug/kg		J
	55	Highest TIC	25000	ug/kg		J
	60	Highest TIC	7400	ug/kg		J
	65	Highest TIC	14000	ug/kg		J
	70	Highest TIC	32000	ug/kg		J
	75	Highest TIC	17000	ug/kg		J
SG-BH4	5	Highest TIC	380000	ug/kg		J
	10	Highest TIC	48000	ug/kg		J
	10(dup)	Highest TIC	15000	ug/kg		J
	15	Highest TIC	130000	ug/kg		J
	20	Highest TIC	55000	ug/kg		J
	25	Highest TIC	9000	ug/kg		J
	25(dup)	Highest TIC	20000	ug/kg		J
	30	Highest TIC	730	ug/kg		J
	35	Highest TIC	5700	ug/kg		J
	40	Highest TIC	15000	ug/kg		J
	45	Highest TIC	7000	ug/kg		J
	45	Vinyl acetate	420	ug/kg	700	J
	50	Highest TIC	100000	ug/kg		J
	55	Highest TIC	86	ug/kg		J
	60	Highest TIC	1400	ug/kg		J
	65	Highest TIC	4200	ug/kg		J
	70	Highest TIC	1800	ug/kg		J
	75	Highest TIC	0	ug/kg		J
	80	Highest TIC	790	ug/kg		J

J : Estimated value

P : Possible Laboratory Contaminant

Texaco Fillmore Remedial Investigation, Aug.-Oct., 90

TABLE 4-5 (cont.)

EPA 8240 Volatile Analysis - Subsurface Soil
Southern Region

SOUTHERN REGION						
Location	Depth (ft)	Constituent	Value	Units	RDL	Qualifier
P3-BH2	20	Highest TIC	4900	ug/kg		J
	20	Toluene	44	ug/kg	25	P
	20	Xylenes (TOTAL)	88	ug/kg	25	
	35	Ethylbenzene	21	ug/kg	25	J
	35	Highest TIC	520	ug/kg		J
	35	Toluene	18	ug/kg	25	PJ
	35	Xylenes (TOTAL)	8	ug/kg	25	J
	50	Ethylbenzene	130	ug/kg	25	
	50	Highest TIC	12000	ug/kg		J
	50	Toluene	220	ug/kg	25	
	50	Xylenes (TOTAL)	220	ug/kg	25	
	75	2-Butanone	19	ug/kg	50	JP
	75	Benzene	16	ug/kg	25	J
	75	Highest TIC	6600	ug/kg		J
	75	Xylenes (TOTAL)	59	ug/kg	25	
P3-BH3	50	Benzene	27	ug/kg	25	
	50	Highest TIC	1000	ug/kg		J
	50	Toluene	12	ug/kg	25	PJ
P3-BH4	40	Benzene	17	ug/kg	5	
	40	Ethylbenzene	3.3	ug/kg	5	J
	40	Highest TIC	140	ug/kg		J
	40	Toluene	11	ug/kg	5	P
	40	Xylenes (TOTAL)	15	ug/kg	5	
P4-BH3	35	Highest TIC	41000	ug/kg		J
	35	Xylenes (TOTAL)	640	ug/kg	500	
	45	Benzene	5.5	ug/kg	25	J
	45	Ethylbenzene	5.6	ug/kg	25	J
	45	Highest TIC	1400	ug/kg		J
	45	Toluene	53	ug/kg	25	P
	45	Xylenes (TOTAL)	21	ug/kg	25	J
P4-BH4	45	Highest TIC	64000	ug/kg		J
	45	Vinyl Acetate	940	ug/kg	1000	J
	45	Xylenes (TOTAL)	100	ug/kg	500	J
P4-BH5	40	Highest TIC	3100	ug/kg		J
P4-BH6	45	Highest TIC	46000	ug/kg		J
	45	Xylenes (TOTAL)	360	ug/kg	500	J
MW19	35	Highest TIC	2700	ug/kg		J
	40	Highest TIC	48000	ug/kg		J
	45	Highest TIC	4200	ug/kg		J
	50	Highest TIC	33000	ug/kg		J
	55	Highest TIC	41000	ug/kg		J
	60	Highest TIC	0	ug/kg		J
	85	Highest TIC	9.6	ug/kg		J
MW20	85	2-Butanone	3	ug/kg	10	PJ
	85	Toluene	5	ug/kg	5	P

J : Estimated value

P : Possible Laboratory Contaminant

Texaco Fillmore Remedial Investigation, Aug.-Oct., 90

detected in 24 samples in the soil gas area, at levels up to 17 times above the reporting limit. The highest value was 8,900 µg/kg.

In the waste pit areas, 16 samples had VOCs detected. The VOCs detected in the waste pit areas are benzene, ethylbenzene, toluene, total xylenes, 2-butanone, and vinyl acetate (detected in one sample). Of the compounds detected, 2-butanone, 2-hexanone, and toluene are identified as common laboratory contaminants.

Benzene was detected in five samples in the waste pit areas (the main waste pit and pit 3). Two of the samples had benzene over the detection limit, and three samples had benzene results flagged as estimated, as the results were below the detection limit. Ethylbenzene was detected in 7 samples in the waste pit areas, with 3 samples above the reporting limit and 4 samples below the reporting limit. The highest ethylbenzene value found in the waste pit areas was 130 ug/kg. Toluene was detected in 12 samples with the highest value being 220 µg/kg detected in pit 3. However, in all but one sample, toluene was flagged as a common laboratory contaminant. Total xylenes were detected in 11 samples in the waste pit areas, at levels up to 16 times the reporting limit. The highest value was 640 µg/kg located at pit 4.

Tentatively identified compounds (TICs) were detected in 77 of the 84 samples analyzed, with TIC levels up to 380,000 ug/kg. Table 4-5 presents the highest TIC concentration detected for each sample. A more detailed breakdown of TICs per sample is provided in Appendix J, Data Validation Reports.

4.1.4.2 TCLP VOC Analyses

TCLP VOC analyses were conducted on approximately 20 percent of the samples from the waste pit and monitoring well boreholes, selected based on the highest EPA 8015 modified laboratory screening results and field OVA readings. The results of these analyses for each of the indicator parameters and other detected VOCs are discussed below.

Benzene. The results of the TCLP analysis for benzene are provided in Table 4-6. As shown in the table, benzene was not detected in 127 of the 142 samples analyzed throughout the facility and exceeded the FSP designated threshold level of 11 µg/l in only four samples. TCLP values for benzene ranged from ND to 38 µg/l. Upon validation of laboratory analytical data, only one sample result, which was below detection limits, was determined to be unusable due to missed holding time. The detection limit for TCLP benzene was 5 µg/l except for one sample collected from the main waste pit which had a detection limit of 10 µg/l.

TABLE 4-6

TCLP Benzene - Subsurface Soil

Main Waste Pit Region

Constituent	Benzene Concentrations (ug/l)																											
Location	MAIN WASTE PIT																		PIT 2		MONITORING WELLS							
Borehole	BH-1	BH-2	BH-902	BH-3	BH-4	BH-904	BH-5	BH-6	BH-906	BH-7	BH-907	BH-8	BH-908	BH-9	BH-10	BH-11	BH-12	BH-13	BH-14	BH-1	BH-2	MW21	MW22S	MW22D	MW23	MW24	MW25D	MW25S	MW902S
Elev. (FT)																													
525																													
520																													
515												<5																	
510												<5 UJ							<5										
505												<5 UJ	<5							<5	<5								
500		6.9 J		< 10								<5 UJ							<5	<5	<5								
495				<5																<5	<5								
490		8.5 J	6.4						<5					<5														<5 UJ	
			<5																										
485	<5			<5		<5					<5	<5 UJ	<5						<5										
													<5	<5															
480	<5															<5			<5		<5								
475	<5		5.8		<5														<5		<5							2.4 R	
470				<5			<5										<5	<5											22
465							<5	<5						<5															
	<5																												
460	<5		<5			<5					<5																		
						<5					<5							<5											
455														<5			7.5	<5											
450									<5																				
									<5																				
445																		<5											
440																													
435																													
430																													
425																	*				<5								<5
																													<5

UJ: Estimated Not Detected
J : Estimated values

R : Unusable
Threshold Level for Benzene : 11 ug/l

Texaco Fillmore Remedial Investigation, Aug-Oct, 90

TABLE 4-6 (cont.)

TCLP Benzene - Subsurface Soil

Southern Region

Constituent	Benzene Concentrations (ug/l)																		
Location	PIT 3						PIT 4						SUSPECT PIT		MONITORING WELLS				BKGND
Borehole	BH-1	BH-2	BH-902	BH-3	BH-4	BH-904	BH-1	BH-2	BH-3	BH-4	BH-5	BH-6	BH-1	BH-2	MW18	MW19	MW1909	MW20	BH-4
Depth (FT)																			
5																			
10	<5 UJ						<5		38			<5							
15	8.9 J		<5				<5												
20								<5					<5						
25		<5 UJ						<5											
30	<5 UJ			<5					<5				<5						
35			<5		<5	25		<5	<5	<5	<5								
40					<5	<5	<5					<5	<5						
45				<5		<5			5.4										
50										<5	<5		6.3		<5				
55				9.6								12					<5		
60				5.5													<5	<5	
65			<5										<5						
70			<5															<5	
75			<5															<5	
80																			
85																		<5	

Texaco Fillmore Remedial Investigation, Aug-Oct, 90

UJ: Estimated Not Detected

TABLE 4-6 (cont.)

TCLP Benzene - Subsurface Soil

Hill Region

Constituent	Benzene Concentrations (ug/l)									
Location	PIT5		PIT6		PIT7			PIT8		BG
Borehole	BH-1	BH-2	BH-1	BH-2	BH-1	BH-2	BH-902	BH-1	BH-2	BH-1
Depth (FT)										
5						<5	<5	<5		
					<5					
10	<5						<5	<5		
						<5	<5			
15										
20	<5					<5				
25	<5				<5			<5		
30					<5			<5		
35		<5								
40								<5		
45										
50								<5		
55										
60										
65										
70										
75										
80										
85										
90										
95										
100										
105										

UJ: Estimated Not Detected

J : Estimated values

TABLE 4-6 (cont.)

TCLP Benzene - Subsurface Soil

Northern Region

Constituent	Benzene Concentrations (ug/l)				
Location	PIT 1		BACKGROUND		
Borehole	BH-1	BH-2	BH-2	BH-3	BH-5
Depth (FT)					
5	<5 UJ				
10	<5 UJ				
15					
20	<5 UJ				
25		<5 UJ			
30					
35					
40					
45					
50					

UJ: Estimated Not Detected

J : Estimated values

Threshold Level for Benzene : 11 ug/l

TCLP Benzene - Subsurface Soil

Soil Gas Area

Constituent	Benzene Conc. (ug/l)				
Location	SOIL GAS AREA				
Borehole	BH-1	BH-901	BH-2	BH-3	BH-4
Depth (FT)					
5					
10					
15					<5
20					
25					
30					
35					
40					
45					
50					
55	<5				

UJ: Estimated Not Detected

J : Estimated values

Threshold Level for Benzene : 11 ug/l

Three of the four samples that exceeded the FSP designated threshold level occurred in the Southern Region. Figures 4-5 and Figure 4-6 depict the spatial distribution of the benzene TCLP concentrations in monitoring well 9025 and in the Southern Region. Two of the four exceedances occurred in two of the eleven boreholes (P3-BH904 and MW9025) that were redrilled because of missed holding times. The original boreholes at these two locations had benzene levels below the FSP threshold or below the detection limit. In the other nine redrilled boreholes, the sampling results were similar in both the original and redrilled boreholes.

Ethylene Dibromide (EDB). The results of the TCLP analysis for EDB are provided in Table 4-7. As shown in the table, EDB was not detected in any of the 162 samples analyzed. The detection limit for each sample was 0.05 µg/l, which was well below the threshold defined in the FSP for this constituent (16,000 µg/l).

Ethylbenzene. The results of the TCLP analysis for ethylbenzene are provided in Table 4-8. As shown in the table, ethylbenzene was not detected in 100 of the 142 samples analyzed throughout the facility, and did not exceed the FSP designated threshold level of 700 µg/l in any of the samples. TCLP values for ethylbenzene ranged from ND to a maximum of 260 µg/l. Upon validation of laboratory analytical data, only one sample result, which was below detection limits, was determined to be unusable due to missed holding time. The three highest values were found in the MWP-BH-3 borehole at shallow depths.

Toluene. The results of the TCLP analysis for toluene are provided in Table 4-9. As shown in the table, toluene was not detected in 93 of the 142 samples analyzed throughout the facility, and did not exceed the FSP designated threshold level of 330 µg/l in any of the samples analyzed. TCLP values for toluene ranged from ND to a maximum of 300 µg/l. Upon validation of laboratory analytical data, only one sample result, which was below detection limits, was determined to be unusable due to missed holding time. As with ethylbenzene, three of the higher values were found in the MWP-BH-3 borehole at shallow depths. In the analytical laboratory reports, toluene was also reported to be a common laboratory contaminant for TCLP analysis.

Xylenes. The results of the TCLP analysis for xylenes are provided in Table 4-10. As shown in the table, xylenes were not detected in 84 of the 142 samples analyzed throughout the facility, and exceeded the FSP designated threshold level of 620 µg/kg in only 3 of 142 samples. All three exceedances occurred in borehole MWP-BH-3 in the MWP Region at 5, 10, and 35 feet, as depicted in Figure 4-7. The highest exceedance value (860 µg/l at 5 feet below grade) is within 40 percent of the threshold. Upon validation of laboratory analytical

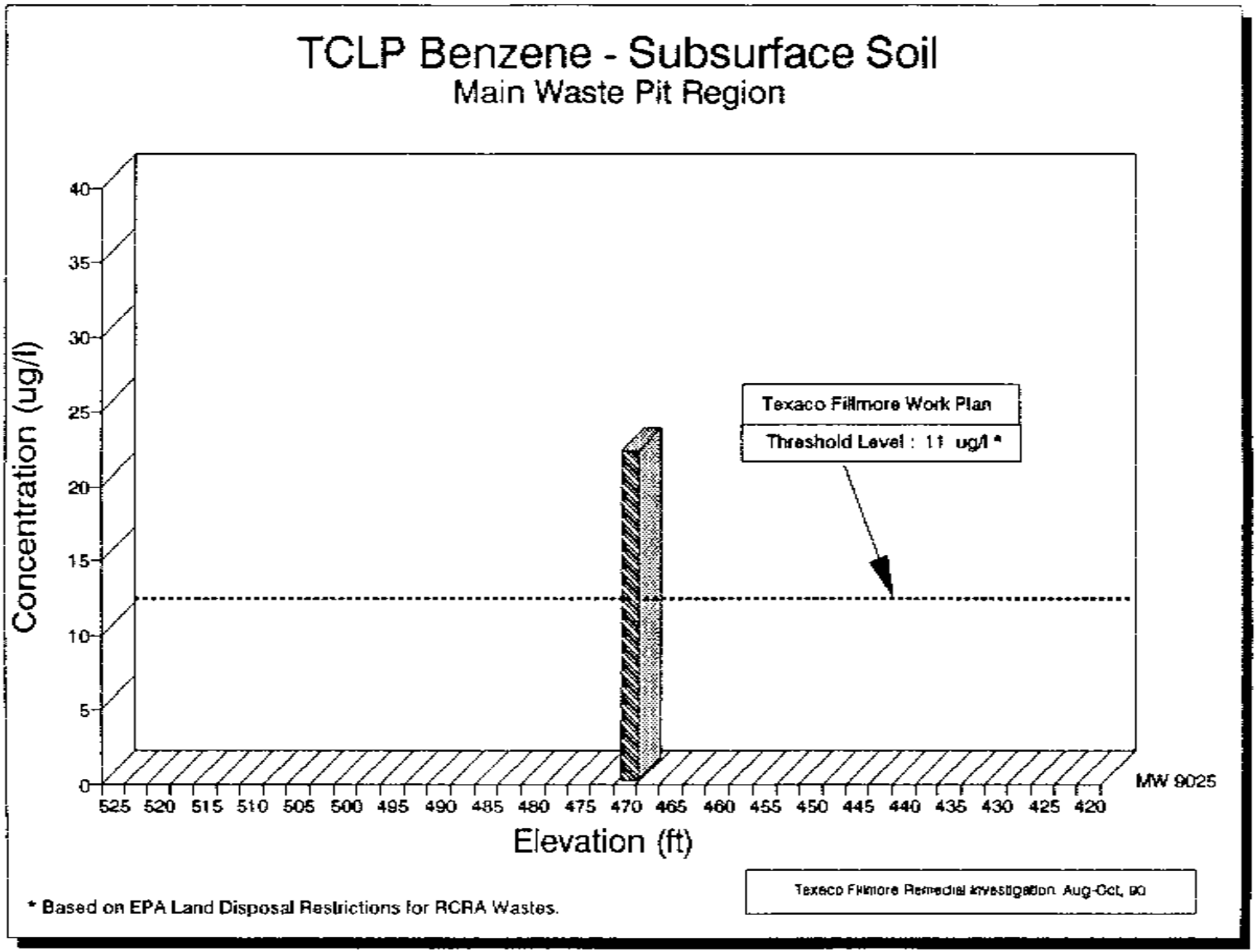

TCLP Benzene - Subsurface Soil
Main Waste Pit Region
Concentration (ug/l)
40
35
30
25
20
15
10
5
0
525 520 515 510 505 500 495 490 485 480 475 470 465 460 455 450 445 440 435 430 425 420
Elevation (ft)
Texaco Fillmore Work Plan
Threshold Level : 11 ug/l *
MW 9025
* Based on EPA Land Disposal Restrictions for RCRA Wastes.
Texaco Fillmore Remedial Investigation Aug-Oct, 90

Figure 4-5

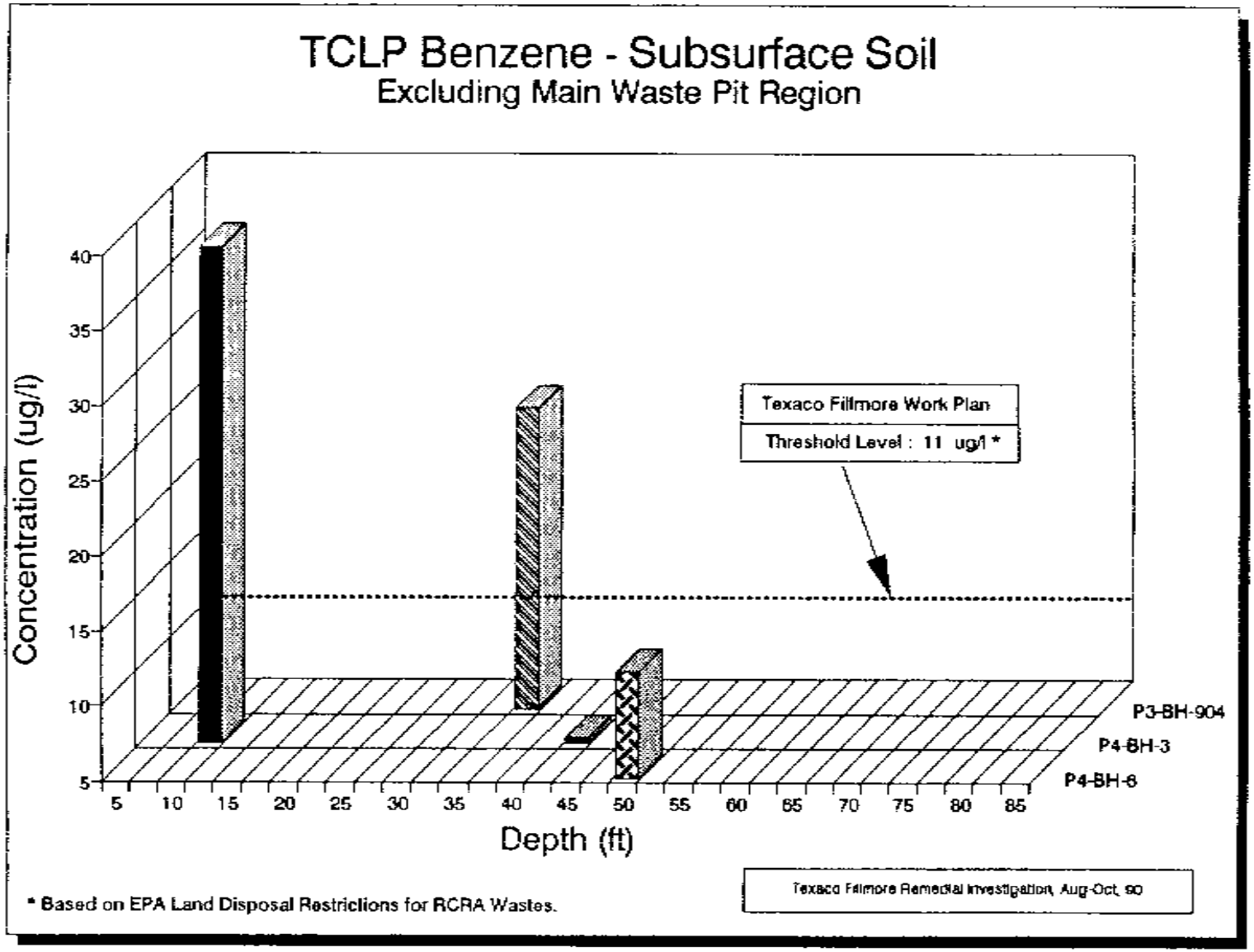

TCLP Benzene - Subsurface Soil
Excluding Main Waste Pit Region
Concentration (ug/l)
40
35
30
25
20
15
10
5
Texaco Fillmore Work Plan
Threshold Level : 11 ug/l *
P3-BH-904
P4-BH-3
P4-BH-6
5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85
Depth (ft)
* Based on EPA Land Disposal Restrictions for RCRA Wastes.
Texaco Fillmore Remedial Investigation, Aug-Oct, 90

Figure 4-6

TABLE 4-7

TCLP EDB - Subsurface Soil

Main Waste Pit Region

Constituent	EDB Concentrations (ug/l)																												
Location	MAIN WASTE PIT																			PIT 2		MONITORING WELLS							
Borehole	BIT-1	BIT-2	BIT-902	BIT-3	BIT-4	BIT-904	BIT-5	BIT-6	BIT-906	BIT-7	BIT-907	BIT-8	BIT-908	BIT-9	BIT-10	BIT-11	BIT-12	BIT-13	BIT-14	BIT-1	BIT-2	MW21	MW22S	MW22D	MW23	MW24	MW25	MW25	MW902
Elev. (FT)																													
525																													
520																													
515												<.05																	
510												<.05							<.05										
505												<.05	<.05							<.05	<.05								
500		<.05		<.05								<.05							<.05	<.05	<.05								
495				<.05																<.05	<.05								
490		<.05	<.05						<.05					<.05												<.05	<.05		
			<.05																										
485	<.05			<.05		<.05				<.05	<.05	<.05	<.05						<.05							<.05		
													<.05	<.05															
480	<.05															<.05			<.05		<.05					<.05			
475	<.05		<.05		<.05														<.05		<.05						<.05		
470				<.05			<.05											<.05										<.05	
465	<.05						<.05	<.05						<.05												<.05			
460	<.05		<.05			<.05				<.05	<.05							<.05											
						<.05																							
455														<.05				<.05											
450									<.05						<.05														
									<.05																				
445																		<.05											
440																													
435																													
430																													
425																						<.05						<.05	
																												<.05	

Threshold Level for EDB : 16,000 ug/l

Texaco Fillmore Remedial Investigation, Aug-Oct, 90

TABLE 4-7 (cont.)

TCLP EDB - Subsurface Soil

Southern Region

Constituent	EDB Concentrations (ug/l)																		
Location	PIT 3						PIT 4						SUSPECT PIT		MONITORING WELLS				BKGND
Borehole	BH-1	BH-2	BH-902	BH-3	BH-4	BH-904	BH-1	BH-2	BH-3	BH-4	BH-5	BH-6	BH-1	BH-2	MW18	MW19	MW9019	MW20	BH-4
Depth (FT)																			
5																			
10	<.05						<.05		<.05			<.05							
15	<.05		<.05				<.05												
		<.05																	
20								<.05					<.05						
25		<.05						<.05						<.05					
30	<.05			<.05					<.05				<.05	<.05					
										<.05									
35		<.05	<.05		<.05	<.05		<.05	<.05	<.05	<.05			<.05					
													<.05						
40					<.05	<.05	<.05					<.05	<.05	<.05		<.05			
						<.05			<.05										
45		<.05		<.05						<.05	<.05				<.05				
													<.05						
50												<.05					<.05		
														<.05					
55				<.05													<.05		
60				<.05													<.05	<.05	
65		<.05	<.05										<.05						
			<.05																
70																		<.05	
75		<.05	<.05															<.05	
80																			
85																		<.05	

Threshold Level for EDB : 16,000 ug/l

Texaco Fillmore Remedial Investigation, Aug-Oct, 90

TABLE 4-7 (cont.)

TCLP EDB - Subsurface Soil

Hill Region

Constituent	EDB Concentrations (ug/l)									
Location	PIT 5		PIT 6		PIT 7			PIT 8		BG
Borehole	BH-1	BH-2	BH-1	BH-2	BH-1	BH-2	BH-902	BH-1	BH-2	BH-1
Depth (FT)										
5						<.05	<.05	<.05		
					<.05					
10	<.05						<.05	<.05		
						<.05	<.05			
15										
20	<.05					<.05				
25	<.05				<.05			<.05		
30					<.05			<.05		
35		<.05								
40								<.05		
45										
50								<.05		
55										
60										
65										
70										
75										
80										
85										
90										
95										
100										
105										

Threshold Level for EDB : 16,000 ug/l

Texaco Fillmore Remedial Investigation, Aug-Oct, 90

TABLE 4-7 (cont.)

TCLP EDB - Subsurface Soil

Northern Region

Constituent	EDB Concentrations (ug/l)				
Location	PIT 1		BACKGROUND		
Borehole	BH-1	BH-2	BH-2	BH-3	BH-5
Depth (FT)					
5	<.05				
10	<.05				
15					
20	<.05				
25		<.05			
30					
35					
40					
45					
50					

Threshold Level for EDB : 16,000 ug/l

Texaco Fillmore Remedial Investigation, Aug-Oct, 90

TABLE 4-7 (cont.)

TCLP EDB - Subsurface Soil

Soil Gas Area

Constituent	EDB Conc. (ug/l)				
Location	SOIL GAS AREA				
Borehole	BH-1	BH-901	BH-2	BH-3	BH-4
Depth (FT)					
5					
10					
15				<.05	<.05
20					
25			<.05		
30					
35					
40				<.05	
45					
50					
55	<.05		<.05		

Threshold Level for EDB : 16,000 ug/l

Texaco Fillmore Remedial Investigation, Aug-O

TABLE 4-8

TCLP Ethylbenzene - Subsurface Soil

Main Waste Pit Region

Constituent	Ethylbenzene Concentrations (ug/l)																											
Location	MAIN WASTE PIT																		PIT 2		MONITORING WELLS							
Borehole	BH-1	BH-2	BH-902	BH-3	BH-4	BH-904	BH-5	BH-6	BH-906	BH-7	BH-907	BH-8	BH-908	BH-9	BH-10	BH-11	BH-12	BH-13	BH-14	BH-1	BH-2	MW21	MW22S	MW22D	MW23	MW24	MW25D	MW25S	MW902S
Elev (FT)																													
525																													
520																													
515												37																	
510												11 J							< 25										
505												1.5 J	< 25							< 25	< 25								
500		39 J		160								< 5 UJ							41	< 25	< 25								
495				120																< 25	< 25								
490		41 J	12 J						< 25					< 25														< 5 UJ	
485	12 J		R3	< 25		< 25					< 25	< 5 UJ	< 25						7.6 J										
480	< 25												< 25	< 25		35			< 25		99								
475	< 25		11 J		< 25														26		< 25							35 R	
470				260			20 J										9.8 J	< 25											47
465	< 25						70	< 25						< 25															
460	83		< 25			10 J			< 25		< 25																		
455						71					6.3 J			6.7 J			< 25	15 J											
450									< 25									< 25											
445									< 25																				
440																													
435																													
430																													
425																						< 25							
420																													
415																													
410																													

UJ: Estimated Not Detected
J : Estimated values

R : Unusable
Threshold Level for Ethylbenzene : 700 ug/l

Texaco Fillmore Remedial Investigation, Aug-Oct, 90

TABLE 4-8 (cont.)

TCLP Ethylbenzene - Subsurface Soil

Southern Region

Constituent	Ethylbenzene Concentrations (ug/l)																		
Location	PIT 3						PIT 4						SUSPECT PIT		MONITORING WELLS				BKGND
Borehole	BH-1	BH-2	BH-902	BH-3	BH-4	BH-904	BH-1	BH-2	BH-3	BH-4	BH-5	BH-6	BH-1	BH-2	MW18	MW19	MW9019	MW20	BH-4
Depth (FT)																			
5																			
10	54 J						<25		<25			74							
15	44 J		<25				<25												
20								<25					<25						
25		<25 UJ						<25											
30	11 J			<25					<25				<25						
35			<25		<25	96		<25	<25	<25	<25								
40					<25	7.3 J	<25					<25	<25						
45				<25		<25			29	<25	9.6 J		21 J		<25				
50												<25					<25		
55				8 J													<25		
60				<25													<25	<25	
65			<25										<25						
70			<25															<25	
75			<25															<25	
80																			
85																		<25	

UJ: Estimated Not Detected

J : Estimated values

Threshold Level for Ethylbenzene : 700 ug/l

Texaco Fillmore Remedial Investigation, Aug-Oct, 90

TABLE 4-8 (cont.)

TCLP Ethylbenzene - Subsurface Soil

Hill Region

Constituent	Ethylbenzene Concentrations (ug/l)									
Location	PIT 5		PIT 6		PIT 7			PIT 8		BG
Borehole	BH-1	BH-2	BH-1	BH-2	BH-1	BH-2	BH-902	BH-1	BH-2	BH-1
Depth (FT)										
5						<25	<25	<25		
					<25					
10	<25						<25	<25		
						<25	<25			
15										
20	36					<25				
25	21 J				<25			<25		
30					<25			<25		
35		<25								
40								<25		
45										
50								<25		
55										
60										
65										
70										
75										
80										
85										
90										
95										
100										
105										

UJ: Estimated Not Detected

J : Estimated values

Threshold Level for Ethylbenzene : 700 ug/l

Texaco Fillmore Remedial Investigation, Aug-Oct. 90

TCLP Ethylbenzene - Subsurface Soil
Northern Region

Constituent	Ethylbenzene Concentrations (ug/l)				
Location	PIT 1		BACKGROUND		
Borehole	BH-1	BH-2	BH-2	BH-3	BH-5
Depth (FT)					
5	<25 UJ				
10	<25 UJ				
15					
20	<25 UJ				
25		<25 UJ			
30					
35					
40					
45					
50					

UJ: Estimated Not Detected

J : Estimated values

Threshold Level for Ethylbenzene : 700 ug/l

Texaco Filmore Remedial Investigation, Aug-Oct, 90

TABLE 4-8 (cont.)

TCLP Ethylbenzene - Subsurface Soil

Soil Gas Area

Constituent	Ethylbenzene Conc. (ug/l)				
Location	SOIL GAS AREA				
Borehole	BH-1	BH-901	BH-2	BH-3	BH-4
Depth (FT)					
5					
10					
15					<25
20					
25					
30					
35					
40					
45					
50					
55	51				

UJ: Estimated Not Detected

J : Estimated values

Threshold Level for Ethylbenzene : 700 ug/l

Texaco Fillmore Remedial Investigation, Aug-Oct. 90

TABLE 4-9

TCLP Toluene - Subsurface Soil

Main Waste Pit Region

Constituent	Toluene Concentrations (ug/l)																												
Location	MAIN WASTE PIT																			PIT 2		MONITORING WELLS							
Borehole	BH-1	BH-2	BH-902	BH-3	BH-4	BH-904	BH-5	BH-6	BH-906	BH-7	BH-907	BH-8	BH-908	BH-9	BH-10	BH-11	BH-12	BH-13	BH-14	BH-1	BH-2	MW2I	MW2S	MW2D	MW23	MW24	MW25	MW25	MW902
Elev. (FT)																													
525																													
520																													
515												11																	
510												3.3 J							<25										
505												1.6 J	<25							<25	<25								
500		37 J		150								3.1 J							31	<25	<25								
495				45																<25	<25								
490		32 J	16 J						<25					1.8 J													<5 UJ		
485	14 J		24 J	<25		<25					<25	4.1 J	<25						<25										
480	9 J												<25	1.7 J		9 J			<25		<25								
475	37		14 J		<25														<25		<25						5.6 R		
470				47			5.5 J										6.3 J	<25										13 J	
465	16 J						19 J	<25						2.4 J															
460	21 J		6.2 J			<25			<25		<25																		
455						16 J								2.1 J			9.6 J	<25											
450									<25									<25											
445									<25																				
440																													
435																													
430																													
425																					<75							<25	
																												<25	

UJ: Estimated Not Detected
J : Estimated values

R : Unusable
Threshold Level for Toluene : 330 ug/l

Texaco Fillmore Remedial Investigation, Aug-Oct, 90

TABLE 4-9 (cont.)

TCLP Toluene - Subsurface Soil

Southern Region

Constituent	Toluene Concentrations (ug/l)																		
Location	PIT 3						PIT 4						SUSPECT PIT		MONITORING WELLS				BKGND
Borehole	BH-1	BH-2	BH-902	BH-3	BH-4	BH-904	BH-1	BH-2	BH-3	BH-4	BH-5	BH 6	BH-1	BH-2	MW18	MW19	MW9019	MW20	BH-4
Depth (FT)																			
5																			
10	9.3 J						<25		37			12 J							
15	19 J		<25				<25												
20								<25					<25						
25		<25 UJ						<25											
30	<25 UJ			<25					8.5 J				<25						
35			<25		5.2 J	300		<25	9.4 J	<25	<25								
40					<25	13 J	<25					<25	9 J 17 J						
45				<25		<25			27	<25	9.1 J				<25				
50												20 J	16 J				<25		
55				<25													<25		
60				<25													<25	<25	
65			<25										7.4 J						
70			<25															<25	
75			<25															<25	
80																			
85																		<25	

UJ: Estimated Not Detected

J : Estimated values

Threshold Level for Toluene : 330 ug/l

Texaco Fillmore Remedial Investigation, Aug-Oct, 90

TABLE 4-9 (cont.)

TCLP Toluene - Subsurface Soil

Hill Region

Constituent	Toluene Concentrations (ug/l)									
Location	PIT5		PIT6		PIT7			PIT8		BG
Borehole	BH-1	BH-2	BH-1	BH-2	BH-1	BH-2	BH-902	BH-1	BH-2	BH-1
Depth (FT)										
5						<25	<25	<25		
					<25					
10	<25						<25	<25		
						<25	<25			
15										
20	<25					<25				
25	<25				<25			<25		
30					<25			<25		
35		<25								
40								<25		
45										
50								<25		
55										
60										
65										
70										
75										
80										
85										
90										
95										
100										
105										

UJ: Estimated Not Detected

J : Estimated values

Threshold Level for Toluene : 330 ug/l

Texaco Fillmore Remedial Investigation, Aug-Oct. 90

TABLE 4-9 (cont.)

TCLP Toluene - Subsurface Soil

Northern Region

Constituent	Toluene Concentrations (ug/l)				
Location	PIT 1		BACKGROUND		
Borehole	BH-1	BH-2	BH-2	BH-3	BH-5
Depth (FT)					
5	<25 UJ				
10	<25 UJ				
15					
20	<25 UJ				
25		<25 UJ			
30					
35					
40					
45					
50					

UJ: Estimated Not Detected

J : Estimated values

Threshold Level for Toluene : 330 ug/l

Texaco Fillmore Remedial Investigation, Aug-Oct, 90

TABLE 4-9 (cont.)

TCLP Toluene - Subsurface Soil

Soil Gas Area

Constituent	Toluene Conc. (ug/l)				
Location	SOIL GAS AREA				
Borehole	BH-1	BH-901	BH-2	BH-3	BH-4
Depth (FT)					
5					
10					
15					<25
20					
25					
30					
35					
40					
45					
50					
55	27				

UJ: Estimated Not Detected

J : Estimated values

Threshold Level for Toluene : 330 ug/l

Texaco Fillmore Remedial Investigation, Aug-Oct, 90

TABLE 4-10

TCLP Xylenes - Subsurface Soil

Main Waste Pit Region

Constituent	Xylenes Concentrations (ug/l)																												
Location	MAIN WASTE PIT																			PIT 2		MONITORING WELLS							
Borehole	BH-1	BH-2	BH-902	BH-3	BH-4	BH-904	BH-5	BH-6	BH-906	BH-7	BH-907	BH-8	BH-908	BH-9	BH-10	BH-11	BH-12	BH-13	BH-14	BH-1	BH-2	MW21	MW22	MW22	MW23	MW24	MW25	MW25	MW902
Elev. (FT)																													
525																													
520																													
515												43																	
510												12 J							<25										
505												1.5 J	<25							<25	<25								
500		280 J		860								3.7 J							<25	<25	<25								
495				640																<25	<25								
490		250 J	66						<25					<25													1.5 R		
485	33		130	<25		<25					<25	<5 UJ	<25						<25										
480	18 J												<25	<25		39			<25		33								
475	19 J		60		<25														24 J		<25						13 R		
470				810			21 J										17 J	<25										33	
465							110	<25						1.7 J															
460	15 J 65		22 J			6.7 J 50					8.4 J 38							20 J											
455														4.2 J			<25	<25											
450									<25																				
445									<25									<25											
440																													
435																													
430																													
425																						<25						<25 <25	

UJ: Estimated Not Detected
J : Estimated values

R : Unusable
Threshold Level for Xylenes : 620 ug/l

Texaco Fillmore Remedial Investigation, Aug-Oct, 90

TABLE 4-10 (cont.)

TCLP Xylenes - Subsurface Soil

Southern Region

Constituent	Xylenes Concentrations (ug/l)																		
Location	PIT 3						PIT 4						SUSPECT PIT		MONITORING WELLS				BKGND
Borehole	BH-1	BH-2	BH-902	BH-3	BH-4	BH-904	BH-1	BH-2	BH-3	BH-4	BH-5	BH-6	BH-1	BH-2	MW18	MW19	MW9019	MW20	BH-4
Depth (FT)																			
5																			
10	230 J						<25		38			290							
15	350 J		<25				<25												
20								<25					<25						
25		<25						<25											
30	35 J			<25					<25				<25						
35			<25		<25	610		6 J	<25	<25 13 J	<25								
40					<25	22 J	<25					7.7 J	10 J 33						
45				<25		<25			40	5.4 J	11 J				<25				
50												14 J	22 J				<25		
55				5.4 J													<25		
60				6.9 J													<25	<25	
65			<25										7.3 J						
70			<25																
75			<25															<25	
80																		<25	
85																		<25	

UJ: Estimated Not Detected

J : Estimated values

Threshold Level for Xylenes : 620 ug/l

Texaco Fillmore Remedial Investigation, Aug-Oct, 90

TABLE 4-10 (cont.)

TCLP Xylenes - Subsurface Soil

Hill Region

Constituent	Xylenes Concentrations (ug/l)									
Location	PIT 5		PIT 6		PIT 7			PIT 8		BG
Borehole	BH-1	BH-2	BH-1	BH-2	BH-1	BH-2	BH-902	BH-1	BH-2	BH-1
Depth (FT)										
5						<25	<25	<25		
					<25					
10	6.2 J						<25	<25		
						<25	<25			
15										
20	230					<25				
25	140				<25			<25		
30					<25			<25		
35		<25								
40								<25		
45										
50								<25		
55										
60										
65										
70										
75										
80										
85										
90										
95										
100										
105										

UJ: Estimated Not Detected

J : Estimated values

Threshold Level for Xylenes : 620 ug/l

TABLE 4-10 (cont.)

TCLP Xylenes - Subsurface Soil

Northern Region

Constituent	Xylenes Concentrations (ug/l)				
Location	PIT 1		BACKGROUND		
Borehole	BH-1	BH-2	BH-2	BH-3	BH-5
Depth (FT)					
5	<25 UJ				
10	<25 UJ				
15					
20	<25 UJ				
25		<25 UJ			
30					
35					
40					
45					
50					

UJ: Estimated Not Detected

J Estimated values

Threshold Level for Xylenes : 620 ug/l

Texaco Fillmore Remedial Investigation, Aug-Oct, 90

TABLE 4-10 (cont.)

TCLP Xylenes - Subsurface Soil

Soil Gas Area

Constituent	Xylenes Concentrations (ug/l)				
Location	SOIL GAS AREA				
Borehole	BH-1	BH-901	BH-2	BH-3	BH-4
Depth (FT)					
5					
10					
15					<25
20					
25					
30					
35					
40					
45					
50					
55	250				

UJ: Estimated Not Detected

J : Estimated values

Threshold Level for Xylenes : 620 ug/l

Texaco Fillmore Remedial Investigation, Aug-Oct, 90

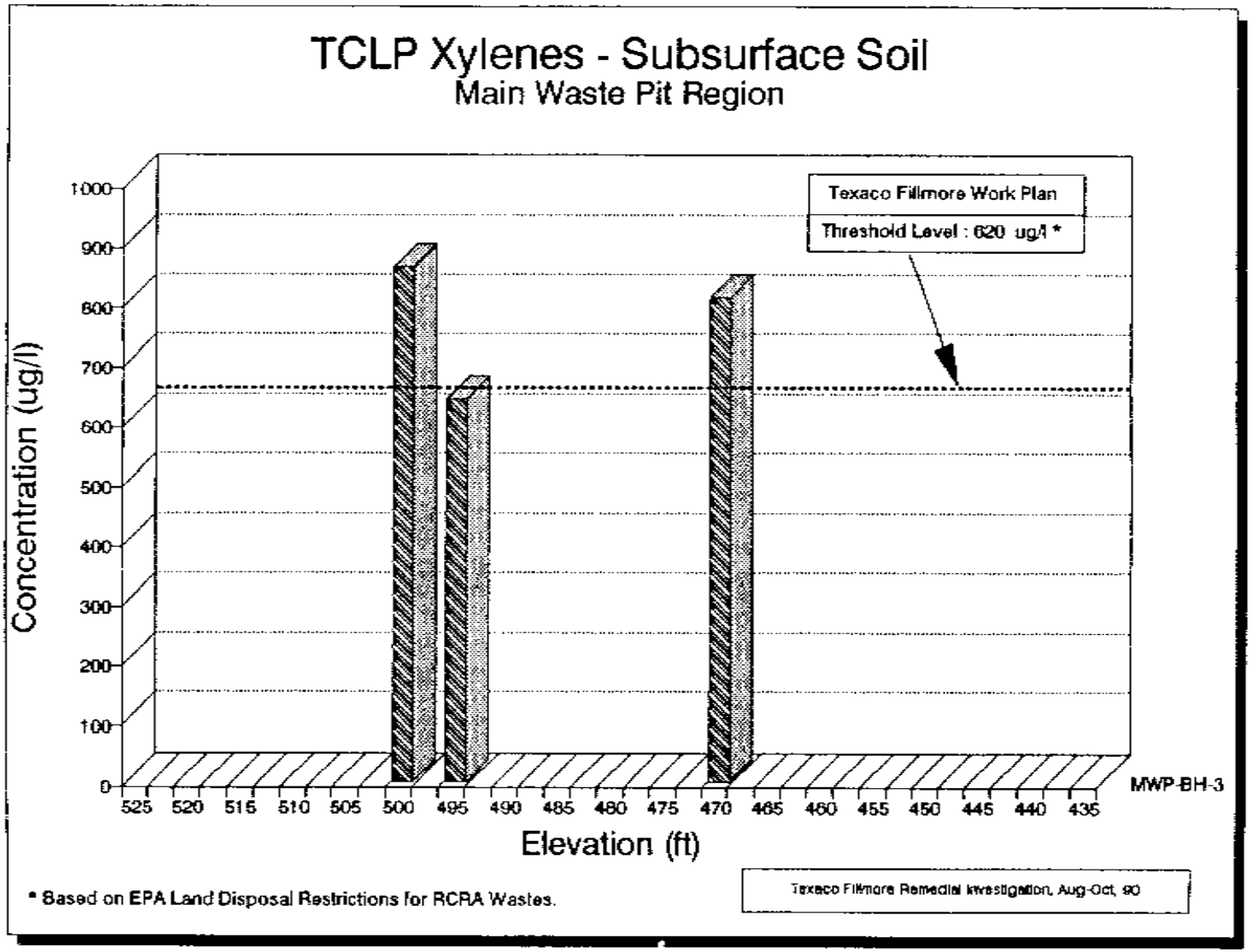

TCLP Xylenes - Subsurface Soil
Main Waste Pit Region
Texaco Fillmore Work Plan
Threshold Level : 620 ug/l *
Concentration (ug/l)
1000
900
800
700
600
500
400
300
200
100
0
525 520 515 510 505 500 495 490 485 480 475 470 465 460 455 450 445 440 435
Elevation (ft)
MWP-BH-3
* Based on EPA Land Disposal Restrictions for RCRA Wastes.
Texaco Fillmore Remedial Investigation, Aug-Oct, 90

Figure 4-7

data, only two sample results, both of which were below detection limits, were determined to be unusable due to missed holding times.

Other Volatile Organic Compounds. Table 4-11 provides a "hits-only" list of TCL VOCs other than the five indicator parameters discussed above that were detected in the samples analyzed for TCLP VOCs. As shown in the table, only four additional TCL compounds were identified and their occurence was limited to five boreholes throughout the facility. In addition, all of these compounds were determined to have estimated values based upon validation of laboratory analytical data. The only other two VOCs detected in the samples were acetone and methylene chloride, which are known to be common laboratory contaminants and, in most instances, were detected in the analytical blanks.

A number of TICs were also detected in 74 of the 142 samples analyzed. Table 4-12 presents the highest TIC concentration found in each sample if any. A more detailed breakdown of the TICs detected in each sample is provided in Appendix J, Data Validation Reports.

4.1.5 Semivolatile Organic Compounds (SVOCs)

This section presents the results of SVOC analyses by EPA method 8270 performed on subsurface soil samples at the Texaco Fillmore site. The discussion is divided into Total and TCLP analyses.

4.1.5.1 Total SVOC Analyses

Total SVOC analyses were conducted using method 8270 for the same 20 samples analyzed for VOCs as described in Section 4.1.4.1. Table 4-13 provides a "hits only" list of SVOCs detected in these samples. SVOCs were detected in seven samples, and the detected compounds are limited to naphthalene and 2-methylnaphthalene. 2,4-Dimethylphenol was not detected in any of the samples analyzed. TICs were detected in 18 of the 20 samples, with TIC levels up to 260 mg/kg. Table 4-13 presents the highest TIC concentration detected for each sample. A more detailed breakdown of TICs per sample is provided in Appendix J, Data Validation Reports.

TABLE 4-11

TCLP EPA 8240 Volatile Analysis (other TCL compounds than indicator parameters) All Regions

ALL REGIONS						
Location	Depth (ft)	Constituent	Value	Units	RDL	Qualifier
MWP-BH8	30	1,2-Dichloroethylene	1.3	ug/l	5	J
	45	1,2-Dichloroethylene	1.7	ug/l	5	J
MWP-BH12	60	Chlorobenzene	6.5	ug/l	25	J
	60	Trichloroethylene	5.1	ug/l	25	J
P3-BH904	35	Chlorobenzene	12	ug/l	25	J
P4-BH6	50	Vinyl Acetate	43	ug/l	50	J
MW25S	15	Tetrachloroethylene	1.5	ug/l	5	J

J : Estimated value

Texaco Fillmore Remedial Investigation, Aug.-Oct., 90

TABLE 4-12

TCLP Tentatively Identified Volatile Organic Compounds (TIC) - Subsurface Soil

Main Waste Pit Region

Constituent	Highest Tentatively Identified Compound Concentration (ug/l) *																												
Location	MAIN WASTE PIT																		PIT 2		MONITORING WELLS								
Borehole	BH-1	BH-2	BH-902	BH-3	BH-4	BH-904	BH-5	BH-6	BH-906	BH-7	BH-907	BH-8	BH-908	BH-9	BH-10	BH-11	BH-12	BH-13	BH-14	BH-1	BH-2	MW21	MW22S	MW22D	MW23	MW24	MW25D	MW25S	MW902S
Elev. (FT)																													
525																													
520																													
515												31																	
510												34							40										
505												25	86							ND	41								
500		66		300								33							1100	41	76								
495				270																8.1	96								
490		74	54						110					110														33	
485	30		91	110		38					ND	27	74						140										
480	ND												ND	100		210			64		130								
475	ND		35		120														120		200						110		
470				460			63										ND	ND										130	
465							190	130						90															
460	ND 27		ND			ND 82					89 69							ND 33											
455														110			57												
450									ND ND																				
445																		ND											
440																													
435																													
430																													
425																					280							180 140	

* = Values represent TIC with the highest concentration identified per sample

ND = None Detected

Texaco Fillmore Remedial Investigation, Aug-Oct, 90

TCLP Tentatively Identified Volatile Organic Compounds (TI C) - Subsurface Soil

Southern Region

Constituent	Highest Tentatively Identified Compound Concentration (ug/l) *																		
Location	PIT 3						PIT 4						SUSPECT PIT		MONITORING WELLS				BKGND
Borehole	BH-1	BH-2	BH-902	BH-3	BH-4	BH-904	BH-1	BH-2	BH-3	BH-4	BH-5	BH-6	BH-1	BH-2	MW18	MW19	MW1909	MW20	BH-4
Depth (FT)																			
5																			
10	280						51		160			340							
15	390		43				95												
20								120					ND						
25		140						130											
30	260			130					110				43						
35			120		110	220		120	69	100 86	71		55						
40					200	200 ND	120		230			230	220						
45				81						77	95		170		150				
50												240					30		
55				100													42		
60				75													47 ND	45	
65			87 56										85						
70																		ND	
75			74															ND	
80																			
85																		25	

* = Values represent TIC with the highest concentration identified per sample

ND = None Detected

Texaco Tillmore Remedial Investigation, Aug-Oct, 90

TABLE 4-12 (cont.)

TCLP Tentatively Identified Volatile Organic Compounds (TIC) - Subsurface Soil
Hill Region

Constituent	Highest Tentatively Identified Compound Concentration (ug/l) *									
Location	PIT5		PIT6		PIT7			PIT8		BG
Borehole	BH-1	BH-2	BH-1	BH-2	BH-1	BH-2	BH-902	BH-1	BH-2	BH-1
Depth (FT)										
5						ND	49	ND		
					ND					
10	130						32	ND		
						ND	ND			
15										
20	350					ND				
25	210				ND			ND		
30					ND			ND		
35		96								
40								ND		
45										
50								ND		
55										
60										
65										
70										
75										
80										
85										
90										
95										
100										
105										

* = Values represent TIC with the highest concentration identified per sample

ND = None Detected

Texaco Fillmore Remedial Investigation, Aug-Oct, 90

TABLE 4-12 (cont.)

TCLP Tentatively Identified Volatile Organic Compounds (TIC) - Subsurface Soil
Northern Region

Constituent	Highest Tentatively Identified Compound Concentration (ug/l) *				
Location	PIT 1		BACKGROUND		
Borehole	BH-1	BH-2	BH-2	BH-3	BH-5
Depth (FT)					
5	ND				
10	ND				
15					
20	ND				
25		ND			
30					
35					
40					
45					
50					

* = Values represent TIC with the highest concentration identified per sample

ND = None Detected

Texaco Fillmore Remedial Investigation, Aug-Oct, 90

TCLP Tentatively Identified Volatile Organic Compounds (TIC) - Subsurface Soil
Soil Gas Area

Constituent	Highest Tentatively Identified Compound Concentration (ug/l) *				
Location	SOIL GAS AREA				
Borehole	BH-1	BH-901	BH-2	BH-3	BH-4
Depth (FT)					
5					
10					
15					1100
20					
25					
30					
35					
40					
45					
50					
55	240				

* = Values represent TIC with the highest concentration identified per sample

ND = None Detected

Texaco Fillmore Remedial Investigation, Aug-Oct, 90

TABLE 4-13

EPA 8270 Semi-volatile Analysis - Subsurface Soil
All Regions

ALL REGIONS						
Location	Depth (ft)	Constituent	Value	Units	RDL	Qualifier
MWP-BH10	40	Highest TIC	40000	ug/kg		J
	50	Highest TIC	0	ug/kg		J
	75	Highest TIC	66000	ug/kg		J
MWP-BH13	65	Highest TIC	58000	ug/kg		J
MWP-BH14	60	2-Methylnaphthalene	1600	ug/kg	1300	
	60	Highest TIC	78000	ug/kg		J
	60	Naphthalene	2900	ug/kg	1300	
P3-BH2	20	2-Methylnaphthalene	3100	ug/kg	20000	J
	20	Highest TIC	1900	ug/kg		J
	20	Naphthalene	4400	ug/kg	20000	J
	35	2-Methylnaphthalene	5500	ug/kg	20000	J
	35	Highest TIC	0	ug/kg		J
	35	Naphthalene	9100	ug/kg	20000	J
	50	Highest TIC	3700	ug/kg		J
	50	Naphthalene	100	ug/kg	330	J
	75	Highest TIC	8000	ug/kg		J
P3-BH3	50	2-Methylnaphthalene	520	ug/kg	330	
	50	Highest TIC	1600	ug/kg		J
	50	Naphthalene	950	ug/kg	330	
P3-BH4	40	Highest TIC	11000	ug/kg		J
P4-BH3	35	2-Methylnaphthalene	13000	ug/kg	20000	J
	35	Highest TIC	0	ug/kg		J
	35	Naphthalene	13000	ug/kg	20000	J
	45	Highest TIC	9700	ug/kg		J
P4-BH4	45	Highest TIC	32000	ug/kg		J
P4-BH5	40	Highest TIC	1400	ug/kg		J
P4-BH6	45	Highest TIC	260000	ug/kg		J
MW19	35	Highest TIC	17000	ug/kg		J
	40	Highest TIC	1200	ug/kg		J
	60	Highest TIC	4400	ug/kg		J
MW20	85	2-Methylnaphthalene	360	ug/kg	330	J
	85	Highest TIC	1300	ug/kg		J
	85	Naphthalene	290	ug/kg	330	J

J : Estimated value

Texaco Fillmore Remedial Investigation, Aug.-Oct., 90

4.1.5.2 TCLP SVOC Analyses

TCLP SVOC analyses were conducted on the same samples analyzed for TCLP VOCs as described in Section 4.1.4.2. The results of these analyses for each of the indicator parameters and other detected SVOCs are discussed below.

2,4-Dimethylphenol. The results of the TCLP analysis for 2,4-dimethylphenol are provided in Table 4-14. As shown in the table, 2,4-dimethylphenol was not detected in 147 of the 154 samples analyzed throughout the facility, and did not exceed the FSP designated threshold level of 330 µg/l in any of the samples. TCLP values for 2,4-dimethylphenol ranged from ND to a maximum of 260 µg/l. Upon validation of laboratory analytical data, seven sample results were determined to be unusable due to missed holding time. However, these seven results were reported as nondetect. The detection limit for TCLP 2,4-dimethylphenol was 50 µg/l except for 18 results, all of which were reported as nondetect below a detection limit of 100 µg/l.

Other Semivolatile Organic Compounds. Table 4-15 lists the TCL SVOCs other than 2,4-dimethylphenol that were detected above the reporting limit for the TCLP analysis. The two compounds detected in the total SVOC analysis (naphthalene and 2-methylnaphthalene) were also detected in samples with the TCLP analysis. Of the 154 samples analyzed throughout the facility, naphthalene was detected in 60 samples with reported results ranging from 10 to 310 µg/l. Of the 60 sample results, 33% were reported as estimated based upon validation of the laboratory analytical data. 2-methylnaphthalene was detected in 34 of the 154 samples with reported results ranging from 10 to 160 µg/l. Of the 34 sample results, 59% were reported as estimated based upon validation of the laboratory analytical data. In addition to these two compounds, 2-methylphenol, 4-methylphenol, hexachlorobutadiene, isophorone, and bis(2ethylhexyl)phthalate were detected in several other samples. Bis(2ethylhexyl)phthalate was flagged as a common laboratory contaminant in the analytical reports. 4-methylphenol, hexachlorobutadiene, and isophorone were all reported as estimated based upon validation of the laboratory analytical data. 2-methylphenol was detected in 4 of the 154 samples with reported results ranging from 52 to 120 µg/l.

Tentatively identified compounds (TICs) were detected in 75 of the 154 samples analyzed. Table 4-16 presents the highest semivolatile TIC concentration detected for each sample. A more detailed breakdown of TICs per sample is provided in Appendix J, Data Validation Reports.

TABLE 4-14

TCLP 2,4-Dimethylphenol - Subsurface Soil
Main Waste Pit Region

Constituent	2,4-Dimethylphenol Concentrations (ug/l)																										
Location	MAIN WASTE PIT																		PIT 2		MONITORING WELLS						
Borehole	BH-1	BH-2	BH-902	BH-3	BH-4	BH-904	BH-5	BH-6	BH-906	BH-7	BH-907	BH-8	BH-908	BH-9	BH-10	BH-11	BH-12	BH-13	BH-14	BH-1	BH-2	MW21	MW22S	MW22D	MW23	MW24	MW25D	MW25S	MW902S
Elev. (FT)																													
525																													
520																													
515												<50																	
510												<50							<50										
505													<50							<50	<100								
500				260								<50							<50	<50	<100								
495				45 J													<50			<50									
490			220						<50					<50															
485	<50 UJ		<50	<50		<50				<100	<50		<50				<50		<50										
480	<50												<50	<50		<50			<50										
475	<50		160		<50												<50		<50		<100								
470				<50															<50		<100								
465							<50	<100									<50	<50										<50	
460	<50		<50			<50					<50			<50			<50 R												
455						<50				<100	<50							<50											
450								<50						<50			<50	<50											
445								<50							<100														
440																		<50											
435																													
430																													
425																													
420																	<50				<50							<50	
415																												<50	
410																													
405																													
400																													
395																													

UJ: Estimated Not Detected
J : Estimated values

R : Unusable
Threshold Level for 2,4-Dimethylphenol : 330 ug/l

Texaco Fillmore Remedial Investigation, Aug-Oct, 90

TABLE 4-14 (cont.)

TCLP 2,4-Dimethylphenol - Subsurface Soil

Southern Region

Constituent	2,4-Dimethylphenol Concentrations (ug/l)																		
Location	PIT 3						PIT 4						SUSPECT PIT		MONITORING WELLS				BKGND
Borehole	BH-1	BH-2	BH-902	BH-3	BH-4	BH-904	BH-1	BH-2	BH-3	BH-4	BH-5	BH-6	BH-1	BH-2	MW18	MW19	MW9019	MW20	BH-4
Depth (FT)																			
5																			
10	78						<50		<50			18 J							
15	<50		<50				<50												
20		<50						<50 UJ					<50						
25		<50						<50 UJ						<100					
30	<50			<50					<50				<50	<100					
35		<50	<50		<50	<50		<50	<50	<50	<50			<100					
40					<50	<50	<50					<50	<50	<100		<100			
45		<50		<50		<50			<50						<50				
50										<50 R	<50	<50	<50						
55				<50										<100			<50		
60				<50													<50 R		
65		<50	<50										<50				<50 R	<50 R	
70			<50																
75			<50															<50 R	
80																		<50	
85																		<50 R	

UJ: Estimated Not Detected

J : Estimated values

R : Unusable

Threshold Level for 2,4-Dimethylphenol : 330 ug/l

Texaco Fillmore Remedial Investigation, Aug-Oct, 90

TCLP 2,4-Dimethylphenol - Subsurface Soil

Hill Region

Constituent	2,4-Dimethylphenol Concentrations (ug/l)									
Location	PIT5		PIT6		PIT7			PIT8		BG
Borehole	BH-1	BH-2	BH-1	BH-2	BH-1	BH-2	BH-902	BH-1	BH-2	BH-1
Depth (FT)										
5							<50	<50		
					<50					
10	<50						<50	<50		
							<50			
15										
20	<50					<50				
25	<50				<50			<50		
30					12 J			<50		
35		<50								
40								<50		
45										
50								<50		
55										
60										
65										
70										
75										
80										
85										
90										
95										
100										
105										

UJ: Estimated Not Detected

J : Estimated values

Threshold Level for 2,4-Dimethylphenol : 330 ug/l

Texaco Fillmore Remedial Investigation, Aug-Oct, 90

TABLE 4-14 (cont.)

TCLP 2,4-Dimethylphenol - Subsurface Soil
Northern Region

Constituent	2,4-Dimethylphenol Concentrations (ug/l)				
Location	PIT 1		BACKGROUND		
Borehole	BH-1	BH-2	BH-2	BH-3	BH-5
Depth (FT)					
5	<50 UJ				
10	<50 UJ				
15					
20	<50 UJ				
25		<50 UJ			
30					
35					
40					
45					
50					

UJ: Estimated Not Detected

J : Estimated values

Threshold Level for 2,4-Dimethylphenol : 330 ug/l

Texaco Fillmore Remedial Investigation, Aug-Oct, 90

TABLE 4-14 (cont.)

TCLP 2,4-Dimethylphenol - Subsurface Soil

Soil Gas Area

Constituent	2,4-Dimethylphenol Conc. (ug/l)				
Location	SOIL GAS AREA				
Borehole	BH-1	BH-901	BH-2	BH-3	BH-4
Depth (FT)					
5					
10					
15				<100	<50
20					
25			<100		
30					
35					
40				<100	
45					
50					
55	<50		<100		

UJ: Estimated Not Detected

J : Estimated values

Threshold Level for 2,4-Dimethylphenol : 330 ug/l

Texaco Fillmore Remedial Investigation, Aug-Oct, 90

TABLE 4-15

TCLP EPA 8270 Semivolatile Analysis (other TCL compounds than indicator parameters)
Main Waste Pit Region

MAIN WASTE PIT REGION						
Location	Depth (ft)	Constituent	Value	Units	RDL	Qualifier
MWP-BH1	45	Naphthalene	77	ug/l	50	
MWP-BH902	15	2-Methylphenol	81	ug/l	50	
	15	Naphthalene	22	ug/l	50	J
	15(dup)	Naphthalene	40	ug/l	50	J
	30	2-Methylphenol	52	ug/l	50	
MWP-BH3	5	2-Methylnaphthalene	33	ug/l	50	J
	5	2-Methylphenol	120	ug/l	50	
	5	4-Methylphenol	28	ug/l	50	J
	5	Naphthalene	150	ug/l	50	
	10	2-Methylnaphthalene	22	ug/l	50	J
	10	2-Methylphenol	76	ug/l	50	
	10	Naphthalene	120	ug/l	50	
	35	2-Methylnaphthalene	17	ug/l	50	J
	35	Naphthalene	300	ug/l	50	
MWP-BH4	30	Naphthalene	11	ug/l	50	J
MWP-BH904	45	2-Methylnaphthalene	21	ug/l	50	J
	45(dup)	2-Methylnaphthalene	33	ug/l	50	J
	45	Naphthalene	87	ug/l	50	
	45(dup)	Naphthalene	220	ug/l	50	
MWP-BH5	40	Naphthalene	66	ug/l	50	
MWP-BH906	55	Hexachlorobutadiene	16	ug/l	50	J
	55	Naphthalene	64	ug/l	50	
MWP-BH907	55	Naphthalene	32	ug/l	50	J
	55(dup)	Naphthalene	54	ug/l	50	
MWP-BH8	15	2-Methylnaphthalene	14	ug/l	50	J
	15	Naphthalene	15	ug/l	50	J
	20	2-Methylnaphthalene	12	ug/l	50	J
	20	Naphthalene	21	ug/l	50	J
MWP-BH908	45	Naphthalene	15	ug/l	50	J
MWP-BH9	40	Naphthalene	16	ug/l	50	J
	50	Naphthalene	14	ug/l	50	J
MWP-BH11	40	2-Methylnaphthalene	25	ug/l	50	J
	40	Naphthalene	190	ug/l	50	
MWP-BH12	20	2-Methylnaphthalene	83	ug/l	50	
	20	Naphthalene	63	ug/l	50	
	30	Naphthalene	12	ug/l	50	J
	50(dup)	2-Methylnaphthalene	61	ug/l	50	
	50(dup)	Naphthalene	200	ug/l	50	
	90	2-Methylnaphthalene	12	ug/l	50	J
	90	Naphthalene	65	ug/l	50	
MWP-BH13	55(dup)	Naphthalene	14	ug/l	50	J
MWP-BH14	30	2-Methylnaphthalene	27	ug/l	50	J
	30	Naphthalene	240	ug/l	50	
	45	2-Methylnaphthalene	19	ug/l	50	J
	45	Naphthalene	80	ug/l	50	
P2-BH1	30	2-Methylnaphthalene	11	ug/l	50	J
	30	Naphthalene	14	ug/l	50	J

Texaco Fillmore Remedial Investigation, Aug.-Oct., 90

TABLE 4-15 (cont.)

MAIN WASTE PIT REGION (Cont.)						
Location	Depth (ft)	Constituent	Value	Units	RDL	Qualifier
P2-BH2	50	Naphthalene	130	ug/l	100	
MW9025	30	2-Methylnaphthalene	32	ug/l	50	J
	30	Naphthalene	180	ug/l	50	

J : Estimated value

TCLP EPA 8270 Semivolatile Analysis (other TCL compounds than indicator parameters) Soil Gas Area

SOIL GAS AREA						
Location	Depth (ft)	Constituent	Value	Units	RDL	Qualifier
SG-BH1	55	2-Methylnaphthalene	110	ug/l	50	
	55	Naphthalene	180	ug/l	50	
SG-BH3	40	Naphthalene	120	ug/l	100	

J : Estimated value

TCLP EPA 8270 Semivolatile Analysis (other TCL compounds than indicator parameters) Southern Region

SOUTHERN REGION						
Location	Depth (ft)	Constituent	Value	Units	RDL	Qualifier
P3-BH1	10	2-Methylnaphthalene	80	ug/l	50	
	10	Naphthalene	130	ug/l	50	
	15	2-Methylnaphthalene	160	ug/l	50	
	15	Naphthalene	310	ug/l	50	
	30	2-Methylnaphthalene	86	ug/l	50	
	30	Naphthalene	160	ug/l	50	
P3-BH2	15(dup)	2-Methylnaphthalene	14	ug/l	50	J
	15(dup)	Naphthalene	180	ug/l	50	
	25	Naphthalene	33	ug/l	50	J
	35	2-Methylnaphthalene	13	ug/l	50	J
	35	Naphthalene	64	ug/l	50	
	45	Naphthalene	10	ug/l	50	J
	65	Naphthalene	43	ug/l	50	J
P3-BH902	35	2-Methylnaphthalene	47	ug/l	50	J
	35	Naphthalene	110	ug/l	50	
	65(dup)	2-Methylnaphthalene	53	ug/l	50	
	65(dup)	Naphthalene	92	ug/l	50	
	65	Naphthalene	27	ug/l	50	J
	75	2-Methylnaphthalene	36	ug/l	50	J
	75	Naphthalene	51	ug/l	50	
P3-BH3	30	Naphthalene	46	ug/l	50	J
	45	Naphthalene	15	ug/l	50	J
	55	2-Methylnaphthalene	64	ug/l	50	
	55	Naphthalene	76	ug/l	50	
	60	2-Methylnaphthalene	78	ug/l	50	
	60	Naphthalene	93	ug/l	50	

Texaco Fillmore Remedial Investigation, Aug.-Oct., 90

TABLE 4-15 (cont.)

SOUTHERN REGION (Cont.)						
Location	Depth (ft)	Constituent	Value	Units	RDL	Qualifier
P3-BH4	35	Naphthalene	58	ug/l	50	
P3-BH904	40	Naphthalene	19	ug/l	50	J
P4-BH1	10	2-Methylnaphthalene	10	ug/l	50	J
	10	Naphthalene	50	ug/l	50	
	15	Naphthalene	35	ug/l	50	J
	40	Naphthalene	63	ug/l	50	
P4-BH3	10	2-Methylnaphthalene	21	ug/l	50	J
	10	Naphthalene	52	ug/l	50	
	35	2-Methylnaphthalene	57	ug/l	50	
	35	Naphthalene	170	ug/l	50	
P4-BH6	10	2-Methylnaphthalene	94	ug/l	50	
	10	Naphthalene	240	ug/l	50	
SP-BH1	40	2-Methylnaphthalene	20	ug/l	50	J
	40	Naphthalene	100	ug/l	50	
	45(dup)	2-Methylnaphthalene	16	ug/l	50	J
	45(dup)	Naphthalene	110	ug/l	50	
	65	2-Methylnaphthalene	35	ug/l	50	J
	65	Naphthalene	52	ug/l	50	
MW20	70(dup)	2-Methylnaphthalene	23	ug/l	50	J
	70(dup)	Naphthalene	34	ug/l	50	J

J : Estimated value

TCLP EPA 8270 Semivolatile Analysis (other TCL compounds than indicator parameters) Hill Region

HILL REGION						
Location	Depth (ft)	Constituent	Value	Units	RDL	Qualifier
P5-BH1	10	2-Methylnaphthalene	68	ug/l	50	
	10	Naphthalene	84	ug/l	50	
	20	2-Methylnaphthalene	71	ug/l	50	
	20	Naphthalene	130	ug/l	50	
	25	2-Methylnaphthalene	82	ug/l	50	
	25	Naphthalene	110	ug/l	50	
P7-BH1	30	4-Methylphenol	15	ug/l	50	J
	30	Isophorone	27	ug/l	50	J

J : Estimated value

Texaco Fillmore Remedial Investigation, Aug.-Oct., 90

TABLE 4-16

TCLP Tentatively Identified Semi-Volatile Organic Compounds (TIC) - Subsurface Soil

Main Waste Pit Region

Constituent	Highest Tentatively Identified Compound Concentration (ug/l) *																										
Location	MAIN WASTE PIT																			PIT 2		MONITORING WELLS					
Borehole	BH-1	BH-2	BH-902	BH-3	BH-4	BH-904	BH-5	BH-6	BH-906	BH-7	BH-907	BH-8	BH-908	BH-9	BH-10	BH-11	BH-12	BH-13	BH-14	BH-1	BH-2	MW21	MW22S	MW22D	MW23	MW24	MW25D
Elev. (FT)																											
525																											
520																											
515												72															
510												72							40								
505													ND							ND	FP						
500				3100								ND							550	66	ND						
495				170													60			ND							
490			140						ND					ND													
485	ND		ND	ND		ND				ND	ND		ND	ND			ND		64								
480	82												ND			89			200		380						
475	ND		110		74												ND		ND		ND						
470				720													ND	55									
465							71	ND						ND													280
460	54 91		ND			47 140				100	ND ND						100 ND	52 ND									
455														ND				54									
450									210 69						ND												
445																											
440																											
435																											
430																											
425																	ND										190
420																											87
415																											
410																											
405																											
400																											
395																											

* = Values represent TIC with the highest concentration identified per sample
ND = None Detected

Texaco Fillmore Remedial Investigation, Aug-Oct, 90

TCLP Tentatively Identified Semi-Volatile Organic Compounds (TIC) - Subsurface Soil

Southern Region

Constituent	Highest Tentatively Identified Compound Concentration (ug/l) *																		
Location	PIT 3						PIT 4						SUSPECT PIT		MONITORING WELLS				BKGND
Borehole	BH-1	BH-2	BH-902	BH-3	BH-4	BH-904	BH-1	BH-2	BH-3	BH-4	BH-5	BH-6	BH-1	BH-2	MW18	MW19	MW9019	MW20	BH-4
Depth (FT)																			
5																			
10	25000						ND		64			210							
15	580		ND				ND												
		82																	
20								130					ND						
25		130						ND						ND					
30	84			150					45				ND	ND					
										80									
35		61	93		41	ND		ND	130	200	ND			ND					
													ND						
40					51	140	ND					65	280	ND		ND			
						ND			42										
45		42		ND						140	100				41				
50												110	230				ND		
55				45										ND			ND		
60				55													55		
65		ND	ND										110				ND	ND	
70			52																
75			ND															ND	
80																		ND	
85																		98	

* = Values represent TIC with the highest concentration identified per sample

Texaco Fillmore Remedial Investigation, Aug-Oct, 90

TABLE 4-16 (cont.)

TCLP Tentatively Identified Semi-Volatile Organic Compounds (TIC) - Subsurface Soil
Hill Region

Constituent	Highest Tentatively Identified Compound Concentration (ug/l) *									
Location	PIT5		PIT6		PIT7			PIT8		BG
Borehole	BH-1	BH-2	BH-1	BH-2	BH-1	BH-2	BH-902	BH-1	BH-2	BH-1
Depth (FT)										
5							ND	42		
10	140				ND		ND	ND		
15							ND			
20	300					62				
25	200				ND			ND		
30					[illegible]			ND		
35		ND								
40								ND		
45										
50								ND		
55										
60										
65										
70										
75										
80										
85										
90										
95										
100										
105										

* = Values represent TIC with the highest concentration identified per sample

ND = None Detected

Texaco Fillmore Remedial Investigation, Aug-Oct, 90

TABLE 4-16 (cont.)

TCLP Tentatively Identified Semi-Volatile Organic Compounds (TIC) - Subsurface Soil
Northern Region

Constituent	Highest Tentatively Identified Compound Concentration (ug/l) *				
Location	PIT 1		BACKGROUND		
Borehole	BH-1	BH-2	BH-2	BH-3	BH-5
Depth (FT)					
5	ND				
10	ND				
15					
20	ND				
25		69			
30					
35					
40					
45					
50					

* = Values represent TIC with the highest concentration identified per sample

ND = None Detected

Texaco Fillmore Remedial Investigation, Aug-Oct, 90

TABLE 4-16 (cont.)

TCLP Tentatively Identified Semi-Volatile Organic Compounds (TIC) - Subsurface Soil
Soil Gas Area

Constituent	Highest Tentatively Identified Compound Concentration (ug/l) *				
Location	SOIL GAS AREA				
Borehole	BH-1	BH-901	BH-2	BH-3	BH-4
Depth (FT)					
5					
10					
15				ND	ND
20					
25			ND		
30					
35					
40				170	
45					
50					
55	270		ND		

* = Values represent TIC with the highest concentration identified per sample

ND = None Detected

Texaco Fillmore Remedial Investigation, Aug-Oct, 90

4.1.6 Inorganic Compounds (Metals)

A large amount of data on inorganic compounds (metals) of interest to the Texaco Fillmore site was generated during the RI. Metals investigated included arsenic, barium, cadmium, total and hexavalent chromium, total and organic lead, copper, nickel and vanadium. This section presents the results of the analyses for these metals performed on subsurface soil samples collected at the site during the RI.

Total metal analyses (California TTLC) for the five indicator parameters (arsenic, barium, cadmium, chromium, and lead) were conducted on all samples collected from the waste pit and monitoring well boreholes. Total metal analyses for copper, nickel, vanadium, and organic lead were also conducted on two samples from these boreholes, typically selected from a depth of 5 to 25 feet, to assess the extent of their presence at the site. Finally, total analyses for all of these metals were conducted on 20 samples from 5 boreholes drilled down to 20 feet in carefully selected background areas throughout the site. The background samples were used to establish naturally occurring levels which could be used compare to the site characterization results.

TCLP analyses for all eight metals investigated were conducted on approximately 20 to 40 percent of the samples from the waste pit and monitoring well boreholes which were previously analyzed for Total concentrations. The samples selected for TCLP analyses were screened based on the highest Total concentrations results for each metal and on observed correlations with TPH results. The samples analyzed for TCLP inorganic analyses are indicated by a double box in the Total concentration results table for each metal presented in the sections that follow.

The results of Total and TCLP analyses for each metal are discussed separately in the sections below. Total metal results are compared to site background levels established from the sampling conducted on site, and to published background levels for the region. TCLP results are compared to the threshold levels defined in the FSP for each of the five indicator parameters and to regulatory levels applicable to land disposal of metal-bearing wastes.

4.1.6.1 Site Background Levels

Background boreholes were located in areas where no past or present activity was believed to have occurred based on a review of the site's historical data. Boreholes BG-BH-2, -3 and -5 were located on the road and hillside areas on the northern portion of the facility. Boreholes BG-BH-1 and -4 were located in predominantly orchard and building areas in the

southern portion of the facility. The Total metal results for the background samples are presented in Table 4-17.

Background values for each metal were calculated using a statistical approach based on the California Site Mitigation Decision Tree Manual guidelines. The statistical background value was defined as the upper limit of a 90 percent student's "t" one-tailed confidence interval. This upper limit can be used to evaluate the result for each characterization sample individually; if the result is above this limit, there is a 90 percent chance that the concentration is above background. However, if background samples and characterization samples came from the same population and if the number of samples from each group was sufficient to truly represent the population, we would expect 10 percent of the characterization samples to exceed the upper limit.

Table 4-17 presents statistical background upper limits calculated using all five boreholes (20 samples) and only three boreholes (13 samples). Boreholes BG-BH-2 and -4 were excluded from the latter calculations based on information from historical photographs and field logs which suggested these areas might not be truly representative of background conditions. No significant changes in the calculations were observed. The lowest value of the upper limit for each metal was selected as the background threshold level.

It is noteworthy that background results do not show any increasing or decreasing trends with depth; the average or the range for the values at each depth do not appear to vary significantly as was the case with the TPH concentrations. This lack of variation with depth is also exhibited by all the characterization samples even at depths much greater than 20 feet. It was therefore permissible to combine all the background samples at different depths in one group and fully use the advantage of a greater number of samples in the statistical analyses. The lack of variation with depth in the waste pit boreholes and monitoring wells enables us to compare characterization samples collected at greater depths with the background samples collected above 20 feet below grade.

4.1.6.2 Published Regional Background Levels

Background data was researched to compare the statistically calculated background levels with published levels for the region. Published values were obtained from U.S. Geological Survey Professional Paper No. 1270, "Element Concentrations in Soils and Other Surficial Materials of the Conterminous United States," dated 1984.

Barium background concentrations in the western United States and southern California regions were found to be higher than those detected in background samples from the

Table 4-17

Background Sam ples Results - Subsurface Soil

		Abbreviated Sample Code																				MDL	Borehole BG-BH-1,3,5			Borehole BG-BH-1,2,3,4,5			Threshold Background Level**
	Borehole	BG-BH-1				BG-BH-2				BG-BH-3				BG-BH 4			BG-BH-5						13			20			
	Depth	5	10	15	20	5	10	15	20	10	10D	15	20	10	20	20D	5	10	15	15D	20		Mean	STDev	Statistical Background	Mean	STDev	Statistical Background	
Parameter	Method	concentration (mg/kg)																											
Arsenic	Hydride, AA	3.6	3.5	3.0	4.0	3.6	4.2	2.6	3.3	4.6	4.6	4.7	4.8	3.0	4.6	3.5	4.4	4.1	4.1	3.7	5.3	0.5	4.2	0.6	4.41	4.0	0.7	4.16	4.16
Barium	EPA 6010	155.0	128.0	127.0	176.0	218.0	180.0	174.0	160.0	128.0	100.0	111.0	122.0	98.9	89.6	85.2	185	165	177	173	259	1.0	154.3	40.5	169.55	150.6	43.7	163.57	163.57
Cadmium	EPA 6010	5.8	4.5	4.8	7.1	5.1	3.8	5.2	3.9	7.0	4.4	6.3	4.8	4.8	6.1	5.0	4.2	3.6	3.2	3.8	4.5	0.5	4.9	1.2	7.10	4.9	1.1	5.21	5.21
Chromium, Total		24.3	25.6	16.4	33.8	39.9	40.4	40.9	41.6	28.4	19.8	41.2	36.7	14.5	23.8	12.8	17.4	14.7	21.2	20.4	22.7	1.0	24.8	7.8	33.80	26.8	9.9	29.78	29.78
Copper	EPA 6010	23.7	48.1	13.9	24.6	27.9	107.0	22.6	21.0	35.5	29.3	49.1	22.1	16.8	36.4	19.4	17	16.3	18.9	18.1	20.8	2.0	26.0	11.1	24.60	29.4	20.3	35.44	24.60
Lead*	EPA 6010	5.0 (ND)	5.0 (ND)	5.0 (ND)	5.0 (ND)	5.0 (ND)	14.1	5.0 (ND)	5.9 (ND)	5.0 (ND)	5.0 (ND)	5.0 (ND)	5.0 (ND)	5.0 (ND)	5.0 (ND)	5.0 (ND)	5.0 (ND)	5.0 (ND)	5.0 (ND)	5.0 (ND)	5.0 (ND)	5.0	5.0	0.0	5.00	5.5	2.0	6.09	5.00
Nickel	EPA 6010	29.1	30.3	21.4	35.3	49.7	47.3	50.9	48.2	39.4	36.2	37.0	39.7	28.1	63.3	29.9	37	37.3	43.3	41.9	46.7	4.0	4.0	6.3	35.30	39.6	9.5	42.41	35.30
Vanadium	EPA 6010	76.7	66.1	53.0	103.0	99.1	98.8	108.0	111.0	89.8	66.7	111.0	107.0	41.9	78.2	43.3	70.4	62.6	77.7	73.4	94.3	1.0	1.0	17.7	103.00	81.6	21.5	88.00	88.00

* ND concentrations reported by lab assumed to be at detection limit for statistical calculations
** Lowest of both statistical values
MDL = Method Detection Limit

Fillmore facility. The estimated arithmetic mean for the western United States was 670 mg/kg. The lowest concentration found in the southern California area was 300 mg/kg (e.g., over 83 percent of the national data is at or above this value) which is greater than the highest background value for barium of 259 mg/kg detected at the Fillmore facility. This value is comparable to the background for the region.

The maximum background value for chromium detected at the facility was 41.6 mg/kg. This value is also in the same range of background values found in the western United States and southern California areas. The arithmetic mean for the western United States was 56 mg/kg.

Naturally-occurring lead levels in the western United States and southern California area range from 10 to 30 mg/kg, again comparably higher than background concentrations for the Fillmore facility which were mostly nondetected at a detection limit of 5 mg/kg. Likewise, the reported arithmetic mean of 5.2 ppm for arsenic in the region was found to be about the same as the maximum background value of 5.3 ppm detected at the facility. No regional background data was available for naturally-occurring cadmium concentrations.

The above findings indicate that the locations selected to collect background samples at the Fillmore facility are truly representative of background conditions for the metals of concern.

4.1.6.3 Arsenic

The results of the analysis for total arsenic are presented in Table 4-18. The data do not appear to vary geographically or with depth. A better representation is given in Figure 4-8 for boreholes in the MWP Region and in Figure 4-9 for all other boreholes. The range of values (0.74 to 15.9) does not vary with depth or with elevation. The average of the population is 3.77 and the standard deviation is 1.59. There are a total of 213 samples with concentrations above the upper limit for background calculated in Section 4.1.6, which represents 31 percent of the total number of samples.

Based on the total arsenic results, from 20 to 55 percent of the samples with the highest concentrations were screened for TCLP arsenic extraction and analysis. Table 4-19 presents a breakdown of the number and distribution of samples selected for TCLP analysis. Figures 4-10 and 4-11 are plots of the distribution of that data by waste pit and for the entire site. The samples selected for TCLP analyses are indicated by a double box around the total arsenic results in Table 4-18.

TABLE 4-18

Total Arsenic - Subsurface Soil

Main Waste Pit Region

Constituent	Arsenic Concentrations (mg/kg)																						
Location	MAIN WASTE PIT														PIT 2		MONITORING WELLS						
Borehole	BH-1	BH-2	BH-3	BH-4	BH-5	BH-6	BH-7	BH-8	BH-9	BH-10	BH-11	BH-12	BH-13	BH-14	BH-1	BH-2	MW21	MW22S	MW22D	MW23	MW24	MW25D	MW25S
ELEV. (FT)																							
525								4.9						4.3	4	4.6							
520								4.8 2.1						4.2	4.3	5							
515								5.1			3.5			4.2	6	3.8							
510							1.2	4.1			2.8	3.3	2.3	4.1	3.9	5.8							
505							1.7	4.2		3.8	3.7	3.2	1.6	2.7	3.6	3.5							
500		2.7	5		3.4		2.5	4.9	3.2	2.8	2.3	2.6	2.8	2	3.6	5.2					3.3		
495	3.6	2.7	4.2	4.7	4.7	3	4.1	1.9	2.6	2.6	3.5	3.8	2.9	3.4 2.2	5.1	5.6						3.7	
490	3.4	4.4	4.3 3.8	3.5	2.4	2.8		4.6	3.7	3.3	3.1	3.4	2.3	3.5	3.5	4.9						3	2.3
485	8.2	1.9	3.6	3.7 3.4	2.1	3.8	3.8	4.2	3.9 2.9	3.2	2.4	2.3	3.4 2.8	2.6	3.5 2.7	6 5.2						2.7	
480	3	4.7	2.9	3.9	2.6	3.2	4.8	2.9 4.2	3.4	3.7	3.9	3.2 3.7	4.3	5	2.7 3.7	4.6				5.9		2.9 2.9	
475	3.2 3.6	3.3	3.8	3.4	1.9	3.7	3	4.1	3.4	4.5	4	2.9	4.6	3.5	2.7	3.3 4		3.8		4.2		4.2	5.3
470	3.8	3.8	2.2	3.8	4.2	3.8	2.8	3.6	3.4	4.9	3.1 2.7	4.7	4.4	3.2	3.8	3.4						3.6	
465	2.4 3	4.6 4.5	3.3	2.7	4.7 4	4.4	3.1 2.9	3.9	3.7 8	5.7	3.7 2.7	4.6 4.6	3.5	2.1 2.8	4.1	4.3		2.2		3.4		3.9 3.6	
460	5.4	3.2	4.5	8.5 8.5	3.2	2.8	4.6 3.2	3	3.1	3.2	2.6	4.4	3.2	4.8						3.7 2.9		1.8	2.8
455	2.9	2.1	2.8	3.8	2.5	2.6	4.2	4.8	2.9	6.3	2.9	4.5	2.9	3.5						3.2		2.7	
450	3.4			4.6		2.7 1.8	4.6		1.8	4.2 3.2	2.4	4.4	2.6	3.6				2.6				3.3	
445	3.7			4.4		3.8	4.8	5.1	2.3	2.5 5.5	2.9	2.6	4.1	1.8	3.2	1.6				2.6		3.7	4.4 2.9
440	3.2		2.2	3.6		3.7	3.7	3.6	3.6	3.5	9	1.8			3.3 2.9	4.9				3.2		2.7	2.5
435	5.9		2.7	3		4.3		3.1	5	6.2	2.5	2.4			2.9	1.8				2.4		1.4	
430	3.6		3.8	3.6		3.3			2.1	2.3	2.2	3.3				2				1.5		3.9	0.9
425	5.4		3.6	4.4		2.1		4.3	2.2			3.6 3.8			2	8				8.2 4.5		3.1	
420	4.6		1.6	5.6		2.7			1.6			4				2.7				2.2		3.8	3.6
415	5.2		2.5	5.3		3.8		3.7 3.7	2.4			0.74				3.3						1.4	1.3
410			2.8	14.7		4.1		4				2.4				3.1				2.9		1.5	
405								1.7 2.8								2.4				4			3.8
400																5.6							
395																4 3.6							
390																3.7 3.7				4			

TABLE 4-18 (cont.)

Total Arsenic - Subsurface Soil
Hill Region

Constituent	Arsenic Concentrations (mg/kg)								
Location	PIT 5		PIT 6		PIT 7		PIT 8		BKGND
Borehole	BH-1	BH-2	BH-1	BH-2	BH-1	BH-2	BH-1	BH-2	BH-1
Depth (FT)									
5	6.1	4.4	3.3	4.6	2.5	2.5	3.7	3.6	3.6
10	4.8	6.2	4.8	3.2	2.7	3	3.9	7.4	3.5
15	4.4 4.8	4.5	7	5.8	1.4	3.3 2.7	6.6	4.1	3
20	3.5	3.9	4.1	6.8	0.8	4.8	4	3.2	4
25	5	4.3	4.4 4.9	7.3	1.1	4.8	2.5	3.7	
30	7.9	5.6	3.9	2.9	4.2	1.7	3.6	3.2 5.8	
35	4.9	4.6 7.6	5	3.3	4.1	1.4		2.1	
40	8.7	5.6	6.1	5	5.4	1.3	2.1	1.6	
45	4.7			3.8	3.7		3.1	2.8	
50	3.2			4.5 2.8	3.5	1	4.3	2	
55	2.4			4.2			2.7	3.6	
60	2.6			3.2 3			4	2.8 3.7	
65	3.1 4.6			2.5			3.1		
70	2.3			4.1			2.9 3.9		
75	3.3			2.8			4.2		
80	2.8			2.4			5		
85	2.8			3.4			4.1		
90	4.2						4.7		
95							3.7 5.1		
100							4		
105							3.7		

TABLE 4-18 (cont.)

Total Arsenic - Subsurface Soil
Northern Region

Constituent	Arsenic Concentrations (mg/kg)				
Location	PIT 1		BACKGROUND		
Borehole	BH-1	BH-2	BH-2	BH-3	BH-5
Depth (FT)					
5	7.1	4.6	3.6		4.4
10	5.4	5.1	4.2	4.6	4.1
		5.7		4.6	
15	5	5.7	2.6	4.7	4.1
					3.7
20	5.2	4.4	3.3	4.8	5.3
25	3.9	5.2			
	6.2				
30	5.5	4.4			
35	5.3	4.5			
40	4	4.7			
45					
50					

TABLE 4-18 (cont.)

Total Arsenic - Subsurface Soil
Soil Gas Area

Constituent	Arsenic Conc. (mg/kg)			
Location	SOIL GAS AREA			
Borehole	BH-1	BH-2	BH-3	BH-4
Depth (FT)				
5	2.8	3.2	3	2.3
10			2.4	
15				
20		4.2		3.9
25	3.8			
30				

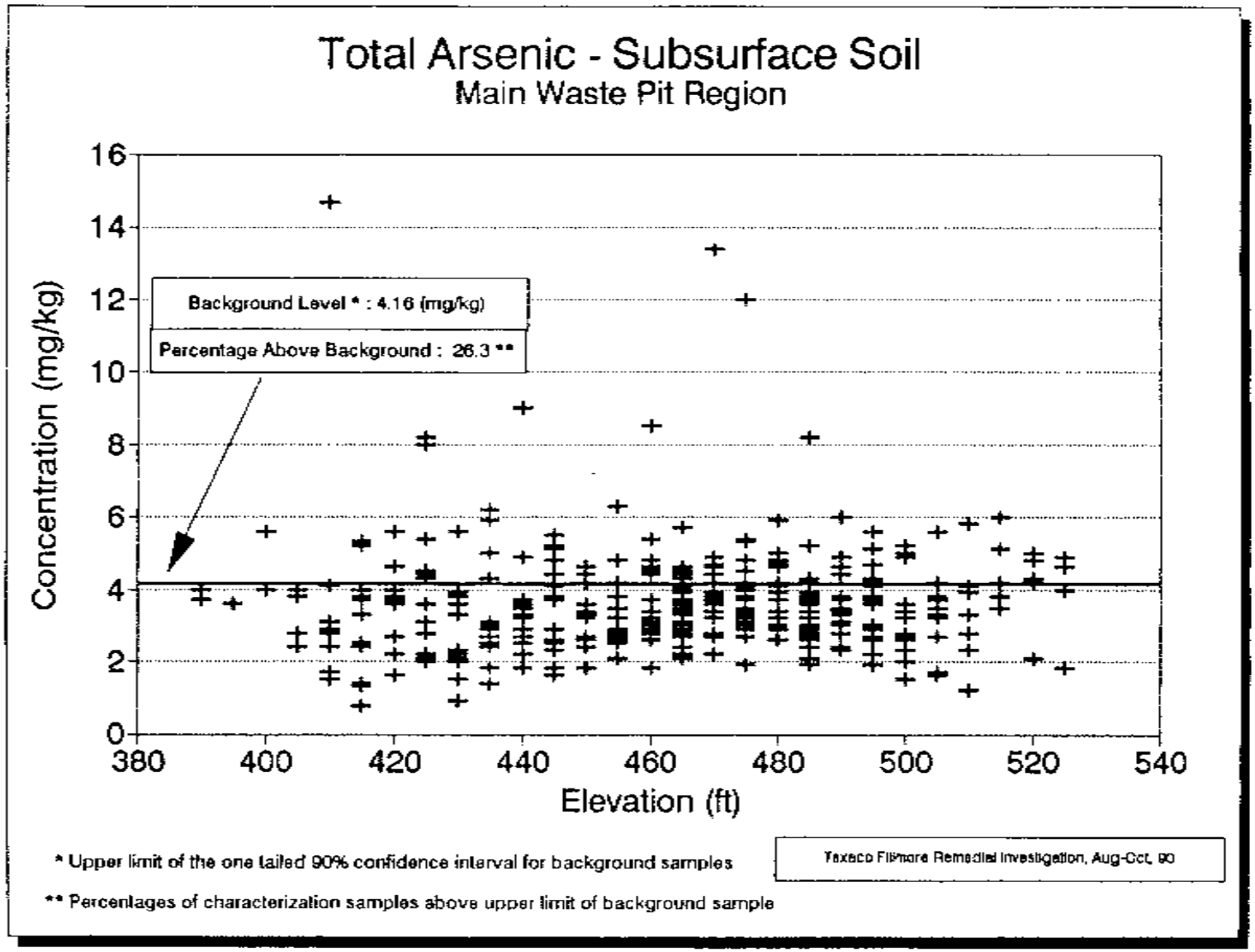

Total Arsenic - Subsurface Soil
Main Waste Pit Region
Concentration (mg/kg)
Elevation (ft)
Background Level * : 4.16 (mg/kg)
Percentage Above Background : 26.3 **
0
2
4
6
8
10
12
14
16
380
400
420
440
460
480
500
520
540
* Upper limit of the one tailed 90% confidence interval for background samples
** Percentages of characterization samples above upper limit of background sample
Texaco Fillmore Remedial Investigation, Aug-Oct, 90

FIGURE 4-8

Samples Selected for TCLP Arsenic Analysis (Based on Total Arsenic Concentrations)

Waste Pit	BH #	Total # of Samples Collected	Median Arsenic Concentration*	TCLP Sample Selection Breakdown			
				Number of Samples Selected for TCLP Analysis		Number of Selected Samples Above Median Concentration	
				#	% of Total	#	% of Total
Main Waste Pit	1	19	3.6	8	42.1	5	26.3
	2	11	3.3	5	45.5	3	27.3
	3	19	3.3	5	26.3	5	26.3
	4	20	4.2	3	15.0	3	15.0
	5	11	3.2	6	54.5	4	36.4
	6	20	3.5	1	5.0	1	5.0
	7	16	3.5	7	43.8	5	31.3
	8	26	4.1	7	26.9	6	23.1
	9	20	3.2	5	25.0	3	15.0
	10	18	3.6	1	5.6	1	5.6
	11	20	2.9	1	5.0	1	5.0
	12	24	3.3	9	37.5	6	25.0
	13	16	3.1	7	43.8	4	25.0
	14	19	3.4	8	42.1	6	31.6
	Total	259		73	28.2	53	20.5
Pit #1	1	9	5.3	5	55.6	3	33.3
	2	9	4.7	5	55.6	3	33.3
	Total	18		10	55.6	6	33.3
Pit #2	1	15	3.8	7	46.7	5	33.3
	2	15	4.9	5	33.3	4	26.7
	Total	30		12	40.0	9	30.0
Pit #3	1	10	3.4	6	60.0	3	30.0
	2	17	3.1	9	52.9	6	35.3
	3	14	3.6	6	42.9	3	21.4
	4	9	3.0	3	33.3	2	22.2
	Total	50		24	48.0	14	28.0
Pit #4	1	10	3.8	3	30.0	3	30.0
	2	11	3.5	2	18.2	2	18.2
	3	11	4.1	5	45.5	3	27.3
	4	11	4.4	6	54.5	3	27.3
	5	11	2.9	3	27.3	2	18.2
	6	11	2.4	4	36.4	1	9.1
	Total	65		23	35.4	14	21.5
Pit #5	1	20	4.3	9	45.0	6	30.0
	2	9	4.6	2	22.2	2	22.2
	Total	29		11	37.9	8	27.6
Pit #6	1	9	4.8	3	33.3	2	22.2
	2	19	3.4	10	52.6	7	36.8
	Total	28		13	46.4	9	32.1
Pit #7	1	10	3.1	4	40.0	3	30.0
	2	10	2.6	4	40.0	3	30.0
	Total	20		8	40.0	6	30.0
Pit #8	1	22	3.9	8	36.4	4	18.2
	2	14	3.4	6	42.9	4	28.6
	Total	36		14	38.9	8	22.2
Pit #9 Suspected Pit	1	18	3.4	9	50.0	5	27.8
	2	13	3.8	8	61.5	6	46.2
	Total	31		17	54.8	11	35.5

* Concentrations exceeded by 50% of samples.

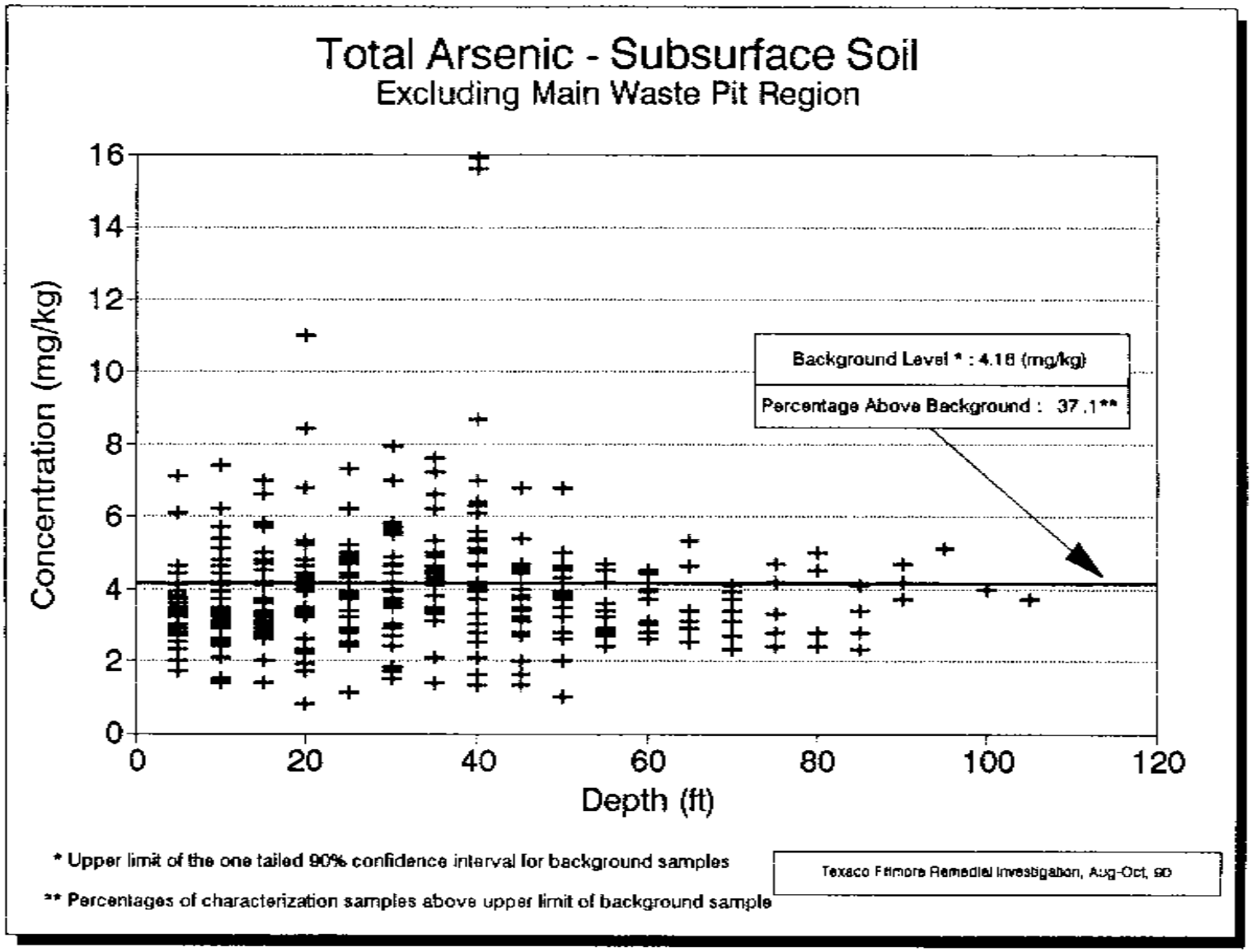

Total Arsenic - Subsurface Soil
Excluding Main Waste Pit Region
Concentration (mg/kg)
Depth (ft)
0
2
4
6
8
10
12
14
16
0
20
40
60
80
100
120
Background Level * : 4.16 (mg/kg)
Percentage Above Background : 37.1**
* Upper limit of the one tailed 90% confidence interval for background samples
** Percentages of characterization samples above upper limit of background sample
Texaco Fillmore Remedial Investigation, Aug-Oct, 90

FIGURE 4-9

Distribution of Samples Selected for TCLP Arsenic Analysis by Waste Pit

(Based on Total Arsenic Concentrations)

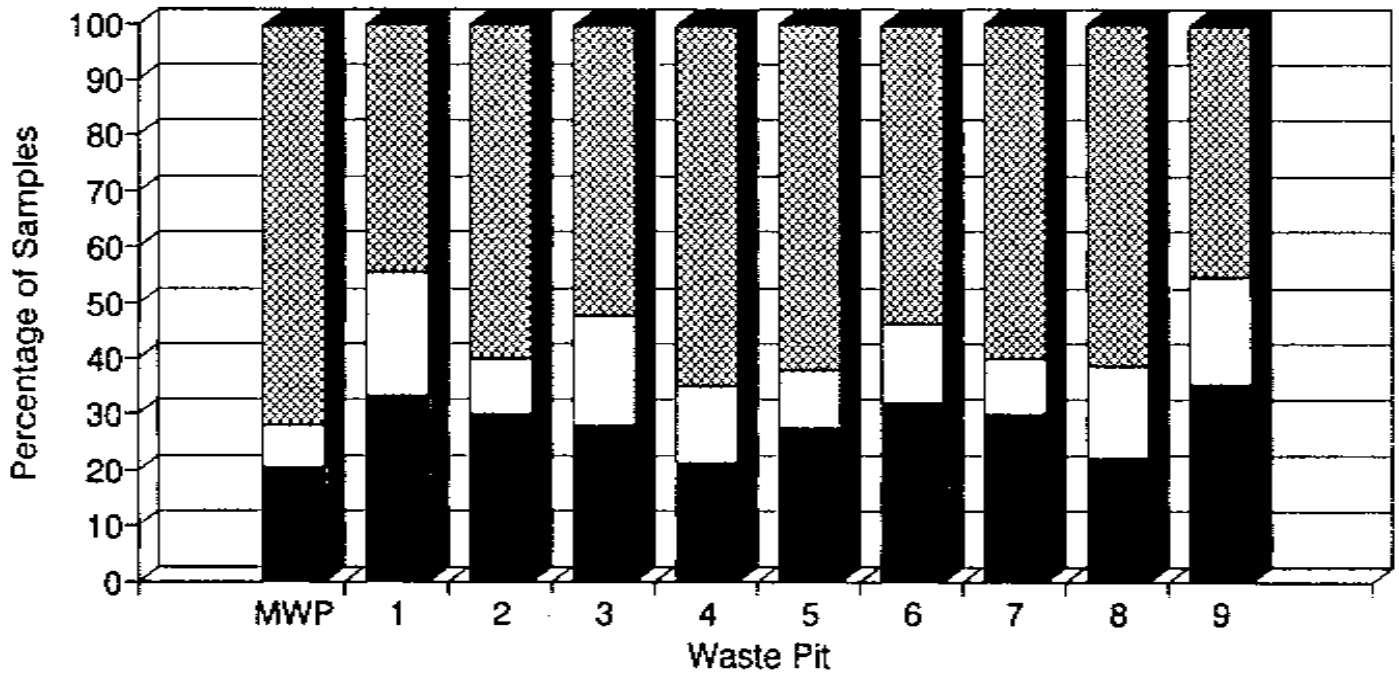


FIGURE 4-10 Texaco Fillmore Remedial Investigation June 1991

Distribution of Samples Selected for TCLP Arsenic Analysis for All Pits

(Based on Total Arsenic Concentrations)

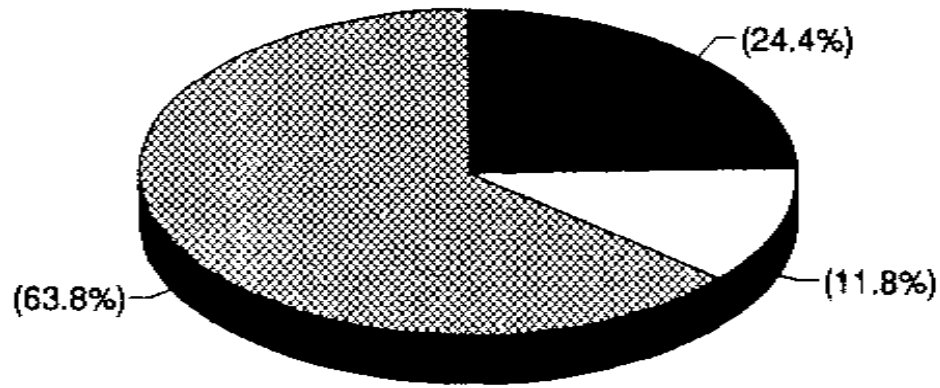


FIGURE 4-11

Texaco Fillmore Remedial Investigation June 1991

The results of the TCLP analysis for arsenic are provided in Table 4-20. As shown in the table, arsenic did not exceed the FSP designated threshold level of 50 µg/l in any of the 230 samples analyzed. TCLP values for arsenic ranged from ND to 43.1 µg/l.

4.1.6.4 Barium

Total barium analyses results are presented in Table 4-21. The data do not appear to vary geographically or with depth. A better representation is given in Figure 4-12 for boreholes in the MWP Region and in Figure 4-13 for all other boreholes. The result of the 90-foot sample (elevation of 415 feet) from monitoring well MW-25S was out of scale omitted from Figure 4-12 in order to make it more readable rather than changing the scale. The range of values (25.6 to 1,450 mg/kg) does not vary with depth. The average concentration of the population is 124 mg/kg and the standard deviation is 85. A total of 106 samples have concentrations above the upper limit for background calculated in Section 4.1.6, representing 18 percent of the total number of samples.

Figure 4-14 presents the normalized frequencies of barium concentrations for both the background and site characterization sample populations. The curves represent Gaussian distributions based on the calculated mean and average for both populations. Using an independent Student's t-test, it is not possible to confirm with 90 percent confidence that the background and characterization samples come from a different population.

Based on the total barium results, from 30 to 60 percent of the samples with the highest concentrations were screened for TCLP barium extraction and analysis. Table 4-22 presents a breakdown of the number and distribution of samples selected for TCLP analysis. Figures 4-15 and 4-16 are plots of the distribution of that data by waste pit and for the entire site. The samples selected for TCLP analyses are indicated by a double box around the total barium results in Table 4-21.

The results of the TCLP analysis for barium are provided in Table 4-23. As shown in the table, barium exceeded the FSP designated threshold level of 1,000 µg/l in 102 of 244 samples analyzed throughout the facility, about 42 percent. Barium was found in excess of threshold levels in boreholes within all four regions. Figures 4-17 through 4-26 depict the spatial distribution of barium TCLP concentrations throughout the facility. As can be seen from the figures, barium concentrations are randomly distributed, and are consistent throughout all depths (i.e., they do not exhibit any direct correlation with depth).

The large volume of data and consistent levels of barium measured throughout the facility lend themselves to a statistical representation of these values. Figure 4-27 shows the

TABLE 4-20

TCLP Arsenic - Subsurface Soil

Main Waste Pit Region

Constituent	Arsenic Concentrations (ug/l)																					
Location	MAIN WASTE PIT														PIT 2		MONITORING WELLS					
Borehole	BH-1	BH-2	BH-3	BH-4	BH-5	BH-6	BH-7	BH-8	BH-9	BH-10	BH-11	BH-12	BH-13	BH-14	BH-1	BH-2	MW21	MW22S	MW22D	MW23	MW24	MW25D	MW25S
Elev. (FT)																							
525								13.2						34.6	<2								
520								10.6							<2	14.1							
515								2.6						<2	<2								
510														3.5		<2							
505													<2		<2								
500			<2					<2						<2									
495			<2		1.3								<2 J		<2								
490	<2							<2						4.8								2.1	2.9
485	13.5		<2				2					<2			<2	3.8						2.6	
480	<2	<2					<1				3			15.7		<2						<2	
475	<2	2.2		<2									<2 J										2.1
470	<2				1.2							<2	<2 J		<2	<2						<2	
465		<2 2			<1 <1	<2	<1		<1			<2											
460	3.2		2.5		1.3		<1					<2											
455		<2		3.3	<1		<1 <1		2.5			<2	2.2 J 2.1 J	5.4									
450									2.7	1.8				7.4								<2	
445	<2												<2 J				<2 J					<2	2
440							<1		<1													2.1	
435	<2							<2	1.5														
430												<2											
425			<2					<2				<2 <2					<2 J						
420								<2				<2											
415																							
410				2.7 J																			
405								<2															

J : Estimated values
Threshold Level for Arsenic : 50 ug/l

Texaco Fillmore Remedial Investigation, Aug-Oct, 90

TABLE 4-20 (cont.)

TCLP Arsenic - Subsurface Soil

Southern Region

Constituent	Arsenic Concentrations (ug/l)															
Location	PIT 3				PIT 4						SUSPECT PIT		MONITORING WELLS			BKGND
Borehole	BH-1	BH-2	BH-3	BH-4	BH-1	BH-2	BH-3	BH-4	BH-5	BH-6	BH-1	BH-2	MW18	MW19	MW20	BH-4
Depth (FT)																
5	18.5		4.5	<2			<2		2.7	<2 J	<2					
10	<1							<2				<1				
15		2.7	<2					<2	3.9							
	<1	2.9														
20	<1	3								<2 J	<1					
25		2.5														
30	<1		<2	<2	<2		<2					<1				
								<2								
35	1	<2		2.3		9.7 J	2.7	2.3								
											<1					
40				4.3	<2	4.8 J		3.5		<2 J		<1		2.7		
							11.7									
45		2.7	7.2				2		<2		2.3		<2			
		3			4.3						2.4		<2			
50								3.4		3 J	2.3					
55		4.6	2.3 J									5.1				
60			7.5								3				2.4	
65											<1				<2	
70		2														
75															4.6	
80											2.1				8.9	
85																

J : Estimated values

Threshold Level for Arsenic : 50 ug/l

Texaco Fillmore Remedial Investigation, Aug-Oct, 90

TABLE 4-20 (cont.)

TCLP Arsenic - Subsurface Soil

Hill Region

Constituent	Arsenic Concentrations (ug/l)								
Location	PIT 5		PIT 6		PIT 7		PIT 8		BG
Borehole	BH-1	BH-2	BH-1	BH-2	BH-1	BH-2	BH-1	BH-2	BH-1
Depth (FT)									
5	5.3					1.5	5.2		
10		5.5					43.1	11.6	
15			5.4	6.8		1.1	10.5	8.3	
20	2.9			7.6		<1		13.1	
25	7.9			11.8	3.2	7.6			
30	<2		1.5		3.2			2.1	
35		3.8		3.9	<2				
40	<2		1.2	<1	2.6		2.7	<2	
45	2.1			1.7					
50				1.2			3.1		
55				5					
60								6	
65	4.7								
70									
75							1.7		
80	3.1			2.8					
85	2.5			<2					
90							1.6		
95									
100									
105							<1		

J : Estimated values

Threshold Level for Arsenic : 50 ug/l

Texaco Fillmore Remedial Investigation, Aug-Oct, 90

TABLE 4-20 (cont.)

TCLP Arsenic - Subsurface Soil
Northern Region

Constituent	Arsenic Concentrations (ug/l)				
Location	PIT 1		BACKGROUND		
Borehole	BH-1	BH-2	BH-2	BH-3	BH-5
Depth (FT)					
5	9.2	4.4			
10	12.1	4.6			
15	<2	3.4			
20	<2				
25		<2			
30	<2				
35					
40		<2			

J : Estimated values

Threshold Level for Arsenic : 50 ug/l

Texaco Fillmore Remedial Investigation, Aug-Oct, 90

TABLE 4-20 (cont.)

TCLP Arsenic - Subsurface Soil

Soil Gas Area

Constituent	Arsenic Conc. (ug/l)			
Location	SOIL GAS AREA			
Borehole	BH-1	BH-2	BH-3	BH-4
Depth (FT)				
5				
10				
15			1.6	<1
20				
25		3.9		
30				
35				
40			2.8	
45				
50				
55	2.1	<2		
60				

J : Estimated values

Threshold Level for Arsenic : 50 ug/l

Texaco Fillmore Remedial Investigation, Aug-Oct, 90

TABLE 4-21

Total Barium - Subsurface Soil

Main Waste Pit Region

Constituent	Barium Concentrations (mg/kg)																						
Location	MAIN WASTE PIT														PIT 2		MONITORING WELLS						
Borehole	BH-1	BH-2	BH-3	BH-4	BH-5	BH-6	BH-7	BH-8	BH-9	BH-10	BH-11	BH-12	BH-13	BH-14	BH-1	BH-2	MW21	MW22S	MW22D	MW23	MW24	MW25D	MW25S
ELEV (FT)																							
525								198						172	146	266							
520								160						133	170	175							
515								34.8 87.8			154			215	99.3	158							
510							31.3	70.8			164	71.2	66.8	63.6	64.8	98.4							
505							113	104		111	122	76.9	97	110	85	92.2							
500		109	272		147		55.5	103	112	86.6	77	62.5	88.5	89.1	90.1	107					330		
495	86.5	155	185	144	109	99.1	115	28.1	83.1	201	87.6	83	180	95 54.2	80.9	100						74.3	
490	121	101	69.7 86.8	160	85.9	91.4		68.7	111	159	73.3	114	104	176	57.8	95.1						103	65.7
485	396	42.6	168	123	51.2	102	88.5	120	60	89.4	118	64.1	138	55.7	56.5 81.5	174 176				68.2		147	
480	69.2	122	86.6 106	195 88.3	148	88.5	175	98	90.7 76	82.7	67.6	84.8	82.3 95	81.6	70.1 63.6	163		126		393		51.6	
475	187	138	67.8	244	78.5	107	124	98.1 108	115	117	89	92.3 76.1	84.5	96.8	54.9	160						72.1 72.5	155
470	182 158	118	101	113	260	158	74.5	153	91	370	83.4 75.9	83.8	104	69.3	133	96.9 270		67.5		134		72.8	
465	238	72.1 114	62.1	127	114 122	148 113	224	86.8	196 72.8	112	115	87.7	74.7	114	125	90.1				80		91.6 63.6	
460	134 147	74.4	184	125	234	105	170 96.6	59.4	77.7	233	126 80.5	79.2 202	53.4	118 124						46.4 416		61.3	58.2
455	72.3	470	69.8	312 102	48.5	68.6	61.1 139	129	78.3	147	93.5	110	101 136	234				90.7				67	
450	123			129		86.5 92.9	129		85.4	101 77	208	93.7	105	166				36.9		148		131	
445	164			146		85.9	180	194	98.7	146 76.3	75.7	170	212	49.8	73.4	184				208		124	267 110
440	161		120	139		104	393	133	126	162	252	97.7			112 135	89.7				151		104	64.7
435	143		78.3	554		148		231	170	128	344	173			127	92				71.6		41.6	
430	135		147	169		428			92	138	109	255 211				414				372 258		102	81.2
425	128		172	143		134		258	148			193			144	217				147		128	
420	151		25.6	52		94.1		258 136	47.5			216				153						217	128
415	142		76.7	131		318		108	103			135				242				92.6		38.6	145.0
410			72.8	129		532		43.8				190				302				161		71.4	
405								218								194							459
400																161 275							
395																166 172				133			

TABLE 4-21 (cont.)

Total Barium - Subsurface Soil
Southern Region

Constituent	Barium Concentrations (mg/kg)															
Location	PIT 3				PIT 4						SUSPECTED PIT		MONITORING WELLS			BCKGRN
Borehole	BH-1	BH-2	BH-3	BH-4	BH-1	BH-2	BH-3	BH-4	BH-5	BH-6	BH-1	BH-2	MW18	MW19	MW20	BH-4
DEPTH (FT)																
5	152	111	99.6	140	91.7	120	220	120	115	100	136	134				
10	57.6	103	148	91.2	87.9	87.6	96.2	119	93.4	58	80.8	244				98.9
15	62.9	102	185	76.9	49	125	98.1	115	105	203	124	69.6				
20	77.3 81.3	134 71.7	78.2	74	93.6	147	133	97.3	208	103	71.4	62.8				89.6 85.2
25	117	91.1	70.6	76.4	128	59.5	62.4	129	97.8	111	120	67.8				
30	198	102	124 104	89.4	72.3	110	101	107	182	122	70.8	172				
35	58.9	75	79.8	74.4 90.2	67.5	79 76.6	83	111 100	98.8 81.6	93.6	54.7	72.4		213		
40	96.2	100	79	71.6	94.3	127	86	113	56.2	99.6	73.8 95.4	89.7 212		94.9 94.3		
45	47.5	143	74.2 70.5		83.5	109	137 89.4	73.7	98.9	73.4 102	131	110	238	114		
50		87.6 79.5	116		88.4	75.4	73.7	110	48.7	82.8	98 96	97.7	150	90.1		
55		108	84.1								95.9	86.2 76.1		95.7		
60			122								101			129	121	
65		122									142				183	
70		126									115				155 112	
75		89.5									120				70.4	
80		120									86.2				99.3	
85															68.8	

TABLE 4-21 (cont.)

Total Barium - Subsurface Soil

Hill Region

Constituent	Barium Concentrations (mg/kg)								
Location	PIT 5		PIT 6		PIT 7		PIT 8		BCKGRN
Borehole	BH-1	BH-2	BH-1	BH-2	BH-1	BH-2	BH-1	BH-2	BH-1
DEPTH (FT)									
5	138	113	89.5	98.1	106	83.5	209	129	155
					96.5				
10	148	97.5	90.3	85.2		94.9	149	133	128
	111					116			
15	103	110	224	89.8	61	75.5	180	140	127
20	75.3	97	114	68.7	32.7	124	116	185	176
			109						
25	115	86.8	72.5	39.8	27.2	168	63.5	72.8	
								126	
30	144	107	386	95.8	77.1	65.7	77.7	213	
		169							
35	117	60.5	83.6	78.8	144	37.5		105	
40	107	102	67.8	122	69.4	43.5	58.2	50.4	
45	118			74.1	130		83.1	76.1	
				132					
50	69.3			116	59.3	35.1	147	58.4	
55	101			79.5			242	119	
				88.7				118	
60	68.9			91.5			147	199	
	53.9								
65	89.6			87.4			60.4		
							60.8		
70	127			84.1			62.9		
75	120			98.4			70.5		
80	75.3			148			118		
85	198			188			145		
90	79.6						147		
							136		
95							86.6		
100							74.2		
105							108		

TABLE 4-21 (cont.)

Total Barium - Subsurface Soil

Northern Region

Constituent	Barium Concentrations (mg/kg)				
Location	PIT 1		BACKGROUND		
Borehole	BH-1	BH-2	BH-2	BH-3	BH-5
DEPTH (FT)					
5	177	190	218		185
10	172	221	180	128	165
		111		100	
15	305	205	174	111	177
					173
20	272	195	160	122	259
25	54.9	60.3			
	54				
30	119	151			
35	193	197			
40	69.3	320			
45					
50					

TABLE 4-21 (cont.)

Total Barium - Subsurface Soil

Soil Gas Area

Constituent	Barium Concentrations (mg/kg)			
Location	SOIL GAS AREA			
Borehole	BH-1	BH-2	BH-3	BH-4
DEPTH (FT)				
5	147	161	56.4	123
10			104	
15				
20		94.8		88.6
25	276			
30				

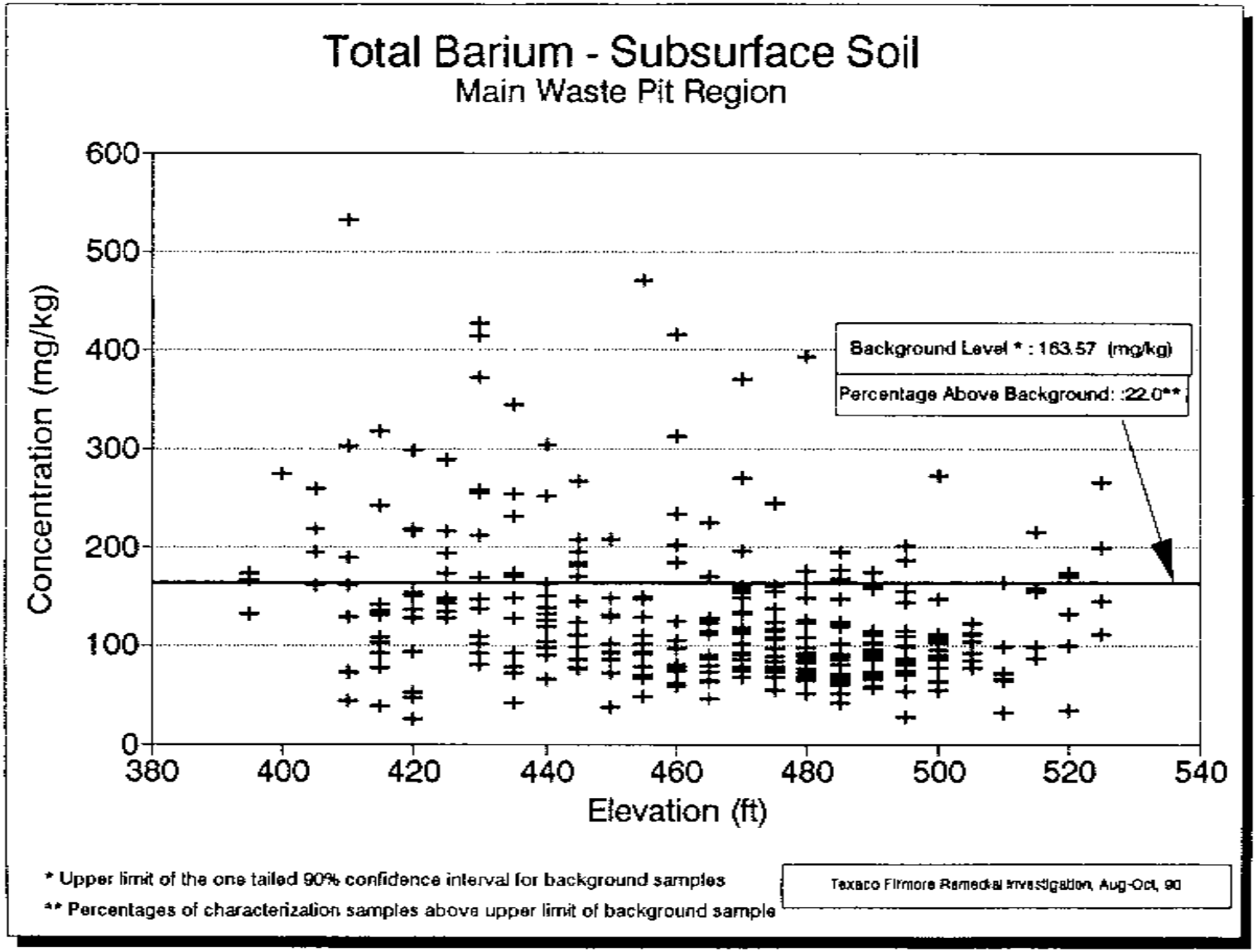

Total Barium - Subsurface Soil
Main Waste Pit Region
Concentration (mg/kg)
600
500
400
300
200
100
0
380
400
420
440
460
480
500
520
540
Elevation (ft)
Background Level * : 163.57 (mg/kg)
Percentage Above Background: :22.0**
* Upper limit of the one tailed 90% confidence interval for background samples
** Percentages of characterization samples above upper limit of background sample
Texaco Fitmore Remedial Investigation, Aug-Oct, 90

FIGURE 4-12

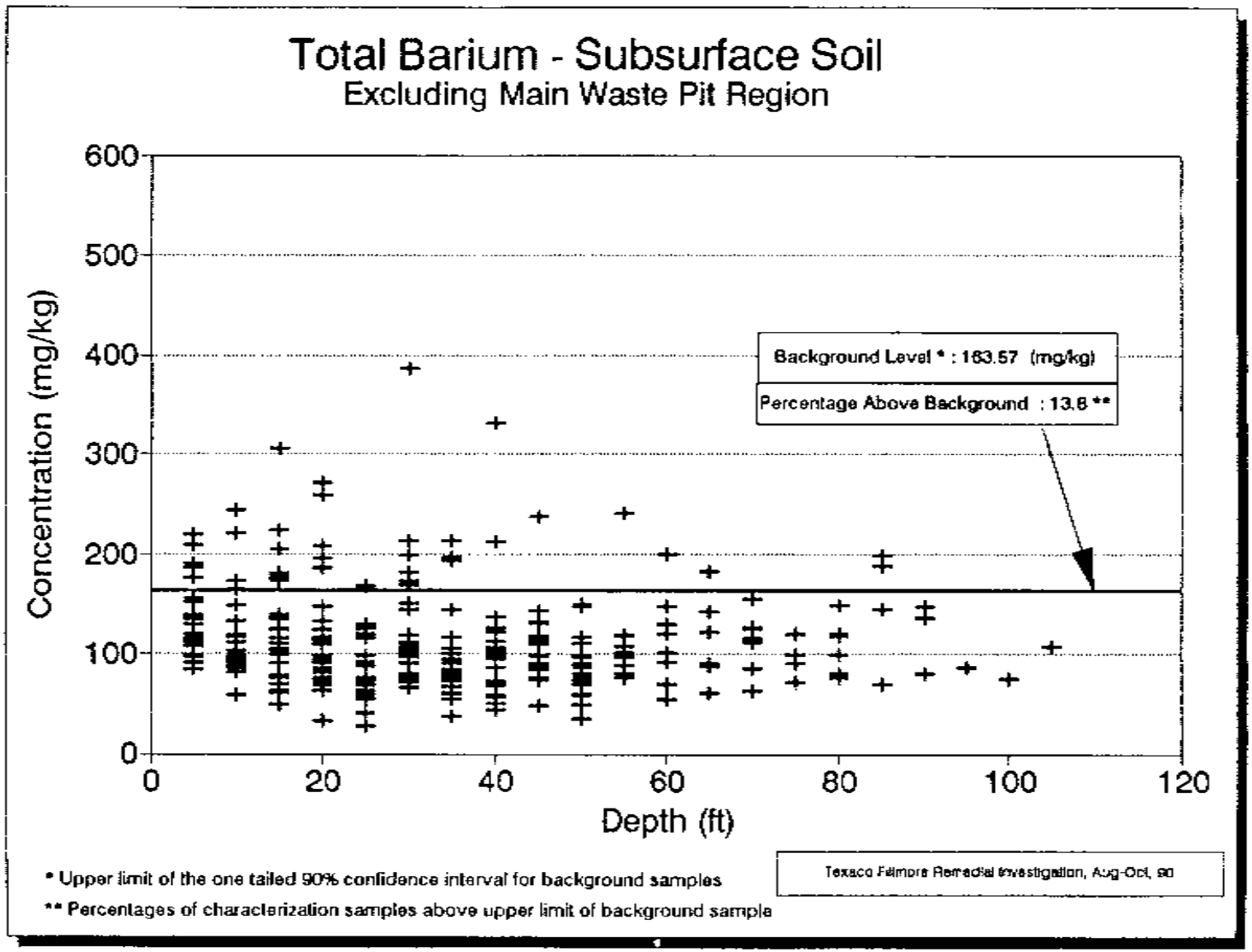

Total Barium - Subsurface Soil
Excluding Main Waste Pit Region
Concentration (mg/kg)
600
500
400
300
200
100
0
0
20
40
60
80
100
120
Depth (ft)
Background Level * : 163.57 (mg/kg)
Percentage Above Background : 13.6 **
* Upper limit of the one tailed 90% confidence interval for background samples
** Percentages of characterization samples above upper limit of background sample
Texaco Felmore Remedial Investigation, Aug-Oct, 90

FIGURE 4-13

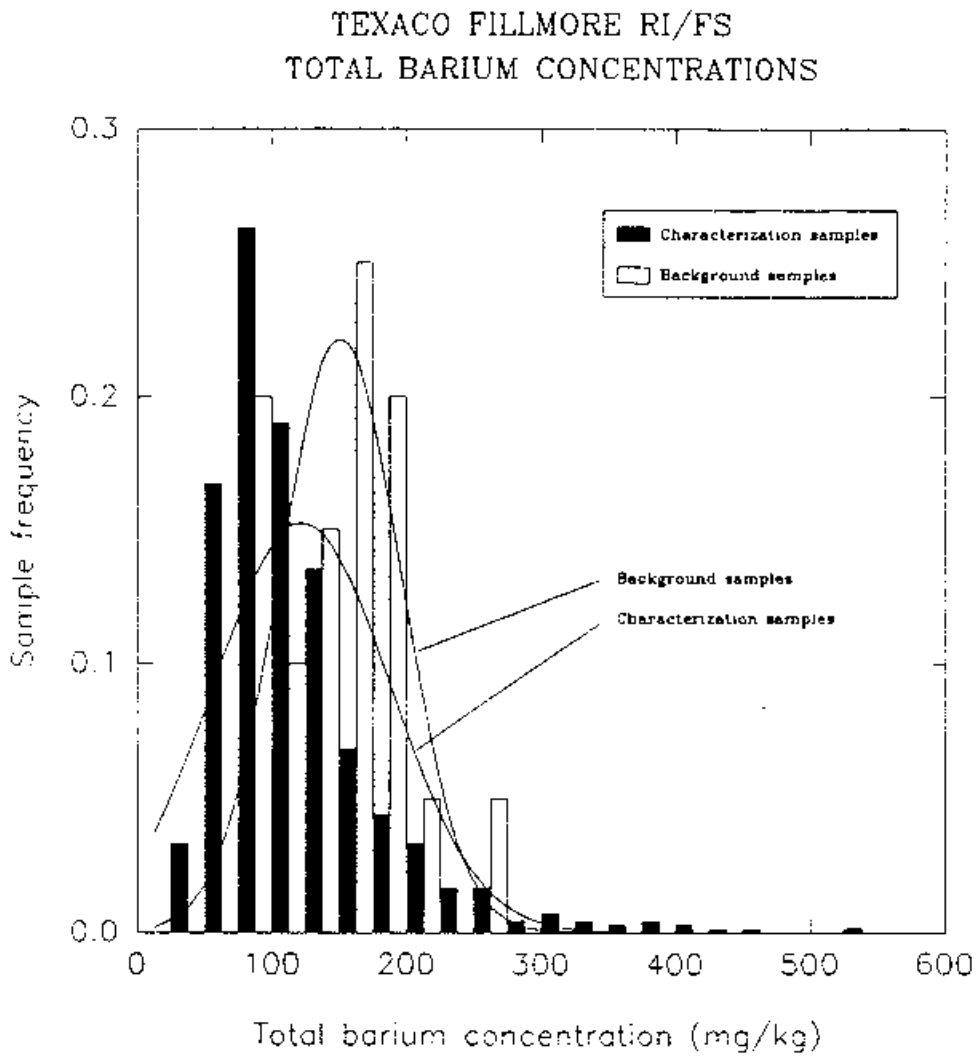

TEXACO FILLMORE RI/FS
TOTAL BARIUM CONCENTRATIONS
0.3
0.2
0.1
0.0
Sample frequency
Characterization samples
Background samples
Background samples
Characterization samples
0
100
200
300
400
500
600
Total barium concentration (mg/kg)

FIGURE 4-14

TABLE 4-22

Samples Selected for TCLP Barium Analysis

(Based on Total Barium Concentrations)

Waste Pit	BH #	Total # of Samples Collected	Median Barium Concentration*	TCLP Sample Selection Breakdown			
				Number of Samples Selected for TCLP Analysis		Number of Selected Samples Above Median Concentration	
				#	% of Total	#	% of Total
Main Waste Pit	1	19	143.0	11	57.9	5	26.3
	2	11	114.0	5	45.5	3	27.3
	3	19	86.8	6	31.6	6	31.6
	4	20	135.0	5	25.0	4	20.0
	5	11	114.0	6	54.5	3	27.3
	6	20	104.5	1	5.0	1	5.0
	7	16	119.5	7	43.8	4	25.0
	8	26	106.0	8	30.8	5	19.2
	9	20	91.5	5	25.0	3	15.0
	10	18	122.5	1	5.6	0	0.0
	11	20	101.3	1	5.0	0	0.0
	12	24	95.7	8	33.3	5	20.8
	13	16	99.0	7	43.8	4	25.0
	14	19	110.0	8	42.1	5	26.3
	Total	259		79	30.5	48	18.5
Pit #1	1	9	172.0	6	66.7	3	33.3
	2	9	195.0	5	55.6	3	33.3
	Total	18		11	61.1	6	33.3
Pit #2	1	15	81.3	7	46.7	5	33.3
	2	15	158.0	5	33.3	4	26.7
	Total	30		12	40.0	9	30.0
Pit #3	1	10	79.3	6	60.0	3	30.0
	2	17	102.0	10	58.8	5	29.4
	3	14	91.9	6	42.9	4	28.6
	4	9	76.9	3	33.3	3	33.3
	Total	50		25	50.0	15	30.0
Pit #4	1	10	88.2	4	40.0	3	30.0
	2	11	109.0	5	45.5	3	27.3
	3	11	96.2	5	45.5	3	27.3
	4	11	111.0	6	54.5	3	27.3
	5	11	98.8	3	27.3	3	27.3
	6	11	100.0	4	36.4	1	9.1
	Total	65		27	41.5	16	24.6
Pit #5	1	20	109.0	11	55.0	7	35.0
	2	9	102.0	6	66.7	4	44.4
	Total	29		17	58.6	11	37.9
Pit #6	1	9	90.3	3	33.3	2	22.2
	2	19	89.8	10	52.6	4	21.1
	Total	28		13	46.4	6	21.4
Pit #7	1	10	73.3	3	30.0	1	10.0
	2	10	79.5	4	40.0	4	40.0
	Total	20		7	35.0	5	25.0
Pit #8	1	22	112.0	8	36.4	5	22.7
	2	14	122.5	6	42.9	5	35.7
	Total	36		14	38.9	10	27.8
Pit #9 Suspected Pit	1	18	97.0	10	55.6	5	27.8
	2	13	89.7	5	38.5	4	30.8
	Total	31		15	48.4	9	29.0

* Concentrations exceeded by 50% of samples.

Distribution of Samples Selected for TCLP Barium Analysis by Waste Pit

(Based on Total Barium Concentrations)

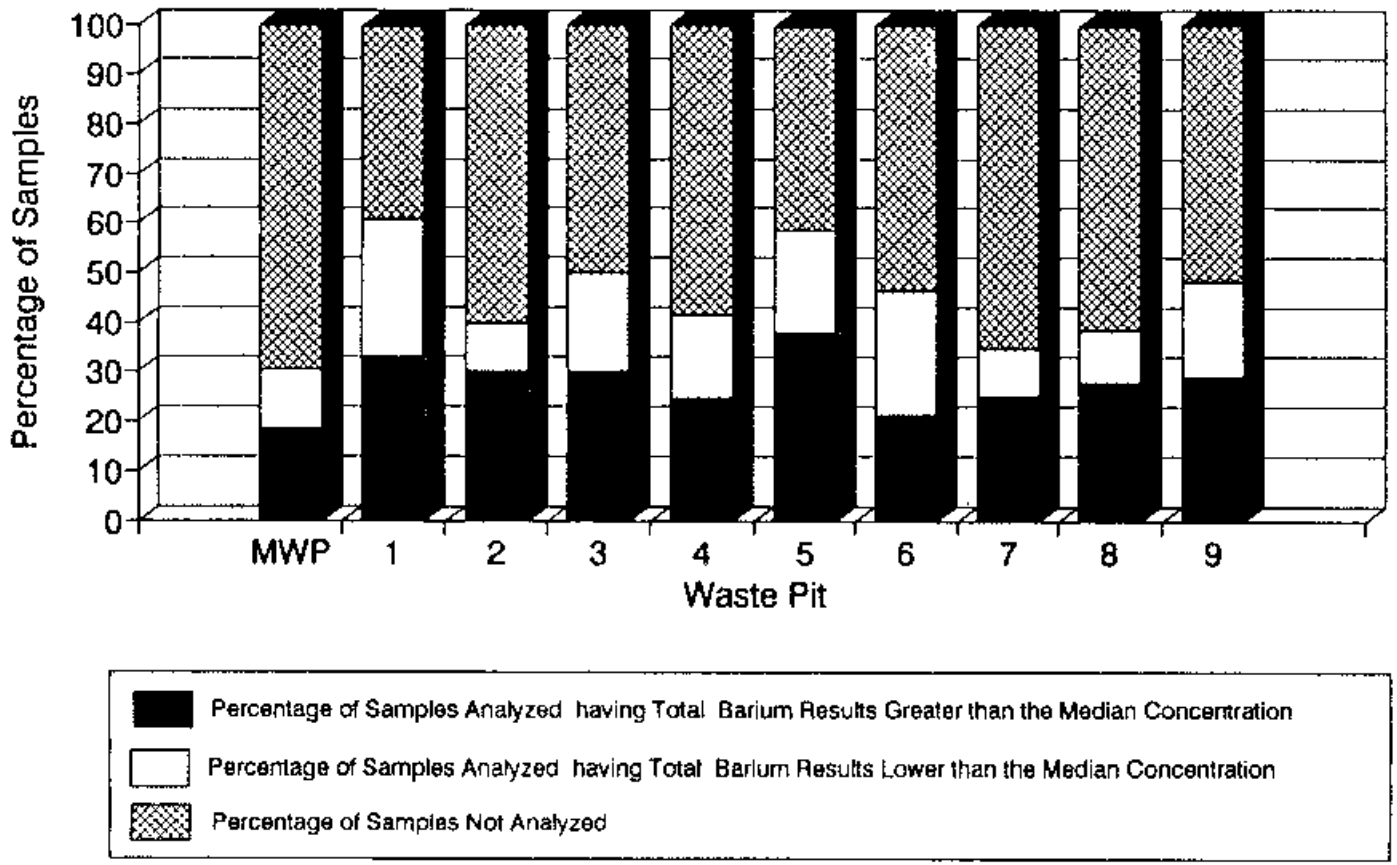


FIGURE 4-15

Texaco Fillmore Remedial Investigation June 1991

Distribution of Samples Selected for TCLP Barium Analysis for All Pits

(Based on Total Barium Concentrations)

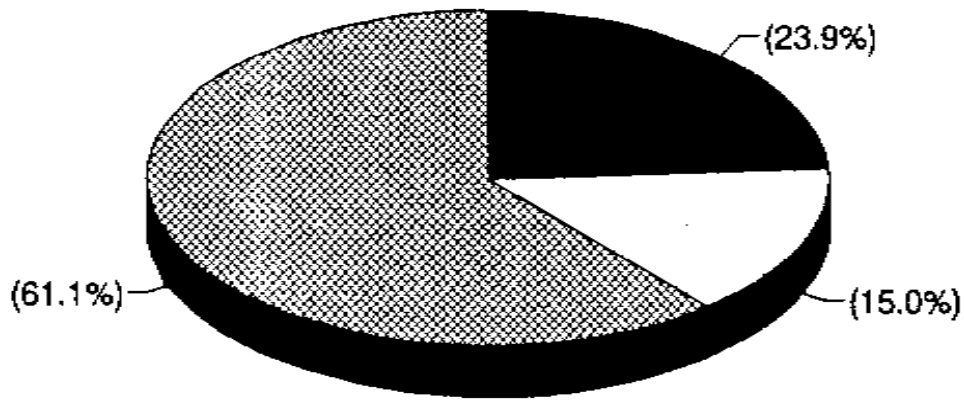


FIGURE 4-16

Texaco Fillmore Remedial Investigation June 1991

TABLE 4-23

TCLP Barium - Subsurface Soil

Main Waste Pit Region

Constituent	Barium Concentrations (ug/l)																					
Location	MAIN WASTE PIT														PIT 2		MONITORING WELLS					
Borehole	BH-1	BH-2	BH-3	BH-4	BH-5	BH-6	BH-7	BH-8	BH-9	BH-10	BH-11	BH-12	BH-13	BH-14	BH-1	BH-2	MW21	MW22S	MW22D	MW23	MW24	MW25D	MW25S
Elev. (FT)																							
525								911						943	611								
520								846							1040	837							
515								1280						456	902								
510								1680						1350		487							
505													218		630								
500			1120											18.5									
495			895		1270								132		714								
490	770													1050								1000	1040
485	2280		671				854					750			242	731						701	
480	845	1320		452			578				645			506		817						665	
475	336	1470		518									125										1110
470	1140		1640		770							486	637		1570	857						953 J	
465		1250			758				1410 J														
		1190			690	251 J	700					1480											
460	761 2110		2640		1770		593					1140	2440										
				871			387																
455		1160			83.1		1480		1280 J			1220	1180	2230									
450	1970								1620 J	1120				1400								1290	
445	1660			367									820				422					1590	1320
440							873		1840 J													1470	
435	1930			490				1390	633 J														
430	1690											1390											
												1310											
425			1640					1400				1410					1230						
420								1280				1110											
415																						3680	
410																							
405								2150														2110	

J : Estimated values
Threshold Level for Barium : 1,000 ug/l

Texaco Fillmore Remedial Investigation, Aug-Oct, 90

TABLE 4-23 (cont.)

TCLP Barium - Subsurface Soil

Southern Region

Constituent	Barium Concentrations (ug/l)															
Location	PIT 3				PIT 4						SUSPECT PIT		MONITORING WELLS			BKGND
Borehole	BH-1	BH-2	BH-3	BH-4	BH-1	BH-2	BH-3	BH-4	BH-5	BH-6	BH-1	BH-2	MW18	MW19	MW20	BH-4
Depth (FT)																
5	1610		1530	687			776		449 J	536	688					
10	1150							279				917				
15		985	1150					649	446 J							
	951	1730														
20	1280	924				787				1150	900					
25		1540			807											
30	1090		903	823	928	976	1150					897				
								877								
35	1100	1340		875		1880	904	1030								
											693					
40				258	1540	1330		417		1040		812		690 J		
							1220									
45		1540	1090			1010	607		758 J		861		814			
		1080			606						1070					
50								431		884	436					
55		648	1100									516				
60			1430								1430				1650	
65											1400				1710	
70		1230														
75															744	
80											1640				1190	
85																

J : Estimated values

Threshold Level for Barium : 1,000 ug/l

Texaco Fillmore Remedial Investigation, Aug-Oct, 90

TABLE 4-23 (cont.)

TCLP Barium - Subsurface Soil
Hill Region

Constituent	Barium Concentrations (ug/l)								
Location	PIT 5		PIT 6		PIT 7		PIT 8		BG
Borehole	BH-1	BH-2	BH-1	BH-2	BH-1	BH-2	BH-1	BH-2	BH-1
Depth (FT)									
5	259	932				181	703		
10	374						469	992	
						705			
15		450	225	124			240	1900	
20	1450			315		544		1080	
25	519			233	448	751			
30	936	868	217					2290	
		1250							
35		523		397	567				
40	795	895	301	276	634		823	1980	
45	1010			242					
				190					
50							1170		
55				296					
60								1650	
65	659								
70									
75							196		
80	1690			612					
85	2120			1570					
90							217		
95									
100									
105							277		

J : Estimated values

Threshold Level for Barium : 1,000 ug/l

TABLE 4-23 (cont.)

TCLP Barium - Subsurface Soil

Northern Region

Constituent	Barium Concentrations (ug/l)				
Location	PIT 1		BACKGROUND		
Borehole	BH-1	BH-2	BH-2	BH-3	BH-5
Depth (FT)					
5	1200	637			
10	1900	169			
15	436	409			
20	411				
25		680			
	91.8				
30					
35					
40		318			

J : Estimated values

Threshold Level for Barium : 1,000 ug/l

Texaco Fillmore Remedial Investigation, Aug-Oct, 90

TABLE 4-23 (cont.)

TCLP Barium - Subsurface Soil

Soil Gas Area

Constituent	Barium Concentrations (ug/l)			
Location	SOIL GAS AREA			
Borehole	BH-1	BH-2	BH-3	BH-4
Depth (FT)				
5				
10				
15			347	390
20				
25		281 J		
30				
35				
40			480	
45				
50				
55	721	858 J		
60				

J : Estimated values

Threshold Level for Barium : 1,000 ug/l

Texaco Fillmore Remedial Investigation, Aug-Oct, 90

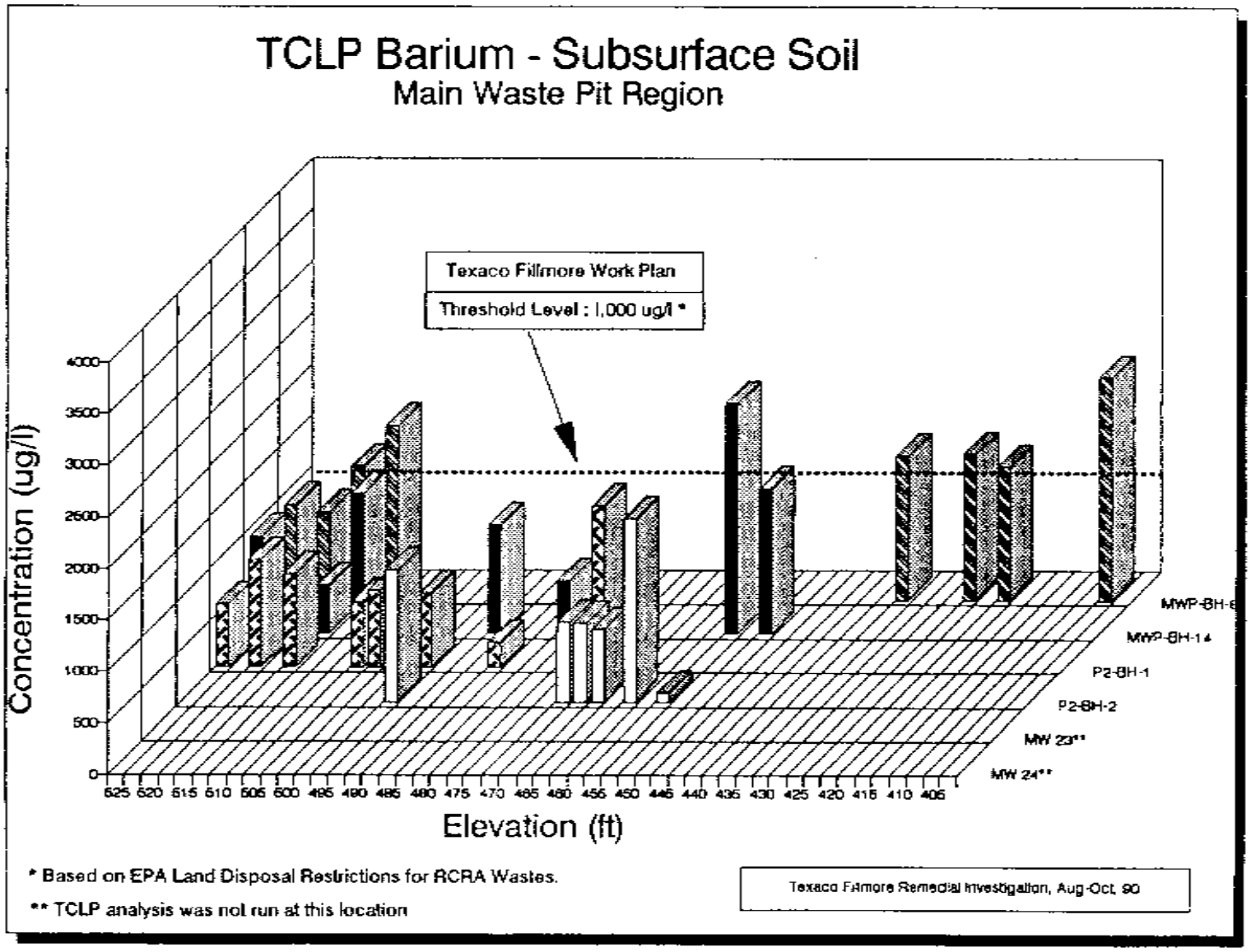

TCLP Barium - Subsurface Soil
Main Waste Pit Region
Texaco Fillmore Work Plan
Threshold Level : 1,000 ug/l *
Concentration (ug/l)
4000
3500
3000
2500
2000
1500
1000
500
0
525 520 515 510 505 500 495 490 485 480 475 470 465 460 455 450 445 440 435 430 425 420 415 410 405
Elevation (ft)
MWP-BH-6
MWP-BH-14
P2-BH-1
P2-BH-2
MW 23**
MW 24**
* Based on EPA Land Disposal Restrictions for RCRA Wastes.
** TCLP analysis was not run at this location
Texaco Fillmore Remedial Investigation, Aug-Oct. 90

FIGURE 4-17

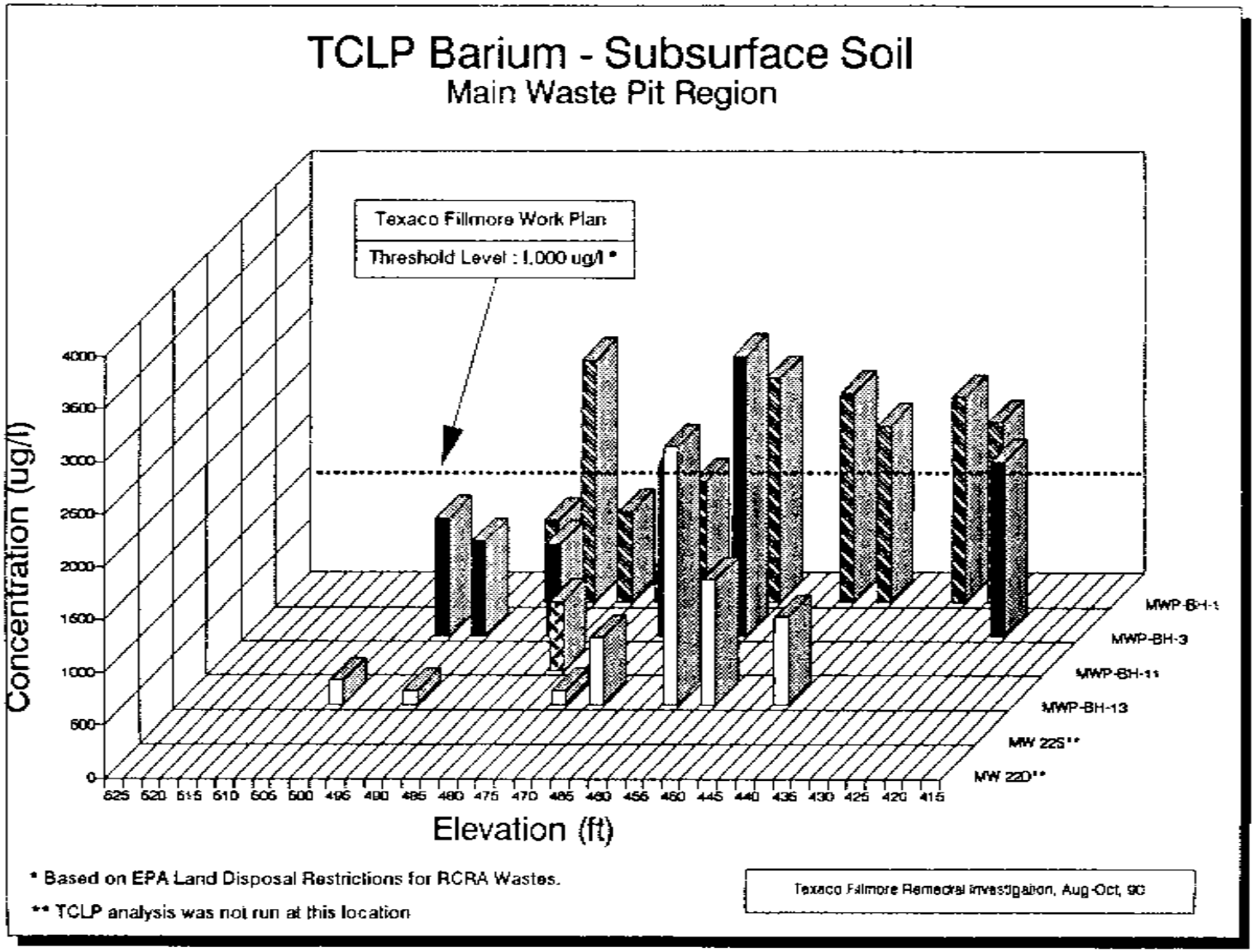

TCLP Barium - Subsurface Soil
Main Waste Pit Region
Texaco Fillmore Work Plan
Threshold Level : 1,000 ug/l *
Concentration (ug/l)
4000
3600
3000
2500
2000
1600
1000
500
0
625 620 615 610 605 600 495 490 485 480 475 470 465 460 455 450 445 440 435 430 425 420 415
Elevation (ft)
MWP-BH-1
MWP-BH-3
MWP-BH-11
MWP-BH-13
MW 22S**
MW 22D**
* Based on EPA Land Disposal Restrictions for RCRA Wastes.
** TCLP analysis was not run at this location
Texaco Fillmore Remedial Investigation, Aug-Oct, 90

FIGURE 4-18

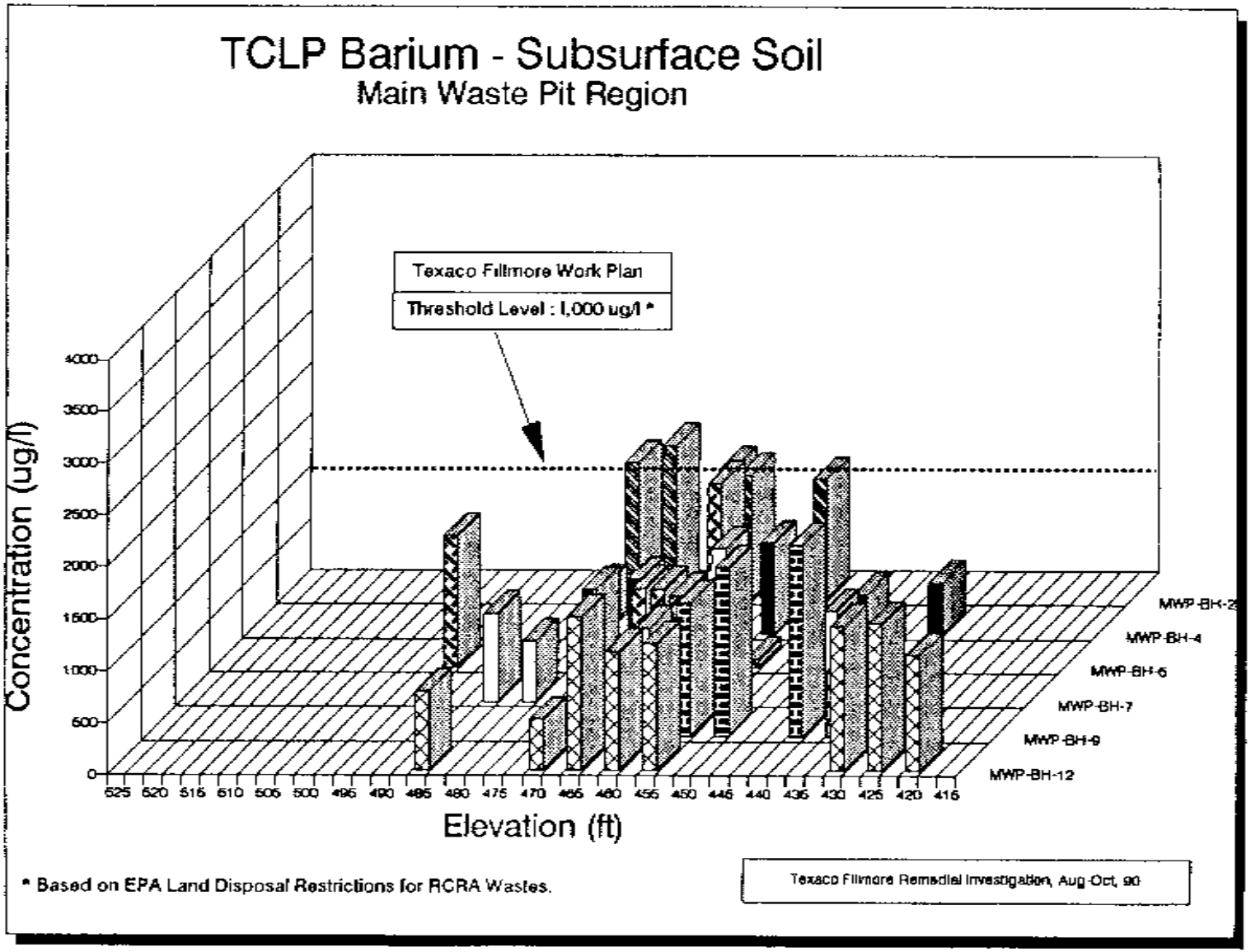

TCLP Barium - Subsurface Soil
Main Waste Pit Region
Texaco Fillmore Work Plan
Threshold Level : 1,000 ug/l *
Concentration (ug/l)
4000
3500
3000
2500
2000
1500
1000
500
0
525 520 515 510 505 500 495 490 485 480 475 470 465 460 455 450 445 440 435 430 425 420 415
Elevation (ft)
MWP-BH-2
MWP-BH-4
MWP-BH-6
MWP-BH-7
MWP-BH-9
MWP-BH-12
* Based on EPA Land Disposal Restrictions for RCRA Wastes.
Texaco Fillmore Remedial Investigation, Aug-Oct, 90

FIGURE 4-19

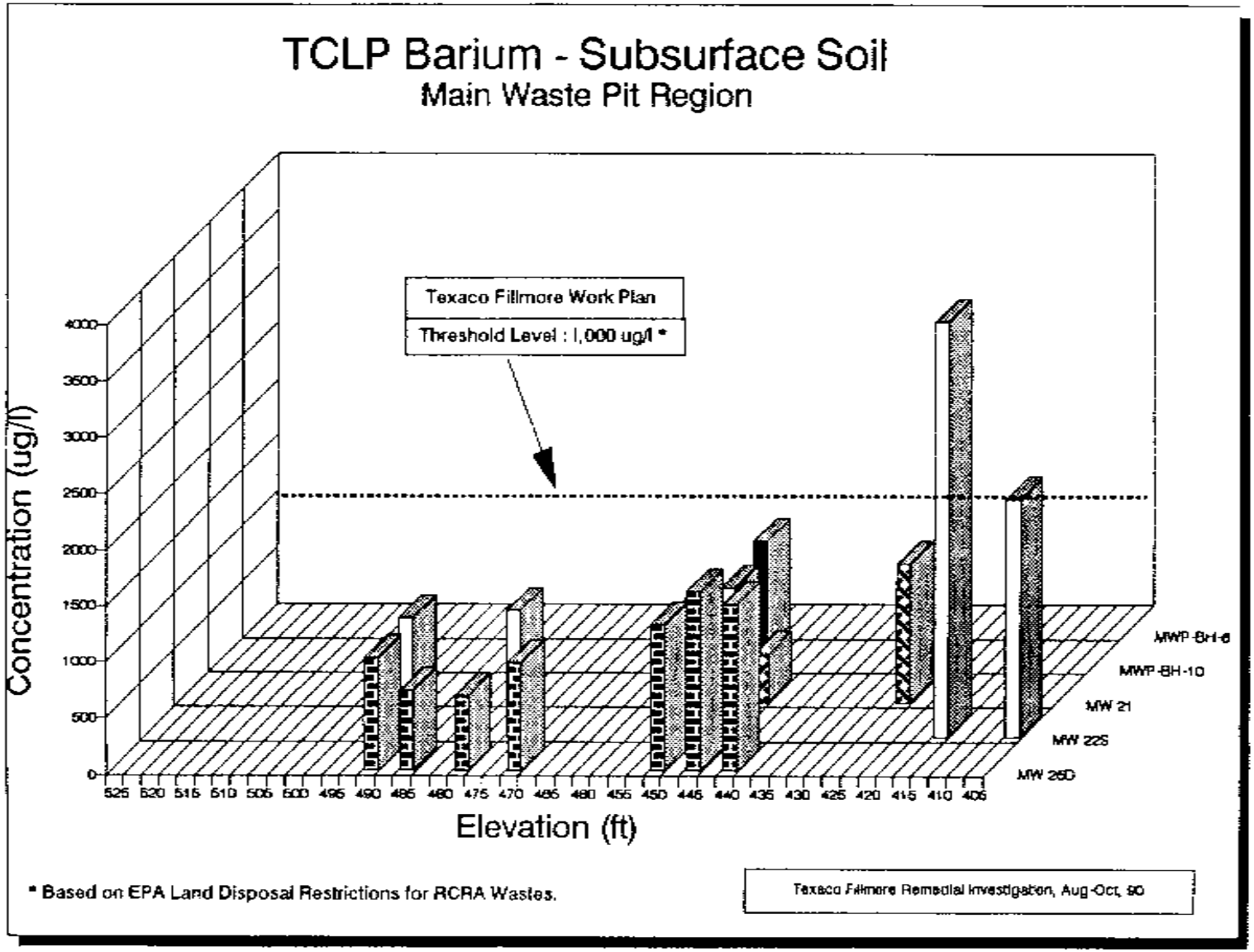

TCLP Barium - Subsurface Soil
Main Waste Pit Region
Texaco Fillmore Work Plan
Threshold Level : 1,000 ug/l *
Concentration (ug/l)
4000
3500
3000
2500
2000
1500
1000
500
0
525 520 515 510 505 500 495 490 485 480 475 470 465 460 455 450 445 440 435 430 425 420 415 410 405
Elevation (ft)
MWP-BH-9
MWP-BH-10
MW 21
MW 22S
MW 25D
* Based on EPA Land Disposal Restrictions for RCRA Wastes.
Texaco Fillmore Remedial Investigation, Aug-Oct, 90

FIGURE 4-20

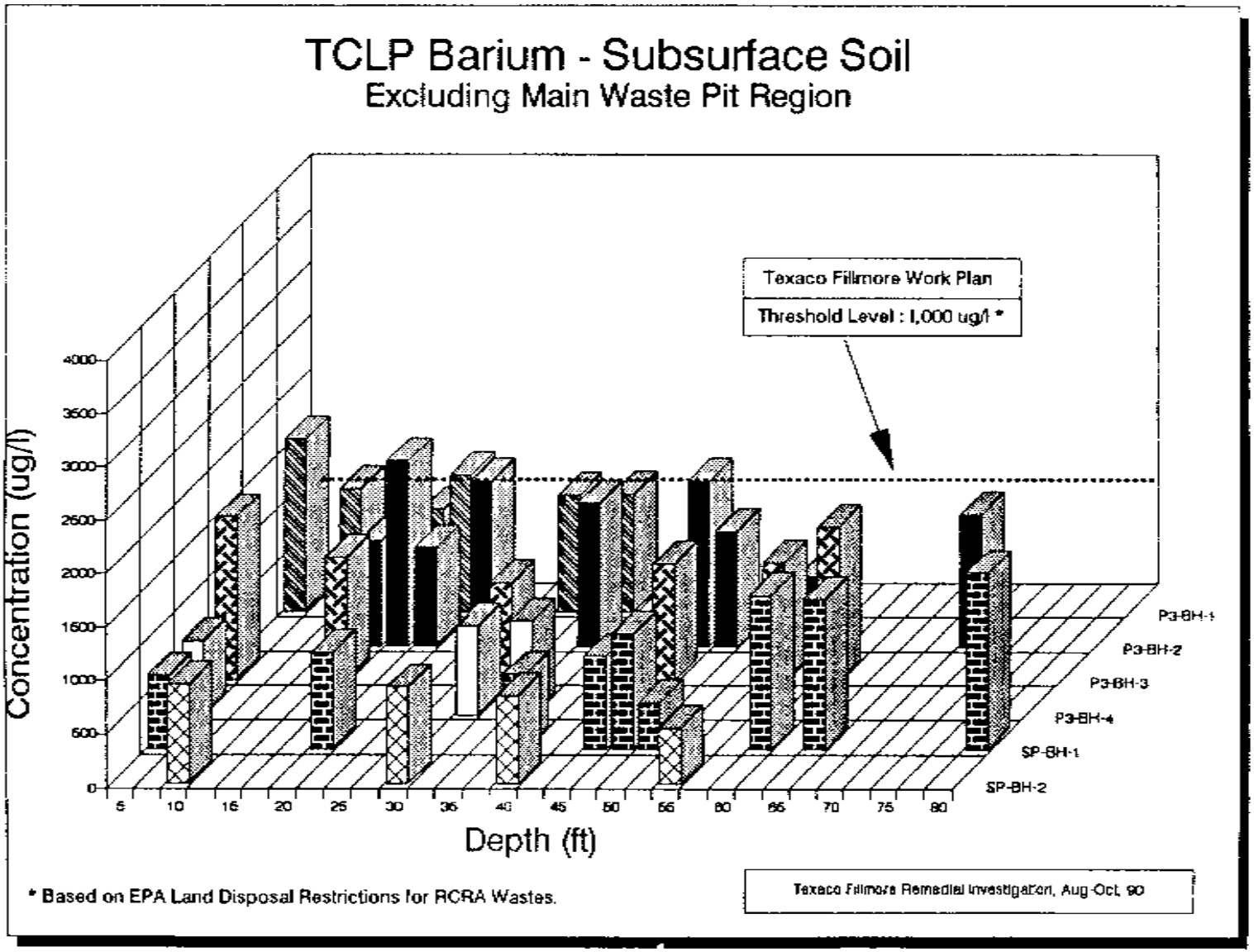

TCLP Barium - Subsurface Soil
Excluding Main Waste Pit Region
Texaco Fillmore Work Plan
Threshold Level : 1,000 ug/l *
Concentration (ug/l)
4000
3500
3000
2500
2000
1500
1000
500
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
Depth (ft)
P3-BH-1
P3-BH-2
P3-BH-3
P3-BH-4
SP-BH-1
SP-BH-2
* Based on EPA Land Disposal Restrictions for RCRA Wastes.
Texaco Fillmore Remedial Investigation, Aug-Oct, 90

FIGURE 4-21

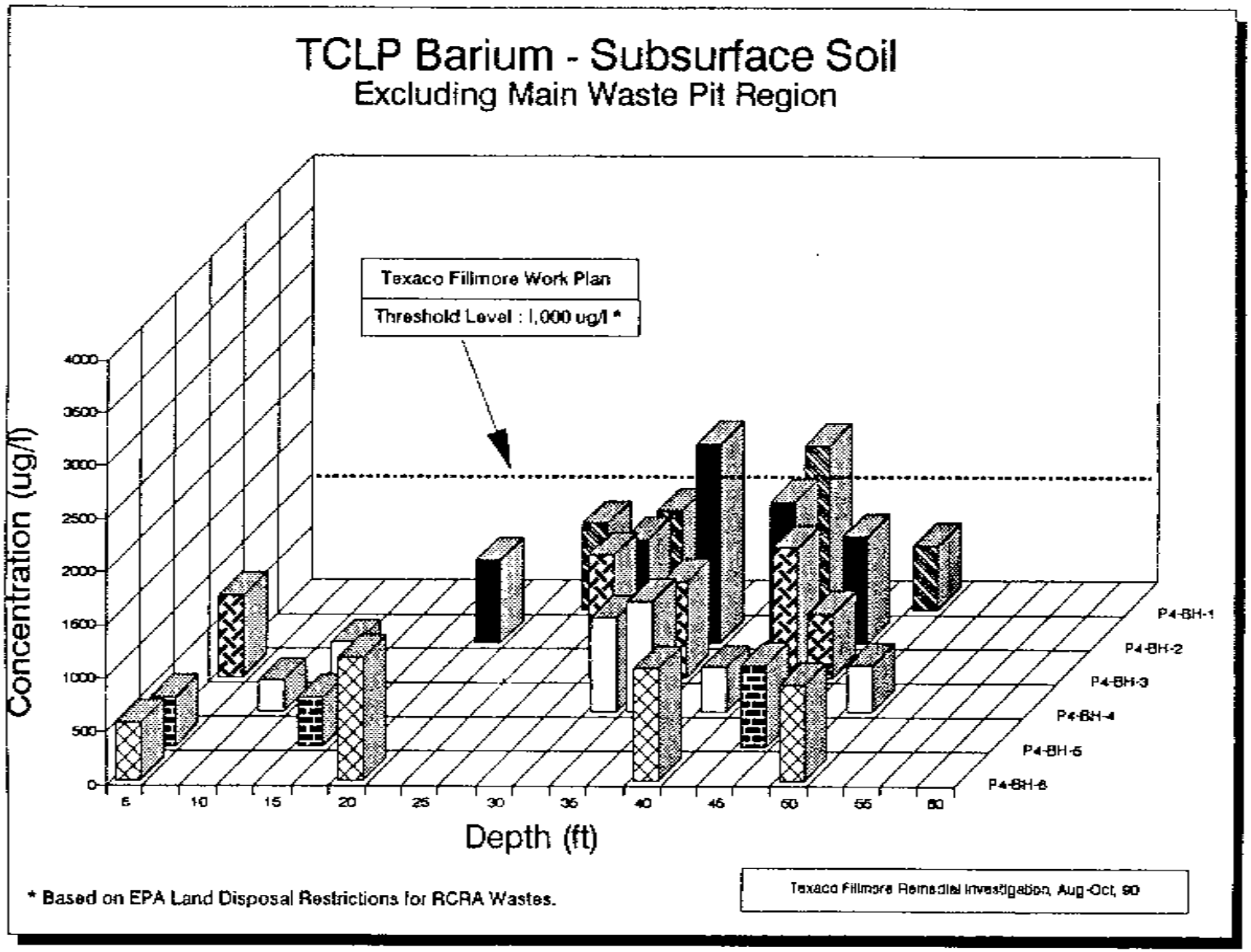

TCLP Barium - Subsurface Soil
Excluding Main Waste Pit Region
Texaco Fillmore Work Plan
Threshold Level : 1,000 ug/l *
Concentration (ug/l)
4000
3500
3000
2500
2000
1500
1000
500
0
5
10
15
20
25
30
35
40
45
50
55
60
Depth (ft)
P4-BH-1
P4-BH-2
P4-BH-3
P4-BH-4
P4-BH-5
P4-BH-6
* Based on EPA Land Disposal Restrictions for RCRA Wastes.
Texaco Fillmore Remedial Investigation, Aug-Oct, 90

FIGURE 4-22

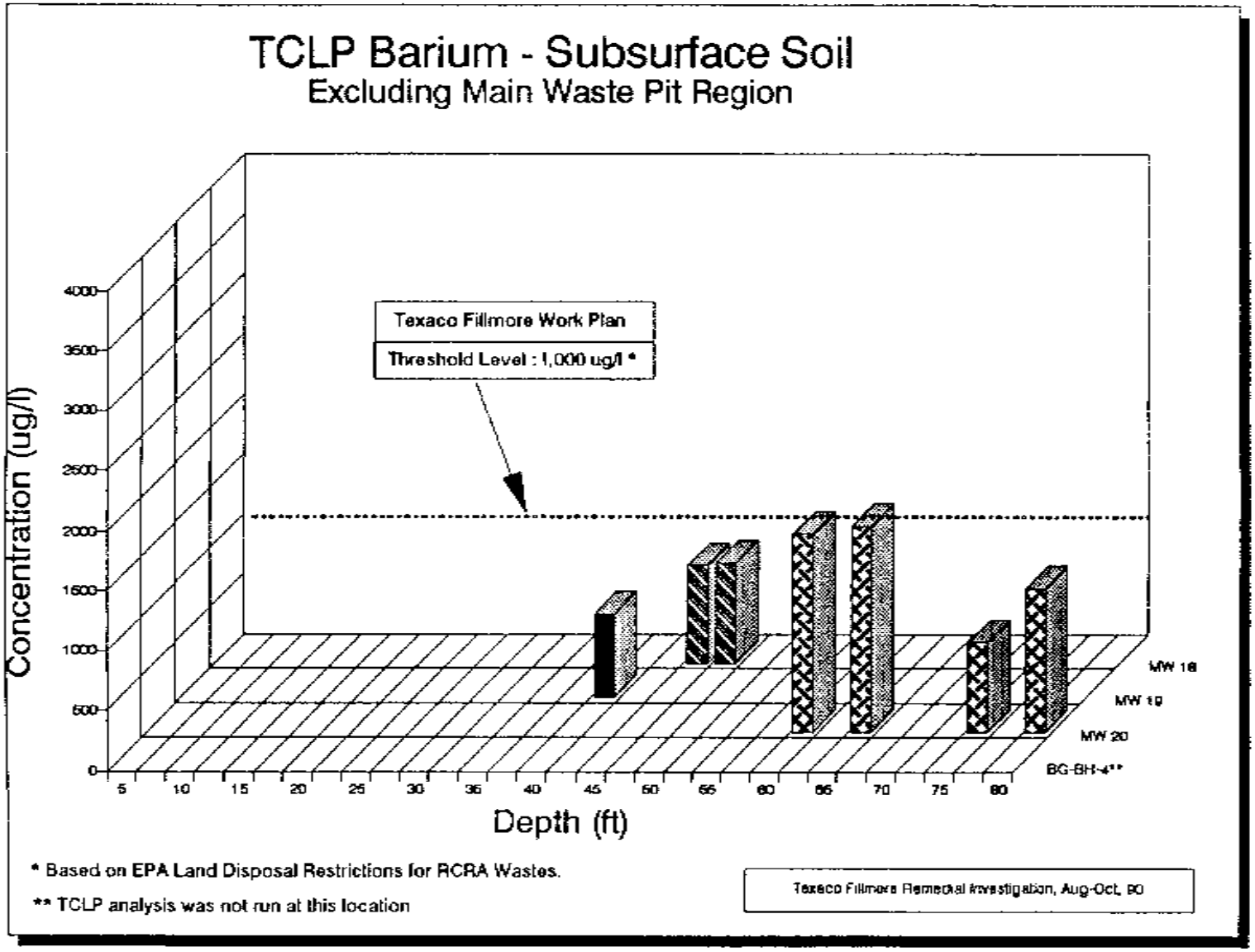

TCLP Barium - Subsurface Soil
Excluding Main Waste Pit Region
Concentration (ug/l)
4000
3500
3000
2500
2000
1500
1000
500
0
Texaco Fillmore Work Plan
Threshold Level : 1,000 ug/l *
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
Depth (ft)
MW 18
MW 19
MW 20
BG-BH-4**
* Based on EPA Land Disposal Restrictions for RCRA Wastes.
** TCLP analysis was not run at this location
Texaco Fillmore Remedial Investigation, Aug-Oct, 90

FIGURE 4-23

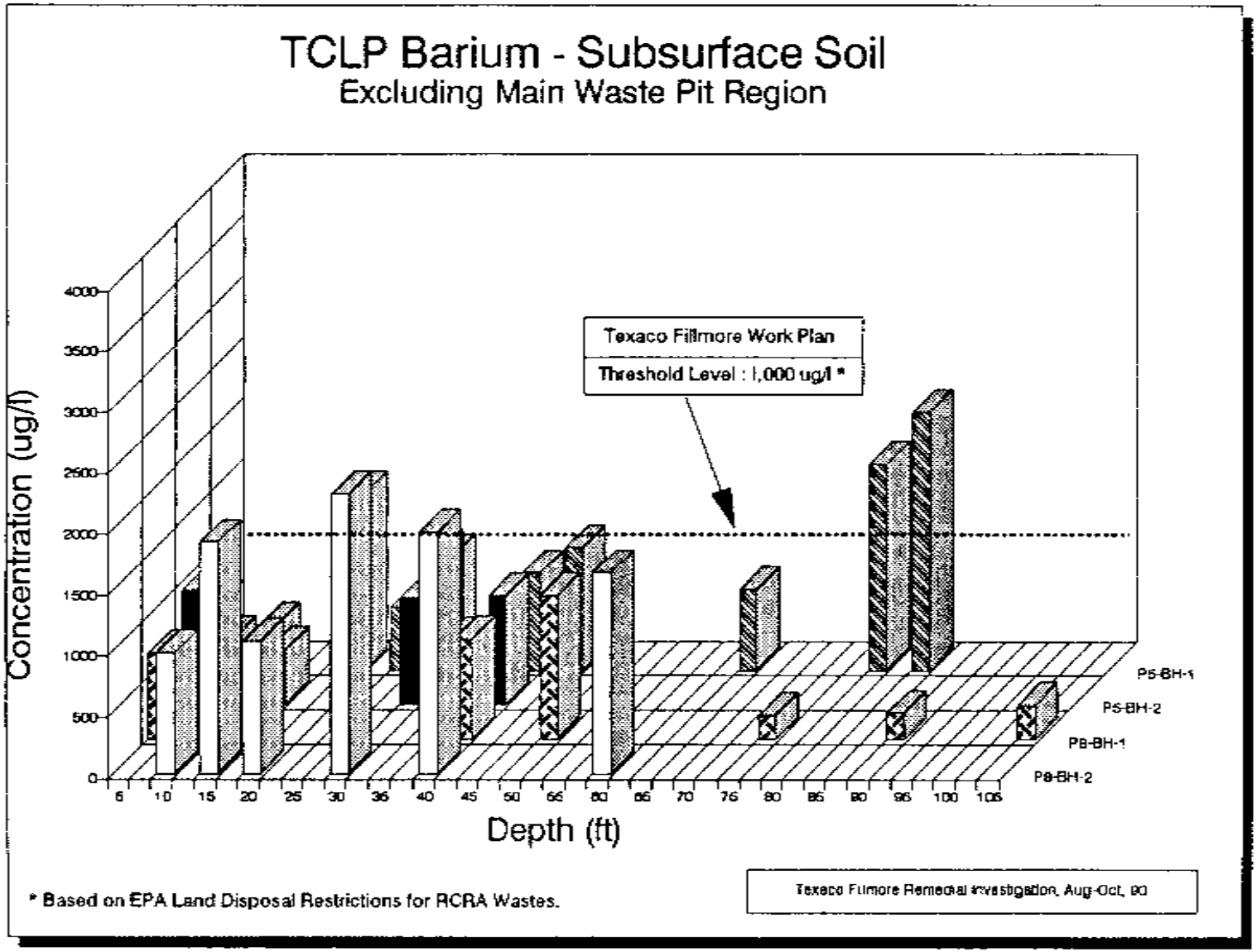

TCLP Barium - Subsurface Soil
Excluding Main Waste Pit Region
Concentration (ug/l)
4000
3500
3000
2500
2000
1500
1000
500
0
Texaco Fillmore Work Plan
Threshold Level : 1,000 ug/l *
P5-BH-1
P5-BH-2
P8-BH-1
P8-BH-2
5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105
Depth (ft)
* Based on EPA Land Disposal Restrictions for RCRA Wastes.
Texaco Fillmore Remedial Investigation, Aug-Oct, 90

FIGURE 4-24

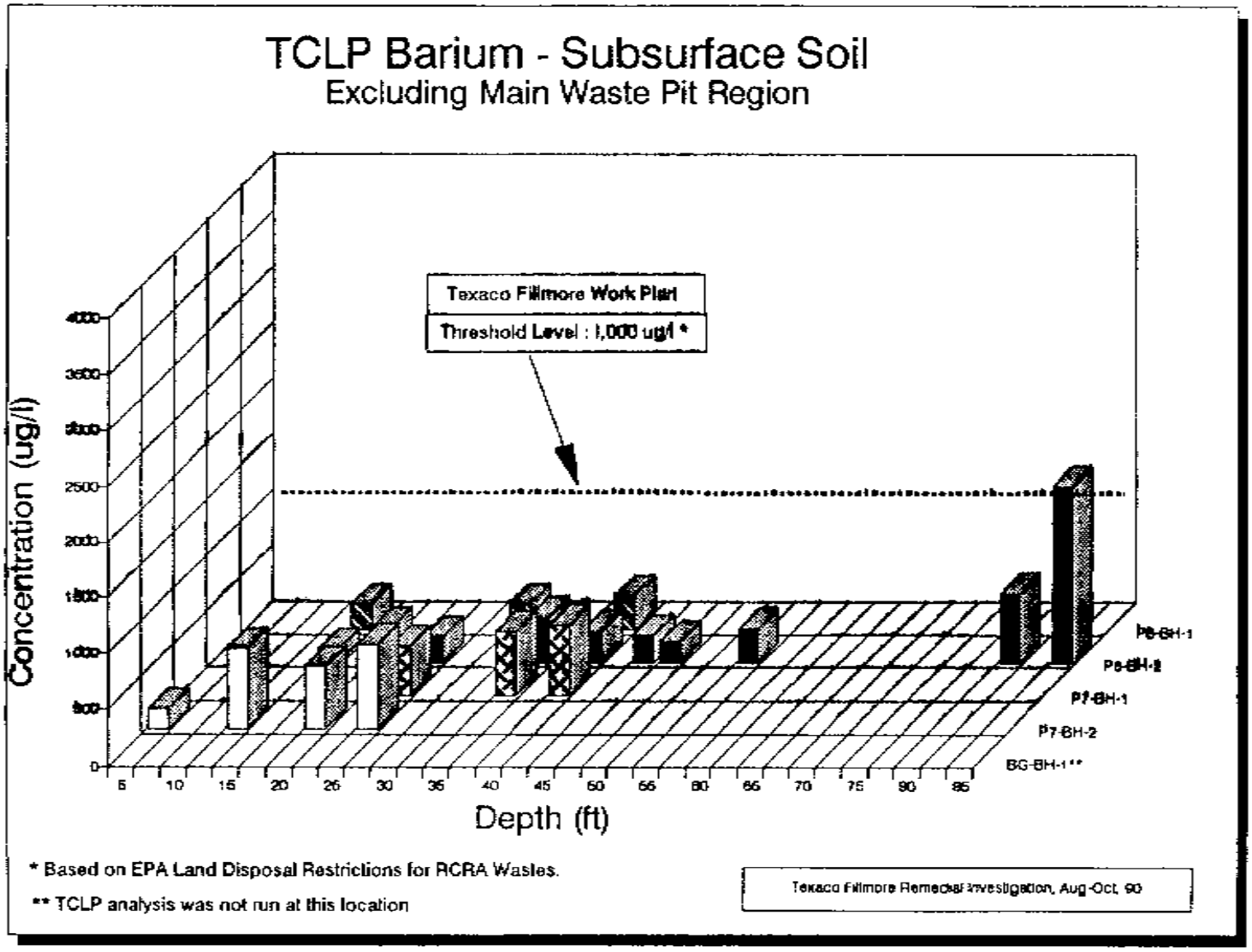

TCLP Barium - Subsurface Soil
Excluding Main Waste Pit Region
Texaco Fillmore Work Plan
Threshold Level : 1,000 ug/l *
Concentration (ug/l)
4000
3500
3000
2500
2000
1500
1000
500
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
Depth (ft)
P6-BH-1
P6-BH-2
P7-BH-1
P7-BH-2
BG-BH-1 **
* Based on EPA Land Disposal Restrictions for RCRA Wastes.
** TCLP analysis was not run at this location
Texaco Fillmore Remedial Investigation, Aug-Oct 90

FIGURE 4-25

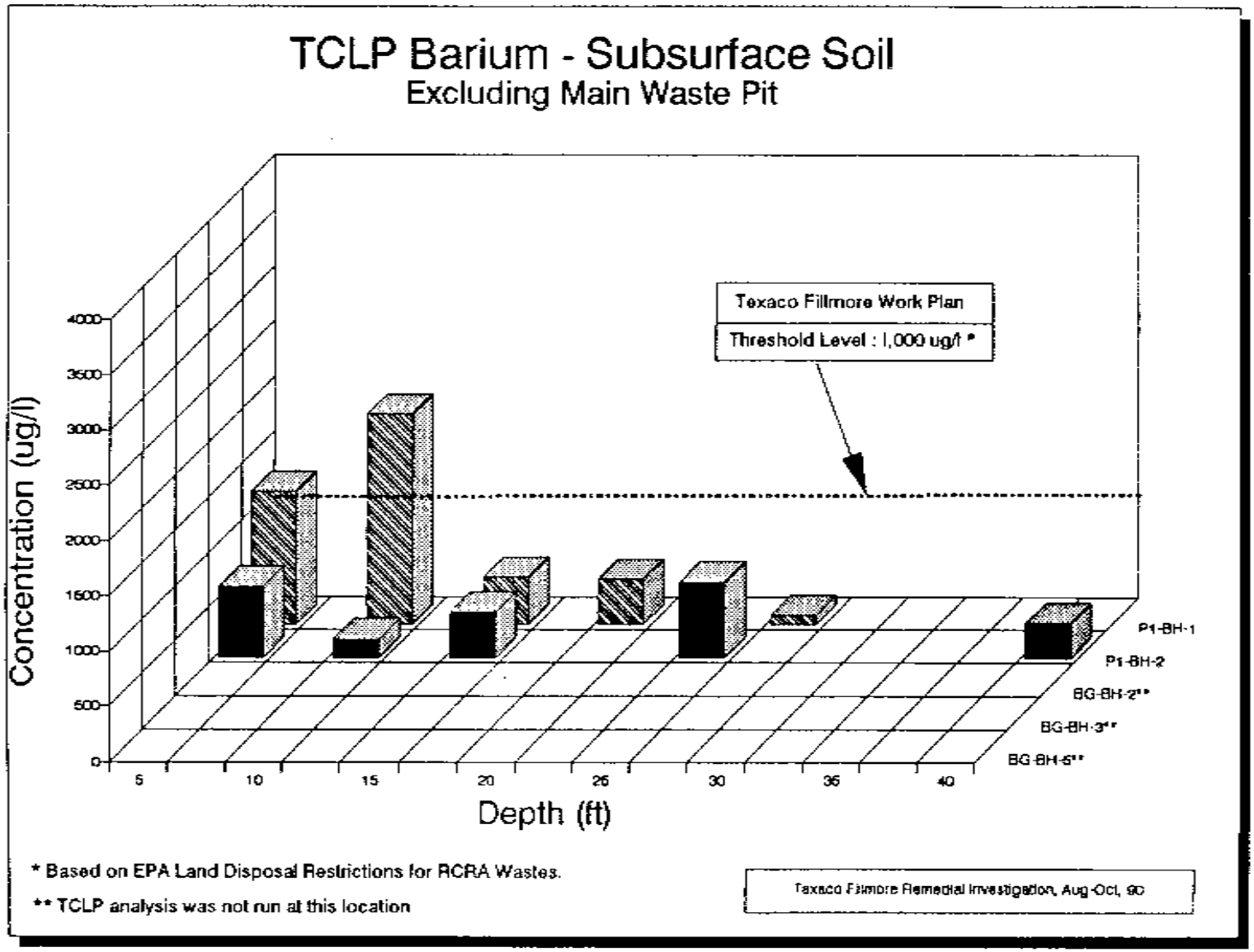

TCLP Barium - Subsurface Soil
Excluding Main Waste Pit
Texaco Fillmore Work Plan
Threshold Level : 1,000 ug/l *
Concentration (ug/l)
4000
3500
3000
2500
2000
1500
1000
500
0
5
10
15
20
26
30
36
40
Depth (ft)
P1-BH-1
P1-BH-2
BG-BH-2**
BG-BH-3**
BG-BH-5**
* Based on EPA Land Disposal Restrictions for RCRA Wastes.
** TCLP analysis was not run at this location
Texaco Fillmore Remedial Investigation, Aug-Oct, 90

FIGURE 4-26

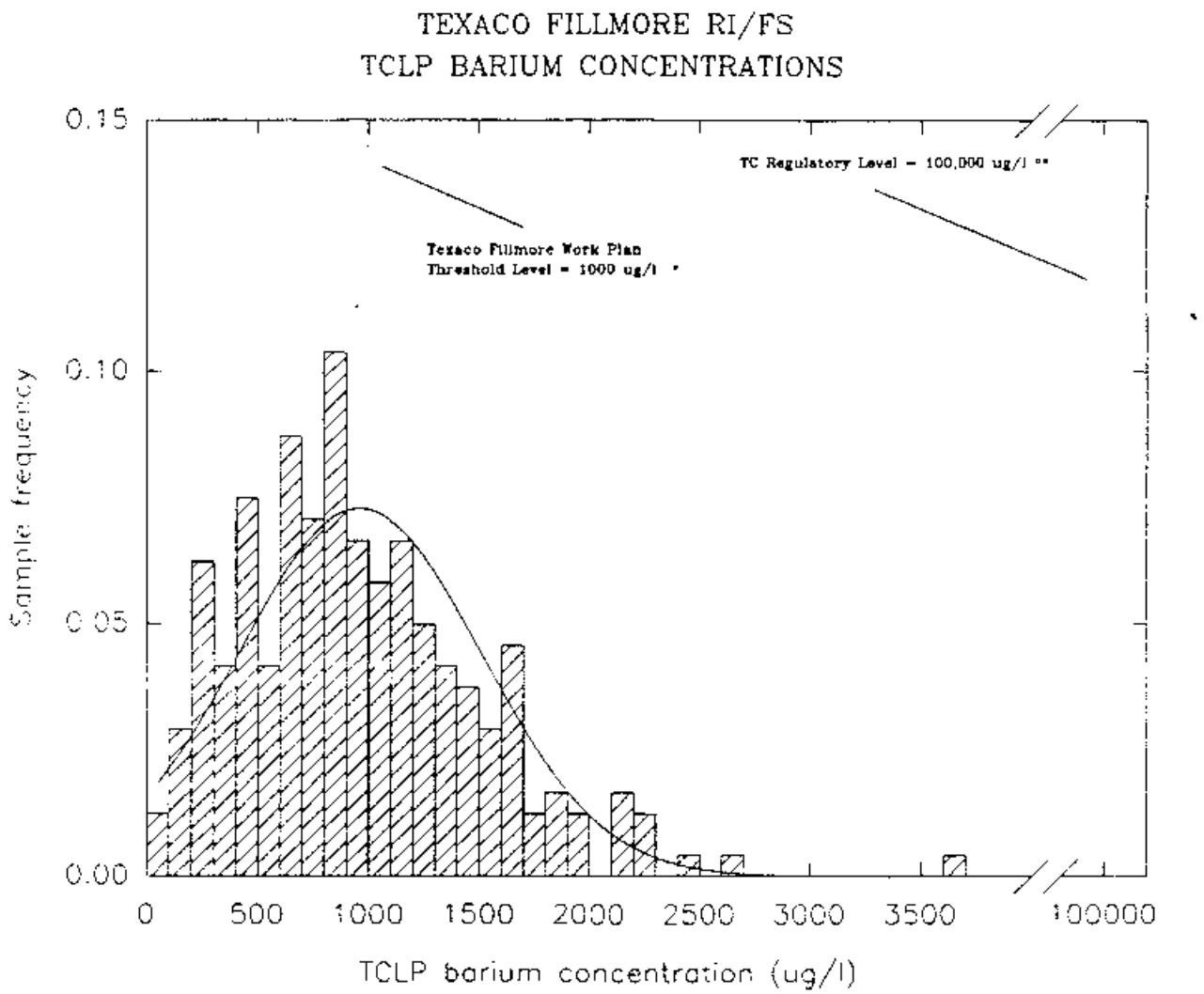

TEXACO FILLMORE RI/FS
TCLP BARIUM CONCENTRATIONS
TC Regulatory Level = 100,000 ug/l **
Texaco Fillmore Work Plan
Threshold Level = 1000 ug/l *
Sample frequency
0.15
0.10
0.05
0.00
0
500
1000
1500
2000
2500
3000
3500
100000
TCLP barium concentration (ug/l)
* Based on EPA land disposal restrictions standards for RCRA first third wastes
** General Toxicity Characteristic regulatory level for non listed RCRA constituents

FIGURE 4-27

statistical distribution of TCLP concentrations for barium for the entire facility. As shown in the graph, the average barium concentration of the samples is near the FSP designated TCLP threshold level, which is the lowest standard identified in 40 CFR 268 for land disposal restrictions under RCRA. However, the highest TCLP concentration of barium measured at the facility (3,680 µg/l) is 27 times lower than the general toxicity characteristics regulatory level applied to land disposal of barium-bearing wastes.

The curve in Figure 4-27 represents a Gaussian distribution based on the calculated mean and standard deviation of the sample population. The bell shaped curve fits the data rather well which suggests that all samples at the facility come from the same population. That is, it is highly unlikely that concentrations above the threshold have been affected by past facility activities.

A direct correlation between TCLP values and total values is impossible to establish as shown in Figure 4-28. The calculated correlation coefficient of 0.022 illustrates how poor the correlation is. It is very probable that the soil type of the samples has a greater impact on the TCLP results than the total values.

4.1.6.5 Cadmium

Total cadmium results are presented in Table 4-24. The data do not appear to vary geographically or with depth. A better representation is given in Figure 4-29 for boreholes in the MWP Region and in Figure 4-30 for all other boreholes. The range of values (0.63 to 31.6 mg/kg) does not vary with depth. The average concentration of the population is 4.7 mg/kg and the standard deviation is 2.28. A total of 201 samples have concentrations above the upper limit for background calculated in Section 4.1.6, representing 30 percent of the total number of samples.

Figure 4-31 presents the normalized frequencies of cadmium concentrations for the background an site characterization sample populations. The curves represent Gaussian distributions based on the calculated mean and average for both populations. Using an unpaired Student's t-test, it is not possible to confirm with 90 percent confidence that the background samples and the characterization samples come from a different population.

Based on the total cadmium results, from 30 to 55 percent of the samples with the highest concentrations were screened for TCLP cadmiun extraction and analysis. Table 4-25 presents a breakdown of the number and distribution of samples selected for TCLP analysis. Figures 4-32 and 4-33 are plots of the distribution of that data by waste pit and for the entire

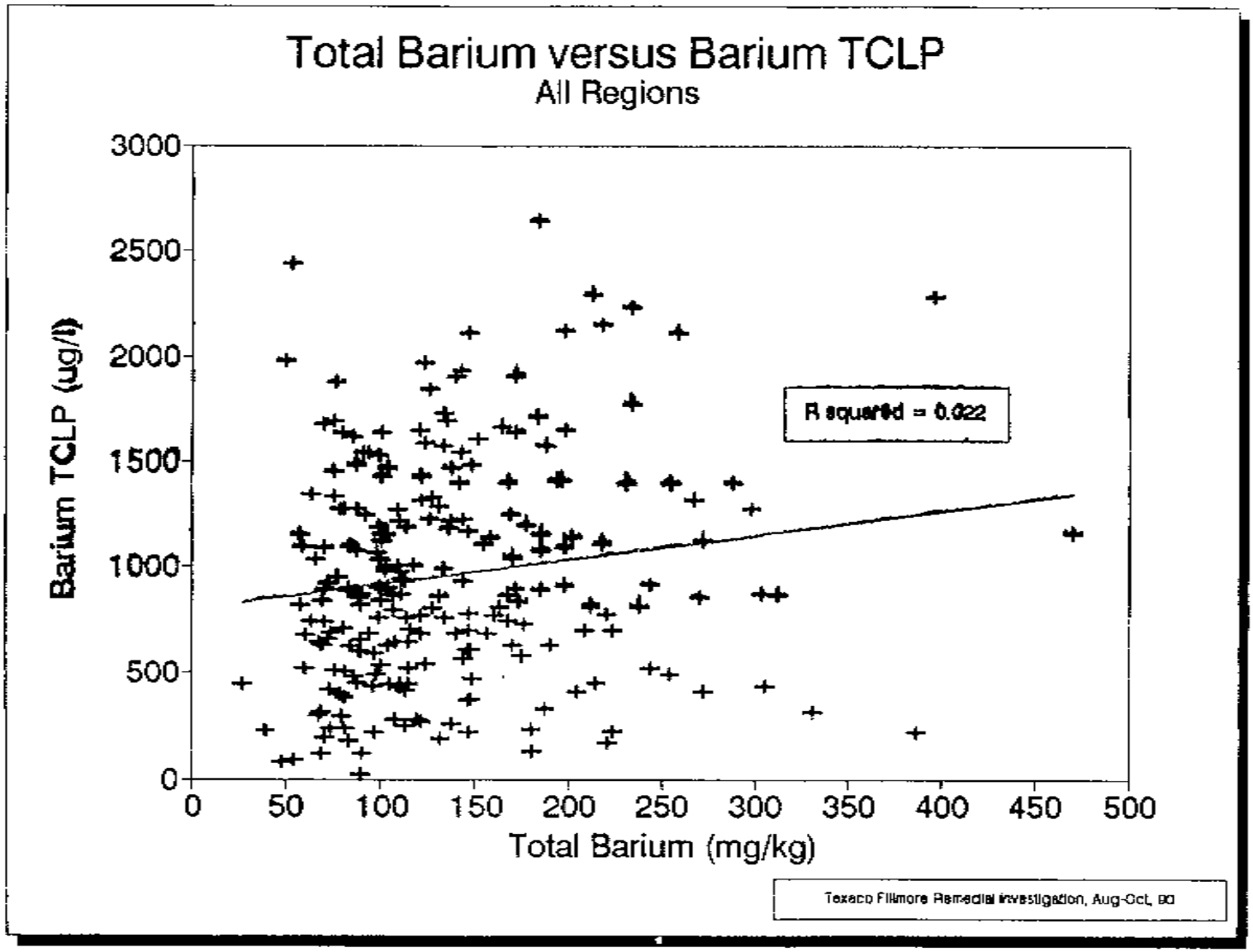

Total Barium versus Barium TCLP
All Regions
Barium TCLP (ug/l)
3000
2500
2000
1500
1000
500
0
0
50
100
150
200
250
300
350
400
450
500
Total Barium (mg/kg)
R squared = 0.022
Texaco Fillmore Remedial Investigation, Aug-Oct, 90

FIGURE 4-28

TABLE 4-24

Total Cadmium - Subsurface Soil

Main Waste Pit Region

Constituent	Cadmium Concentrations (mg/kg)																								
Location	MAIN WASTE PIT															PIT 2		MONITORING WELLS						
Borehole	BH-1	BH-2	BH-3	BH-4	BH-5	BH-6	BH-7	BH-8	BH-9	BH-10	BH-11	BH-12	BH-13	BH-14		BH-1	BH-2	MW21	MW22S	MW22D	MW23	MW24	MW25D	MW25S
ELEV. (FT)																									
525								3.5																	
520								3.9						1.9		4.3	5.7								
515								4						3.8		5.8	5.8								
510								4.3			4.2			5.9		3.9	6.1								
505							0.73	8.8			3.2	2.6	3.3	4.1		5.1	7.5								
500		4.3	5.8		5.3		4.3	4.2		6	4.5	3.3	7	3.5		6.2	6.2								
495	3.6	3.5	5.8	7.3	3	3.2	2.5	4.3	5.1	4.3	2.3	4.4	3.9	2.4		5.1	5.9					4.7			
490	5	4.3	4.1	5.9	3.3	3.1	4.7	3.5	3.5	3.3	3.8	5	9.1	3.3		5.8	7.2								
485	11.2	2	5.4	6.1	2.6	3.4	4.8	5.1	3.7	2.9	4.1	5	4.2	2.6		2.8	6.4						4.2		
480	5.1	5.3	4.8	5.2	4	3.4	6.3	4.6	4.8	4.1	3.1	3.1	4.9	3.9		2.9	6.4						4.1	3.6	
475	6.9	5	4.5	4.3		3.4		4.5	4.9	4.3	5.1	3.7	3.3			9.4	9.3					4	3.2		
470	5.6	4.6	3.6	6.7	4.3	3.9	5.2	4.6	5.2			4.6	3.6	2.4		4.9	5								
465	5.1	3.4	3.9	3.8	3.9	4.6	5	6.5	4.7	6	7.1	3.7	4	5.1		4.4	5		4.6		8.4		4.4		
460	4.2	5	3.2	1.8	4.7	5.1	3.8	3.8	6.5	6.8	3.6	4	5	6.4		4.2	10.1						4.2	7.1	
455	9.6	5.5	8.4	12.6	10.7	4.1	6.7	3.1	6.7	6	3.3	5	5	6.3		6.3	8.7		5.1		6		5.1		
450	2.6	6.3	3.7	10.1	3.7	3.5	8.9	2.5	4.3	6.9	7.4	5	3.3	2.9		3.2	3.4				2.7		4.9		
445	3.4			3		3.2	5.2	10.7	4.3	17.7	7.1	4.3	2.6	4.3							2.2		4		
440	8			3.8		2.6	4.9		6.9	4.5	2	5.8	7.5	4.7					2.3		6.1		4.7	2.8	
435	6.4		1.7	5.5		3.8	4.9	3.5	2.9	4.4	2.9	3	1.6	6.6							2		4		
430	8.9		4	3.2		8.3	3.5	4.7	6.9	3.6	4.1	3.4	5.2	3.9					1.8		6		6.1		
425	5.4		4.5	6.6		4.8		4.9	8.4	7.3	4.9	6.9	7						6		3.4		7	15.2	
420	6		6.9	2.4		5.1			2.6	13.8	13.9	3.6		2.7				5.6	3.4		2.6		7.7	3.3	
415	3.2		1	3.9		1.7		5.3	2.2		5.7	6.2						4.4	2.5		2.6		0.94		
410	5.1		3.8	6.1		3		7	1.2		4	6.1						6			6.2		3.2	ND(0.5)	
405			2.1	2.2		6.7		3.2	2			6.2									3.4		5.3		
400						5.8		3.3				5.3						3.5			4.1				
395								2.3				2.1							2.3		2.9		4.1	6.5	
390												3.8							4.7		2.9		0.63	ND(2.5)	
385								3				5.9							1.8		4.2		1		
																			10.4					7.6	
																			4.5						
																			4.6						
																			3.6						
																			5.1						

Detection limits are shown in parenthesis

TABLE 4-24 (cont.)

Total Cadmium - Subsurface Soil

Southern Region

Constituent	Cadmium Concentrations (mg/kg)															
Location	PIT 3				PIT 4						SUSPECT PIT		MONITORING WELLS			BKGND
Borehole	BH-1	BH-2	BH-3	BH-4	BH-1	BH-2	BH-3	BH-4	BH-5	BH-6	BH-1	BH-2	MW18	MW19	MW20	BH-4
Depth (ft)																
5	2.5	4	5.6	3.9	4.4	4.8	5.7	5.2	3	2.8	2.7	5.4				
10	1.8	4.4	5.3	3.8	4.5	6.4	2.6	4.8	3.4	3.6	2.6	8.2				4.8
15	5.8	4.6	8.4	4	3.6	4.2	3.4	7.2	3.1	4.1	3.8	4.9				
20	6.9 4.7	4.6 6.7	4.6	5.2	3.1	3.9	3.1	5.2	4	3.3	4.3	3.7				6.1
25	3.3	3.8	5.1	4.8	3.8	4	5.4	5.6	4.4	4.4	4.1	3.2				5
30	5.2	6.1	4.9 4.3	5.2	4.2	6.7	4.8	5.8	3.7	4.3	3.5	3.8				
35	4.1	3.8	5.7	4.2 4.1	5	3.9 5.7	4.4	7.1 6.6	3.6 4	4.1	3.5	4.1		4		
40	4	5.8	4.9	4.1	5.9	6.9	4.2	5.3	3.5	5.1	3.9 4.5	4.2 7.1		4.1 4.9		
45	3.6	5.4	3.7 4.6		8.7	5	3.1 6.4	5.2	2.8	5.2 4.4	4.6	4.2	5.5	4.1		
50		4.7 3.9	6.4		10.1	2.4	2.9	6	3.5	4	4.5 4.3	4	3	5.2		
55		31.6	6.1								4.7	3.1 5.1		3.3		
60			5.3								5.8			5.5	3.7	
65		4.4									5.6				5.7	
70		7.2									1.3				4.2	
75		3.4									2.8				5.1 2.5	
80		3.1									6.6				4.7	
85															3	

TABLE 4-24 (cont.)

Total Cadmium - Subsurface Soil

Hill Region

Constituent	Cadmium Concentrations (mg/kg)								
Location	PIT5		PIT6		PIT7		PIT8		BG
Borehole	BH-1	BH-2	BH-1	BH-2	BH-1	BH-2	BH-1	BH-2	BH-1
Depth (ft)									
5	4.2	3.1	2.7	3.8	0.88	1.2	4.2	4.3	5.8
10	3.8	3.1	3.7	2.5	1.6	1.4	6	6.3	4.5
15	3 2.9	4.1	3.4	2.9	0.85	1.8 1.8	4.1	7.1	4.8
20	2.2	3.6	3.5	3	ND(0.5)	1.5	2.3	4.5	7.1
25	4.4	3.4	2.4 1.8	3	(ND(0.5)	4.2	2.9	1.5	
30	7.5	6.6	2.8	2.8	1.2	ND(0.5)	2.4	6.7 2.6	
35	5.4	5.9 6.1	3.4	4.2	9.1	ND(0.5)		5.1	
40	5.3	6.2	2.9	6.3	2.5	ND(0.5)	1.7	0.89	
45	6.8			5.2	3.9		1.2	1.7	
50	4.3			6.4 5.5	2.9	ND(0.5)	2.6	1.4	
55	2.5			7			3.8	10.1	
60	2.8			3.2 2.4			5.9	5.6 4.5	
65	3.1 6.9			2.6			2.5		
70	5.5			2.4			2.8 3		
75	3.2			3.7			2.6		
80	7.1			2.5			6.2		
85	3.4			4.5			2.8		
90	2.1						4.9		
95							3.4 4		
100							1.7		
105							6		

Detection limits are shown in parenthesis

TABLE 4-24 (cont.)

Total Cadmium - Subsurface Soil

Northern Region

Constituent	Cadmium Concentrations (mg/kg)				
Location	PIT 1		BG		
Borehole	BH-1	BH-2	BH-2	BH-3	BH-5
Depth (ft)					
5	5	4.5	5.1		4.2
10	5.9	11.3	3.8	7	3.6
		7.8		4.4	
15	4.5	6	5.2	6.3	3.2
					3.8
20	6.9	6.8	3.9	4.8	4.5
25	5.8	3.4			
	3.6				
30	4.2	6.7			
35	5.2	6.5			
40	4.2	7.4			
45					
50					

TABLE 4-24 (cont.)

Total Cadmium - Subsurface Soil
Soil Gas Area

Constituent	Cadmium Concentrations (mg/kg)			
Location	SOIL GAS AREA			
Borehole	1	2	3	4
Depth (ft)				
5	6.1	4.5	4	4.5
10			6.9	
15				
20		5.4		5.2
25	6			
30				

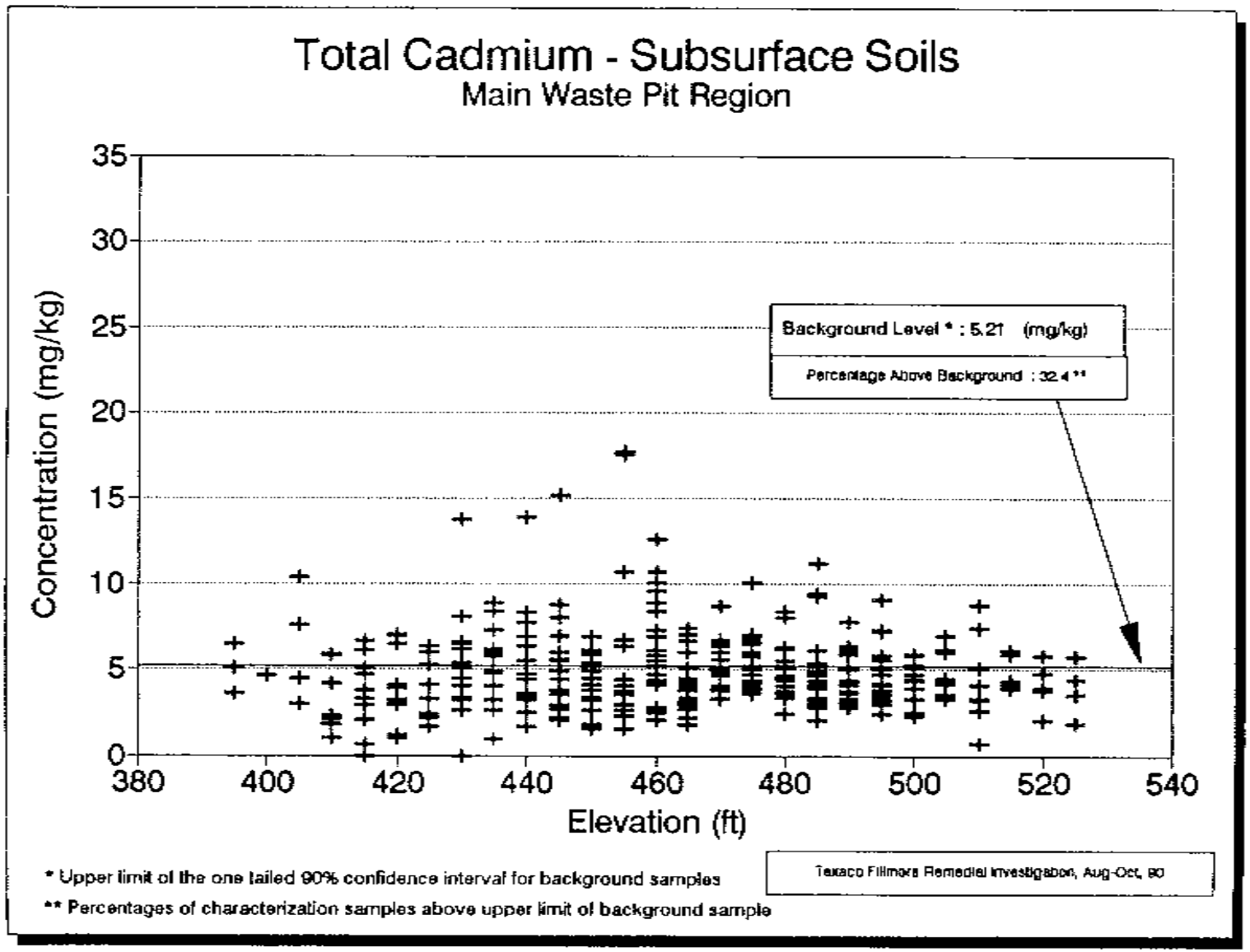

Total Cadmium - Subsurface Soils
Main Waste Pit Region
Concentration (mg/kg)
35
30
25
20
15
10
5
0
380
400
420
440
460
480
500
520
540
Elevation (ft)
Background Level * : 5.21 (mg/kg)
Percentage Above Background : 32.4 **
* Upper limit of the one tailed 90% confidence interval for background samples
** Percentages of characterization samples above upper limit of background sample
Texaco Fillmore Remedial Investigation, Aug-Oct, 90

FIGURE 4-29

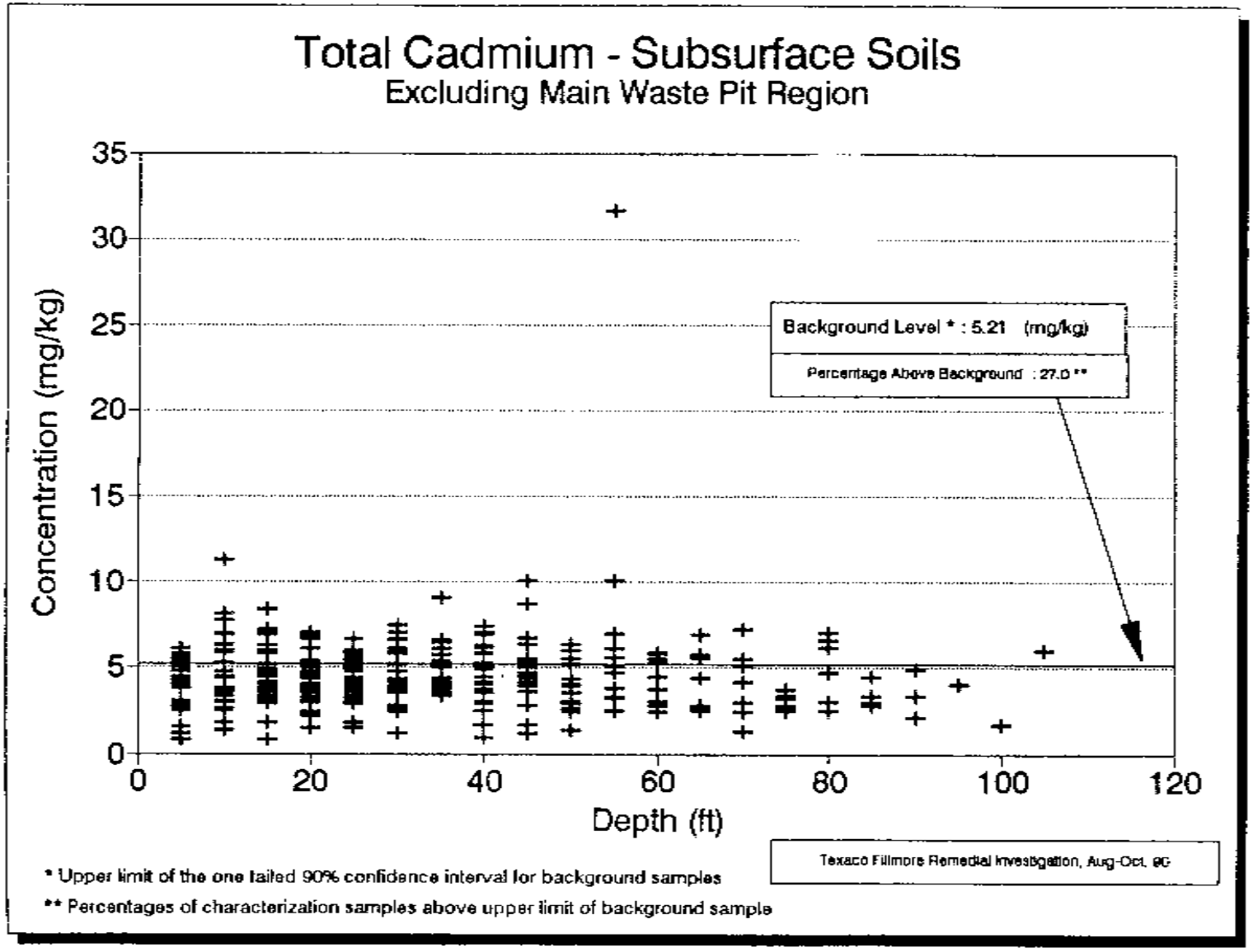

Total Cadmium - Subsurface Soils
Excluding Main Waste Pit Region
Concentration (mg/kg)
Depth (ft)
0
5
10
15
20
25
30
35
0
20
40
60
80
100
120
Background Level * : 5.21 (mg/kg)
Percentage Above Background : 27.0 **
Texaco Fillmore Remedial Investigation, Aug-Oct. 90
* Upper limit of the one tailed 90% confidence interval for background samples
** Percentages of characterization samples above upper limit of background sample

FIGURE 4-30

TEXACO FILLMORE RI/FS
TOTAL CADMIUM CONCENTRATIONS

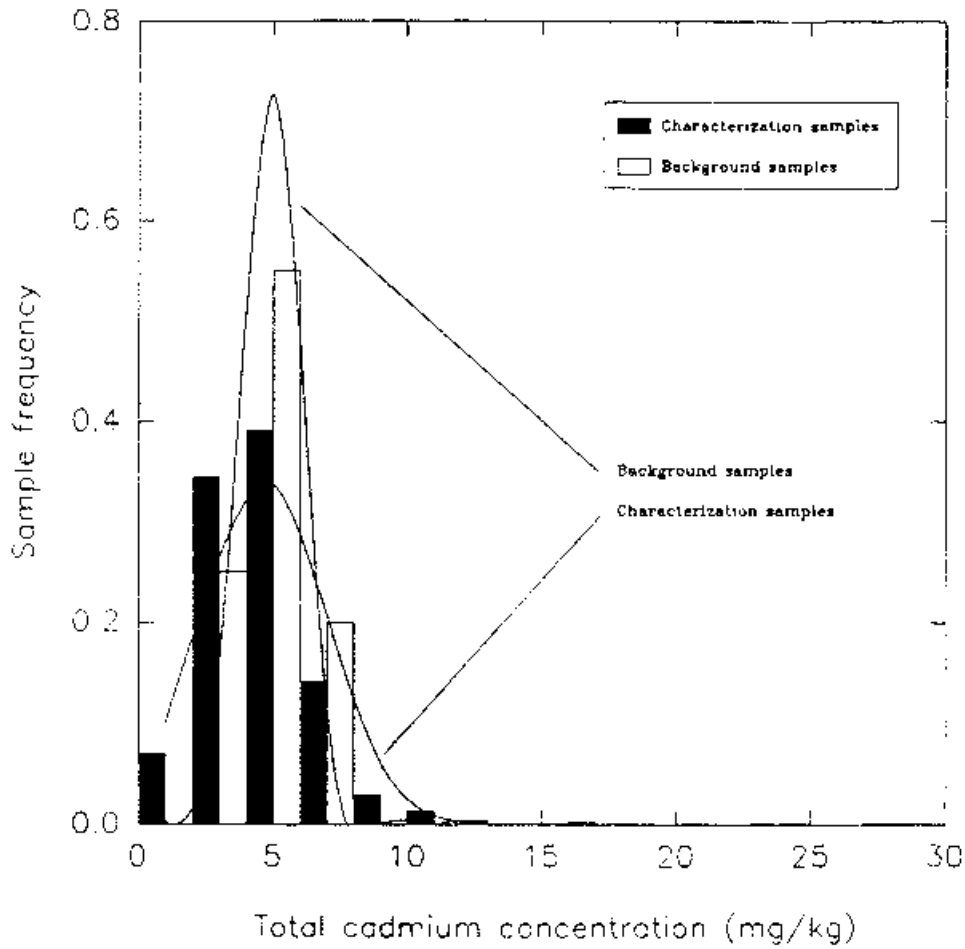


FIGURE 4-31

TABLE 4-25

Samples Selected for TCLP Cadmium Analysis (Based on Total Cadmium Concentrations)

Waste Pit	BH #	Total # of Samples Collected	Median Cadmium Concentration*	TCLP Sample Selection Breakdown			
				Number of Samples Selected for TCLP Analysis		Number of Selected Samples Above Median Concentration	
				#	% of Total	#	% of Total
Main Waste Pit	1	19	5.4	11	57.9	7	36.8
	2	11	4.6	5	45.5	5	45.5
	3	19	4.3	6	31.6	7	36.8
	4	20	5.4	5	25.0	3	15.0
	5	11	4.0	6	54.5	4	36.4
	6	20	3.8	1	5.0	0	0.0
	7	16	4.9	7	43.8	6	37.5
	8	26	4.3	8	30.8	6	23.1
	9	20	4.6	5	25.0	5	25.0
	10	18	4.7	1	5.6	0	0.0
	11	20	4.1	1	5.0	1	5.0
	12	24	4.3	9	37.5	6	25.0
	13	16	4.1	7	43.8	6	37.5
	14	19	3.9	8	42.1	6	31.6
	Total	259		80	30.9	62	23.9
Pit #1	1	9	5.0	5	55.6	2	22.2
	2	9	6.7	5	55.6	2	22.2
	Total	18		10	55.6	4	22.2
Pit #2	1	15	4.9	7	46.7	6	40.0
	2	15	6.4	5	33.3	4	26.7
	Total	30		12	40.0	10	33.3
Pit #3	1	10	4.1	6	60.0	5	50.0
	2	17	4.6	9	52.9	6	35.3
	3	14	5.2	6	42.9	5	35.7
	4	9	4.1	3	33.3	1	11.1
	Total	50		24	48.0	17	34.0
Pit #4	1	10	4.5	4	40.0	2	20.0
	2	11	4.8	5	45.5	5	45.5
	3	11	4.2	5	45.5	5	45.5
	4	11	5.6	6	54.5	5	45.5
	5	11	3.5	3	27.3	0	0.0
	6	11	4.1	4	36.4	1	9.1
	Total	65		27	41.5	18	27.7
Pit #5	1	20	4.0	10	50.0	8	40.0
	2	9	4.1	6	66.7	5	55.6
	Total	29		16	55.2	13	44.8
Pit #6	1	9	2.9	3	33.3	2	22.2
	2	19	3.2	10	52.6	7	36.8
	Total	28		13	46.4	9	32.1
Pit #7	1	10	1.4	3	30.0	3	30.0
	2	18	1.3	4	40.0	4	40.0
	Total	28		7	35.0	7	35.0
Pit #8	1	22	3.0	8	36.4	6	27.3
	2	14	4.5	6	42.9	3	21.4
	Total	36		14	38.9	9	25.0
Pit #9 Suspected Pit	1	18	4.2	10	55.6	9	50.0
	2	13	4.2	4	30.8	3	23.1
	Total	31		14	45.2	12	38.7

* Concentrations exceeded by 50% of samples.

Distribution of Samples Selected for TCLP Cadmium Analysis by Waste Pit

(Based on Total Cadmium Concentrations)

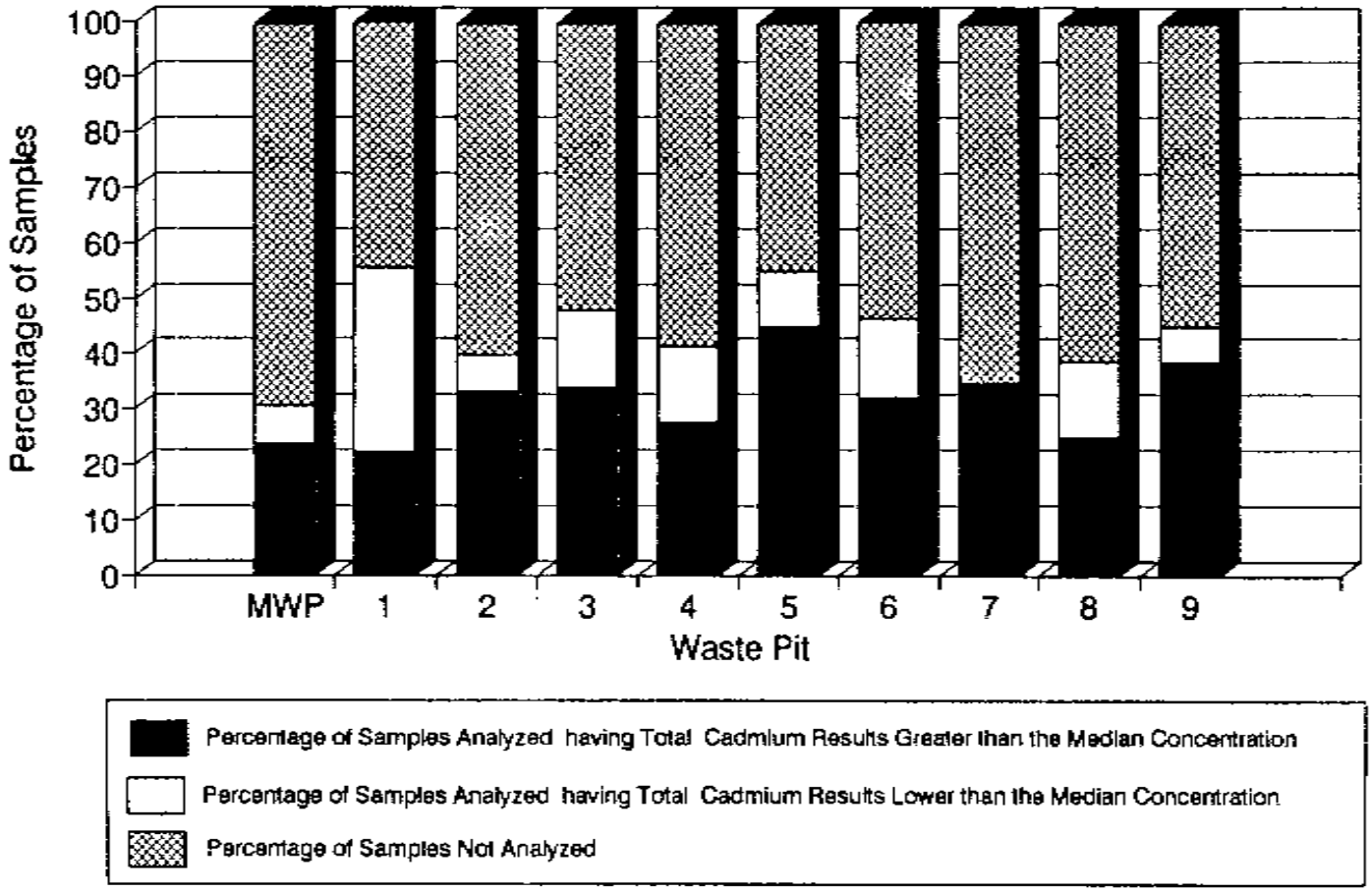


FIGURE 4-32

Texaco Fillmore Remedial Investigation June 1991

Distribution of Samples Selected for TCLP Cadmium Analysis for All Pits

(Based on Total Cadmium Concentrations)

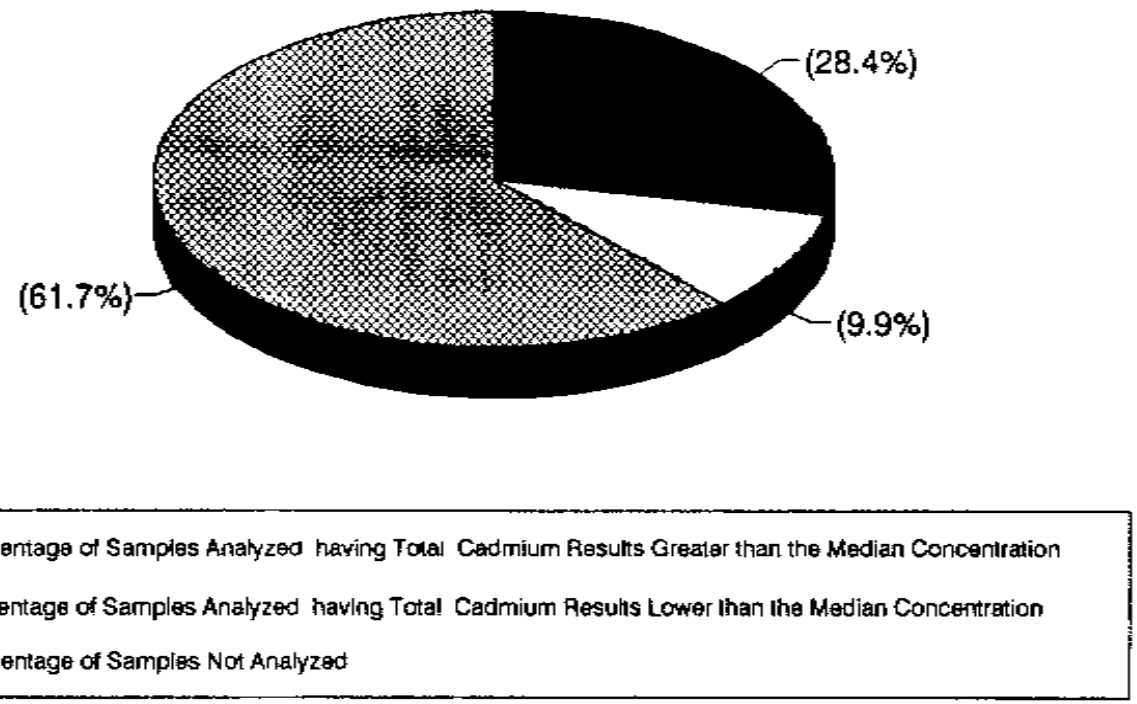


FIGURE 4-33

Texaco Fillmore Remedial Investigation June 1991

site. The samples selected for TCLP analyses are indicated by a double box around the total cadmium results in Table 4-24.

The results of the TCLP analysis for cadmium are provided in Table 4-26. As shown in the tables, cadmium exceeded the FSP designated threshold level of 66 µg/l in 56 of 243 samples analyzed throughout the facility, about 23 percent. Cadmium was found in excess of threshold levels in boreholes within all four regions. Figures 4-34 through 4-41 depict the spatial distribution of cadmium TCLP concentrations throughout the facility for each borehole in which there was an exceedance. As can be seen from the figures, barium concentrations are randomly distributed, and are consistent throughout all depths (i.e., they do not exhibit any direct correlation with depth).

The large volume of data and consistent levels of cadmium measured throughout the facility, lend themselves to a statistical representation of these values. Figure 4-42 shows the statistical distribution of TCLP concentrations for cadmium for the entire facility. As shown in the graph, the average cadmium concentration of the samples is near the FSP designated TCLP threshold level, which is the lowest standard identified in 40 CFR 268 for land disposal restrictions under RCRA. However, the highest TCLP concentration of cadmium measured at the facility (364 µg/l) is 2.7 times lower than the general toxicity characteristics regulatory level applied to land disposal of cadmium-bearing wastes.

The curve in Figure 4-42 represent a Gaussian distribution based on the calculated mean and standard deviation of the sample population. The bell-shaped curve fits the data rather well which suggests that all samples at the facility come from the same population. That is, it is highly unlikely that concentrations above the threshold have been affected by past facility activities.

A direct correlation between TCLP values and total values is impossible to establish as shown in Figure 4-43. The calculated correlation coefficient of 0.037 illustrates how poor the correlation is. It is very probable that the soil type of the samples has a greater impact on the TCLP results than the total values.

4.1.6.6 Chromium

Total chromium analyses results are presented in Table 4-27. The data do not appear to vary geographically or with depth. A better representation is given in Figure 4-44 for boreholes in the MWP Region and in Figure 4-45 for all other boreholes. The range of values (1.9 to 60 mg/kg) does not vary with depth or with elevation. The average of the population is 17.9 mg/kg and the standard deviation is 8.63. A total of 81 samples have concentrations above

TABLE 4-26

TCLP Cadmium - Subsurface Soil

Main Waste Pit Region

Constituent	Cadmium Concentrations (ug/l)																						
Location	MAIN WASTE PIT														PIT 2		MONITORING WELLS						
Borehole	BH-1	BH-2	BH-3	BH-4	BH-5	BH-6	BH-7	BH-8	BH-9	BH-10	BH-11	BH-12	BH-13	BH-14	BH-1	BH-2	MW21	MW22S	MW22D	MW23	MW24	MW25D	MW25S
Elev. (FT)																							
525								33.2						8.5 J	32								
520								14.7							16.4	82.4							
515								45.5						49.2	52								
510								122						55.9		56.4							
505													<3		29.9								
500			<2.9											<3									
495			70		33.3								3.6		45.5								
490	34.1													74.4								20.8 J	98.7
485	32.4		44.6				28.3					45.9 J			10.6	24.2						50.4	
480	14 J	39.1		5.5			27.5				31			20.6		28.7							
475	3 J	30.2		37.2									3.3									51.8	40.5
470	47.8		77.5		52.2							3.3 J	28.5		78.6	65.7						31.5	
		28.6			32.5				107 J														
465		36.4			67.1	<6 J	27.4					60.6 J											
	12.3 J																						
460	191		98.3		253		68					61 J											
				<2.9			32.2						96										
455		24.2			<10		53		<25			6.1 J	12	85.6									
450	119								87.6	37.7				67.4								45.2	
445	101			<2.9									49.1				31.3					97.9	140
440							17.2		140													141	
435	82.7			<2.9				45	28.4														
430	68.8											17.6											
												30.7											
425			121					34.4				53.7					29						
420								46.7				33.9											
415																							47.3
410																							
405								32.8														67.4	

J : Estimated values
Threshold Level for Cadmium : 66 ug/l

Texaco Fillmore Remedial Investigation, Aug-Oct, 90

TABLE 4-26 (cont.)

TCLP Cadmium - Subsurface Soil
Southern Region

Constituent	Cadmium Concentrations (ug/l)															
Location	PIT 3				PIT 4						SUSPECT PIT		MONITORING WELLS			BKGND
Borehole	BH-1	BH-2	BH-3	BH-4	BH-1	BH-2	BH-3	BH-4	BH-5	BH-6	BH-1	BH-2	MW18	MW19	MW20	BH-4
Depth (FT)																
5	94.2		80.1	58.1			31.5		<6	45.6	27.6					
10	72.9							<2.9				47.2				
15		58.4	86.9					7.4 J	45.7							
	32.6	81.1														
20	55.1	49				47.5				39.3	62.8 J					
25		56.3			62.6											
30	47.8		30.5	41.7	61.9	55.6	49.6					18.8				
								41								
35	52.8	28.1		47		30.4	60.6	50.4								
											35.3 J					
40				43.9	93.5	41.1		<2.9		46.7		31.9		25.9		
							73.8									
45		58.5	24.3			48.7	22.9		41.6		46.3 J		23.5 J			
		35.5			27						38.8 J					
50								17.6		15.4	14.8 J					
55		77.1	44.9									20.7				
60			36.6								65.7				49.1	
65											51.8 J				60	
70		37.7														
75															12.3 J	
80											86.6 J				29.9	
85																

J : Estimated values

Threshold Level for Cadmium : 66 ug/l

Texaco Fillmore Remedial Investigation, Aug-Oct, 90

TABLE 4-26 (cont.)

TCLP Cadmium - Subsurface Soil

Hill Region

Constituent	Cadmium Concentrations (ug/l)								
Location	PIT 5		PIT 6		PIT 7		PIT 8		BG
Borehole	BH-1	BH-2	BH-1	BH-2	BH-1	BH-2	BH-1	BH-2	BH-1
Depth (FT)									
5	52.7	51.8				<10	10.2		
10	79.1						215	108	
15		10.2	6.7	5.5 J		<5	46.4	57.7	
20	51.2			17.4 J		<5		252	
25	121			<5	3.7 J	<10			
30	74.6	93.4	<5					138	
35		111 76.1		18.8 J	35.2				
40	90.2	88.3	<5.0	8.7 J	32.4		64.4	86.9	
45	77.2			<5					
50				<5			224		
55				<5					
60								39.9	
65	31.9								
70									
75							<5		
80	364			19.7 J					
85	133			59.8					
90							<5		
95									
100									
105							<5		

J : Estimated values

Threshold Level for Cadmium : 66 ug/l

Texaco Fillmore Remedial Investigation, Aug-Oct, 90

TABLE 4-26 (cont.)

TCLP Cadmium - Subsurface Soil

Northern Region

Constituent	Cadmium Concentrations (ug/l)				
Location	PIT 1		BACKGROUND		
Borehole	BH-1	BH-2	BH-2	BH-3	BH-5
Depth (FT)					
5	83.1	30.2 J			
10	131	5.3 J			
15	28.8 J	36.3			
20	85.2				
25		70.3			
30	9.1 J				
35					
40		44.9			

J : Estimated values

Threshold Level for Cadmium : 66 ug/l

Texaco Fillmore Remedial Investigation, Aug-Oct, 90

TABLE 4-26 (cont.)

TCLP Cadmium - Subsurface Soil

Soil Gas Area

Constituent	Cadmium Concentrations (ug/l)			
Location	SOIL GAS AREA			
Borehole	BH-1	BH-2	BH-3	BH-4
Depth (FT)				
5				
10				
15			<10 J	<10
20				
25		<6		
30				
35				
40			<10 J	
45				
50				
55	<6	<6		
60				

J : Estimated values

Threshold Level for Cadmium : 66 ug/l

Texaco Fillmore Remedial Investigation, Aug-Oct, 90

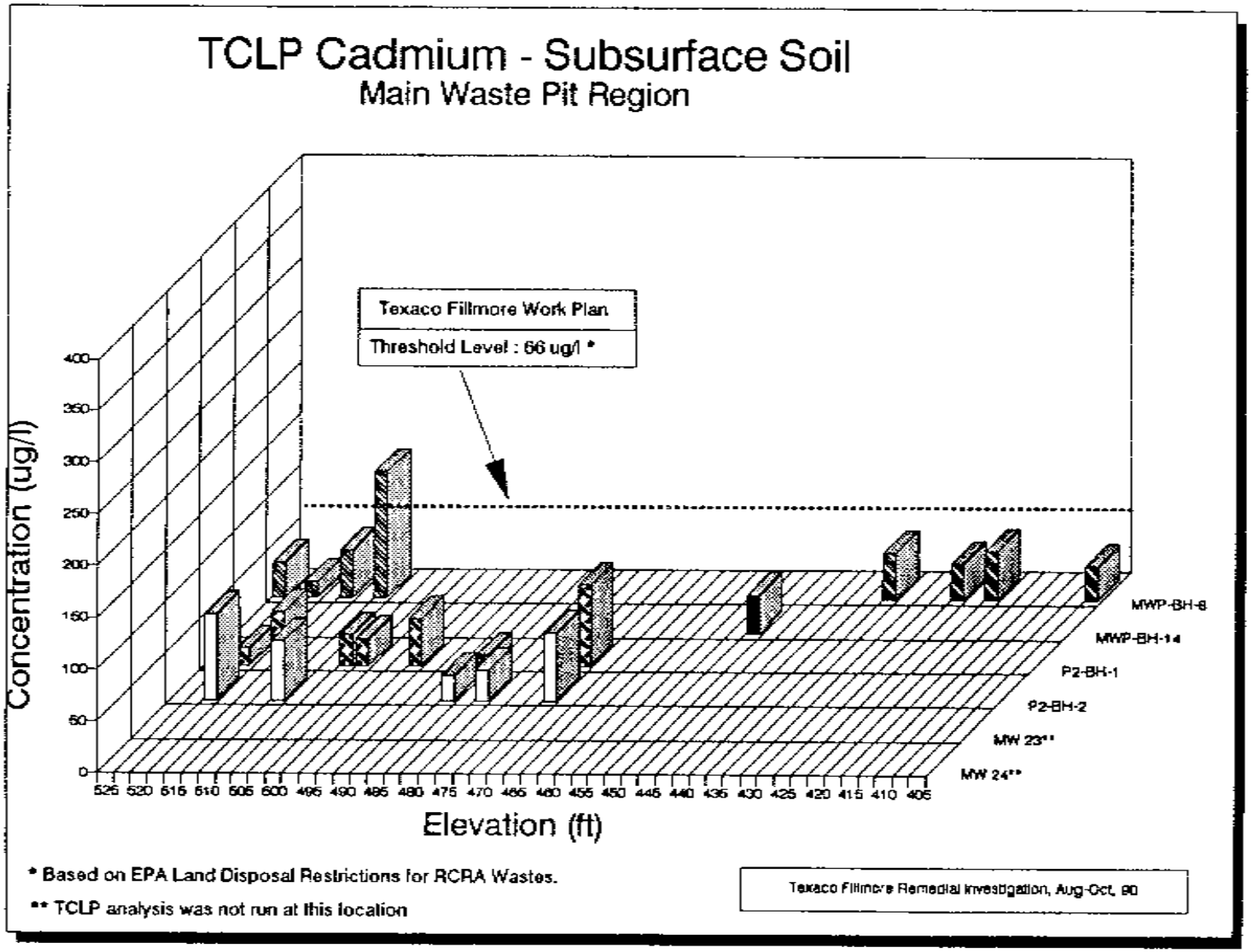

TCLP Cadmium - Subsurface Soil
Main Waste Pit Region
Texaco Fillmore Work Plan
Threshold Level : 66 ug/l *
Concentration (ug/l)
0
50
100
150
200
250
300
350
400
MWP-BH-8
MWP-BH-14
P2-BH-1
P2-BH-2
MW 23**
MW 24**
525 520 515 510 505 500 495 490 485 480 475 470 465 460 455 450 445 440 435 430 425 420 415 410 405
Elevation (ft)
* Based on EPA Land Disposal Restrictions for RCRA Wastes.
** TCLP analysis was not run at this location
Texaco Fillmore Remedial Investigation, Aug-Oct, 90

FIGURE 4-34

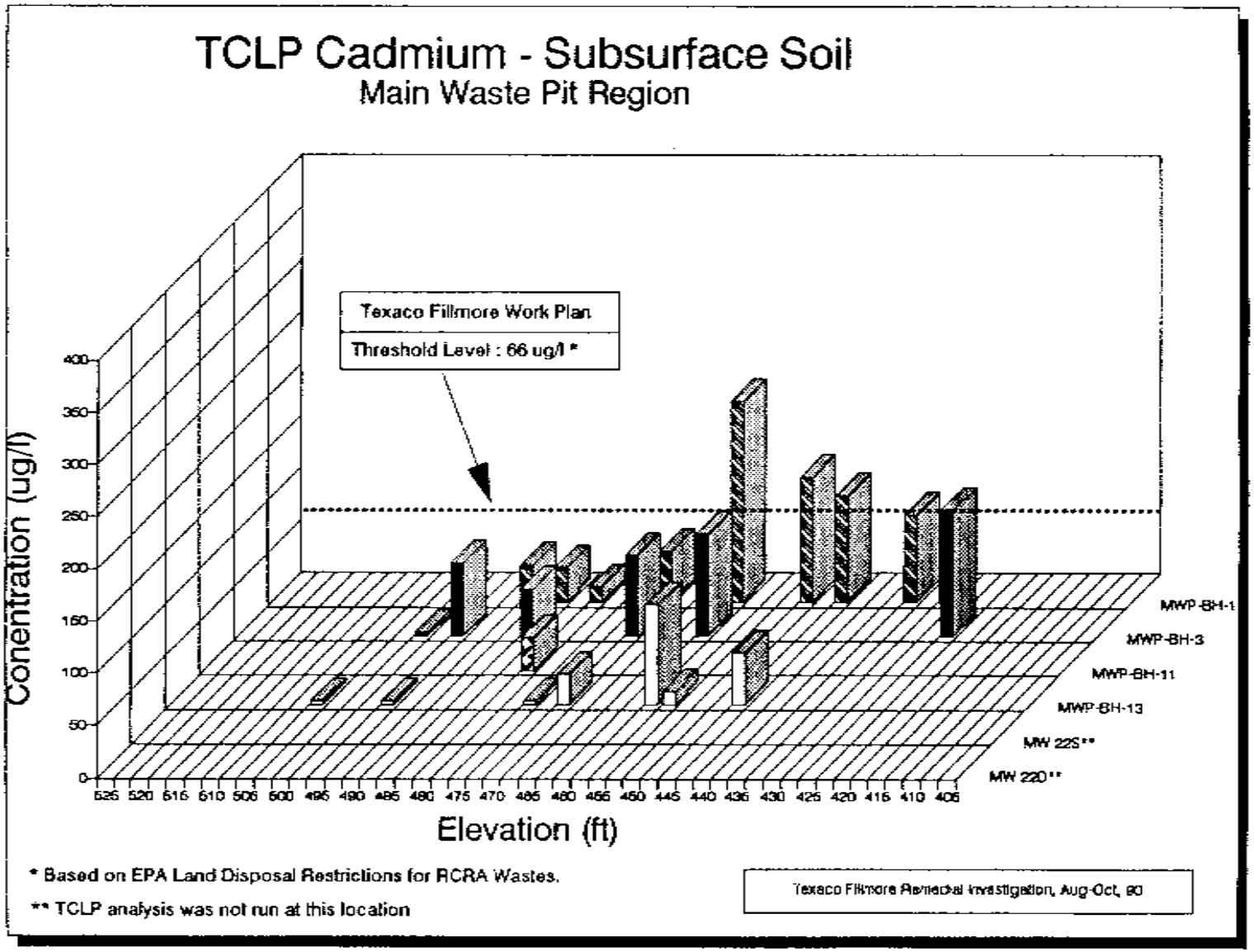

TCLP Cadmium - Subsurface Soil
Main Waste Pit Region
Texaco Fillmore Work Plan
Threshold Level : 66 ug/l *
Conentration (ug/l)
0
50
100
150
200
250
300
350
400
MWP-BH-1
MWP-BH-3
MWP-BH-11
MWP-BH-13
MW 22S**
MW 22D**
525 520 515 510 505 500 495 490 485 480 475 470 465 460 455 450 445 440 435 430 425 420 415 410 405
Elevation (ft)
* Based on EPA Land Disposal Restrictions for RCRA Wastes.
** TCLP analysis was not run at this location
Texaco Fillmore Remedial Investigation, Aug-Oct, 90

FIGURE 4-35

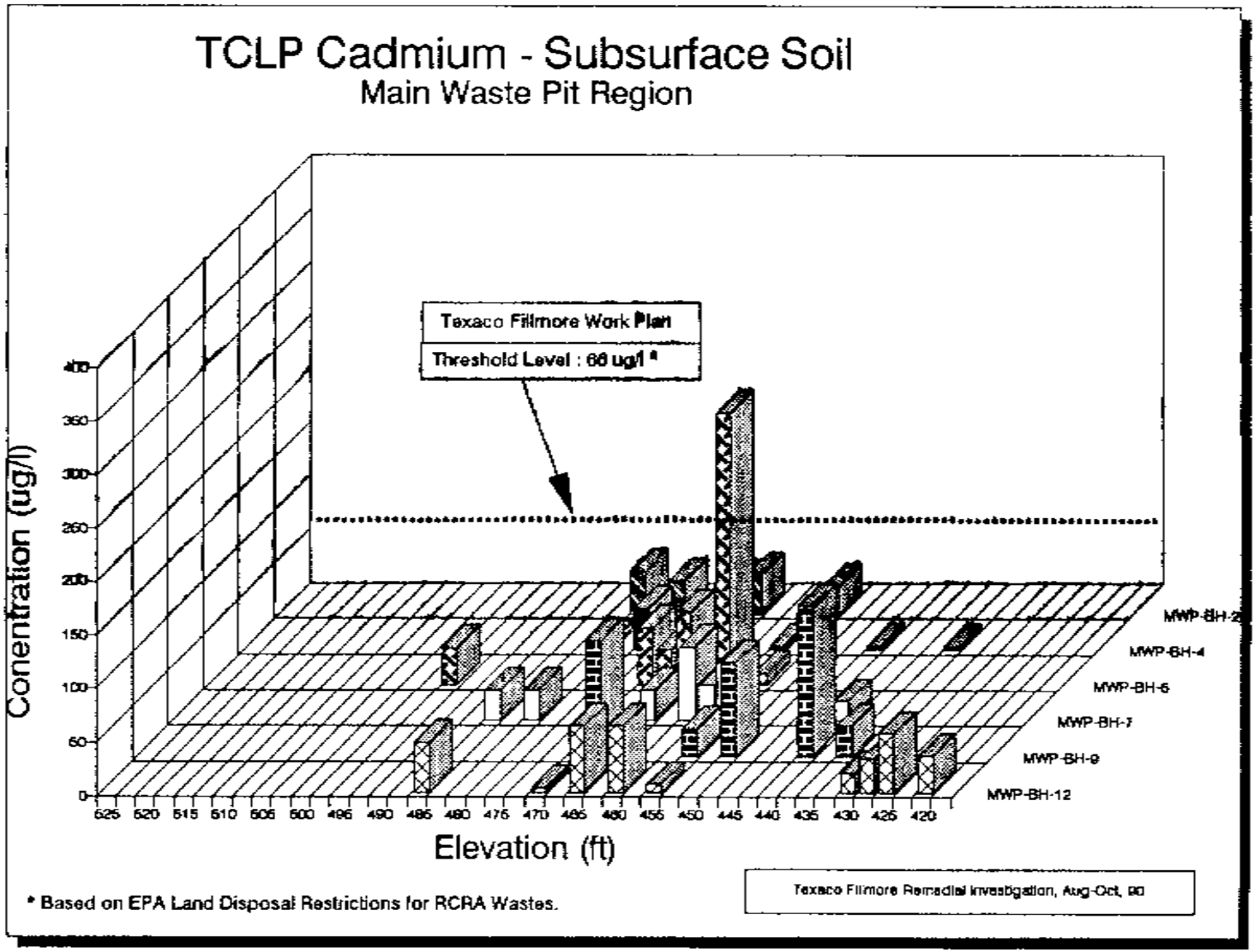

TCLP Cadmium - Subsurface Soil
Main Waste Pit Region
Texaco Fillmore Work Plan
Threshold Level : 60 ug/l *
Conentration (ug/l)
400
350
300
250
200
150
100
50
0
625 620 615 610 605 600 595 590 585 580 575 570 565 560 555 550 545 540 535 530 525 520
Elevation (ft)
MWP-BH-2
MWP-BH-4
MWP-BH-5
MWP-BH-7
MWP-BH-9
MWP-BH-12
* Based on EPA Land Disposal Restrictions for RCRA Wastes.
Texaco Fillmore Remedial Investigation, Aug-Oct, 90

FIGURE 4-36

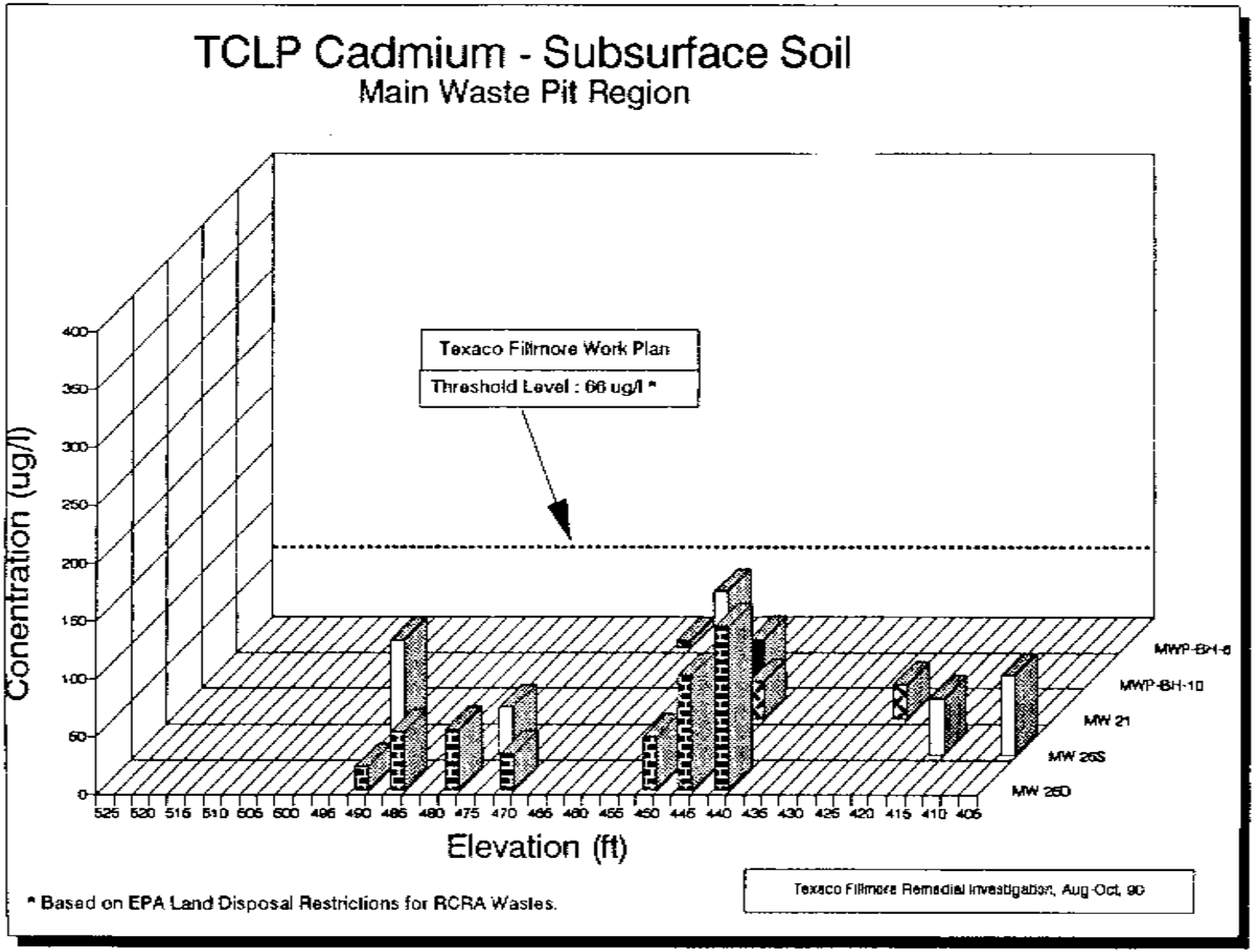

TCLP Cadmium - Subsurface Soil
Main Waste Pit Region
Texaco Fillmore Work Plan
Threshold Level : 66 ug/l *
Conentration (ug/l)
0
50
100
150
200
250
300
350
400
525 520 515 510 505 500 495 490 485 480 475 470 465 460 455 450 445 440 435 430 425 420 415 410 405
Elevation (ft)
MWP-BH-9
MWP-BH-10
MW 21
MW 26S
MW 26D
* Based on EPA Land Disposal Restrictions for RCRA Wastes.
Texaco Fillmore Remedial Investigation, Aug-Oct, 90

FIGURE 4-37

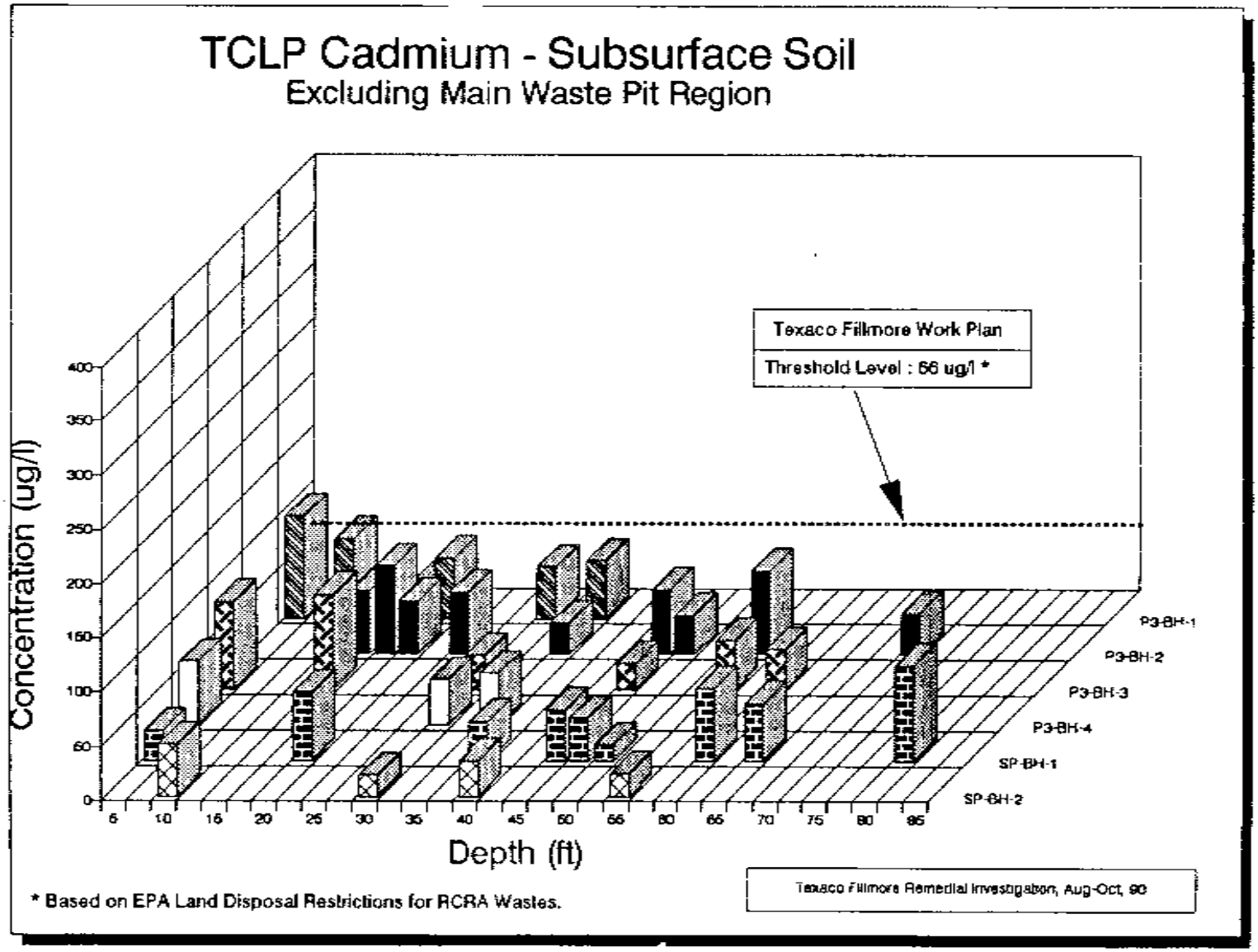

TCLP Cadmium - Subsurface Soil
Excluding Main Waste Pit Region
Texaco Fillmore Work Plan
Threshold Level : 66 ug/l *
Concentration (ug/l)
0
50
100
150
200
250
300
350
400
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
Depth (ft)
P3-BH-1
P3-BH-2
P3-BH-3
P3-BH-4
SP-BH-1
SP-BH-2
* Based on EPA Land Disposal Restrictions for RCRA Wastes.
Texaco Fillmore Remedial Investigation, Aug-Oct, 90

FIGURE 4-38

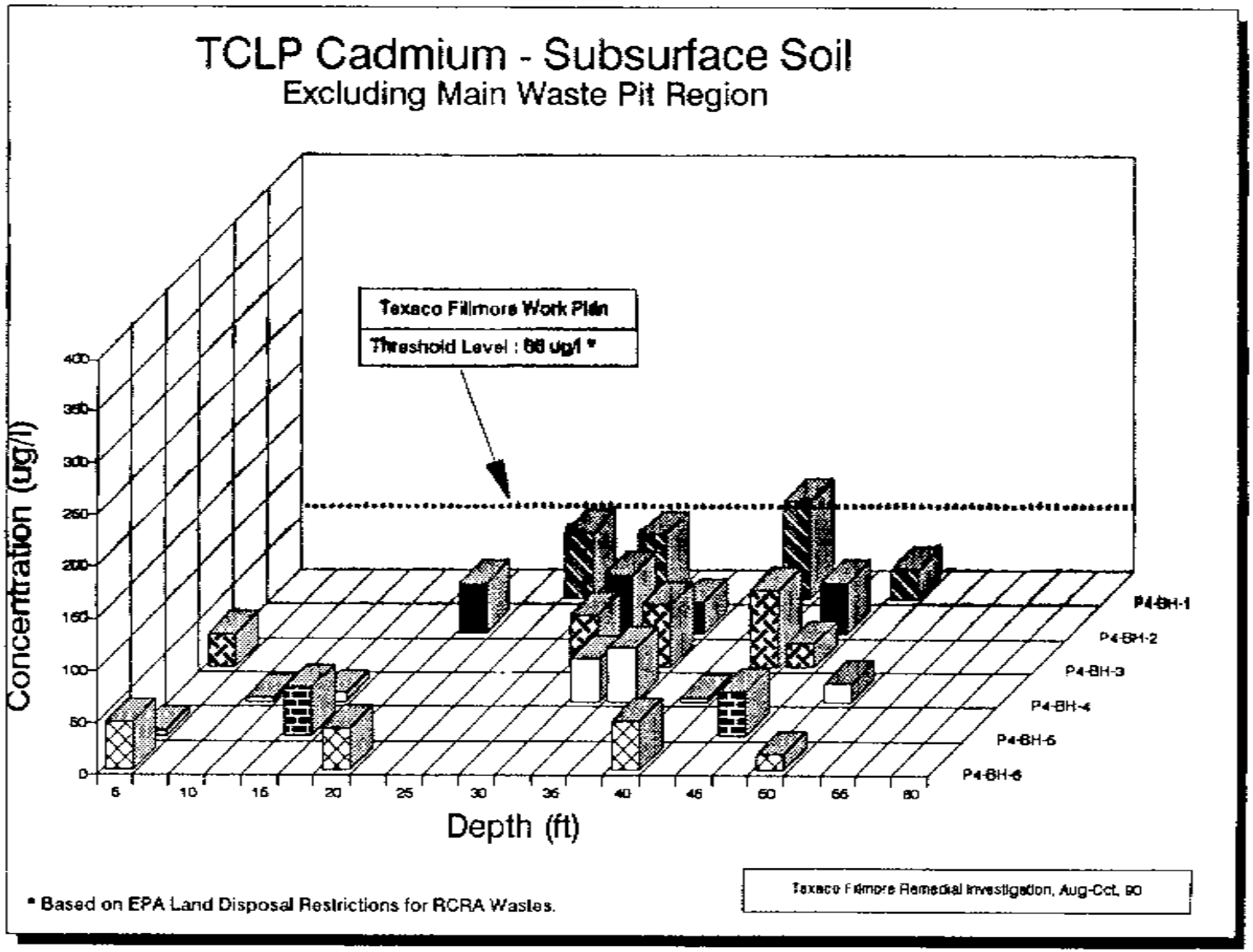

TCLP Cadmium - Subsurface Soil
Excluding Main Waste Pit Region
Texaco Fillmore Work Plan
Threshold Level : 66 ug/l *
Concentration (ug/l)
0
50
100
150
200
250
300
350
400
5
10
15
20
25
30
35
40
45
50
55
60
Depth (ft)
P4-BH-1
P4-BH-2
P4-BH-3
P4-BH-4
P4-BH-5
P4-BH-6
* Based on EPA Land Disposal Restrictions for RCRA Wastes.
Texaco Fillmore Remedial Investigation, Aug-Oct, 90

FIGURE 4-39

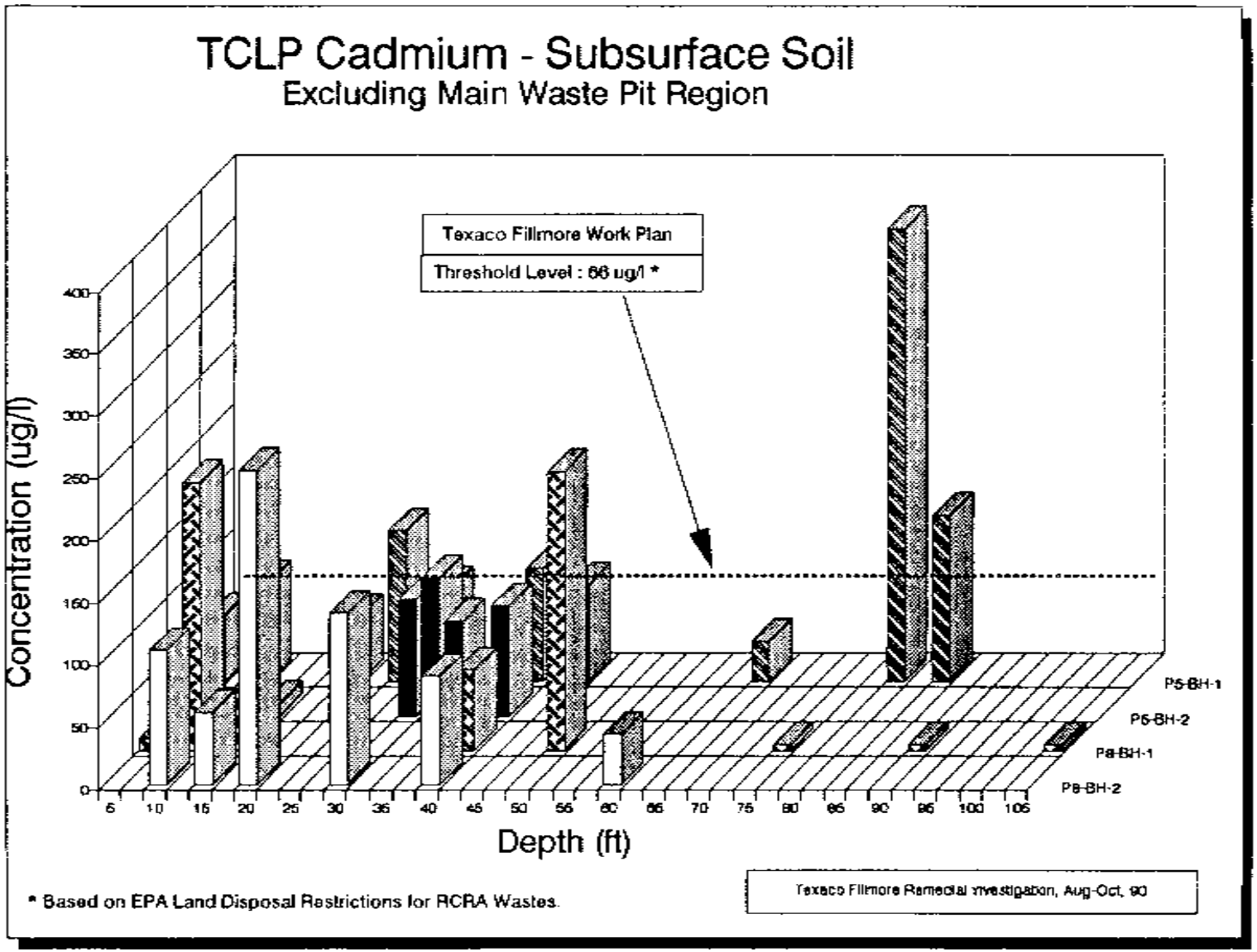

TCLP Cadmium - Subsurface Soil
Excluding Main Waste Pit Region
Texaco Fillmore Work Plan
Threshold Level : 66 ug/l *
Concentration (ug/l)
0
50
100
150
200
250
300
350
400
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
105
Depth (ft)
P5-BH-1
P5-BH-2
P8-BH-1
P8-BH-2
* Based on EPA Land Disposal Restrictions for RCRA Wastes.
Texaco Fillmore Remedial Investigation, Aug-Oct, 90

FIGURE 4-40

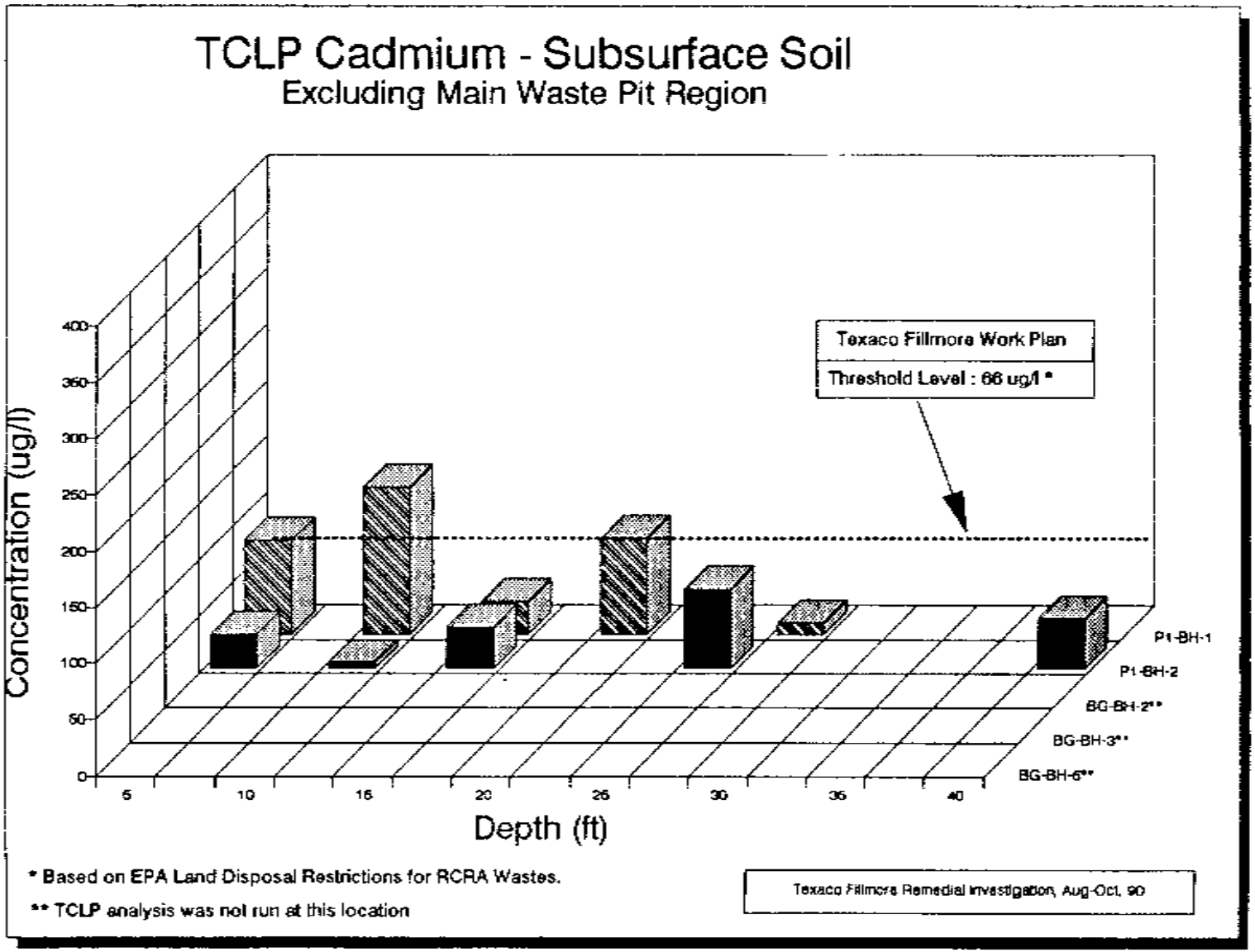

TCLP Cadmium - Subsurface Soil
Excluding Main Waste Pit Region
Concentration (ug/l)
400
350
300
250
200
150
100
50
0
Texaco Fillmore Work Plan
Threshold Level : 66 ug/l *
P1-BH-1
P1-BH-2
BG-BH-2**
BG-BH-3**
BG-BH-6**
5
10
15
20
25
30
35
40
Depth (ft)
* Based on EPA Land Disposal Restrictions for RCRA Wastes.
** TCLP analysis was not run at this location
Texaco Fillmore Remedial Investigation, Aug-Oct, 90

FIGURE 4-41

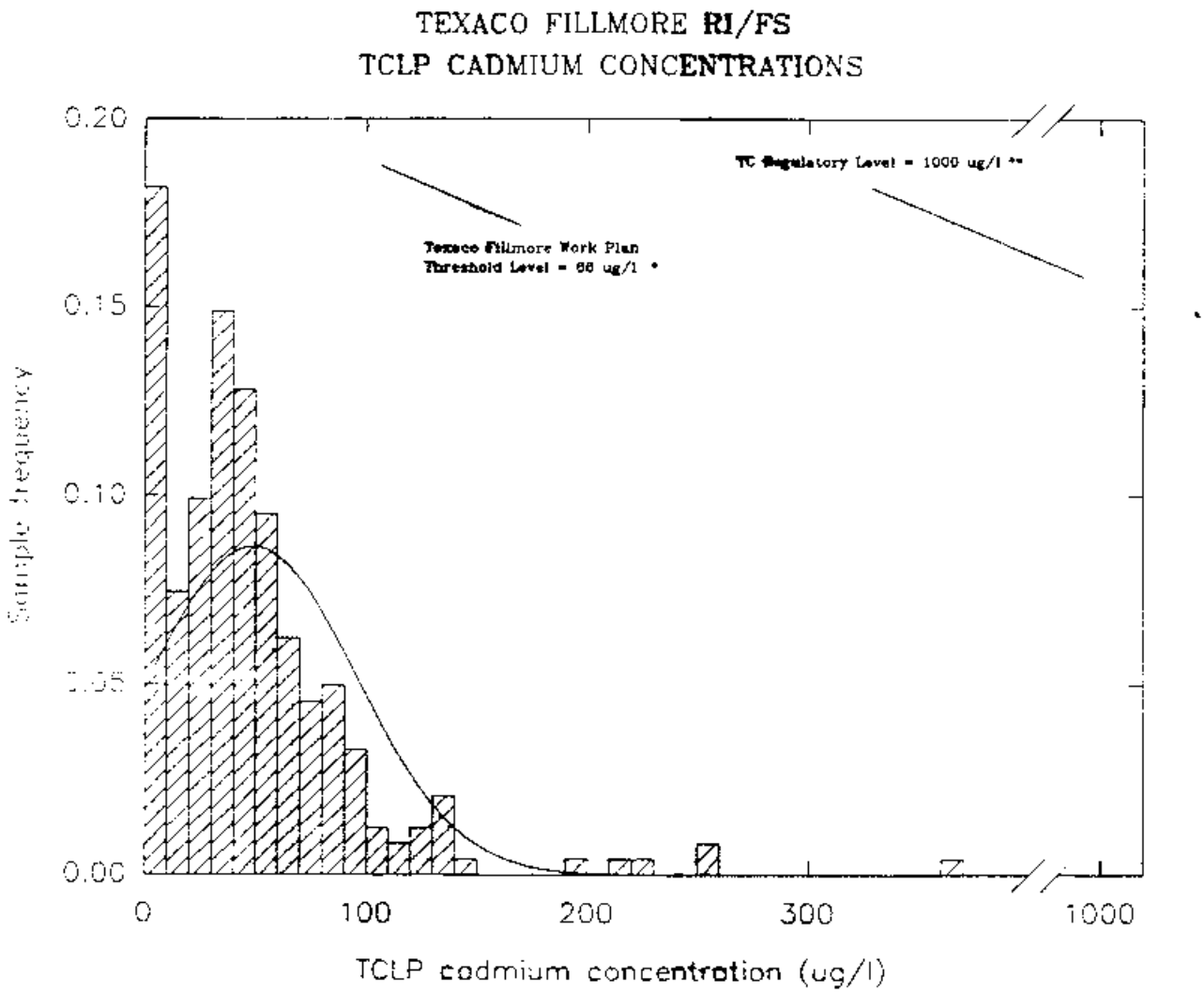

TEXACO FILLMORE RI/FS
TCLP CADMIUM CONCENTRATIONS
0.20
0.15
0.10
0.05
0.00
Sample frequency
TC Regulatory Level = 1000 ug/l **
Texaco Fillmore Work Plan
Threshold Level = 66 ug/l *
0
100
200
300
1000
TCLP cadmium concentration (ug/l)
* Based on EPA land disposal restrictions standards for RCRA first third wastes
** General Toxicity Characteristic regulatory level for non listed RCRA constituents

FIGURE 4-42

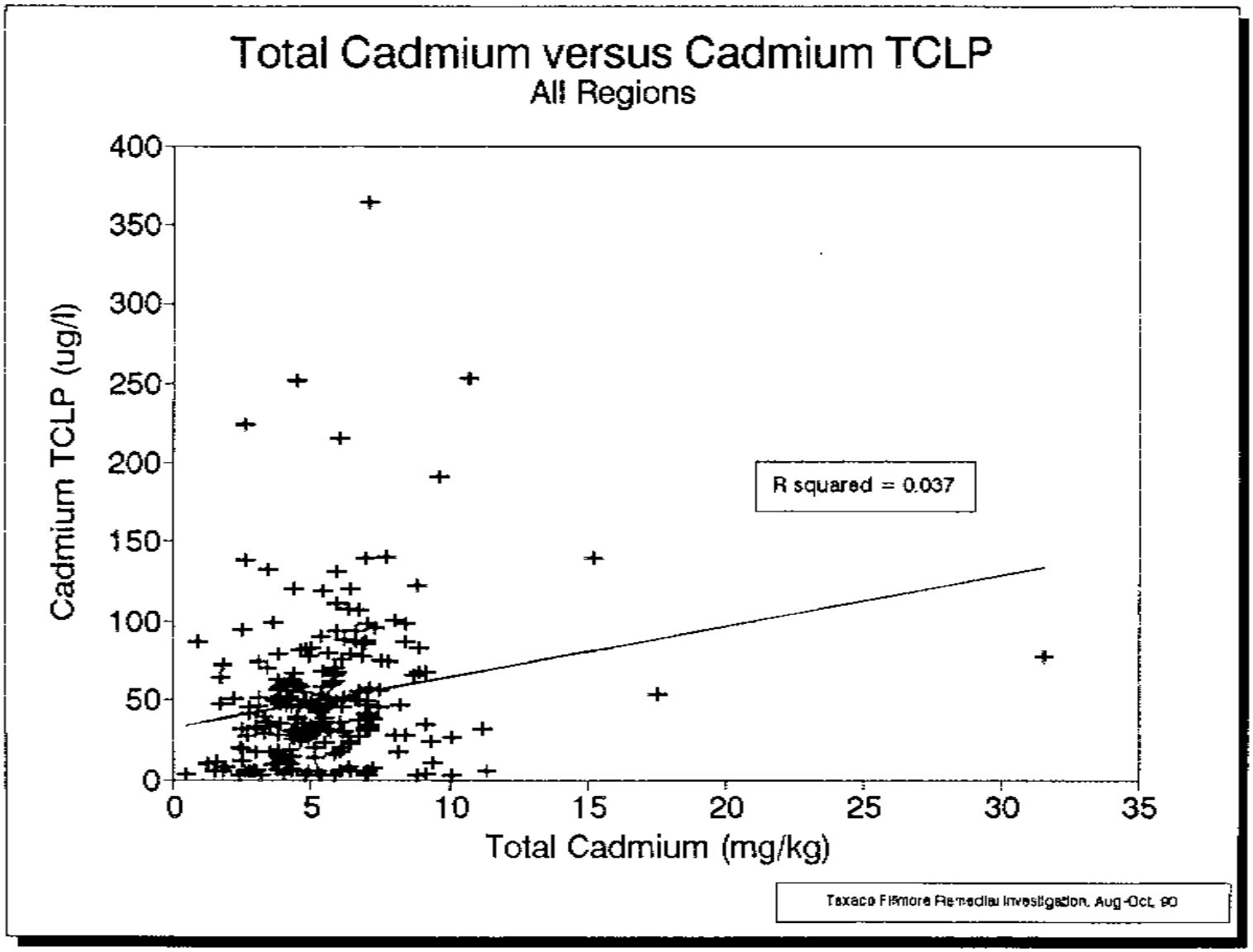

Total Cadmium versus Cadmium TCLP
All Regions
Cadmium TCLP (ug/l)
400
350
300
250
200
150
100
50
0
0
5
10
15
20
25
30
35
Total Cadmium (mg/kg)
R squared = 0.037
Texaco Fillmore Remedial Investigation, Aug-Oct, 90

FIGURE 4-43

TABLE 4-27

Total Chromium - Subsurface Soil
Main Waste Pit Region

Constituent	Chromium Concentrations (mg/kg)																						
Location	MAIN WASTE PIT													PIT 2		MONITORING WELLS							
Borehole	BH-1	BH-2	BH-3	BH-4	BH-5	BH-6	BH-7	BH-8	BH-9	BH-10	BH-11	BH-12	BH-13	BH-14	BH-1	BH-2	MW21	MW22S	MW22D	MW23	MW24	MW25D	MW25S
ELEV. (FT)																							
525								18.9						11.1	14	30.8							
520								26.7						14	34.4	33.8							
								8.2															
515								17.2			31.9			35.4	11.2	32.4							
510							12.8	19.6			20.4	4.7	9.3	11.5	10.3	32.6							
505							21.7	18.3		27.9	16.4	6.5	13.4	10.2	10.2	25.1							
500		8.9	18		20.6		16.1	18.5	13	26	18.8	6.5	10.8	13.4	17.2	32.3					17.7		
495	23.6	10	13.8	20.2	38.1	9.3	23.8	13.2	8.5	34.3	25.3	11.7	19.4	11.2 11.3	13.4	26.8						9	
490	17.2	11.9	13.1 13.8	14.6	18.6	10.7		28.2	11	24.7	17.1	11	17.8	60	7.3	27.5						21	9.6
485	19.7	6	13	23	13.6	9.3	27.3	14.4	9.7	39	12.6	8.8	18.2	15.7	7.2 12.2	29.1 33.2				14.3		12	
480	12.6	36.7	16 12.3	21.9 29.6	13.1	10.2	35.3	16.5	7.9 13.4	23.7	16.6	7	16.2 12	20.2	13.4 11.2	31.3							
475	17.8	30	11.8	13	20	13.1	16.7	17.7 21.1	15.1	40.8	22.7	9 8.2	13.6	14.4	5.6	27.4		13		12.9		15.6 26.2	
470	18.4 33.1	17	13	12.3	11.6	9.9	19.5	14.7	21.6	30.6	12.7 11.3	12.1	16.6	11.1	14.3	25.1 31.4		11.4		11.8		22.6 21.2	15.4
465	20.9	14 16.5	14.1	13	12.4 13	11.2 10.4	24.1	16	11.8 13.3	33.2	11.4	8.7	14.3	16	11.1	24.9				11.5		18.9 20.2	
460	26.2 20.7	19.3	13.8	23	10.2	10.8	26.1 29.2	15.8	16.4	31.3	9.4 10.6	12.4 8.2	11.8	16.4 22.1						9.3 14		13.8	13
455	11	10.3	12.5	38.5 18.9	6.6	10.3	16.9 17.3	31.5	13	34.1	11.9	10.8	16 16.8	13.3				9.5				19.2	
450	33.1			20		11.9 12	25.2		31.6	32.3 25.2	9.5	10.8	13.5	26.2				6.3		4.3		18.7	
445	26.7			21.4		10.9	27.1	25.6	9	13.8 16	10.7	8.2	16.8	6.2	20.7	17		14.5				25	10.2 11.5
440	16.8		8.2	22		9.9	16.3	14.1	13.5	19.5	31.3	18.6			16.3 15.3	8.6		13.1				18.6	10.4
435	21.8		11	12.5		10.2		9.4	21.2	36.2	20.4	21.5			16.2	7.5		5.2				6.3	
430	32.6		8.8	17.3		16.3			8.7	31.1	15.6	32 18.8				11.8		12.6 10.7				14	1.9
425	19.3		12.3	12.9		8.2		28.2	10.2			32.9			12.6	10.6		6.3				14.9	
420	24.7		4.8	7.4		9		17.6	7.7			22.9				10.2						14.4	15.6
415	16.8		11.3	16.9		16		16.5 14.5	9.6			20.9				11.8		7.8				8.8	6
410			6.3	13.8		18.2		4.7				10.8				9.4		11				8.2	
405								18.5								12.8							12.5
400																11.3							
395																12.1							
390																10.4							
385																10.2							
380																							
375																							

TABLE 4-27 (cont.)

Total Chromium - Subsurface Soil
Southern Region

Constituent	Chromium Concentrations (mg/kg)															
Location	PIT 3				PIT 4						SUSPEC PIT		MONITORING WELLS			BKGND
Borehole	BH-1	BH-2	BH-3	BH-4	BH-1	BH-2	BH-3	BH-4	BH-5	BH-6	BH-1	BH-2	MW18	MW19	MW20	BH-4
Depth (ft)																
5	15.8	18.6	11.5	9.6	14.7	14.2	19.7	34.1	12.7	9.6	16.8	13.6				
10	34.3	15.1	14.2	9	10	13.5	11.5	22.8	13.8	13.1	8.6	14.4				14.5
15	18.2	36.8	16.1	10.3	7.8	12.8	16	35.8	18.2	13.8	13	15.1				
20	18.2 18.8	17.9 18.1	16.9	12.8	6.9	9.6	12.5	38.3	10.7	12.1	16.8	16.5				23.8 12.8
25	16	14.2	15.6 19.5	11.9	9.1	10.5	20.2	30.6	13.4	18	17.6	15.4				
30	13	26.1	15.3	13.4 10.9	16.5	14.3 13.1	11.6	39 33	9.9 16.2	24	17	12.1				
35	14.2	18.8	15.1	19.5	14.2	14.3	24.4	38.3	15.3	15.7	11 13	12.1 15.2		13.6 9.5		
40	18.9	20.7	18 16.6	13.3	14.9	30.6	20.4 16.3	48.8	11.8	21.2 17.9	22.8	10.1		20.8		
45	15.6	17.3 22.6	16.3		16.9 16.1	18.1	27.6	38	13	18.9	14.3 13	15	9.8	12		
50		19.8	25			12.8	21	38.7	12.6	25.5	17.1	11.9 12.3	15.5	14.9		
55		13.8	13.2								12.1	17.3		14.7		
60			18.7								15.7			18.3	20.4	
65		13.6									17.4				27.5	
70		14.4									12.7				17.2	
75		15.8									10.8				18.6 23.5	
80		13.8									11.8				26	
85															17	

TABLE 4-27 (cont.)

Total Chromium - Subsurface Soil
Hill Region

Constituent	Chromium Concentrations (mg/kg)								
Location	PIT 5		PIT 6		PIT 7		PIT 8		BG
Borehole	BH-1	BH-2	BH-1	BH-2	BH-1	BH-2	BH-1	BH-2	BH-1
Depth (ft)									
5	19.3	21	7.2	32	9.5	11.5	30.8	18.2	24.3
					11.2				
10	25.9	21.2	14.9	19.9		15.3	22.7	18.3	25.6
	25.3					16.7			
15	22.1	28.7	14.3	34.2	5.3	11.9	29.2	17.9	16.4
20	15.2	23.7	21.2	37	3.1	20.8	31.7	21.8	33.8
			12						
25	26.1	23	6.3	32.5	3.1	13.4	15.2	11.2	
								13.2	
30	26.6	26.2	46.2	25.8	9.2	5.8	16.9	16.4	
		32							
35	22.7	23.6	19.9	34.3	10.6	5.4		7.7	
40	32.2	27.3	25.3	31.9	11.1	4.5	16	4.9	
45	20.1			37.7	8.7		23.8	12.4	
				33.5					
50	13.5			21.3	7.1	4	23.3	6.5	
55	10.9			22.6			20.5	10.8	
				27.2				11.6	
60	11.5			24.9			18.7	21.3	
	12.6								
65	11.4			25.9			14.1		
							15.7		
70	9.8			18			13		
75	14			17.6			18.3		
80	10.4			19			15.6		
85	20.1			17.8			22		
90	10.4						25		
							23.2		
95							15.3		
100							21.7		
105							25.7		

TABLE 4-27 (cont.)

Total Chromium - Subsurface Soil
Northern Region

Constituent	Chromium Concentrations (mg/kg)				
Location	PIT 1		BG		
Borehole	BH-1	BH-2	BH-2	BH-3	BH-5
Depth (ft)					
5	35.9	45.4	39.9		17.4
10	49	50.7	40.4	28.4	14.7
		34.6		19.8	
15	24.3	32.7	40.9	41.2	21.2
					20.4
20	36.3	38.3	41.6	36.7	22.7
25	35	16.4			
	29.7				
30	23.2	33.9			
35	30.9	36.2			
40	34.2	18.5			
45					
50					

TABLE 4-27 (cont.)

Total Chromium - Subsurface Soil
Soil Gas Area

Constituent	Chromium Concentrations (mg/kg)			
Location	SOIL GAS AREA			
Borehole	BH-1	BH-2	BH-3	BH-4
Depth (ft)				
5	37.7	22.1	16.3	19.6
10			34.1	
15				
20		32.8		34.5
25	25.6			
30				

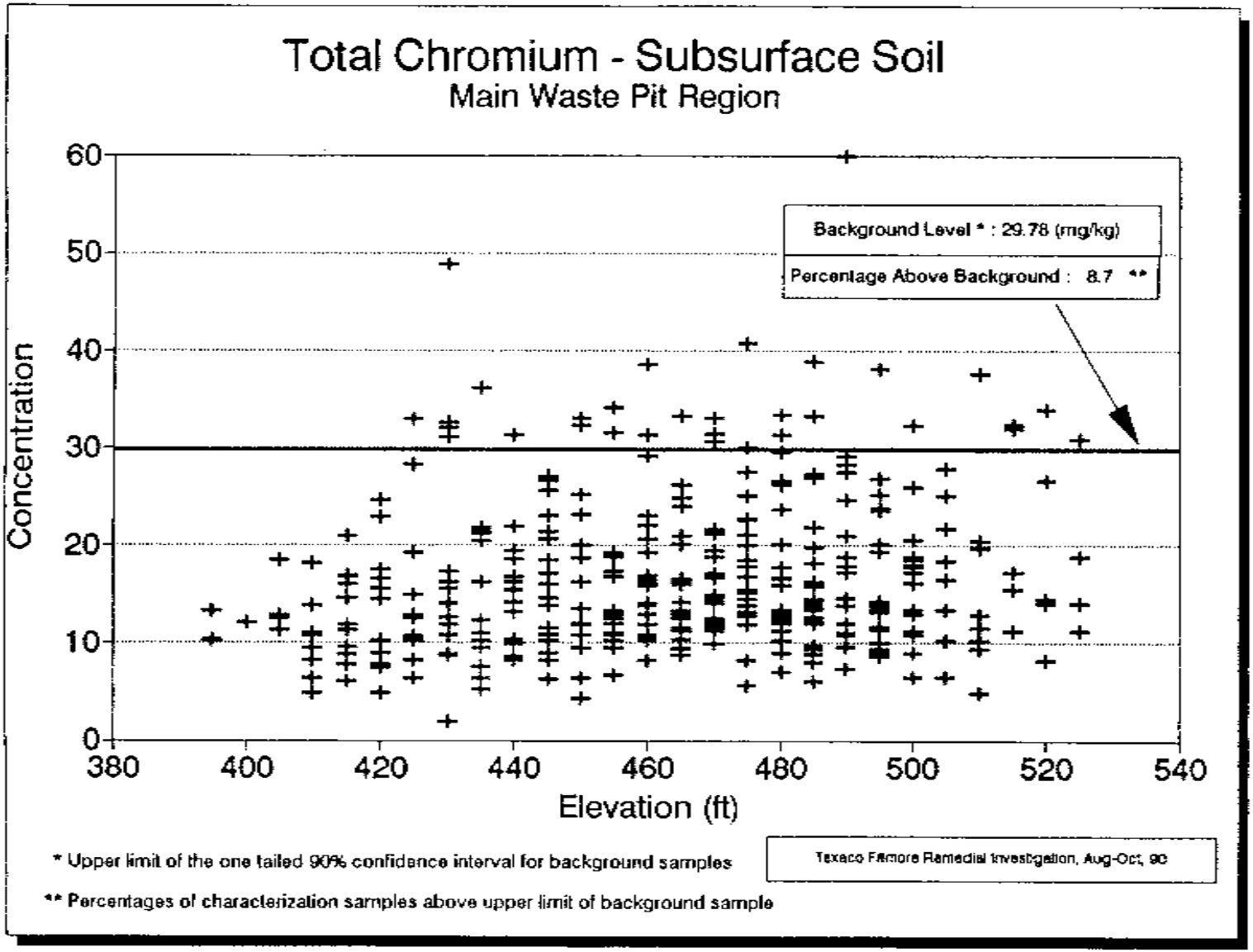

Total Chromium - Subsurface Soil
Main Waste Pit Region
Concentration
Elevation (ft)
0
10
20
30
40
50
60
380
400
420
440
460
480
500
520
540
Background Level * : 29.78 (mg/kg)
Percentage Above Background : 8.7 **
* Upper limit of the one tailed 90% confidence interval for background samples
** Percentages of characterization samples above upper limit of background sample
Texaco Fillmore Remedial Investigation, Aug-Oct, 90

FIGURE 4-44

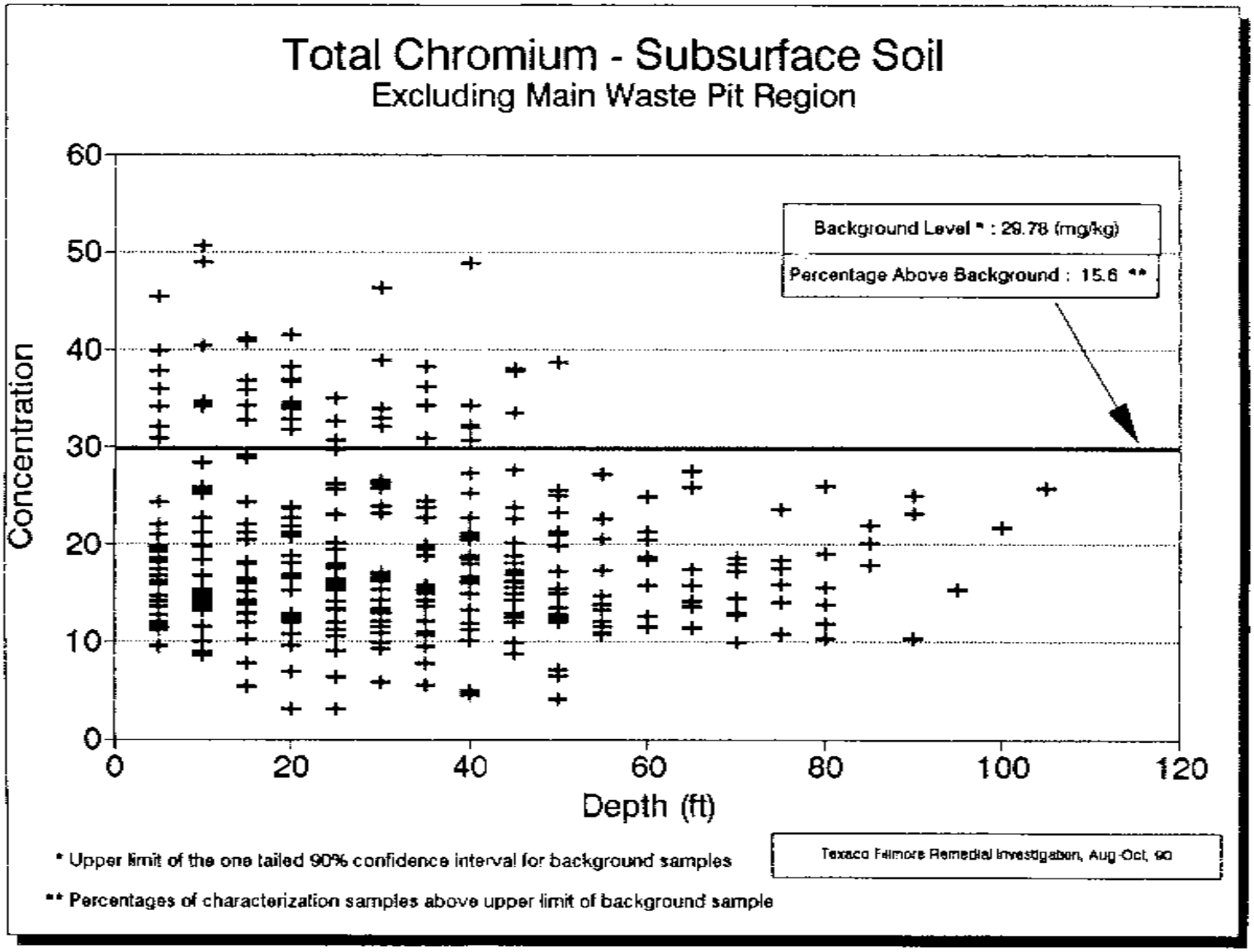

Total Chromium - Subsurface Soil
Excluding Main Waste Pit Region
Concentration
Depth (ft)
0
10
20
30
40
50
60
0
20
40
60
80
100
120
Background Level * : 29.78 (mg/kg)
Percentage Above Background : 15.6 **
Texaco Fellmore Remedial Investigation, Aug-Oct, 90
* Upper limit of the one tailed 90% confidence interval for background samples
** Percentages of characterization samples above upper limit of background sample

FIGURE 4-45

the upper limit for background calculated in Section 4.1.6 , representing 12 percent of the total number of samples.

Based on the total chromium results, from 30 to 55 percent of the samples with the highest concentrations were screened for TCLP chromium extraction and analysis. Table 4-28 presents a breakdown of the number and distribution of samples selected for TCLP analysis. Figures 4-46 and 4-47 are plots of the distribution of that data by waste pit and for the entire site. The samples selected for TCLP analyses are indicated by a double box around the total chromium results in Table 4-27.

The results of the TCLP analysis for chromium are provided in Table 4-29. As shown in the table, chromium did not exceed the FSP designated threshold level of 200 µg/l in any of the 241 samples analyzed. TCLP values for chromium ranged from ND to 83.7 µg/l.

4.1.6.7 Lead

Total lead analysis results are presented in Table 4-30. The data do not appear to vary geographically or with depth. The exception to this trend is the single detection of lead in P1-BH-1 at a depth of 5 feet. A better representation is given in Figure 4-48 for boreholes in the MWP Region and in Figure 4-49 for all other boreholes. The average concentration of the population is 19.6 mg/kg and the standard deviation is 207. There are a total of 111 samples with concentrations or detection limits above the upper limit for background calculated in Section 4.1.6, which represents 16 percent of the total number of samples.

Based on the total lead results, from 17 to 55 percent of the samples with the highest concentrations were screened for TCLP lead extraction and analysis. Table 4-31 presents a breakdown of the number and distribution of samples selected for TCLP analysis. Figures 4-50 and 4-51 are plots of the distribution of that data by waste pit and for the entire site. The samples selected for TCLP analyses are indicated by a double box around the total lead results in Table 4-30.

The results of the TCLP analysis for lead are provided in Table 4-32. As shown in the table, lead exceeded the FSP designated threshold level of 180 µg/l in only one of the 223 samples analyzed, borehole P3-BH-1 at 10 feet. This finding correlates directly with the elevated total lead concentration detected in the screen analysis for this location. Figure 4-52 depicts the spatial distribution of lead TCLP concentrations in borehole P3-BH-1. As seen from the figure, the exceedance appears localized to a shallow depth within the borehole. The exceedance value of 207 µg/l is within 15 percent of the threshold.

TABLE 4-28

Samples Selected for TCLP Chromium Analysis (Based on Total Chromium Concentrations)

Waste Pit	BH #	Total # of Samples Collected	Median Chromium Concentration*	TCLP Sample Selection Breakdown			
				Samples Selected Total		Samples Selected Above Median Concentration	
				#	% of Total	#	% of Total
Main Waste Pit	1	19	20.7	11	57.9	6	31.6
	2	11	14.0	5	45.5	3	27.3
	3	19	12.5	6	31.6	5	26.3
	4	20	18.1	5	25.0	3	15.0
	5	11	13.1	6	54.5	1	9.1
	6	20	10.6	1	5.0	0	0.0
	7	16	22.8	7	43.8	4	25.0
	8	26	17.4	8	30.8	6	23.1
	9	20	11.8	5	25.0	3	15.0
	10	18	29.3	1	5.6	1	5.6
	11	20	16.0	1	5.0	1	5.0
	12	24	10.8	9	37.5	5	20.8
	13	16	16.1	7	43.8	4	25.0
	14	19	14.0	8	42.1	4	21.1
	Total	259		80	30.9	46	17.8
Pit #1	1	9	34.2	5	55.6	3	33.3
	2	9	34.6	5	55.6	2	22.2
	Total	18		10	55.6	5	27.8
Pit #2	1	15	11.2	7	46.7	5	33.3
	2	15	30.8	5	33.3	5	33.3
	Total	30		12	40.0	10	33.3
Pit #3	1	10	17.1	6	60.0	3	30.0
	2	17	17.9	9	52.9	4	23.5
	3	14	16.2	6	42.9	2	14.3
	4	9	11.9	3	33.3	2	22.2
	Total	50		24	48.0	11	22.0
Pit #4	1	10	14.5	4	40.0	3	30.0
	2	11	13.5	5	45.5	4	36.4
	3	11	19.7	5	45.5	2	18.2
	4	11	38.0	6	54.5	3	27.3
	5	11	13.0	3	27.3	1	9.1
	6	11	17.9	4	36.4	2	18.2
	Total	65		27	41.5	15	23.1
Pit #5	1	20	17.3	10	50.0	7	35.0
	2	9	23.8	6	66.7	4	44.4
	Total	29		16	55.2	11	37.9
Pit #6	1	9	14.9	3	33.3	2	22.2
	2	19	25.9	10	52.6	7	36.8
	Total	28		13	46.4	9	32.1
Pit #7	1	10	9.0	3	30.0	2	20.0
	2	10	11.7	4	40.0	3	30.0
	Total	20		7	35.0	5	25.0
Pit #8	1	22	21.1	8	36.4	6	27.3
	2	14	12.8	6	42.9	5	35.7
	Total	36		14	38.9	11	30.6
Pit #9 Suspected Pit	1	18	14.7	9	50.0	6	33.3
	2	13	14.4	4	30.8	1	7.7
	Total	31		13	41.9	7	22.6

* Concentrations exceeded by 50% of samples.

Distribution of Samples Selected for TCLP Chromium Analysis by Waste Pit

(Based on Total Chromium Concentrations)

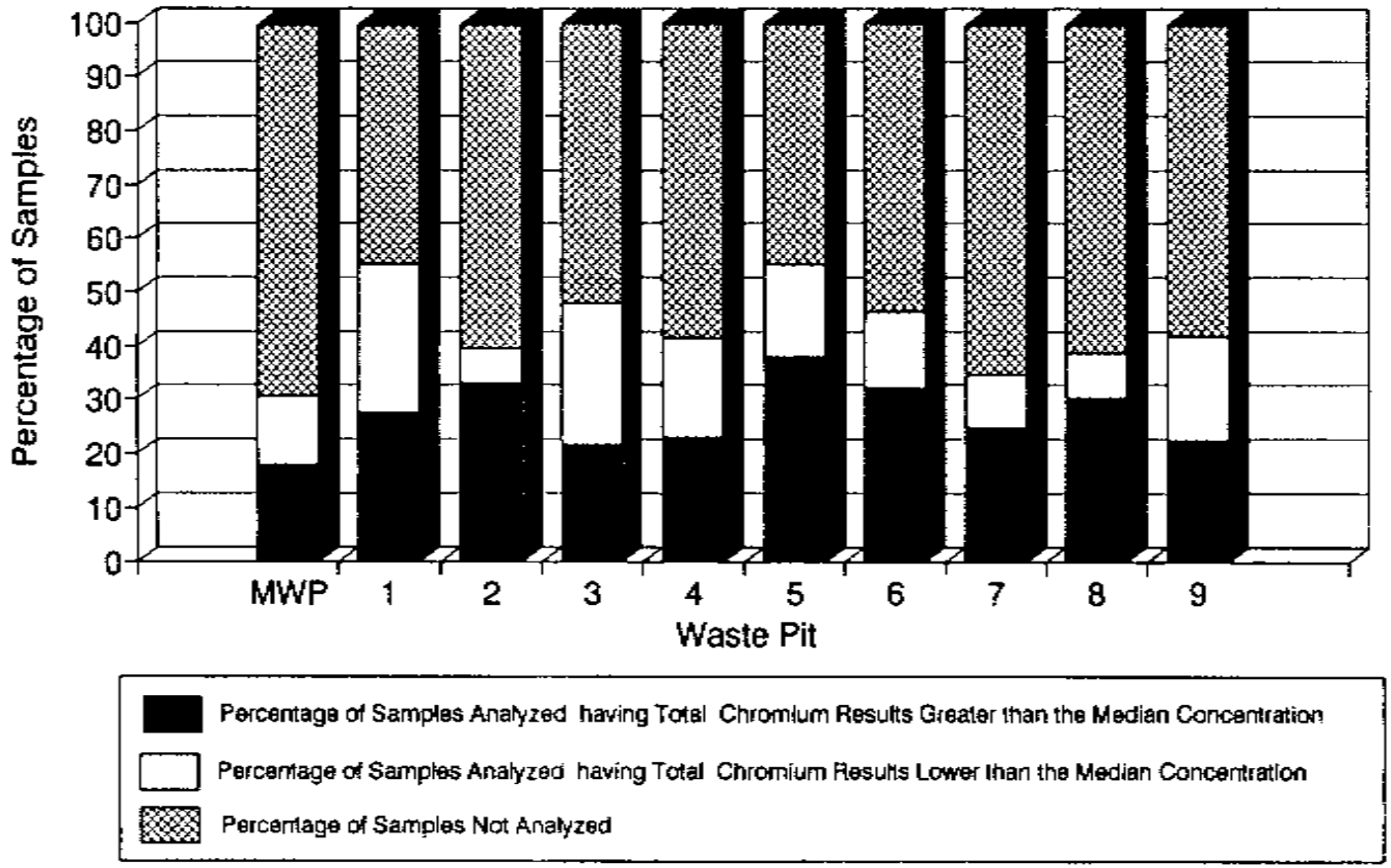


FIGURE 4-46

Texaco Fillmore Remedial Investigation June 1991

Distribution of Samples Selected for TCLP Chromium Analysis for All Pits

(Based on Total Chromium Concentrations)

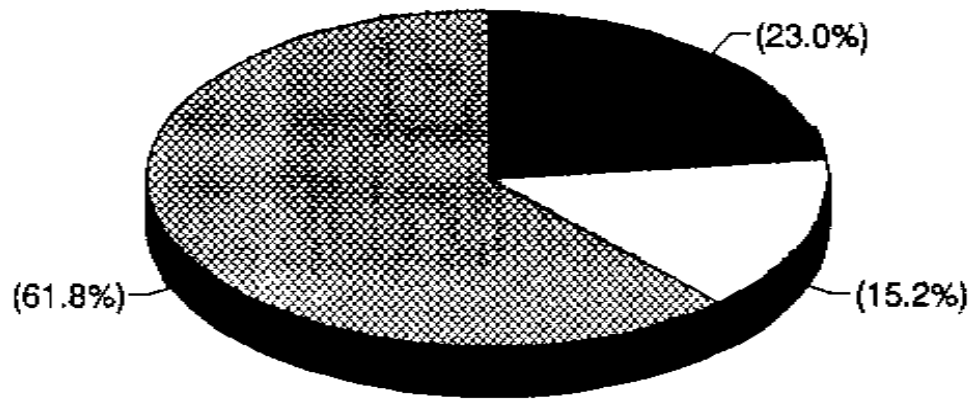


FIGURE 4-47

Texaco Fillmore Remedial Investigation June 1991

TABLE 4-29

TCLP Chromium - Subsurface Soil

Main Waste Pit Region

Constituent	Chromium Concentrations (ug/l)																						
Location	MAIN WASTE PIT														PIT 2		MONITORING WELLS						
Borehole	BH-1	BH-2	BH-3	BH-4	BH-5	BH-6	BH-7	BH-8	BH-9	BH-10	BH-11	BH-12	BH-13	BH-14	BH-1	BH-2	MW2I	MW22S	MW22D	MW23	MW24	MW25D	MW25S
Elev. (FT)																							
525								<2.8						<6	<2.8								
520								<2.8							<2.8	<2.8							
515								<2.8						<2.8	<2.8								
510								<2.8						<6		<2.8							
505													<4		<2.8								
500			<2.8											<6									
495			<2.8		<10								<4		<2.8								
490	<2.8													<12								<2.8	3.1
485	16.7		<2.8				<5					<2.8 J			<2.8	<2.8						<2.8	
480	<2.8	<8		<2.8			<10				<10			<12		<2.8						3.2	4.8
475	<2.8	<8		<2.8									<4										
470	<2.8		<2.8		<10							<2.8 J	<4		<2.8	<2.8						<2.8 J	
465		<8			<10	<6	<10		<5			<2.8 J											
460	<2.8 8.9		<2.8		<10		<10 <5					<2.8 J	<8										
455		<8		<2.8	<10		<10		<25			<2.8 J	4	<12								<2.8	
450	<2.8								<5	<5				<12								3.5	<2.8
445	<2.8			<2.8									<8				<8					<2.8	
440							<10		<5														
435	<2.8			<2.8				<2.8	5.1														
430	<2.8											<2.8											
425			<2.8					<2.8				<2.8					<4						
420								<2.8				<2.8											<2.8
415																							
410																							<2.8
405								<2.8															

Texaco Fillmore Remedial Investigation, Aug-Oct, 90

J : Estimated values
Threshold Level for Chromium : 200 ug/l

TABLE 4-29 (cont.)

TCLP Chromium - Subsurface Soil
Southern Region

Constituent	Chromium Concentrations (ug/l)															
Location	PIT 3				PIT 4						SUSPECT PIT		MONITORING WELLS			BKGND
Borehole	BH-1	BH-2	BH-3	BH-4	BH-1	BH-2	BH-3	BH-4	BH-5	BH-6	BH-1	BH-2	MW18	MW19	MW20	BH-4
Depth (FT)																
5	11.1 J		<12	<2.8			<8		7.9	<8	<2.8					
10	14.5 J							<2.8				<5				
15		<3	2.8 J					<2.8	<6							
	11.2 J	<6														
20	14.5 J	4.7				<2.8				<8	<10					
25		<12			<2.8											
30	12.3 J		3.8 J	<6	<2.8	<2.8	<4					<5				
								<2.8								
35	10 J	6.3		<6		<2.8	<8	<2.8								
											<10					
40				<6	<2.8	<2.8		<2.8		<8		<5		3.5		
							<8									
45		<6	<12			<2.8	<8		5.4		12.4		<6			
		<3			<2.8						<10					
50								<2.8		<4	<10					
55		<3	2.8 J									<5				
60			<6								<2.8				<6	
65											<10				<6	
70		<2.8														
75															<6	
80											<10				<6	
85																

J : Estimated values

Threshold Level for Chromium : 200 ug/l

Texaco Fillmore Remedial Investigation, Aug-Oct, 90

TABLE 4-29 (cont.)

TCLP Chromium - Subsurface Soil

Hill Region

Constituent	Chromium Concentrations (ug/l)								
Location	PIT 5		PIT 6		PIT 7		PIT 8		BG
Borehole	BH-1	BH-2	BH-1	BH-2	BH-1	BH-2	BH-1	BH-2	BH-1
Depth (FT)									
5	<2.8	<2.8				<10	<10		
10	<2.8						22.3 J	29.8	
15		<2.8	<2.8	5		6.7	<2.8	<8	
20	<2.8			<10		<5		22.3	
25	4.8			<5	<2.8	<10			
30	<2.8	<2.8	<5					<24	
35		<2.8 <2.8		5.6	2.9				
40	<2.8	<2.8	6.2	<5	<2.8		<2.8	<8	
45	<2.8			<5					
50				<5			12.2 J		
55				<5					
60								<8	
65	<2.8								
70									
75							<5 J		
80	<2.8			<2.8					
85	83.7			<2.8					
90							7.3 J		
95									
100									
105							5.6 J		

J : Estimated values

Threshold Level for Chromium : 200 ug/l

Texaco Fillmore Remedial Investigation, Aug-Oct, 90

TABLE 4-29 (cont.)

TCLP Chromium - Subsurface Soil

Northern Region

Constituent	Chromium Concentrations (ug/l)				
Location	PIT 1		BACKGROUND		
Borehole	BH-1	BH-2	BH-2	BH-3	BH-5
Depth (FT)					
5	4.2	<2.8			
10	5.6	<2.8			
15	<2.8	<2.8			
20	3.4				
25		4.3			
30	<2.8				
35					
40		<2.8			

J : Estimated values

Threshold Level for Chromium : 200 ug/l

Texaco Fillmore Remedial Investigation, Aug-Oct, 90

TABLE 4-29 (cont.)

TCLP Chromium - Subsurface Soil

Soil Gas Area

Constituent	Chromium Conc. (ug/l)			
Location	SOIL GAS AREA			
Borehole	BH-1	BH-2	BH-3	BH-4
Depth (FT)				
5				
10				
15			<10	
20				
25		<6		
30				
35				
40				
45				
50				
55	<8	<6		
60				

J : Estimated values

Threshold Level for Chromium : 200 ug/l

Texaco Fillmore Remedial Investigation, Aug-Oct, 90

TABLE 4-30

Total Lead - Subsurface Soil
Main Waste Pit Region

Constituent	Lead Concentrations (mg/kg)																								
Location	MAIN WASTE PIT														PIT 2		MONITORING WELLS								
Borehole	BH-1	BH-2	BH-3	BH-4	BH-5	BH-6	BH-7	BH-8	BH-9	BH-10	BH-11	BH-12	BH-13	BH-14	BH-1	BH-2	MW21	MW22S	MW22D	MW23	MW24	MW25D	MW25S		
Elev. (FT)																									
525								6.1						66.6	12.4	ND(5)									
520								ND(5)						13	27.7	5.6									
515								ND(5)			ND(5)			ND(50)	ND(5)	5.4									
510							ND(5)	ND(5)			ND(5)	ND(5)	ND(5.0)	16.1	ND(5)	6.1									
505							ND(5)	ND(5)		ND(5)	ND(5)	ND(5)	ND(5.0)	7.5	ND(5)	5.3									
500		ND(5)	29.5		ND(5)		ND(5)	ND(10)	ND(5)	ND(5)	ND(5)	ND(5)	ND(5.0)	8.5	ND(5)	ND(5)					ND(5.0)				
495	2.7	ND(5)	ND(5)	ND(5)	ND(5)	6.4	ND(5)	ND(5)	ND(5)	ND(5)	ND(5)	ND(5)	ND(5.0)	9.4 ND(5)	ND(5)	5.2						ND(5)			
490	3.6	ND(5)	ND(5)	ND(5)	ND(5)	ND(5)		ND(5)	ND(5)	ND(5)	ND(5)	ND(10)	ND(5.0)	ND(5.0)	ND(5)	ND(5)						5.5	ND(5)		
485	ND(5.0)	ND(5)	ND(5)	ND(5)	ND(5)	ND(5)	ND(5)	ND(5)	ND(5)	ND(5)	ND(5)	ND(5)	ND(5.0)	ND(5.0)	ND(5)	5.8			ND(5)			ND(5)			
480	ND(5.0)	2.6	ND(5)	ND(5)	ND(5)	ND(5)	ND(5)	ND(5)	ND(5)	ND(5)	ND(5)	ND(5)	ND(5.0)	ND(5.0)	ND(5)	ND(5)	ND(5)					ND(5)			
475	ND(5.0)	ND(5)	ND(5)	ND(5)	ND(5)	ND(5)	ND(5)	ND(5)	ND(5)	ND(5)	ND(5)	ND(5)	ND(5.0)	ND(5.0)	ND(5)	ND(5)		ND(5)		ND(5)		ND(5)			
470	18.2	ND(5)	ND(5)	ND(5)	ND(5)	ND(5)	ND(5)	ND(5)	ND(5)	ND(5)	ND(5)	ND(5)	ND(5.0)	ND(5.0)	ND(3)	5						ND(5)			
465	ND(5.0)	ND(5)	ND(5)	ND(10)	ND(5)	ND(5)	ND(5)	ND(5)	ND(5)	ND(5)	ND(5)	ND(5)	ND(5.0)	ND(5.0)	ND(5)	ND(5)						ND(5)			
460	ND(5.0)	ND(5)	ND(5)	ND(5)	ND(10)	ND(5)	ND(5)	ND(5)	ND(5)	ND(5)	ND(10)	ND(5)	ND(5.0)	ND(5.0)											
455	2.9	ND(5)	ND(5)	ND(5)	ND(5)	ND(5)	ND(5)	ND(5)	ND(5)	ND(5)	ND(5)	ND(5)	ND(5.0)	ND(5.0)											
450	ND(5.0)			ND(5)		ND(5) ND(5)	6		ND(5)	ND(5)	ND(10)	ND(5)	ND(5.0)	ND(5.0)											
445	ND(5.0)			ND(5)		ND(5)	ND(5)	ND(5)	ND(5)	ND(5)	ND(5) ND(5)	ND(5)	ND(5.0)	ND(5.0)											
440	ND(5.0)		ND(5)	ND(5)		ND(5)	ND(25)	ND(5)	ND(5)	ND(5)	ND(5)	ND(5)	ND(5.0)												
435	6		ND(10)	ND(5)		ND(5)		ND(5)	ND(5)	ND(5)	ND(10)	ND(5)													
430	ND(5.0)		ND(5)	ND(5)		ND(25)			ND(5)	ND(5)	ND(10)	ND(10)													
425			ND(5)	ND(5)		ND(10)		ND(10)	ND(5)			ND(10)													
420			ND(5)	ND(5)		ND(5)		ND(10)	ND(5)			ND(5)													
415			ND(5)	6.3		ND(25)		ND(5)	ND(5)			ND(5)													
410			ND(5)	ND(5)		ND(25)		ND(10)				ND(10)													
405								ND(5)																	
400																									
395																									

Detection limits are shown in parenthesis

TABLE 4-30 (cont.)

Total Lead - Subsurface Soil
Southern Region

Constituent	Lead Concentrations (mg/kg)															
Location	PIT 3				PIT 4						SUSPECT PIT		MONITORING WELLS			BKGND
Borehole	BH-1	BH-2	BH-3	BH-4	BH-1	BH-2	BH-3	BH-4	BH-5	BH-6	BH-1	BH-2	MW18	MW19	MW20	BH-4
Depth (FT)																
5	5.3	ND(5)	1280	30	11.6	ND(5)	ND(10)	5.2	11.7	163	8.3	ND(10)				
10	1040	ND(5)	ND(5.0)	ND(5)	ND(2.5)	ND(5)	ND(5)	6	ND(5)	26.5	ND(5)	ND(10)				ND(5)
15	25.4	5.4	ND(5.0)	ND(5)	2.7	ND(5)	ND(5)	ND(5)	11.6	ND(5.0)	ND(5)	ND(5)				
20	1.33	ND(5)	ND(5.0)	ND(5)	ND(2.5)	ND(5)	ND(5)	ND(5)	ND(5)	19.6	ND(5)	ND(5)				ND(5)
25	ND(5)	ND(5)	ND(5.0)	ND(5)	ND(2.5)	ND(5)	ND(5)	ND(5)	ND(5)	ND(5.0)	ND(5)	ND(5)				ND(5)
30	ND(5)	ND(5)	ND(5.0)	ND(5)	ND(2.5)	ND(5)	ND(5)	ND(5)	ND(5)	ND(5.0)	ND(5)	ND(5)				
35	ND(5)	ND(5)	ND(5.0)	ND(5)	ND(2.5)	ND(5)	ND(5)	5.9	ND(5)	ND(5.0)	ND(5)	ND(5)		ND(10)		
40	ND(5)	ND(5)	ND(5.0)	ND(5)	2.7	ND(5)	ND(5)	ND(5)	ND(5)	ND(5.0)	ND(5)	ND(10)		ND(5)		
45	ND(5)	5.6	ND(5.0)		2.5	ND(5)	ND(5)	ND(5)	ND(5)	ND(5.0)	ND(5)	ND(5)	ND(30)	ND(5)		
50		ND(5)	ND(5.0)		3.1	ND(5)	ND(5)	5.5	ND(5)	ND(5.0)	ND(5)	ND(5)	ND(10)	ND(5)		
55		ND(10)	ND(5.0)								ND(5)	ND(5)		ND(5)		
60			ND(5.0)								ND(5)	ND(5)			ND(5)	
65		ND(5)									ND(5)				ND(5)	
70		ND(5)									ND(5)				ND(5)	
75		ND(5)									ND(5)				ND(10)	
80		ND(5)									ND(5)				ND(5)	
85															ND(5)	
															ND(5)	

Detection limits are shown in parenthesis

TABLE 4-30 (cont.)

Total Lead - Subsurface Soil
Hill Region

Constituent	Lead Concentrations (mg/kg)								
Location	PIT5		PIT6		PIT7		PIT8		BG
Borehole	BH-1	BH-2	BH-1	BH-2	BH-1	BH-2	BH-1	BH-2	BH-1
Depth (FT)									
5	ND(5)	ND(5)	ND(5)	ND(5)	ND(5)	4900	17.4	ND(5)	ND(5.0)
					ND(5)				
10	ND(5)	ND(5)	ND(5)	ND(5)		5.9	73.2	ND(25)	ND(5.0)
	ND(5)					1570			
15	ND(5)	ND(5)	ND(5)	ND(5)	ND(5)	ND(5)	10.4	ND(5)	ND(5.0)
20	ND(5)	ND(5)	ND(5)	ND(5)	ND(5)	ND(5)	7.8	ND(5)	ND(5.0)
			ND(5)						
25	ND(5)	ND(5)	ND(5)	ND(5)	ND(5)	ND(5)	ND(5)	ND(5)	
								ND(10)	
30	ND(5)	ND(5)	6.7	ND(5)	ND(5)	ND(5)	ND(5)	ND(15)	
		ND(5)							
35	ND(5)	ND(5)	ND(5)	ND(5)	ND(10)	ND(5)		ND(5)	
40	5.5	ND(5)	ND(5)	ND(5)	3.5	ND(5)	ND(5)	ND(5)	
45	ND(5)			ND(5)	ND(5)		8.5	ND(5)	
				ND(5)					
50	ND(5)			ND(5)	ND(5)	ND(5)	ND(5)	ND(5)	
55	ND(5)			ND(5)			ND(5)	ND(5)	
				ND(5)				ND(5)	
60	ND(5)			ND(5)			5.1	ND(5)	
	ND(5)								
65	ND(5)			ND(5)			ND(5)		
							ND(5)		
70	ND(5)			ND(5)			ND(5)		
75	ND(5)			ND(5)			7		
80	ND(5)			ND(5)			ND(5)		
85	ND(5)			ND(5)			ND(10)		
90	ND(5)						ND(5)		
							5.4		
95							ND(5)		
100							ND(5)		
105							ND(5)		

Detection limits are shown in parenthesis

TABLE 4-30 (cont.)

Total Lead - Subsurface Soil
Northern Region

Constituent	Lead Concentrations (mg/kg)				
Location	PIT 1		BACKGROUND		
Borehole	BH-1	BH-2	BH-2	BH-3	BH-5
Depth (FT)					
5	10.8	ND(5)	ND(5.0)		ND(5)
10	ND(5)	ND(5)	ND(5.0)	ND(5.0)	ND(5)
		ND(5)		ND(5.0)	
15	ND(5)	ND(5)	ND(5.0)	ND(5.0)	ND(5)
					ND(5)
20	ND(5)	ND(5)	5.9	ND(5.0)	ND(5)
25	ND(5)	ND(5)			
	ND(5)				
30	ND(5)	ND(5)			
35	ND(5)	ND(5)			
40	ND(5)	ND(5)			
45					
50					

Detection limits are shown in parenthesis

TABLE 4-30 (cont.)

Total Lead - Subsurface Soil
Soil Gas Area

Constituent	Lead Concentrations (mg/kg)			
Location	SOIL GAS AREA			
Borehole	BH-1	BH-2	BH-3	BH-4
Depth (FT)				
5	3.6	19.4	3.2	2.2
10			3.4	
15				
20		2.8		2.8
25	2			
30				

Detection limits are shown in parenthesis

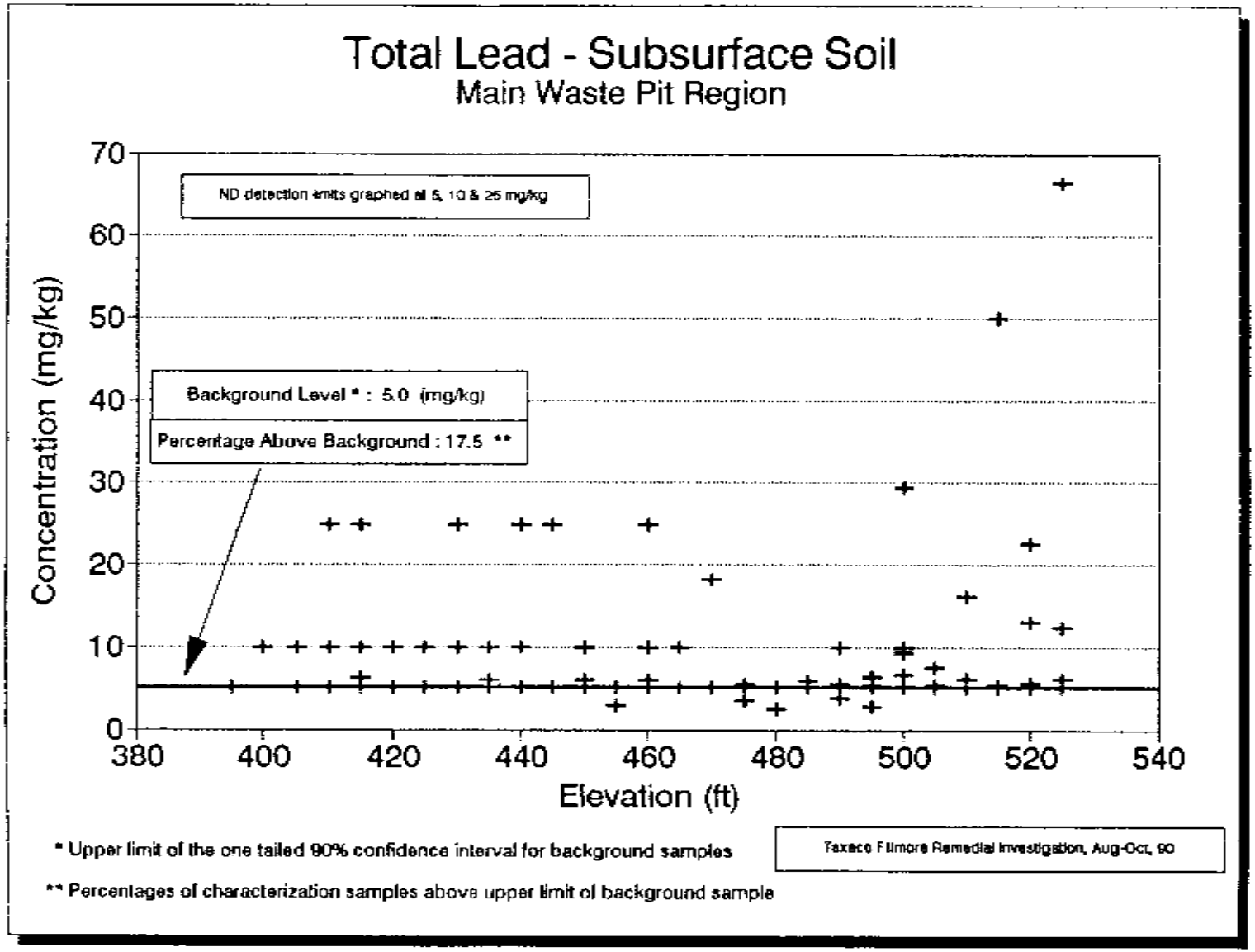

Total Lead - Subsurface Soil
Main Waste Pit Region
ND detection limits graphed at 5, 10 & 25 mg/kg
Background Level * : 5.0 (mg/kg)
Percentage Above Background : 17.5 **
Concentration (mg/kg)
0
10
20
30
40
50
60
70
380
400
420
440
460
480
500
520
540
Elevation (ft)
* Upper limit of the one tailed 90% confidence interval for background samples
** Percentages of characterization samples above upper limit of background sample
Texaco Fillmore Remedial Investigation, Aug-Oct, 90

FIGURE 4-48

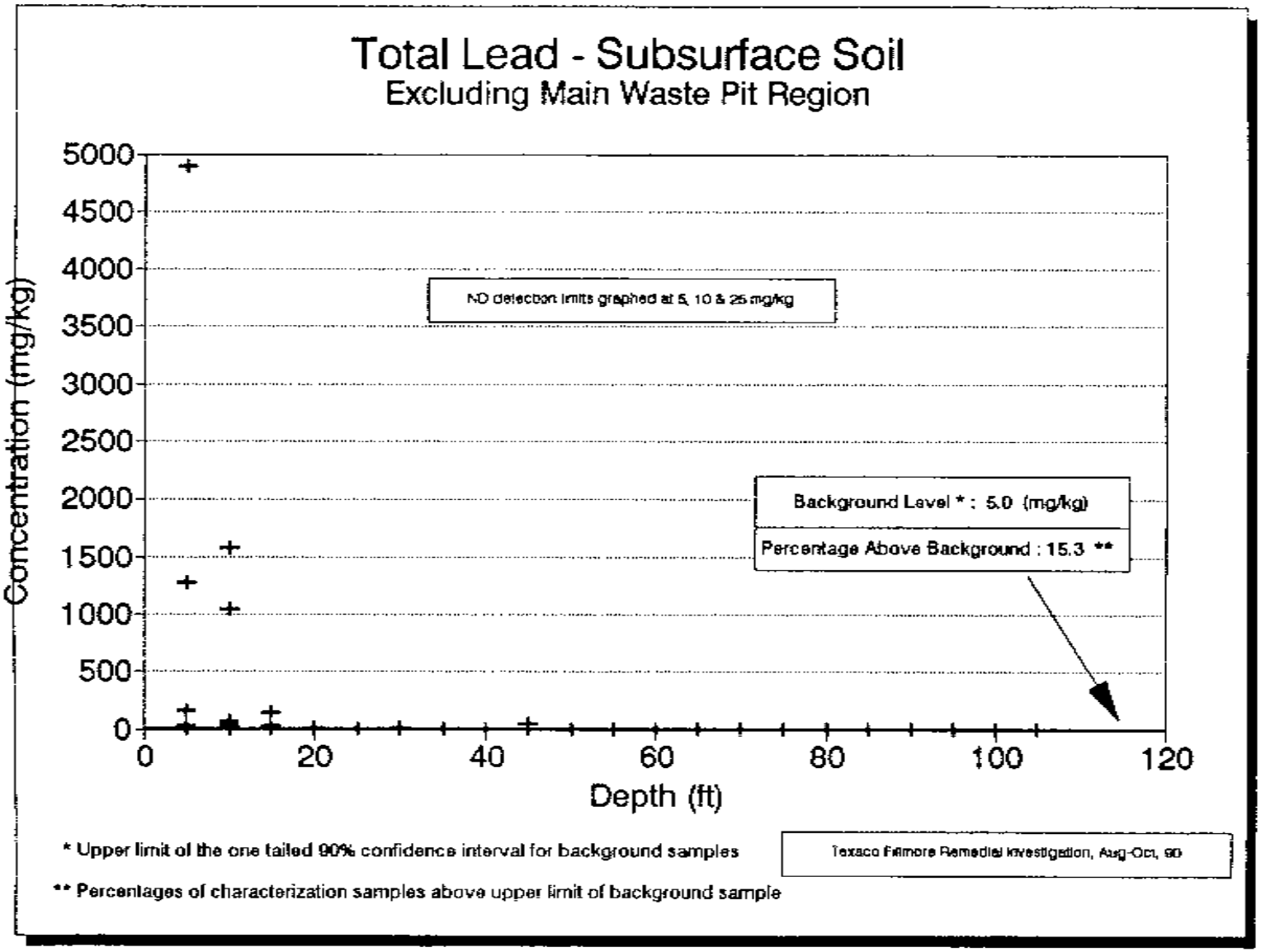

Total Lead - Subsurface Soil
Excluding Main Waste Pit Region
Concentration (mg/kg)
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
0
20
40
60
80
100
120
Depth (ft)
ND detection limits graphed at 5, 10 & 25 mg/kg
Background Level * : 5.0 (mg/kg)
Percentage Above Background : 15.3 **
* Upper limit of the one tailed 90% confidence interval for background samples
** Percentages of characterization samples above upper limit of background sample
Texaco Fillmore Remedial Investigation, Aug-Oct, 90

FIGURE 4-49

TABLE 4-31

Samples Selected for TCLP Lead Analysis (Based on Total Lead Concentrations)

Waste Pit	BH #	Total # of Samples Collected	Median Lead Concentration*	TCLP Sample Selection Breakdown			
				Number of Samples Selected for TCLP Analysis		Number of Selected Samples Above Median Concentration	
				#	% of Total	#	% of Total
Main Waste Pit	1	16	5.0	8	50.0	3	18.8
	2	11	5.0	5	45.5	0	0.0
	3	19	5.0	5	26.3	1	5.3
	4	20	5.0	3	15.0	2	10.0
	5	11	5.0	6	54.5	2	18.2
	6	20	5.0	1	5.0	0	0.0
	7	16	5.0	7	43.8	2	12.5
	8	26	5.0	6	23.1	3	11.5
	9	20	5.0	5	25.0	0	0.0
	10	18	5.0	1	5.6	0	0.0
	11	20	5.0	1	5.0	0	0.0
	12	24	5.0	9	37.5	3	12.5
	13	16	5.0	7	43.8	1	6.3
	14	19	5.0	8	42.1	5	26.3
	Total	256		72	28.1	22	8.6
Pit #1	1	9	5.0	5	55.6	1	11.1
	2	9	5.0	5	55.6	0	0.0
	Total	18		10	55.6	1	5.6
Pit #2	1	15	5.0	7	46.7	3	20.0
	2	15	5.0	5	33.3	3	20.0
	Total	30		12	40.0	6	20.0
Pit #3	1	10	5.0	6	60.0	4	40.0
	2	17	5.0	9	52.9	4	23.5
	3	14	5.0	6	42.9	2	14.3
	4	9	5.0	3	33.3	1	11.1
	Total	50		24	48.0	11	22.0
Pit #4	1	10	2.5	2	20.0	2	20.0
	2	11	5.0	1	9.1	0	0.0
	3	11	5.0	5	45.5	1	9.1
	4	11	5.0	6	54.5	4	36.4
	5	11	5.0	3	27.3	2	18.2
	6	11	5.0	4	36.4	2	18.2
	Total	65		21	32.3	11	16.9
Pit #5	1	20	5.0	9	45.0	2	10.0
	2	9	5.0	2	22.2	0	0.0
	Total	29		11	37.9	2	6.9
Pit #6	1	9	5.0	3	33.3	1	11.1
	2	19	5.0	10	52.6	1	5.3
	Total	28		13	46.4	2	7.1
Pit #7	1	10	5.0	4	40.0	1	10.0
	2	10	5.0	4	40.0	2	20.0
	Total	20		8	40.0	3	15.0
Pit #8	1	22	5.0	6	27.3	5	22.7
	2	14	5.0	0	0.0	0	0.0
	Total	36		6	16.7	5	13.9
Pit #9 Suspected Pit	1	18	5.0	9	50.0	2	11.1
	2	13	5.0	4	30.8	2	15.4
	Total	31		13	41.9	4	12.9

* Concentrations exceeded by 50% of samples.

Distribution of Samples Selected for TCLP Lead Analysis by Waste Pit

(Based on Total Lead Concentrations)

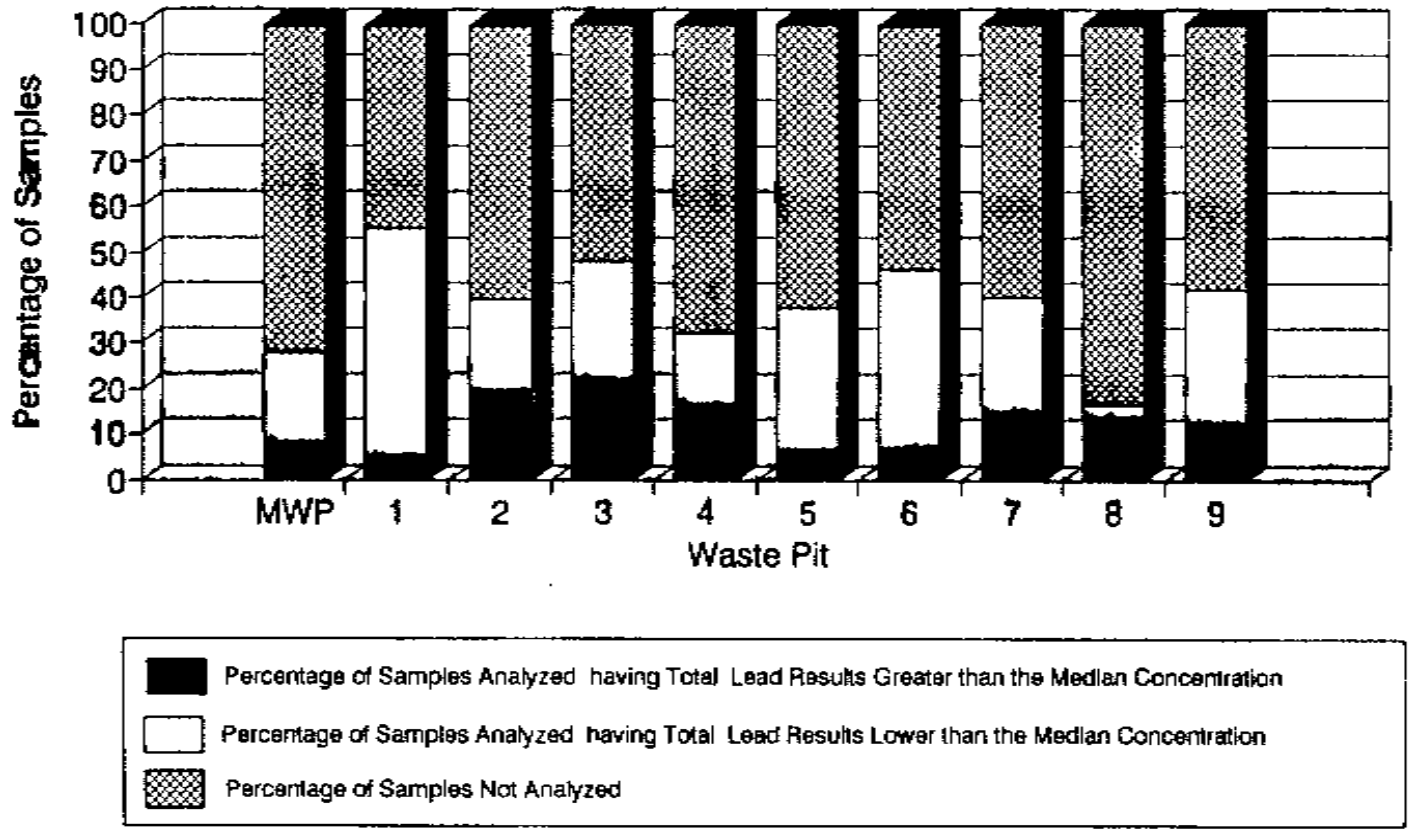


FIGURE 4-50

Texaco Fillmore Remedial Investigation June 1991

Distribution of Samples Selected for TCLP Lead Analysis for All Pits

(Based on Total Lead Concentrations)

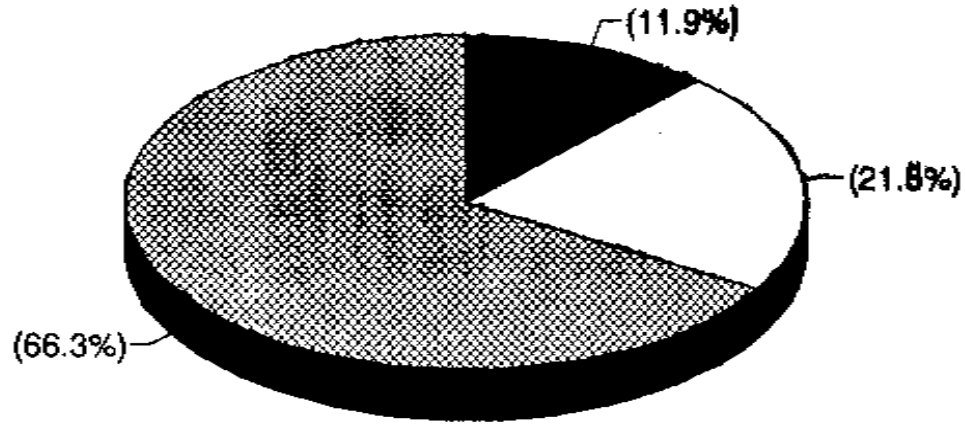


FIGURE 4-51

Texaco Fillmore Remedial Investigation June 1991

TABLE 4-32

TCLP Lead - Subsurface Soil

Main Waste Pit Region

Constituent	Lead Concentrations (ug/l)																						
Location	MAIN WASTE PIT														PIT 2		MONITORING WELLS						
Borehole	BH-1	BH-2	BH-3	BH-4	BH-5	BH-6	BH-7	BH-8	BH-9	BH-10	BH-11	BH-12	BH-13	BH-14	BH-1	BH-2	MW21	MW22S	MW22D	MW23	MW24	MW25D	MW25S
Elev. (FT)																							
525														3	14.5								
520								<2.2							<2.2	<2.2							
515								<2.2						<2.2	<2.2								
510														4.9		<2.2							
505													<2		<2.2								
500			<2.2											<1	<2.2								
495			<2.2		<1								<2		<2.2								
490	<2.2 J													16.1								18.7	<2.2
485	<2.2		<2.2				<1 J					<2.2 J		15.4	<2.2	<2.2						24	
480	<2.2 J	2					<1 J				<1			1		<2.2							
475	<2.2	2.4		<2.2									<2									20.4	<2.2
470	<2.2				3							<2.2 J	<2		<2.2	<2.2						5.5	
		3			1.7				<1														
465		<2			38	5.6	<1 J					<2.2 J											
460	<2.2		<2.2		<1		<1 J					<2.2 J											
				<2.2			<1						<2										
455		<2			6.6		<1 J		<10			<2.2 J	<2	1.5									
450									<1	<1				1.5								3	
445	<2.2												<2				<2					<2.2	<2.2
440							<1		<1													<2.2	
435	<2.2							2.3	<1														
430												<2.2											
												<2.2											
425			<2.2					<2.2				<2.2					<2						
420								<2.2				<2.2											
415				<2.2																			
410																							
405								<2.2															

J : Estimated values
Threshold Level for Lead : 180 ug/l

Texaco Fillmore Remedial Investigation, Aug-Oct, 90

TABLE 4-32 (cont.)

TCLP Lead - Subsurface Soil
Southern Region

Constituent	Lead Concentrations (ug/l)															
Location	PIT 3				PIT 4						SUSPECT PIT		MONITORING WELLS			BKGND
Borehole	BH-1	BH-2	BH-3	BH-4	BH-1	BH-2	BH-3	BH-4	BH-5	BH-6	BH-1	BH-2	MW18	MW19	MW20	BH-4
Depth (FT)																
5	15.1		1.6	<2.2			2.6		<2	97.3	<2.2					
10	207							<2.2				<1				
15		2.2 J	<2.2					<2.2	3.2							
	94.2	3.4 J														
20	<1	2.3 J								<2	<1					
25		3.5 J														
30	<1		<2.2	<1			<2					<1				
35	1	2.8 J		<1		4.4	12.2	<2.2 5.6								
40				<1	<2.2			<2.2		<2 J	1.1	<1		8.6 J		
45		3.7 J	<1				3.6 <2		5.1		1.1		<1			
50		3.1 J			<2.2			<2.2		<2	<1 <1		<1			
55		2.6 J	<2.2									<1				
60			3.3								2.2				<2 J	
65											1.7				3 J	
70		<2.2														
75															<2 J	
80											1.2				<2 J	
85																

J : Estimated values

Threshold Level for Lead : 180 ug/l

Texaco Fillmore Remedial Investigation, Aug-Oct, 90

TABLE 4-32 (cont.)

TCLP Lead - Subsurface Soil

Hill Region

Constituent	Lead Concentrations (ug/l)								
Location	PIT 5		PIT 6		PIT 7		PIT 8		BG
Borehole	BH-1	BH-2	BH-1	BH-2	BH-1	BH-2	BH-1	BH-2	BH-1
Depth (FT)									
5	<2.2					6.5	1.5		
10		<2.2					<1	<2	
15			<2.2	<1		<1	<2.2	<2	
20	<2.2			9.5 J		<1		<2	
25	<2.2			<1 J	<2.2	<1			
30	<2.2		<1		<2.2			<2	
35		<2.2		<1	<2.2				
40	<2.2		<1	<1	<2.2		<2.2	<2	
45	<2.2			1.3 J					
50				<1			<1		
55				<1					
60								<2	
65	<2.2								
70									
75							<1		
80	<2.2			<2.2					
85	3.3			<2.2					
90							<1		
95									
100									
105							<1		

J : Estimated values

Threshold Level for Lead : 180 ug/l

Texaco Fillmore Remedial Investigation, Aug-Oct, 90

TABLE 4-32 (cont.)

TCLP Lead - Subsurface Soil

Northern Region

Constituent	Lead Concentrations (ug/l)				
Location	PIT 1		BACKGROUND		
Borehole	BH-1	BH-2	BH-2	BH-3	BH-5
Depth (FT)					
5	2.6	<2.2			
10		<2.2			
15	<2.2	<2.2			
20	<2.2				
25		<2.2			
30	<2.2				
35					
40		<2.2			

J : Estimated values

Threshold Level for Lead : 180 ug/l

Texaco Fillmore Remedial Investigation, Aug-Oct, 90

TABLE 4-32 (cont.)

TCLP Lead - Subsurface Soil

Soil Gas Area

Constituent	Lead Concentrations (ug/l)			
Location	SOIL GAS AREA			
Borehole	BH-1	BH-2	BH-3	BH-4
Depth (FT)				
5				
10				
15			<1	<1
20				
25		6.4		
30				
35				
40			12	
45				
50				
55	<2	6		
60				

J : Estimated values

Threshold Level for Lead : 100 ug/l

Texaco Fillmore Remedial Investigation, Aug-Oct, 90

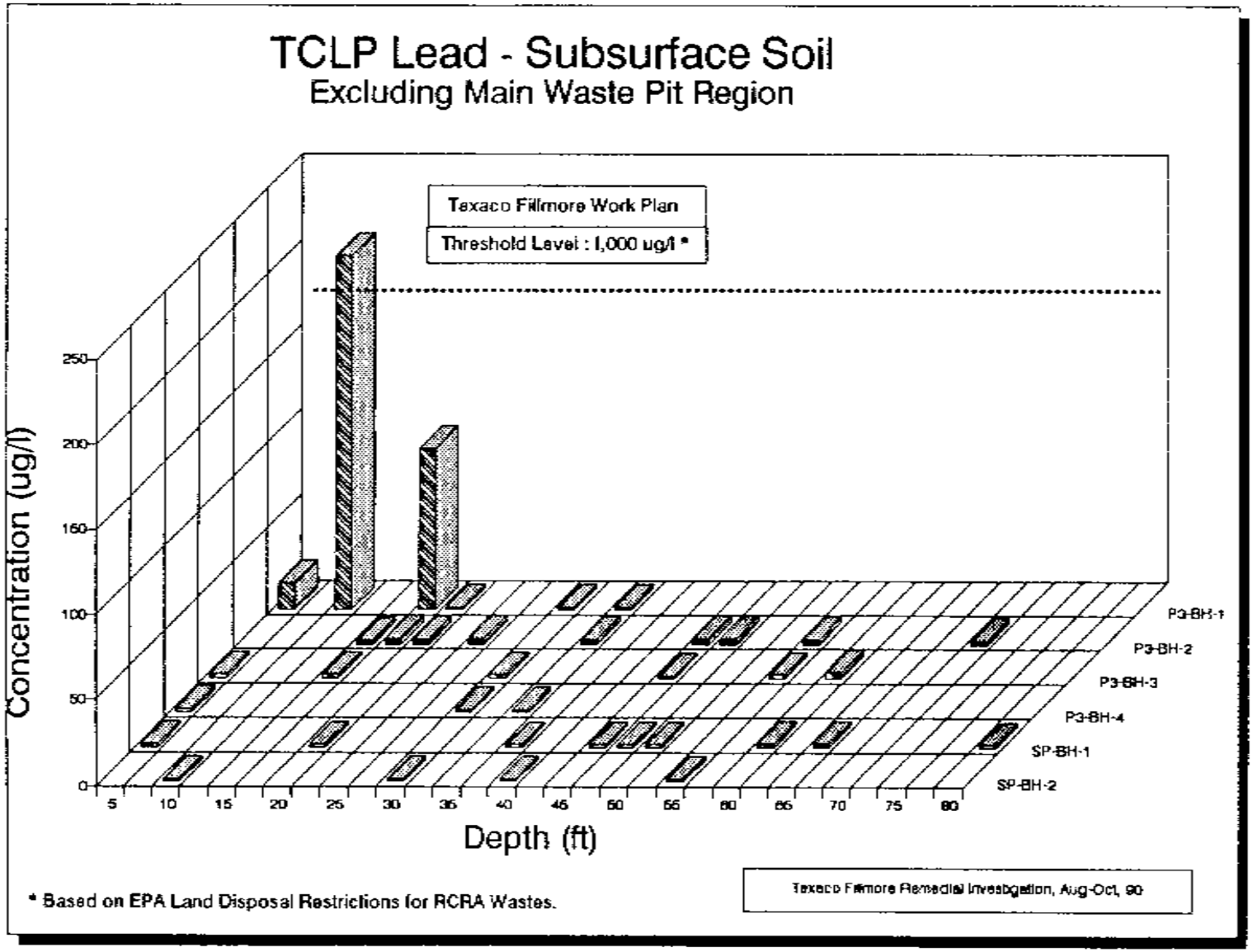

TCLP Lead - Subsurface Soil
Excluding Main Waste Pit Region
Texaco Fillmore Work Plan
Threshold Level : 1,000 ug/l *
Concentration (ug/l)
0
50
100
150
200
250
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
Depth (ft)
P3-BH-1
P3-BH-2
P3-BH-3
P3-BH-4
SP-BH-1
SP-BH-2
* Based on EPA Land Disposal Restrictions for RCRA Wastes.
Texaco Fillmore Remedial Investigation, Aug-Oct, 90

FIGURE 4-52

4.1.6.8 Copper

Total copper analyses results are presented in Table 4-33. The data do not appear to vary geographically or with depth. A better representation is given in Figure 4-53 for boreholes in the MWP Region and in Figure 4-54 for all other boreholes. The range of values (7.7 to 546 mg/kg) does not vary with depth. The average of the population is 32.1 mg/kg and the standard deviation is 45. A total of 96 samples have concentrations above the upper limit for background calculated in Section 4.1.6, representing 52 percent of the total number of samples.

While TCLP thresholds were not defined in the FSP for copper, a total of 243 samples were extracted and analyzed for TCLP. The highest value obtained was 427 µg/l, in MWP BH-3. The results of the TCLP analysis for copper are provided in Table 4-34.

4.1.6.9 Nickel

Total nickel analyses results are presented in Table 4-35. The data do not appear to vary geographically or with depth. A better representation is given in Figure 4-55 for boreholes in the MWP Region and in Figure 4-56 for all other boreholes. The range of values (4.4 to 79.5 mg/kg) does not vary with depth. The average concentration of the population is 33 mg/kg and the standard deviation is 11. A total of 63 samples have concentrations above the upper limit for background calculated in Section 4.1.6, representing 39 percent of the total number of samples.

While TCLP thresholds were defined for Nickel in the FSP, a total of 244 samples were extracted and analyzed for TCLP. The highest value obtained was 428 µg/l, in MWP BH-1. The results of the TCLP analysis for nickel are provided in Table 4-36.

4.1.6.10 Vanadium

Total vanadium analyses results are presented in Table 4-37. The data do not appear to vary geographically or with depth. A better representation is given in Figure 4-57 for boreholes in the MWP Region and in Figure 4-58 for all other boreholes. The range of values (9.5 to 159 mg/kg) does not vary with depth. The average concentration of the population is 67.7 mg/kg and the standard deviation is 27. A total of 51 samples with concentrations above the upper limit for background calculated in Section 4.1.6, representing 27 percent of the total number of samples.

TABLE 4-33

Total Copper - Subsurface Soil
Main Waste Pit Region

Constituent	Copper Concentrations (mg/kg)																						
Location	MAIN WASTE PIT														PIT 2		MONITORING WELLS						
Borehole	BH-1	BH-2	BH-3	BH-4	BH-5	BH-6	BH-7	BH-8	BH-9	BH-10	BH-11	BH-12	BH-13	BH-14	BH-1	BH-2	MW21	MW22S	MW22D	MW23	MW24	MW25D	MW25S
Elev. (ft)																							
525								18.8							27.5	31.7							
520														17.4	44.9	27.7							
515											22.9			22		34.5							
510							16.4	22.2			21.5				27.2	39.8							
505							29.9			23.7		20.4	11			32.2							
500					40.8		25.8		15.2	30.5						29.5							
495		22.1			36.2		25.2		10	30		25.3	20.4			122							
490	16.1		19.7	45.9						34						28.7						22.6	
485		15.1				15	26.1			28.7						33.5 27.7							
480	21.6		16.1	47.2		20.4	33.9			43.8						39.2							
475							28.1			52.2						29.3						66.4	
470							34.6			25.1						33 40.4							
465							21.7			23.4						24.9							
460							23.7 31.9			28.4													
455							27.1 29			24.9													
450							27.3			15.6													
445							60.3			12.8 16.1													
440							26			48.2 34													
435										37.8												7.7	
430										16.7													
425																						23.9	

TABLE 4-33 (cont.)

Total Copper - Subsurface Soil
Southern Region

Constituent	Copper Concentrations (mg/kg)															
Location	PIT 3				PIT 4						SUSPEC	PIT	MONITORING WELLS			BG
Borehole	BH-1	BH-2	BH-3	BH-4	BH-1	BH-2	BH-3	BH-4	BH-5	BH-6	BH-1	BH-2	MW18	MW19	MW20	BH-4
Depth (ft)																
5		25.4	24.2	24.2			32	29.7	33.2							
10			18.2	19.3			12.5	24.6	19.1	13.4	9.4					16.8
15		37.8			13.6			24.7		14.2	59.8	19.8				
20	34.3				8.3	8.6		24.6				16.8				36.4
25	30.8					15.3		20.4								19.4
30								26.3								
35								21.7 23.2								
40								40.7								
45								20.6						20.2		
50								19.1						29.7		
55																
60																
65															29	
70																
75																
80															19.1	

TABLE 4-33 (cont.)

Total Copper - Subsurface Soil
Hill Region

Constituent	Copper Concentrations (mg/kg)								
Location	PIT 5		PIT 6		PIT 7		PIT 8		BKGRN
Borehole	BH-1	BH-2	BH-1	BH-2	BH-1	BH-2	BH-1	BH-2	BH-1
Depth (ft)									
5		13.8	15.1	15.8		15.6	546	21.3	23.7
10			18.4				226	12.1	48.1
15	26.7	15.5		26.2		26.6	215		13.9
20					13.6		27.4		24.6
25	20.7						61.1		
30					14.7		13.6		
35									
40							11.9		
45							14.2		
50							23.4		
55							25.1		
60							16.4		
65							18.8		
70							10.9 29.9		
75							35.3		
80							30		
85							25.1		
90							31.8		
95							31.8 19.3		
100							24		
105							34.4		

TABLE 4-33 (cont.)

Total Copper - Subsurface Soil
Northern Region

Constituent	Copper Concentrations (mg/kg)				
Location	PIT 1		BACKGROUND		
Borehole	BH-1	BH-2	BH-2	BH-3	BH-5
Depth (ft)					
5		22.6	27.9		17
10	25.4		107	35.5	16.3
				29.3	
15	41.7	45.9	22.6	49.1	18.9
					18.1
20			21	22.1	20.8

TABLE 4-33 (cont.)

Total Copper - Subsurface Soil

Soil Gas Area

Constituent	Copper Concentrations (mg/kg)			
Location	SOIL GAS			
Borehole	BH-1	BH-2	BH-3	BH-4
Depth (ft)				
5	40.9	35.6	34	39.3
10			37.5	
15				
20		25.2		47.5
25	35.3			

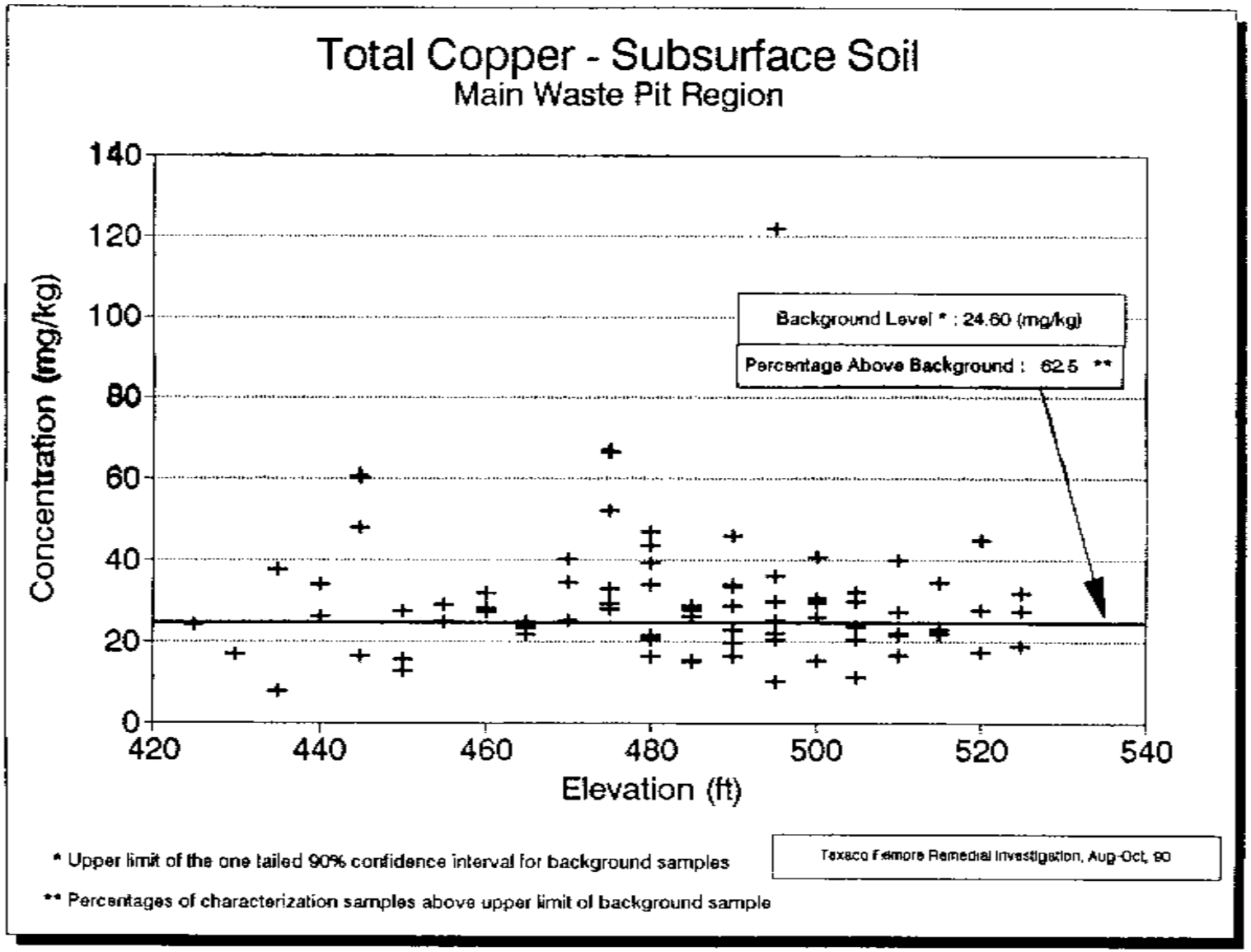

Total Copper - Subsurface Soil
Main Waste Pit Region
Concentration (mg/kg)
140
120
100
80
60
40
20
0
420
440
460
480
500
520
540
Elevation (ft)
Background Level * : 24.60 (mg/kg)
Percentage Above Background : 62.5 **
* Upper limit of the one tailed 90% confidence interval for background samples
** Percentages of characterization samples above upper limit of background sample
Texaco Fremont Remedial Investigation, Aug-Oct, 90

FIGURE 4-53

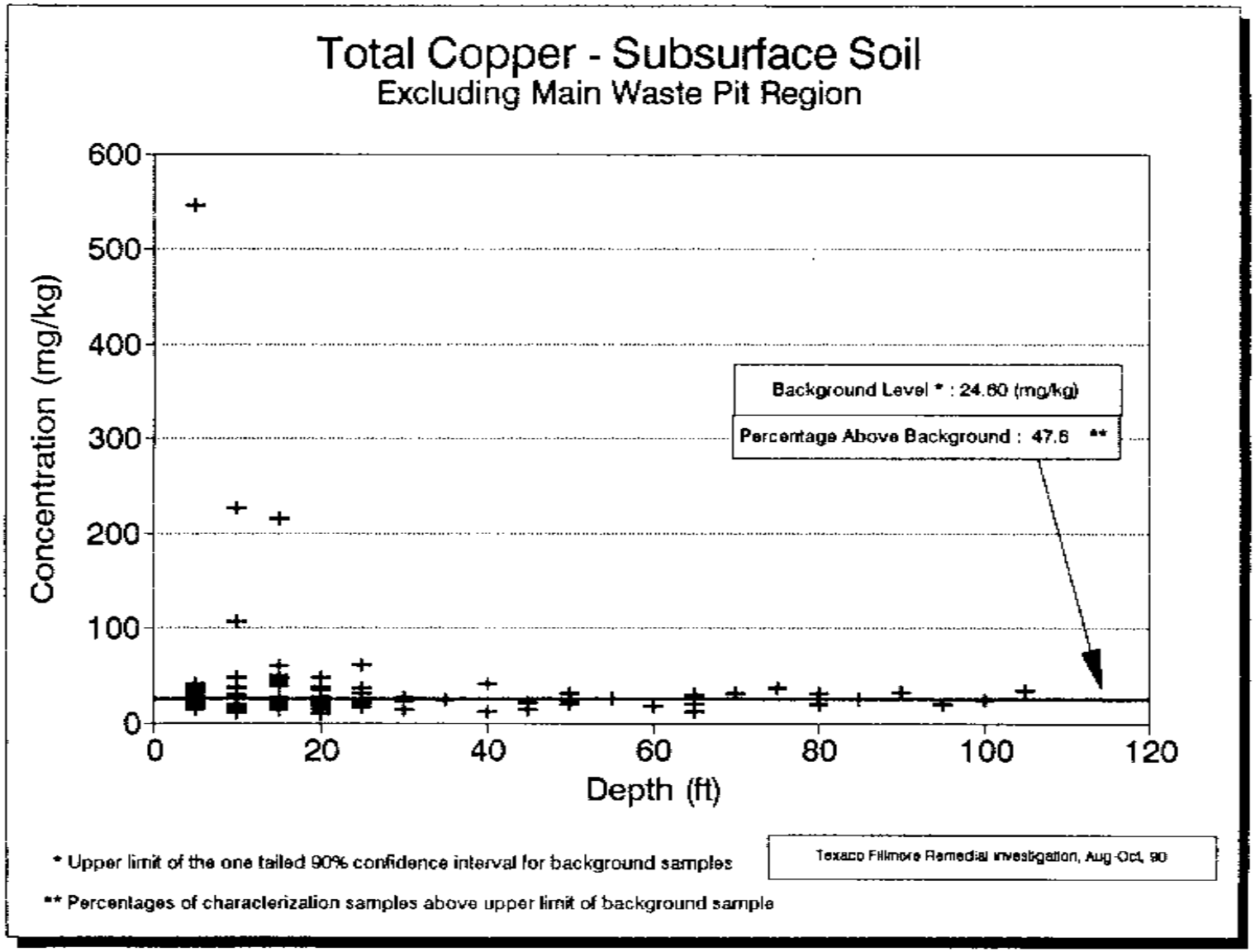

Total Copper - Subsurface Soil
Excluding Main Waste Pit Region
Concentration (mg/kg)
600
500
400
300
200
100
0
0
20
40
60
80
100
120
Depth (ft)
Background Level * : 24.60 (mg/kg)
Percentage Above Background : 47.6 **
* Upper limit of the one tailed 90% confidence interval for background samples
** Percentages of characterization samples above upper limit of background sample
Texaco Fillmore Remedial Investigation, Aug-Oct, 90

FIGURE 4-54

TABLE 4-34

TCLP Copper - Subsurface Soil

Main Waste Pit Region

Constituent	Copper Concentrations (ug/l)																					
Location	MAIN WASTE PIT														PIT 2		MONITORING WELLS					
Borehole	BH-1	BH-2	BH-3	BH-4	BH-5	BH-6	BH-7	BH-8	BH-9	BH-10	BH-11	BH-12	BH-13	BH-14	BH-1	BH-2	MW2I	MW22S	MW22D	MW23	MW24	MW25D	MW25S
Elev. (FT)																							
525								47.6						<6	12								
520								25.4							<7.4	15							
515								50.6						16.3	<7.4								
510								20.1						<6	12								
505													8.1		<7.4								
500			10.1											<6		<4							
495			101		10.2								<6		<7.4								
490	<7.4													26.6		6.3						18.6 J	14.2 J
485	<7.4		61.7				8.9 J					12.6 J			<7.4							31.8 J	
480	<7.4	<12		9.9			<8 J				10.2			<12									
475	<7.4	<12		<7.4									<6			4.7						7.6 J	20.9 J
470	<7.4	<12	35.6		18.3							<7.4 J	<6		<7.4							<7.4 J	
465	<7.4	<12			<8 13.2	<6	10.3 J		30.1			<7.4 J			<8								
460	32.9		427		48.8		<8 J					10.4 J											
455		<12		7.9	32.5		5.7 J 10.3 J		<20			<7.4 J	<12 <6	23.5									
450	<7.4								17.3	22.2				<12	<8							9 J	
445	<7.4			9.7									<12				<12					<7.4	25.4 J
440							8.3 J		12.2													54.8	
435	<7.4			7.4				14.9	21.3														
430	<7.4											65.4											
425			44.2					16.2				21.4 18.8					<6						
420								25.3				10.8											
415																							28
410																							
405								13.4															18.9

J : Estimated values

Texaco Fillmore Remedial Investigation, Aug-Oct, 90

TABLE 4-34 (cont.)

TCLP Copper - Subsurface Soil

Southern Region

Constituent	Copper Concentrations (ug/l)															
Location	PIT 3				PIT 4						SUSPECT PIT		MONITORING WELLS			BKGND
Borehole	BH-1	BH-2	BH-3	BH-4	BH-1	BH-2	BH-3	BH-4	BH-5	BH-6	BH-1	BH-2	MW18	MW19	MW20	BH-4
Depth (FT)																
5	9.4		36	13.6			16.2		10.1	<12	24.6					
10	<8							<7.4				15				
15		<3	24.6 J					<7.4	7.7							
20	<8 8.4	14.7 5.7				10.7				<12	20.6 J					
25		<12			48											
30	<8		7.4 J	<6	30.8	<7.4	<6	<7.4				<4				
35	11.6	10.9		<6		<7.4	<12	<7.4			20.6 J					
40					24.4	<7.4	38.7	<7.4		<12		6.3		3.8		
45		18.8	<12			<7.4	12		8.3		13.4 J		<6			
50		12.1			11.2			<7.4		<6	<8 J 8.3 J					
55		17.8	7.4 J									4.7				
60			<6								11.6				12	
65											<8 J				11.3	
70		9.7														
75															57	
80											<8 J				6.6	
85																

J : Estimated values

Texaco Fillmore Remedial Investigation, Aug-Oct, 90

TABLE 4-34 (cont.)

TCLP Copper - Subsurface Soil

Hill Region

Constituent	Copper Concentrations (ug/l)								
Location	PIT 5		PIT 6		PIT 7		PIT 8		BG
Borehole	BH-1	BH-2	BH-1	BH-2	BH-1	BH-2	BH-1	BH-2	BH-1
Depth (FT)									
5	21.4	37.2				<8 J	65.1		
10	60.5						325	44.6	
						8.7 J			
15		14.4	<7.4	4.6 J			283	15.1	
20	23.9			55.8 J		8.9 J		23.3	
25	61			40.6 J	52.2	<8 J			
30	14	27	<4					<36	
		240							
35		11.5		5.6 J	8.2				
40	13.4	13.8	4.6 J	<4	<7.4		<7.4	57.6	
45	27.6 J			<4					
				<4					
50							34.2		
55				6.7 J					
60								<12	
65	14.6 J								
70									
75							9.3		
80	15.5 J			48.6					
85	16.3 J			35.7					
90							4.6		
95									
100									
105							4.6		

J : Estimated values

Texaco Fillmore Remedial Investigation, Aug-Oct, 90

TABLE 4-34 (cont.)

TCLP Copper - Subsurface Soil
Northern Region

Constituent	Copper Concentrations (ug/l)				
Location	PIT 1		BACKGROUND		
Borehole	BH-1	BH-2	BH-2	BH-3	BH-5
Depth (FT)					
5	17.8	22.6			
10	35.1	7.5			
15	55.6	40.7			
20	98.2				
25		98.4			
30	<7.4				
35					
40		26.7			

J : Estimated values

Texaco Fillmore Remedial Investigation, Aug-Oct, 90

TABLE 4-34 (cont.)

TCLP Copper - Subsurface Soil
Soil Gas Area

Constituent	Copper Concentrations (ug/l)			
Location	SOIL GAS AREA			
Borehole	BH-1	BH-2	BH-3	BH-4
Depth (FT)				
5				
10				
15			8.2 J	10.3
20				
25		6.5		
30				
35				
40			<8	
45				
50				
55	<12	<6		
60				

J : Estimated values

Texaco Fillmore Remedial Investigation, Aug-Oct, 90

TABLE 4-35

Total Nickel - Subsurface Soil

Main Waste Pit Region

Constituent	Nickel Concentrations (mg/kg)																						
Location	MAIN WASTE PIT														PIT 2		MONITORING WELLS						
Borehole	BH-1	BH-2	BH-3	BH-4	BH-5	BH-6	BH-7	BH-8	BH-9	BH-10	BH-11	BH-12	BH-13	BH-14	BH-1	BH-2	MW21	MW22S	MW22D	MW23	MW24	MW25D	MW25S
Elev. (ft)																							
525								46.6							33.7	31.6							
520														31.7	38.3	40.8							
515											45.9			36.9		39.1							
510							11.4	31.6			36.1				43.2	52.2							
505							31.7			27.9		21.9	15.9										
500					32.6		16		31.9	22.6													
495		22.1			42.5		32.3		19.8	16.3		32	24.4										
490	26.6		30.7	33						19.2						44.6						33	
485		28				20.4	48.3			37.5						33.6 79.5							
480	30.4		28.3	42		26.8	45			39.5													
475							33.3			36.5						30						32.9	
470							30.2									45.2							
465							30			29.9						39							
460							36.2 32.1 31.3																
455							51.6			42.6													
450							29			33.3 56.9													
445							35.8			15.2 18.9													
440							26			25.4													
435																						15	
430										35.2													
425																						28.9	

TABLE 4-35 (cont.)

Total Nickel - Subsurface Soil
Southern Region

Constituent	Nickel Concentrations (mg/kg)															
Location	PIT 3				PIT 4						SUSPEC PIT		MONITORING WELLS			BG
Borehole	BH-1	BH-2	BH-3	BH-4	BH-1	BH-2	BH-3	BH-4	BH-5	BH-6	BH-1	BH-2	MW18	MW19	MW20	BH-4
Depth (ft)																
5		29.3	26.1	18.3			31.2	46.1	20.5							
10			28.2	29			17.2	28.2	18.6	23.4	17.5					28.1
15		35.6			28.5			36.8		21.9	22.9	33.4				
20	32				17.4	16.1		37				41.7				63.3
25	24.9					45.8		38.7								29.9
30								47								
35																
40								61.6								
45														32		
50								40.2						30.3		
55																
60																
65															33	
70																
75																
80															43.3	

TABLE 4-35 (cont.)

Total Nickel - Subsurface Soil
Hill Region

Constituent	Nickel Concentrations (mg/kg)								
Location	PIT 5		PIT 6		PIT 7		PIT 8		BKGRN
Borehole	BH-1	BH-2	BH-1	BH-2	BH-1	BH-2	BH-1	BH-2	BH-1
Depth (ft)									
5		29.4	27.1	31.4		20.4		40.8	29.1
10			37.9					30.2	30.3
15	32.1	36.8		47.9		21.1	46.5		21.4
20					4.4		36.5		35.3
25									
30					30				
35									
40									
45							27.7		
50									
55							43.5		
60							38.6		
65							19.1		
70							19.7 20.4		
75							24.5		
80							37.1		
85							24.2		
90							35		
95							31 38.1		
100							36.1		
105							34.2		

TABLE 4-35 (cont.)

Total Nickel - Subsurface Soil
Northern Region

Constituent	Nickel Conc. (mg/kg)				
Location	PIT 1		BACKGROUND		
Borehole	BH-1	BH-2	BH-2	BH-3	BH-5
Depth (ft)					
5		59.4	49.7		37
10			47.3	39.4	37.3
				36.2	
15	18.6	41.6	50.9	37	43.3
					41.9
20			48.2	39.7	46.7

TABLE 4-35 (cont.)

Total Nickel - Subsurface Soil

Soil Gas Area

Constituent	Nickel Concentration (mg/kg)			
Location	SOIL GAS			
Borehole	BH-1	BH-2	BH-3	BH-4
Depth (ft)				
5		20.7		25
10				
15				
20		33		33
25				

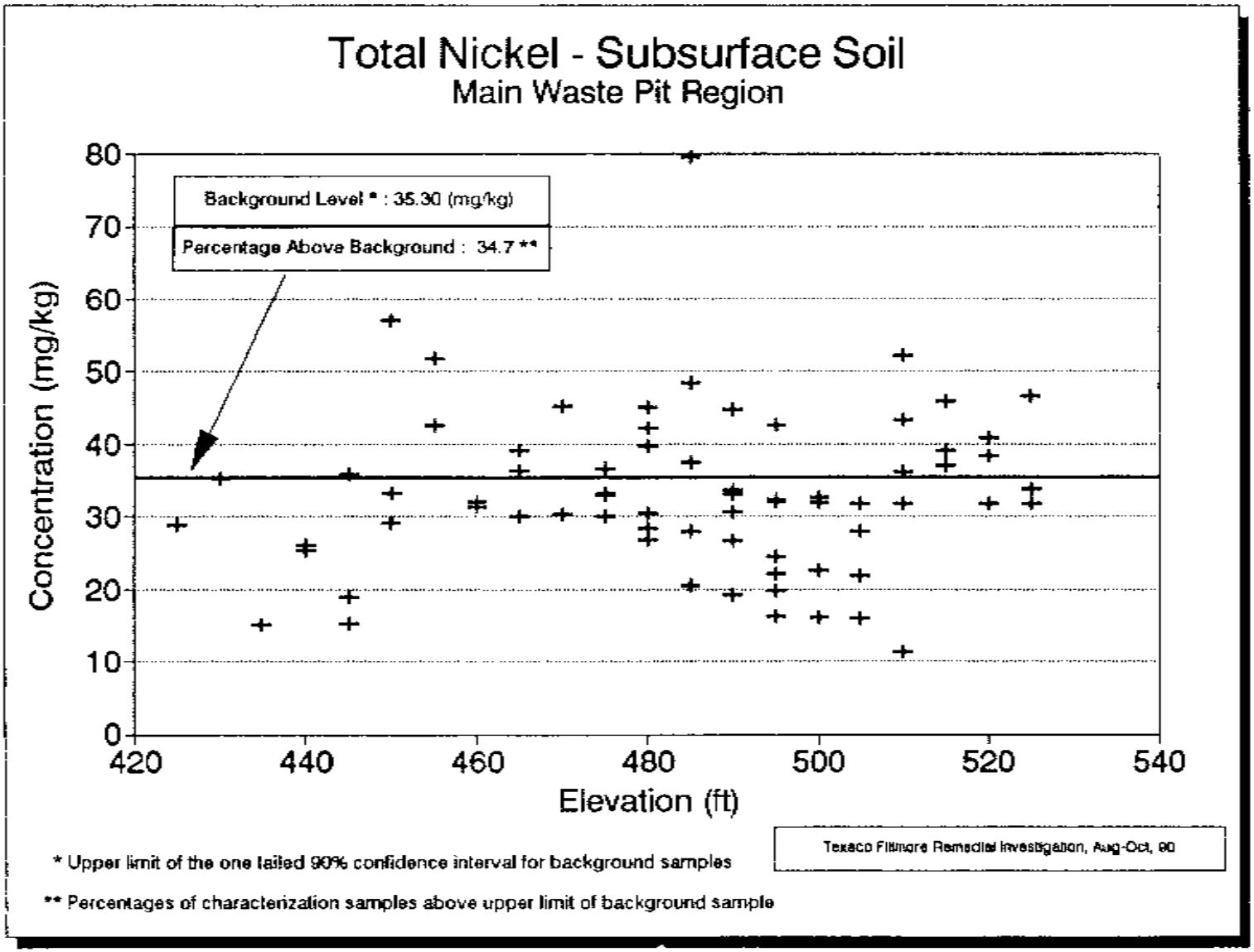

Total Nickel - Subsurface Soil
Main Waste Pit Region
Background Level * : 35.30 (mg/kg)
Percentage Above Background : 34.7 **
Concentration (mg/kg)
0
10
20
30
40
50
60
70
80
420
440
460
480
500
520
540
Elevation (ft)
Texaco Fillmore Remedial Investigation, Aug-Oct, 90
* Upper limit of the one tailed 90% confidence interval for background samples
** Percentages of characterization samples above upper limit of background sample

FIGURE 4-55

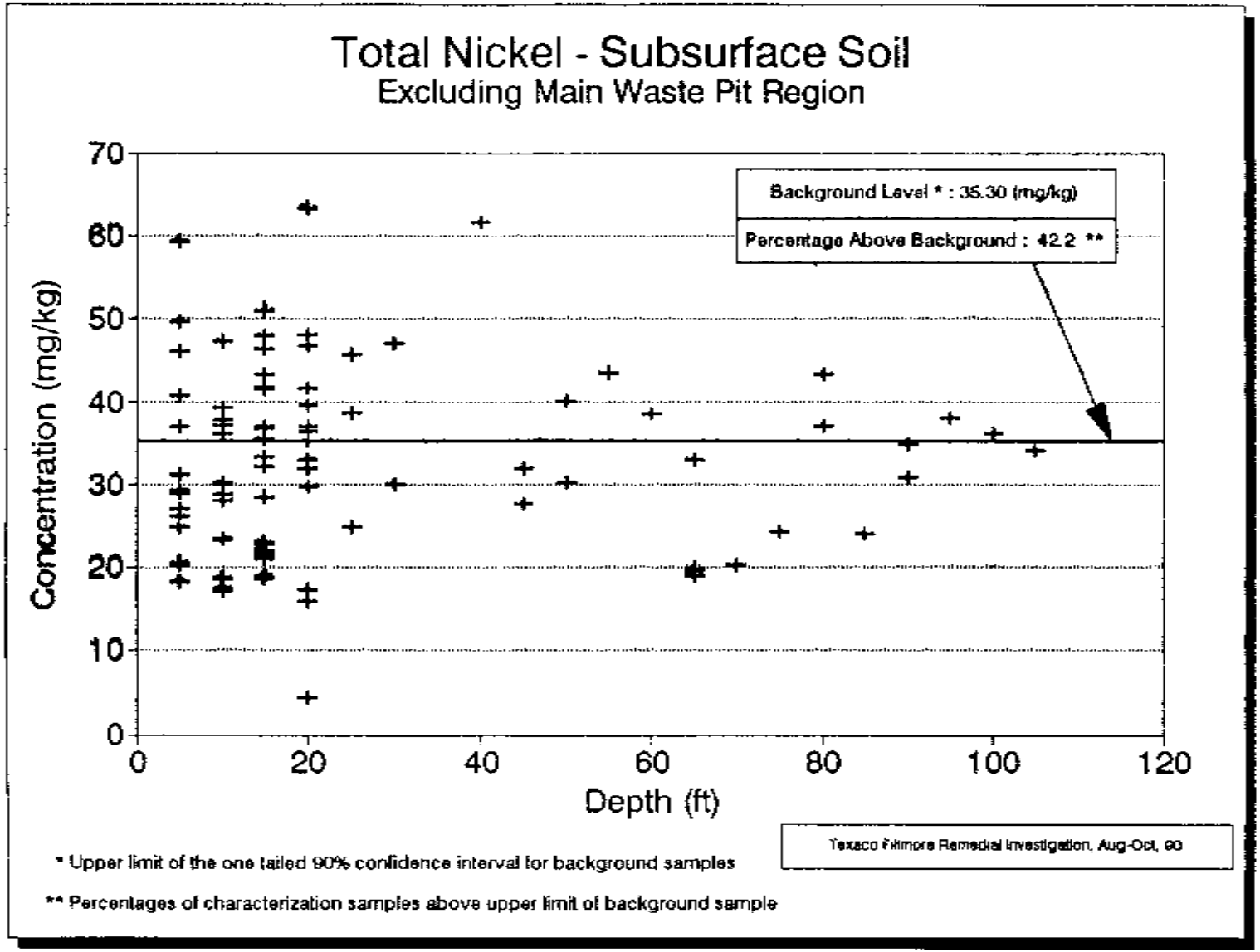

Total Nickel - Subsurface Soil
Excluding Main Waste Pit Region
Background Level * : 35.30 (mg/kg)
Percentage Above Background : 42.2 **
Concentration (mg/kg)
Depth (ft)
0
10
20
30
40
50
60
70
0
20
40
60
80
100
120
Texaco Fillmore Remedial Investigation, Aug-Oct, 90
* Upper limit of the one tailed 90% confidence interval for background samples
** Percentages of characterization samples above upper limit of background sample

FIGURE 4-56

TABLE 4-36

TCLP Nickel - Subsurface Soil

Main Waste Pit Region

Constituent	Nickel Concentrations (ug/l)																					
Location	MAIN WASTE PIT														PIT 2		MONITORING WELLS					
Borehole	BH-1	BH-2	BH-3	BH-4	BH-5	BH-6	BH-7	BH-8	BH-9	BH-10	BH-11	BH-12	BH-13	BH-14	BH-1	BH-2	MW21	MW22S	MW22D	MW23	MW24	MW25D	MW25S
Elev. (FT)																							
525								29.2						63	43.2								
520								75.5							29.8	85.7							
515								235						104	96.2								
510								242						120		166							
505													<10		145								
500			313											<4.0									
495			288		47.6								<10		48.5								
490	192													189								108	94.1
485	428		153				92.6					105			25	36.4						144	
480	180	174		<21.6			38.5				126			24.1		112						133	
475	23.2	211		62.2									<10										196
470	211		362		207							<21.6	120		140	188						142	
465		118 196			217 167	<48	123		181 J			284											
460	386	77.2	181		426		53					186											
455		409		<21.6	<20		69.8 31.3		101			22.4	80.5 64.5	68.6									
450	105								86.9	92.5				75.6								181	
445	79.7			<21.6									25.7			127						122	206
440							45.7		286													198	
435	137			<21.6				54.8	176														
430	89.5											38.6											
425			85.3					52.1				29.1 111				40.9							
420								32.2				61											
415																							99.8
410																							
405								34.3															85.3

J : Estimated values

Texaco Fillmore Remedial Investigation, Aug-Oct, 90

TABLE 4-36 (cont.)

TCLP Nickel - Subsurface Soil

Southern Region

Constituent	Nickel Concentrations (ug/l)															
Location	PIT 3				PIT 4						SUSPECT PIT		MONITORING WELLS			BKGND
Borehole	BH-1	BH-2	BH-3	BH-4	BH-1	BH-2	BH-3	BH-4	BH-5	BH-6	BH-1	BH-2	MW18	MW19	MW20	BH-4
Depth (FT)																
5	163		99.1	147			79.1		<48	49.6	44.5					
10	225							<21.6				46.9				
15		140	158					23.2	91.3							
	182	207														
20	382	154				93.7				146	142					
25		195			124											
30	194		128	109	<105	122	173					<10				
								151								
35	145	218		114		244	343	225								
											147					
40				84	171	151		<21.6		130		69.7		80.2		
							124									
45		213	276			131	169		105		257		137			
		193			74.5						183					
50								67.3		74	31.2					
55		197	65.3									44.5				
60			101								193				109	
65											200				95.2	
70		156														
75															104	
80											91.3				96.8	
85																

J : Estimated values

Texaco Fillmore Remedial Investigation, Aug-Oct, 90

TABLE 4-36 (cont.)

TCLP Nickel - Subsurface Soil

Hill Region

Constituent	Nickel Concentrations (ug/l)								
Location	PIT 5		PIT 6		PIT 7		PIT 8		BG
Borehole	BH-1	BH-2	BH-1	BH-2	BH-1	BH-2	BH-1	BH-2	BH-1
Depth (FT)									
5	49.8	47.5				26.4	25.4		
10	51.2						120	98.7	
15		<21.6	<21.6	<10		49.1	43	85.7	
20	56.8			<20		75.4		148	
25	92.2			10.2	<21.6	21.6			
30	73.8	75.1	<10					149	
		78.9							
35		161		31.1	42.6				
40	124	108	10.8	32.4	68.5		87.8	42.3	
45	142			18.1					
				<10					
50							110		
55				28.9					
60								113	
65	124								
70									
75							<10		
80	225			42.9					
85	211			118					
90							<10		
95									
100									
105							<10		

J : Estimated values

Texaco Fillmore Remedial Investigation, Aug-Oct, 90

TABLE 4-36 (cont.)

TCLP Nickel - Subsurface Soil

Northern Region

Constituent	Nickel Concentrations (ug/l)				
Location	PIT 1		BACKGROUND		
Borehole	BH-1	BH-2	BH-2	BH-3	BH-5
Depth (FT)					
5	39.3	<21.6			
10	98	<21.6			
15	91.7	37.9			
20	130				
25		92.7			
30	27.2				
35					
40		66.2			

J : Estimated values

Texaco Fillmore Remedial Investigation, Aug-Oct, 90

TABLE 4-36 (cont.)

TCLP Nickel - Subsurface Soil

Soil Gas Area

Constituent	Nickel Concentrations (ug/l)			
Location	SOIL GAS AREA			
Borehole	BH-1	BH-2	BH-3	BH-4
Depth (FT)				
5				
10				
15			<20	<20
20				
25		<48		
30				
35				
40			<20	
45				
50				
55	<20	<48		
60				

J : Estimated values

Texaco Fillmore Remedial Investigation, Aug-Oct, 90

TABLE 4-37

Total Vanadium - Subsurface Soil

Main Waste Pit Region

Constituent	Vanadium Concentrations (mg/kg)																				
Location	MAIN WASTE PIT														PIT 2		MONITORING WELLS				
Borehole	BH-1	BH-2	BH-3	BH-4	BH-5	BH-6	BH-7	BH-8	BH-9	BH-10	BH-11	BH-12	BH-13	BH-14	BH-1	BH-2	MW21	MW22S	MW22D	MW23	MW24	MW25D	MW25S
Elev. (ft)																							
525								70.2							41.2	86.8							
520														45.4	45	95.8							
515											81.5			89.6		113							
510							13.9	49.6			48.8				63.1	112							
505							61.2			88.4		24.9	42.4			73.8							
500					69.7		35.5		41.2	77.7						95.6							
495		45.8			90.5		73		28.5	45.8		43.3	70.6			82							
490	58.5		48.7	43.2						81.4						87.3						57.7	
485		20.6				40	79			98.3						93.5 82.1							
480	42.6		45.2	59.5		33.5	94.7			64.2						88.7							
475							67.7			123						80.5						65	
470							59.7			130						70.8 124							
465							75.2			99.7						72.3							
460						40	82.5 89.3			98.6													
455				43.2		33.5	49.1 63.5			101													
450							73.3			78.9													
445				59.5			69.4			67.5 32.7													
440							45.2			39.3 54													
435						40				98.6												20.3	
430						33.5				89.1													
425				43.2																		50.5	

TABLE 4-37 (cont.)

Total Vanadium - Subsurface Soil

Southern Region

Constituent	Vanadium Concentrations (mg/kg)																
Location	PIT 3				PIT 4						SUSPEC	PIT	MONITORING WELLS				BKGRN
Borehole	BH-1	BH-2	BH-3	BH-4	BH-1	BH-2	BH-3	BH-4	BH-5	BH-6	BH-1	BH-2	MW18	MW19	MW20		BH-4
Depth (ft)																	
5		51.5	39	40.5			64	91.8	39.4								
10			53.1	32.2			33.4	62.5	46.4	39.9	26.2						41.9
15		67.3			27.5			106		89.4	45	53.9					
20	59.2				24.8	40.3		103				56.9					78.2
25	52.9					40.2		91.1									43.3
30								113									
35								102 108									
40								130									
45								111						43.5			
50								98.3						46.9			
55																	
60																	
65															60.9		
70																	
75																	
80															74.8		

TABLE 4-36

TCLP Nickel - Subsurface Soil

Main Waste Pit Region

Constituent	Nickel Concentrations (ug/l)																					
Location	MAIN WASTE PIT														PIT 2		MONITORING WELLS					
Borehole	BH-1	BH-2	BH-3	BH-4	BH-5	BH-6	BH-7	BH-8	BH-9	BH-10	BH-11	BH-12	BH-13	BH-14	BH-1	BH-2	MW21	MW22S	MW22D	MW23	MW24	MW25D	MW25S
Elev. (FT)																							
525								29.2						63	43.2								
520								75.5							29.8	85.7							
515								235						104	96.2								
510								242						120		166							
505													<10		145								
500			313											<4.0									
495			288		47.6								<10		48.5								
490	192													189								108	94.1
485	428		153				92.6					105			25	36.4						144	
480	180	174		<21.6			38.5				126			24.1		112						133	
475	23.2	211		62.2									<10										196
470	211		362		207							<21.6	120		140	188						142	
465		118 196			217 167	<48	123		181 J			284											
460	386	77.2	181		426		53					186											
455		409		<21.6	<20		69.8 31.3		101			22.4	80.5 64.5	68.6									
450	105								86.9	92.5				75.6								181	
445	79.7			<21.6									25.7			127						122	206
440							45.7		286													198	
435	137			<21.6				54.8	176														
430	89.5											38.6											
425			85.3					52.1				29.1 111				40.9							
420								32.2				61											
415																							99.8
410																							
405								34.3															85.3

J : Estimated values

Texaco Fillmore Remedial Investigation, Aug-Oct, 90

TABLE 4-36 (cont.)

TCLP Nickel - Subsurface Soil

Southern Region

Constituent	Nickel Concentrations (ug/l)															
Location	PIT 3				PIT 4						SUSPECT PIT		MONITORING WELLS			BKGND
Borehole	BH-1	BH-2	BH-3	BH-4	BH-1	BH-2	BH-3	BH-4	BH-5	BH-6	BH-1	BH-2	MW18	MW19	MW20	BH-4
Depth (FT)																
5	163		99.1	147			79.1		<48	49.6	44.5					
10	225							<21.6				46.9				
15		140	158					23.2	91.3							
	182	207														
20	382	154				93.7				146	142					
25		195			124											
30	194		128	109	<105	122	173					<10				
								151								
35	145	218		114		244	343	225								
											147					
40				84	171	151		<21.6		130		69.7		80.2		
							124									
45		213	276			131	169		105		257		137			
		193			74.5						183					
50								67.3		74	31.2					
55		197	65.3									44.5				
60			101								193				109	
65											200				95.2	
70		156														
75															104	
80											91.3				96.8	
85																

J : Estimated values

Texaco Fillmore Remedial Investigation, Aug-Oct, 90

TABLE 4-37 (cont.)

Total Vanadium - Subsurface Soil
Hill Region

Constituent	Vanadium Concentrations (mg/kg)								
Location	PIT 5		PIT 6		PIT 7		PIT 8		BKGRN
Borehole	BH-1	BH-2	BH-1	BH-2	BH-1	BH-2	BH-1	BH-2	BH-1
Depth (ft)									
5		46.7	36.8	74.5		30.6	78.9	64.6	76.7
10			48.2				69.6	65.6	66.1
15	62.2	70.1		82.9		31.2	103		53
20					9.5		106		103
25	72.2						54		
30					31.9		46.8		
35									
40							37.1		
45							58		
50							63.7		
55							60.6		
60							56.2		
65							42.1		
							48.3		
70							41.2		
75							43.3		
80							54.2		
85							59.4		
90							61.2		
							69.9		
95							49.6		
100							48.2		
105							75.3		

TABLE 4-37 (cont.)

Total Vanadium - Subsurface Soil
Northern Region

Constituent	Vanadium Concentrations (mg/kg)				
Location	PIT 1		BACKGROUND		
Borehole	BH-1	BH-2	BH-2	BH-3	BH-5
Depth (ft)					
5		136	99.1		70.4
10	159		98.8	89.8	62.6
				66.7	
15	125	120	108	111	77.7
					73.4
20			111	107	94.3

TABLE 4-37 (cont.)

Total Vanadium - Subsurface Soil

Soil Gas Area

Constituent	Vanadium Concentrations (mg/kg)			
Location	SOIL GAS			
Borehole	BH-1	BH-2	BH-3	BH-4
Depth (ft)				
5	98.1	64.7	46.6	62.6
10			89.3	
15				
20		101		101
25	95.6			

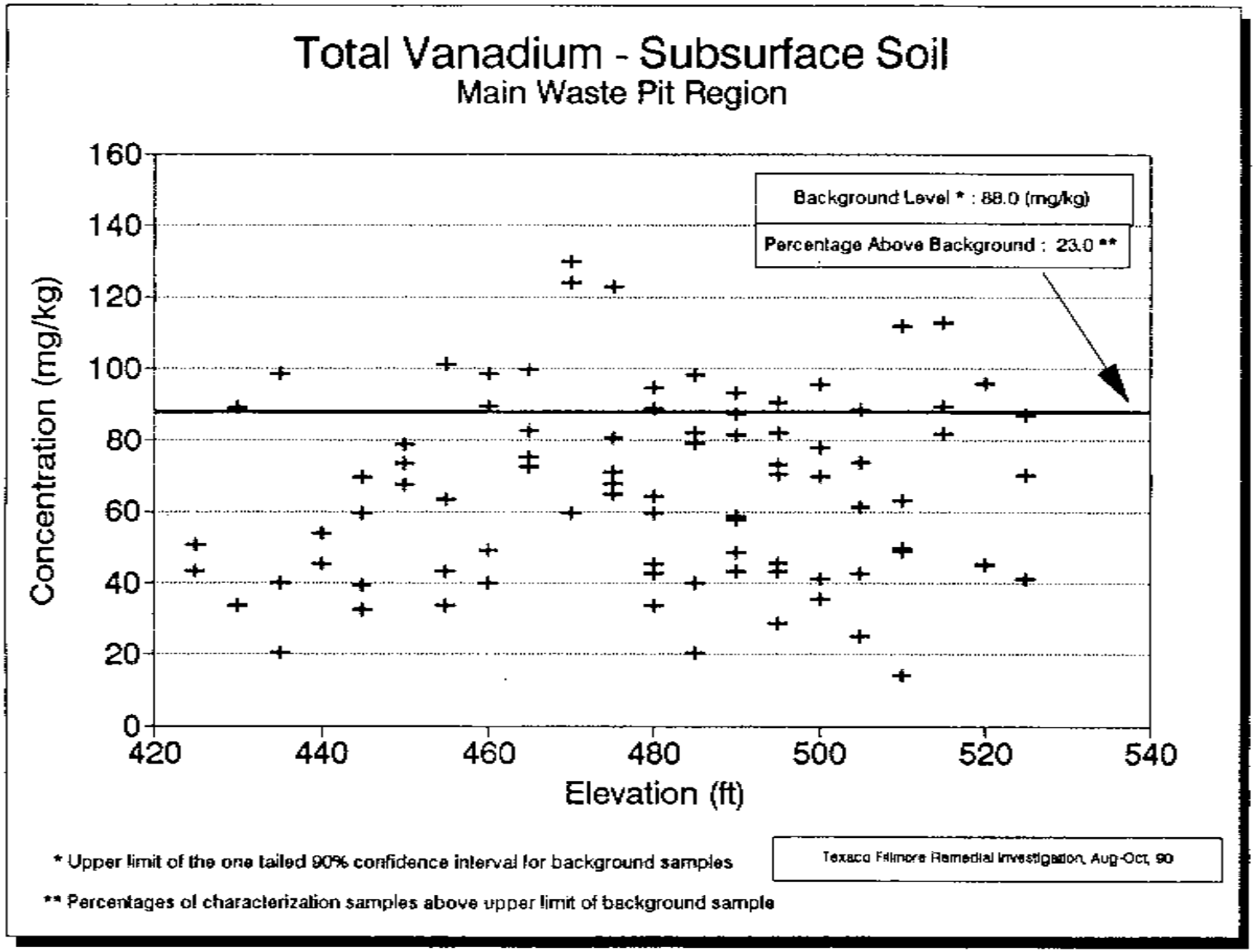

Total Vanadium - Subsurface Soil
Main Waste Pit Region
Background Level * : 88.0 (mg/kg)
Percentage Above Background : 23.0 **
Concentration (mg/kg)
160
140
120
100
80
60
40
20
0
420
440
460
480
500
520
540
Elevation (ft)
* Upper limit of the one tailed 90% confidence interval for background samples
** Percentages of characterization samples above upper limit of background sample
Texaco Fillmore Remedial Investigation, Aug-Oct, 90

FIGURE 4-57

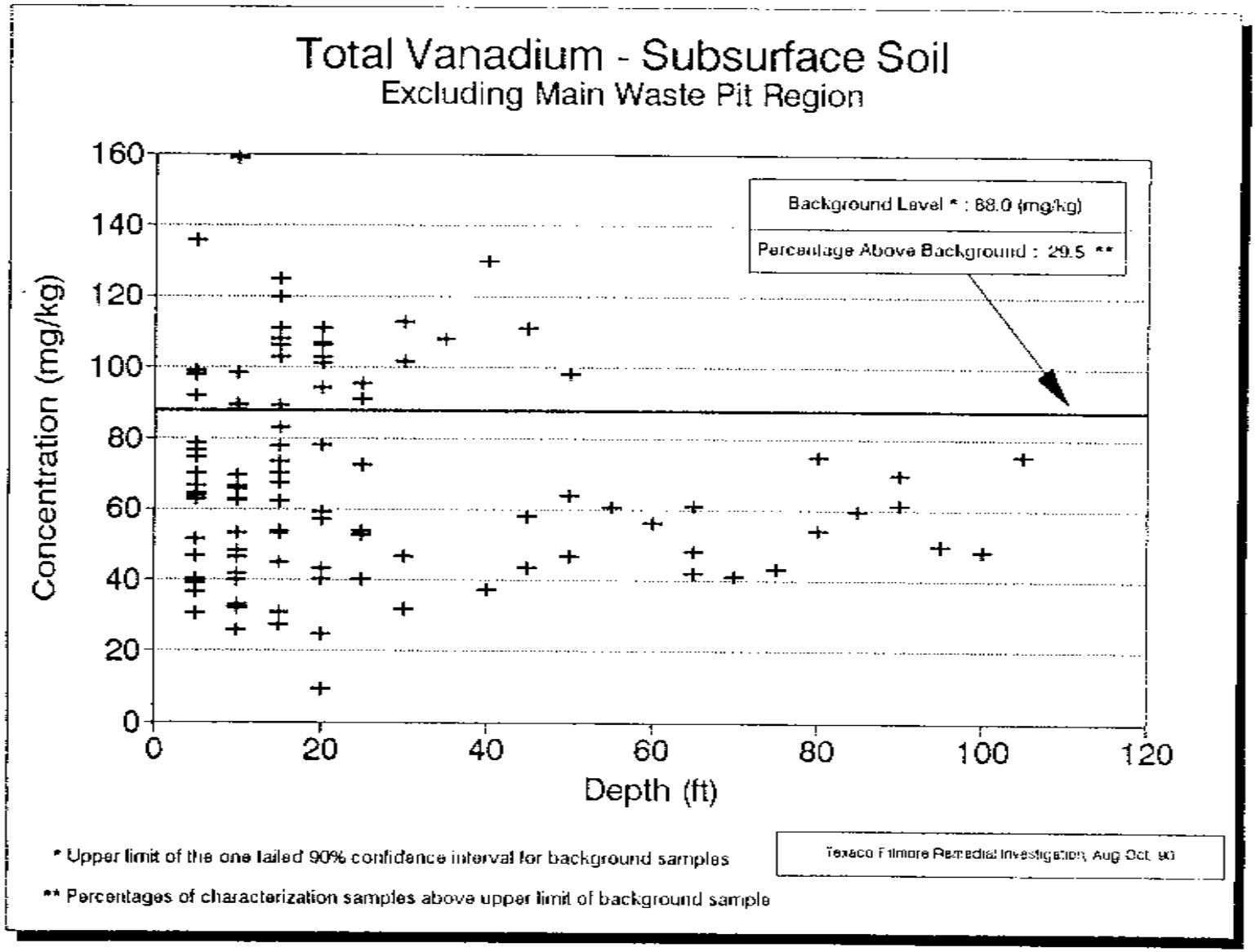

Total Vanadium - Subsurface Soil
Excluding Main Waste Pit Region
Concentration (mg/kg)
Depth (ft)
0
20
40
60
80
100
120
140
160
Background Level * : 88.0 (mg/kg)
Percentage Above Background : 29.5 **
* Upper limit of the one tailed 90% confidence interval for background samples
** Percentages of characterization samples above upper limit of background sample
Texaco Fillmore Remedial Investigation, Aug-Oct '90

FIGURE 4-58

While TCLP thresholds were defined for vanadium in the FSP, a total of 244 samples were extracted and analyzed for TCLP. The highest value obtained is 107 µg/l, in MWP BH-1. The results of the TCLP analysis for vanadium are provided in Table 4-38.

4.1.6.11 Organic Lead

The results for organic lead are presented in Table 4-39. Organic lead was not detected in over 96 percent of the samples analyzed, at the detection limit of 1 µg/l. The few samples in which organic lead was detected were the same samples with high total lead concentrations. No thresholds or background values were set for organic lead.

4.1.7 pH

The pH results for 320 samples analyzed are presented in Table 4-40. The average pH throughout the facility was 8.0 and the standard deviation was 0.47. The lowest pH value was 6.5 and the highest was 9.7. These values are within the range for natural soils. The pH of the soil does not appear to be affected by past activities at the facility

4.1.8 Summary

Over 785 subsurface soil samples from 78 boreholes distributed throughout the site were collected. The results of laboratory and field analyses indicate the presence of very low levels of VOCs and some semivolatile organics in the MWP and Southern Regions of the facility. VOCs detected at the site include benzene, toluene, ethylbenzene, total xylenes, acetone, methylene chloride, and 2-butanone (methyl ethyl ketone). Semivolatile organics detected included 2-methylnaphthalene, naphthalene, 2-methylphenol, and bis(2-ethylhexyl)phthalate. Where they do occur, organic constituents exist in the upper 65 feet of unsaturated soils.

Benzene was detected in only four samples above the FSP TCLP threshold of 11 ppb, and xylenes in only three samples above the TCLP threshold of 620 ppb.

Total levels for all metals were found to be within background levels in all samples. Except for one shallow (10 feet deep) sample, where lead exceeded the FSP threshold, only barium and cadmium exceeded TCLP thresholds. Organic lead was only detected in four samples.

The laboratory- and field-measured pH values of soil samples collected ranged from 6.5 to 9.7, well within normal levels for natural soils.

TABLE 4-38

TCLP Vanadium - Subsurface Soil

Main Waste Pit Region

Constituent	Vanadium Concentrations (ug/l)																						
Location	MAIN WASTE PIT														PIT 2		MONITORING WELLS						
Borehole	BH-1	BH-2	BH-3	BH-4	BH-5	BH-6	BH-7	BH-8	BH-9	BH-10	BH-11	BH-12	BH-13	BH-14	BH-1	BH-2	MW21	MW22S	MW22D	MW23	MW24	MW25D	MW25S
Elev. (FT)																							
525								92.6						33.6	12.3 J	2							
520								12.2 J							9.2 J	15.2							
515								21.6 J						12.7	20.1 J								
510								30.1 J						20.6		3.8							
505													<5		11.7 J								
500			10.9 J											<3									
495			9.1 J		<8								<5		8.7 J								
490	6.5 J													6.2								7.4 J	4.4 J
485	107		8.8 J				<4 J					16.6 J			<1.9							14.2 J	
480	6 J	<10		4.8 J			11.3 J				8.1			12		4.7							
475	<1.9 J	<10		7.1 J									<5			<1.9						8.5 J	3.2 J
470	9.9 J		9.6 J		<8							<1.9 J	42.4		8.9 J							6.9 J	
465		<10			<8				<4							<1.9							
	5.4 J	12.6			<8	<6	<8 J					12.6 J											
460	39		5.3 J		<8		<8 J					10 J											
				3.9 J			<4 J						16.3										
455		<10			<8		13.5 J		25.9			4.1 J	<5	9.9									
450	11.6 J								<4	6				8.2								2.2 J	
445	10.1 J			2.6 J									<10				<10					6.5	15.9 J
440							<8 J		5.3													23	
435	11 J			4.7 J				9.6	5.7														
430	11.2 J											2.4 J											
												7.4 J											
425			17 J					9				13 J					<5						
420								6.3				9.2 J											
415																							2.8 J
410																							
405								9.3															<1.9

J : Estimated values

Texaco Fillmore Remedial Investigation, Aug-Oct, 90

TABLE 4-38 (cont.)

TCLP Vanadium - Subsurface Soil

Southern Region

Constituent	Vanadium Concentrations (ug/l)															
Location	PIT 3				PIT 4						SUSPECT PIT		MONITORING WELLS			BKGND
Borehole	BH-1	BH-2	BH-3	BH-4	BH-1	BH-2	BH-3	BH-4	BH-5	BH-6	BH-1	BH-2	MW18	MW19	MW20	BH-4
Depth (FT)																
5	32		6.5	15.9			<10		6.5	<10	16.9					
10	<8							<1.9				6.4				
15		<3	18.5					4	<6							
	<8	<6														
20	<8	17.4				15.8 J				<10	<8					
25		40			10.1											
30	27.8		14.5	<3	8.3	14.9 J	5.4					5.2				
								8.8								
35	<8	<6		<3		2.4 J	<10	5.2								
											23.7 J					
40				4.6	11.1	11.3 J		3		<10		4.1		<3		
							<10									
45		<6	6.2			<1.9	<10		<3		17.6 J		<3			
		<3			4.4						19.8 J					
50								<1.9		<5	14.6 J					
55		<3	18.3									10.4				
60			9.9								17.4				<6	
65											13.5 J				<6	
70		13.7														
75															<6	
80											<8 J				6.8	
85																

J : Estimated values

Texaco Fillmore Remedial Investigation, Aug-Oct, 90

TABLE 4-38 (cont.)

TCLP Vanadium - Subsurface Soil

Hill Region

Constituent	Vanadium Concentrations (ug/l)								
Location	PIT 5		PIT 6		PIT 7		PIT 8		BG
Borehole	BH-1	BH-2	BH-1	BH-2	BH-1	BH-2	BH-1	BH-2	BH-1
Depth (FT)									
5	39.8 J	43.9 J				11.8	34.4		
10	33.8 J						55.1	42.9	
15		13.6 J	18 J	7.5		<4	77.1	81.3	
20	16.7 J			15.1		<4		100	
25	23.7 J			17	2.3	14.5			
30	10.2 J	31.4 J	18.4					39.1	
35		30.4 J 12.4 J		8.1	25.8				
40	18.4 J	15.5 J	20.1	8.7	15.7		17.8	19.9	
45	11.9 J			8.5					
50				21.5			15.6		
55				18.2					
60								10.1	
65									
70									
75							24.2		
80	36.7 J			<1.9					
85	15.3 J			9.5					
90							10.6		
95									
100									
105							9.2		

J . Estimated values

Texaco Fillmore Remedial Investigation. Aug-Oct, 90

TABLE 4-38 (cont.)

TCLP Vanadium - Subsurface Soil

Northern Region

Constituent	Vanadium Concentrations (ug/l)				
Location	PIT 1		BACKGROUND		
Borehole	BH-1	BH-2	BH-2	BH-3	BH-5
Depth (FT)					
5	121	45.9			
10	81.9	52.2			
15	8.8 J	24.5			
20	26.1				
25		33.3			
30	6.3 J				
35					
40		16.1			

J : Estimated values

Texaco Fillmore Remedial Investigation, Aug-Oct, 90

TABLE 4-38 (cont.)

TCLP Vanadium - Subsurface Soil

Soil Gas Area

Constituent	Vanadium Conc. (ug/l)			
Location	SOIL GAS AREA			
Borehole	BH-1	BH-2	BH-3	BH-4
Depth (FT)				
5				
10				
15			14.1 J	10.2
20				
25		23.6		
30				
35				
40			8.9 J	
45				
50				
55	<10	<6		
60				

J : Estimated values

Texaco Fillmore Remedial Investigation, Aug-Oct, 90

TABLE 4-39

Total Organic Lead - Subsurface Soil

Main Waste Pit Region

Constituent	Organic Lead Concentrations (mg/kg)																						
Location	MAIN WASTE PIT														PIT 2		MONITORING WELLS						
Borehole	BH-1	BH-2	BH-3	BH-4	BH-5	BH-6	BH-7	BH-8	BH-9	BH-10	BH-11	BH-12	BH-13	BH-14	BH-1	BH-2	MW21	MW22S	MW22D	MW23	MW24	MW25D	MW25S
Elev. (FT)																							
525								ND(1)							2.6								
520														ND(1)	ND(1)	ND(1)							
515											ND(1)			ND(1)									
510								ND(1)			ND(1)					ND(1)							
505							ND(1)			ND(1)		ND(1.5)	ND(1)										
500					ND(1)				ND(1)	ND(1)													
495	ND(1)	ND(1)			ND(1)		ND(1)		ND(1)			ND(1.5)	ND(1)										
490			ND(1)	ND(1)																		18.7	
485	ND(1)	ND(1)				ND(1)																	
480			ND(1)	ND(1)		ND(1)																	
475																						ND(1)	
470																							
465																							
460																							
455																							
450																							
445																							
440																							
435																							
430																							
425																							
420																							
415																							
410																							

Detection limits are shown in parenthesis

TABLE 4-39 (cont.)

Total Organic Lead - Subsurface Soil
Southern Region

Constituent	Organic Lead Concentrations (mg/kg)															
Location	PIT 3				PIT 4						SUSPECT PIT		MONITORING WELLS			BKGND
Borehole	BH-1	BH-2	BH-3	BH-4	BH-1	BH-2	BH-3	BH-4	BH-5	BH-6	BH-1	BH-2	MW18	MW19	MW20	BH-4
Depth (FT)																
5		ND(1)	ND(1)	ND(1)			ND(1)	ND(1)	ND(1)							
10			ND(1)	ND(1)			ND(1)		ND(1)	13.8	ND(1)					
15		ND(1)			ND(1)			ND(1)		ND(1)	ND(1)	ND(1)				
20	ND(1)				ND(1)	ND(1)						ND(1)				
25	ND(1)					ND(1)										
30																
35																
40																
45														ND(1.5)		
50														ND(1.8)		
55																
60																
65															ND(1)	
70																
75																
80															ND(1)	
85																

Detection limits are shown in parenthesis

TABLE 4-39 (cont.)

Total Organic Lead - Subsurface Soil

Hill Region

Constituent	Organic Lead Concentrations (mg/kg)								
Location	PIT 5		PIT 6		PIT 7		PIT 8		BG
Borehole	BH-1	BH-2	BH-1	BH-2	BH-1	BH-2	BH-1	BH-2	BH-1
Depth (FT)									
5		ND(1)	ND(1)	ND(1)		23	ND(1)	ND(1.5)	
10			ND(1)				ND(1)	ND(1)	
15	ND(1)	ND(1)		ND(1)		ND(1)			
20					ND(1)				
25	ND(1)								
30					ND(1)				
35									
40							ND(1)		
45									
50									
55									
60									
65									
70									

Detection limits are shown in parenthesis

TABLE 4-39 (cont.)

Total Organic Lead - Subsurface Soil

Northern Region

Constituent	Organic Lead Concentrations (mg/kg)				
Location	PIT 1		BACKGROUND		
Borehole	BH-1	BH-2	BH-2	BH-3	BH-5
Depth (FT)					
5		ND(1)			
10	ND(1)				
15	ND(1)	ND(1)			
20					
25					
30					
35					

Detection limits are shown in parenthesis

TABLE 4-39 (cont.)

Total Organic Lead - Subsurface Soil

Soil Gas Area

Constituent	Organic Lead Concentrations (mg/kg)			
Location	SOIL GAS AREA			
Borehole	BH-1	BH-2	BH-3	BH-4
Depth (FT)				
5	ND(1)	ND(1)	ND(1)	ND(1)
10			ND(1)	
15				
20		ND(1)		ND(1)
25	ND(1)			
30				

Detection limits are shown in parenthesis

TABLE 4-40

pH - Subsurface Soil
Main Waste Pit Region

Constituent	pH																												
Location	MAIN WASTE PIT																		PIT 2		MONITORING WELLS								
Borehole	BH-1	BH-2	BH-902	BH-3	BH-4	BH-904	BH-5	BH-6	BH-906	BH-7	BH-907	BH-8	BH-908	BH-9	BH-10	BH-11	BH-12	BH-13	BH-14	BH-1	BH-2	MW21	MW22S	MW22	MW23	MW24	MW25	MW25S	MW902
Elev. (FT)																													
525												8.2							6.5	7.8									
520												8.3								7.6	7.7								
515												8 7.8							7.5	7.6									
510												8							7.4		7.5								
505												8.3	8.2					7.8		7.7	7.4								
500		8.8		8.1								7.9							7.4	7.8	8.2								
495				9.3			8										8.1	8		7.2	8								
490	9.4	9.4	8.4						7.6			8.9		8.1					7.3							8.2			
485	9.1		7.9 8.2			8.3				7.3	7.7	8.1	7.4				8.4		7.5	8.1	7.7					7.7			
480	8.4	8.6			7.6					8.1			7.5	8.2		7.4			8		7.9								
475	8.6	8.9	7.8		7.6							8.9					8.4	8.2	8.3		8.3					8.3	8.2		
470	8.4			8.2			8.2										7.9	8.1		7.6	7.4					8.3		8.7	
465		8.1 7.9					8.2 8.1	8		8				8.3 8.7			7.5									8.3			
460	8.6 8		8	8.5		7.8	8.5			8.1	7.6						7.6 8.2												
455		8.1			7.7	7.8				8.6 8.3	7.7	9.3		8.9			8.4 8	8	8.4										
450	8.8								8.2					8.1	7.8				8.6							8.6			
445	8.7				9.4				8	8.9		8.7						8.8								8.7	8.6		
440										8.7				9												8.6			
435	8.6				8.4							8.7		9.1															
430	8.5																8.1												
425				8.1								8.6					8.1 8				8.2							8	
420												8.8					8.2											7.9	
415																											8.9		
410					8.2																								
405												8.5															7.1		

TABLE 4-40 (cont.)

pH - Subsurface Soil

Southern Region

Constituent	pH																		
Location	PIT 3						PIT 4						SUSPECT PIT		MONITORING WELLS				BKGND
Borehole	BH-1	BH-2	BH-902	BH-3	BH-4	BH-904	BH-1	BH-2	BH-3	BH-4	BH-5	BH-6	BH-1	BH-2	MW18	MW19	MW9019	MW20	BH-4
Depth (FT)																			
5	7.6			7.9	7.6				7.6		9.7	7.4	8						
10	7.4						7.9		7.9	8.3				8					
15	8.1	8	7.7	7.9			8.1			8.2	7.6								
	8.3	8																	
20	7.4	7.7						8.5				7.8	7.3						
25		7.1					8.2	7.6						7.6					
30	7.8			7.8	7.6		7.6	8.1	7.6				7.5	7.6					
										8									
35	7.8	8.3	7.7		7.3	8.2		7.7	7.9	7.7	7.7			8.1					
													7.7						
40					7.6	7.9	7.8	8		7.8		7.7	8.1	6.8		7.5			
						8			7.8										
45		7.7		7.8				8.1	7.5	7.9	8.1		7.8		7.8				
		8					8.5						7.5						
50										7.5		7.9	8.5				7.4		
														8.1					
55		8.2		8.6										8.5			7.7		
																	7.5		
60				8.4									8.4				8.1	8.1	
65		8	8										8.2					8.8	
			8																
70		8.1																8.5	
75		8.2	8.1															7.5	
80													8.4					7.9	
85																		8	

TABLE 4-40 (cont.)

pH - Subsurface Soil

Hill Region

Constituent	pH									
Location	PIT5		PIT6		PIT7			PIT8		BG
Borehole	BH-1	BH-2	BH-1	BH-2	BH-1	BH-2	BH-902	BH-1	BH-2	BH-1
Depth (FT)										
5	7.8					7.4	7.9	7.7		
					7.9					
10	7.9	8.2					7.3	7.9	8.5	
						7.6	7.4			
15			7.8	7.3				7.9	9	
20	7.7			7.9		7.3			8.5	
25	7.8			7.7	7.4	7.7		7.5		
30	8	8.2	7.8		7.4			8.3	8.3	
		8.1								
35		8.3		7.3	7.7					
40	8.1	7.9	7.7	7.9	7.9			8	9.2	
45	7.4			8.1						
				8.1						
50				7.9				9		
55				7.9						
60									8.6	
65	7.9									
70										
75								8.8		
80	8.3			7.5						
85	8.6			7.7						
90								8		
95										
100										
105								7.9		

TABLE 4-40 (cont.)

pH - Subsurface Soil

Northern Region

Constituent	pH				
Location	PIT 1		BACKGROUND		
Borehole	BH-1	BH-2	BH-2	BH-3	BH-5
Depth (FT)					
5	7.9	8.3			
10	8.5	8.2			
15	8.6	8.7			
20	8.1				
25		8.7			
30	7.9				
35					
40		8.5			
45					
50					

TABLE 4-40 (cont.)

pH - Subsurface Soil

Soil Gas Region

Constituent	pH				
Location	SOIL GAS AREA				
Borehole	BH-1	BH-901	BH-2	BH-3	BH-4
Depth (FT)					
5					
10					
15				8	8.1
20					
25			7.8		
30					
35					
40				7.9	
45					
50					
55	8.1		7.8		

4.2 Groundwater

As described in Section 2.0, the extent of the groundwater investigation at the Texaco Fillmore site involved sampling and analysis of the site's active monitoring well network, offsite monitoring wells from the neighboring Ultramar gas station to the south of the site, and private supply wells within one mile of the site and the onsite production well.

The RI groundwater sampling program consisted of four separate sampling events conducted between August 1990 and May 1991, and involved the installation of 20 monitoring wells in two phases to expand and update the site's pre-existing monitoring well network.

Twenty-five of the network's 37 monitoring wells currently in place, including the RI's Phase I and II wells, were active during at least one of RI sampling events. As depicted in Table 4-41, these wells are presumed to be distributed in three distinct hydrologic units beneath the site - Perched Zone, Aquifer 1 and Aquifer 2 - and are identified by the letters "P", "S" and "D" respectively. Table 4-41 also presents the sampling chronology of each well during the RI.

As shown in Table 4-41, all but two of the pre-RI monitoring wells, MW-10P and MW-6S, are dry leaving the site's currently active network at 22. MW-10P is the only active well screened in the perched zone. A total of 16 monitoring wells are screened in Aquifer 1 and 8 wells in in Aquifer 2. Of these, MW-8S and MW-11S in Aquifer 1 and MW-16D in Aquifer 2 were only sampled during the second event and have since been dry. All Phase I wells were sampled in at least the second, third and fourth events, while all Phase II wells were only sampled during the third and fourth events which provide the most complete and up-to-date data for the site.

4.2.1 Chemical Analyses

All groundwater samples collected during the first three events up to January 1991 were submitted for analysis as stipulated in the Texaco Fillmore QAPP (ENSR Doc 6600-035-130). This included the following analyses:

- Arsenic (CLP EPA 7060)
- Barium, Cadmium, Chromium, Copper, Nickel, and Vanadium (CLP EPA 6010)
- Hexavalent Chromium (CLP EPA 7196)
- Lead (CLP EPA 7421)
- Total Extractable Petroleum Hydrocarbons (TEPH) by CA DHS LUFT/EPA 8015m)
- Volatile Organics (CLP EPA 8240)
- Semivolatile Organics (CLP EPA 8270)
- Ethylene Dibromide (EPA 504).

TABLE 4-41

Distribution and Sampling Chronology of
Texaco Fillmore Site
Active Monitoring Well Network During RI

Hydrologic Unit	Well Construction Period	Well ID No.	RI Sampling Events			
			First	Second	Third	Fourth
			Aug. 90	Sep.-Oct. 90	Jan. 91	May-Apr. 91
Perched Zone	Pre-RI	MW-10P		X	X	X
Aquifer 1	Pre-RI	MW-6S		X	X	X
		MW-8S		X		
		MW-11S		X		
	Phase I	MW-18S		X	X	X
		MW-19S		X	X	X
		MW-20S		X	X	X
		MW-21S		X	X	X
		MW-22S	X	X	X	X
		MW-25S	X	X	X	X
		MW-26S	X	X	X	X
	Phase II	MW-27S			X	X
		MW-28S			X	X
		MW-29S			X	X
		MW-30S			X	X
		MW-32S			X	X
		MW-34S			X	X
Aquifer 2	Pre-RI	MW-16D		X		
	Phase I	MW-22D		X	X	X
		MW-23D	X	X	X	X
		MW-24D	X	X	X	X
		MW-25D	X	X	X	X
	Phase II	MW-29D			X	X
		MW-31D			X	X
		MW-33D			X	X

As recommended in ENSR's letter dated April 15, 1991 and approved by EPA, groundwater samples collected during the fourth sampling event (May 1991) were analyzed for a restricted level of chemical analyses, based on knowledge gained from the previous sampling events. The laboratory analyses requested included:

- Arsenic (CLP EPA 7060)
- Total Extractable Petroleum Hydrocarbons (TEPH) by CA DHS LUFT/EPA 8015m)
- Volatile Organics (CLP EPA 8240)
- Semivolatile Organics (CLP EPA 8270)

Copies of laboratory reports for the January and May 1991 sampling events are provided in Appendix A. Laboratory reports for the previous sampling events were provided in Appendices B and C of the "Texaco Fillmore RI/FS Hydrological Field Investigation Preliminary Draft Report" (ENSR Doc # 6600-047-180) and are not duplicated for this report.

4.2.2 Perched Zone Wells Analytical Results

Table 4-42 presents the results of laboratory analyses for monitoring well MW-10P. Due to insufficient water in the well, only TPH and VOC analyses were ran during the third (January 1991) sampling event.

4.2.2.1 TPH Analyses

TPH concentrations in MW-10P increased from 22 to 61 mg/l from the October 1990 sampling event to the January 1991 sampling event, but exhibited a ten-fold decrease from 61 to 5.4 mg/l during the January 1991 to May 1991 period. This is consistent with the decrease in TPH levels detected in Aquifer 1 and may be attributed to natural biodegradation of petroleum hydrocarbon constituents.

4.2.2.2 VOC Analyses

VOC concentrations remained at relatively low levels with comparable results detected during the October 1990 and January 1991 sampling events. However, benzene and toluene concentrations doubled from 10 to 19 µg/l and 4 to 8 µg/l, respectively, during the same period. Benzene was the only compound detected above the Federal and California maximum contaminant levels (MCLs) of 5 and 1 µg/l, respectively.

TABLE 4-42

Groundwater Chemical Analyses for MW-10P (Perched Zone)

Analysis	Concentration (µg/L) 10/03/90	01/17/91	05/01/91*	Compound
Metals				
EPA 7060 CLP	< 14.1	—	9.8	Arsenic
EPA 6010 CLP	416	—	—	Barium
EPA 6010 CLP	< 1.8	—	—	Cadmium
EPA 6010 CLP	3.5	—	—	Chromium
EPA 7196 CLP	< 20	—	—	Hexavalent Chromium
EPA 6010 CLP	12.6	—	—	Copper
EPA 7421 CLP	< 4.5	—	—	Lead
EPA 6010 CLP	5.3 J	—	—	Nickel
EPA 6010 CLP	3.2	—	—	Vanadium
TEPH				
8015 (M) CA DHS LUFT	22,000	61,000	5,400	TPH
Volatile Organics				
EPA 8240 CLP	—	6	< 1	Carbon Disulfide
	34 J	< 20	< 20	Acetone
	9	10	19	Benzene
	13	13	< 10	4-Methyl-2-Pentanone (MIBK)
	4	< 2	8	Toluene
	4	3	3	Total Xylenes
	500	400	200	TIC
Semivolatile Organics				
EPA 8270 CLP	Tr < 10	—	Tr < 10	Naphthalene
	19	—	Tr < 10	2-Methylnaphthalene
	200	—	200	TIC
EDB				
EPA 504	< 0.020	—	—	Ethylene Dibromide

* Data not yet validated for CLP deliverables
ND Nondetected
TPH Total Petroleum Hydrocarbons
TCL Target Compound List
TIC Tentatively Identified Compounds (reflects highest TIC concentration in sample)
J Estimated
TR Trace

4.2.2.3 SVOC Analyses

SVOC concentrations also remained at low levels with only trace levels of naphthalene detected and a decrease in the concentration of 2-methylnaphthalene from 19 µg/l to trace levels between the October, 1990 and May, 1991 sampling events.

4.2.2.4 Inorganic Analyses

Levels of arsenic decreased slightly from 14.1 ppb in October, 1990 to 9.8 ppb in May, 1991.

4.2.3 Aquifer 1 Wells Analytical Results

The results of chemical analyses performed on groundwater samples collected from Aquifer 1 monitoring wells are presented in Tables 4-43 through 4-58 and discussed below.

4.2.3.1 TPH Analyses

TPH concentrations in MW-28S and MW-32S located near the Main Waste Pit, declined from 1,400 and 880 µg/l in January 1991 to 870 µg/l and below detection limits (less than 500 µg/l) in May 1991 respectively. However, TPH concentrations in MW-27S located northeast of the Main Waste Pit increased from below detection limit to 3,700 µg/l during the same period. These wells were not sampled during the October 1990 sampling event. TPH concentrations in MW-21S, MW-22S, and MW-25S, located west and south of the Main Waste Pit, remained at below detection levels (less than 500 µg/l) during these sampling events. This indicates that off-site migration of the plume has not occured to the west and confirms separation between the main waste pit and southern plumes.

TEPH concentrations also show a general decline in MW-18S, MW-19S, MW-20S, and MW-26S located in the southern portion of the site, going from ranges of 1,000 to 9,200 µg/l in October 1990 to ranges of below detection limit to 4,000 µg/l in May 1991. The greatest decline was observed in MW-18S located southeast of the site, from 7,000 to 800 µg/l between October 1990 and May 1991. Monitoring well MW-30S also located southeast of the site has shown TEPH concentrations below detection limit in all sampling events. These two wells have been determined to lie upgradient of the site and, based on the latest sampling, appear to confirm the southeastern boundary of the southern plume. Monitoring well MW-34S located off site to the west, has also been below the TPH detection limit in all sampling events and defines the northwestern boundary of the southern plume.

TABLE 4-43

Groundwater Chemical Analyses for MW-6S
(Aquifer 1)

Analysis	Concentration (µg/L) 09/25/90	01/18/91	05/03/91*	Compound
Metals				
EPA 7060 CLP	2.1	< 2.0	< 1.3	Arsenic
EPA 6010 CLP	523	163	—	Barium
EPA 6010 CLP	< 1.8	< 2.0	—	Cadmium
EPA 6010 CLP	< 2.5	< 5.0	—	Chromium
EPA 7196 CLP	70	—	—	Hexavalent Chromium
EPA 6010 CLP	< 4.0	< 3.0	—	Copper
EPA 7421 CLP	< 1.3	1.2	—	Lead
EPA 6010 CLP	8.0 J	< 5.0	—	Nickel
EPA 6010 CLP	< 3.0	< 4.0	—	Vanadium
TEPH				
8015 (M) CA DHS LUFT	< 500	< 500	< 500	TPH
Volatile Organics				
EPA 8240 CLP	20	< 1	< 1	Benzene
	20	28	10	TIC
Semivolatile Organics				
EPA 8270 CLP	< 10 - < 50	< 10 - < 50	< 10 - < 50	TCL
	20	100	30	TIC
EDB				
EPA 504	< 0.020	< 0.020	—	Ethylene Dibromide

* Data not yet validated for CLP deliverables
TPH Total Petroleum Hydrocarbons
TCL Target Compound List
TIC Tentatively Identified Compounds (reflects highest TIC concentration in sample)
J Estimated

TABLE 4-44

Groundwater Chemical Analyses for MW-8S
(Aquifer 1)

Analysis	Concentration (µg/L) 10/04/90	Compound
Metals		
EPA 7060 CLP	316 J	Arsenic
EPA 6010 CLP	544	Barium
EPA 6010 CLP	< 1.8	Cadmium
EPA 6010 CLP	2.6 J	Chromium
EPA 7196 CLP	< 20	Hexavalent Chromium
EPA 6010 CLP	6.2 J	Copper
EPA 7421 CLP	2.9	Lead
EPA 6010 CLP	< 2.4	Nickel
EPA 6010 CLP	< 3.0	Vanadium
TEPH		
8015 (M) CA DHS LUFT	< 500	TPH
Volatile Organics		
EPA 8240 CLP	230	Benzene
	74	Toluene
	6	Ehtylbenzene
	25	Total Xylenes
	200	TIC
Semivolatile Organics		
EPA 8270 CLP	46	2-methylnaphthalene
	500	TIC
EDB		
EPA 504	< 0.020	Ethylene Dibromide

TPH Total Petroleum Hydrocarbons
TIC Tentatively Identified Compounds (reflects highest TIC concentration in sample)
J Estimated

TABLE 4-45

Groundwater Chemical Analyses for MW-11S
(Aquifer 1)

Analysis	Concentration (µg/L) 10/03/90	Compound
Metals		
EPA 7060 CLP	< 1.7	Arsenic
EPA 6010 CLP	33.2	Barium
EPA 6010 CLP	< 1.8	Cadmium
EPA 6010 CLP	< 2.5	Chromium
EPA 7196 CLP	< 20	Hexavalent Chromium
EPA 6010 CLP	< 4.1	Copper
EPA 7421 CLP	< 1.3	Lead
EPA 6010 CLP	< 2.4	Nickel
EPA 6010 CLP	< 3.0	Vanadium
TEPH		
8015 (M) CA DHS LUFT	< 500	TPH
Volatile Organics		
EPA 8240 CLP	< 1 - < 20	TCL
Semivolatile Organics		
EPA 8270 CLP	< 10 - < 50	TCL
EDB		
EPA 504	< 0.020	Ethylene Dibromide

TPH Total Petroleum Hydrocarbons
TCL Target Compound List

TABLE 4-46

Groundwater Chemical Analyses for MW-18S
(Aquifer 1)

Analysis	Concentration (µg/L) 09/26/90	01/17/91	05/03/91*	Compound
Metals				
EPA 7060 CLP	< 1.7	< 2.0	< 1.3	Arsenic
EPA 6010 CLP	353	56.9	—	Barium
EPA 6010 CLP	< 1.8	< 2.0	—	Cadmium
EPA 6010 CLP	< 2.5	< 5.0	—	Chromium
EPA 7196 CLP	< 20	< 20	—	Hexavalent Chromium
EPA 6010 CLP	< 4.1	5.4	—	Copper
EPA 7421 CLP	< 1.3	1.3	—	Lead
EPA 6010 CLP	< 2.4	< 5.0	—	Nickel
EPA 6010 CLP	< 3.0	< 4.0	—	Vanadium
TEPH				
8015 (M) CA DHS LUFT	7000	< 500	800	TPH
Volatile Organics				
EPA 8240 CLP	1 J	< 1	< 1	Ethylbenzene
	3	< 1	< 1	Total Xylenes
	200	20	50	TIC
Semivolatile Organics				
EPA 8270 CLP	< 10	< 10	17	Bis(2-ethylhexyl)phthalate
	60	ND	50	TIC
EDB				
EPA 504	< 0.020	< 0.020	—	Ethylene Dibromide

* Data not yet validated for CLP deliverables
ND Nondetected
TPH Total Petroleum Hydrocarbons
TIC Tentatively identified Compounds (reflects highest TIC concentration in sample)
J Estimated

TABLE 4-47

Groundwater Chemical Analyses for MW-19S
(Aquifer 1)

Analysis	Concentration (µg/L) 09/26/90	01/17/91	05/01/91*	Compound
Metals				
EPA 7060 CLP	< 22.2	20.8	11.5	Arsenic
EPA 6010 CLP	1360	562	—	Barium
EPA 6010 CLP	< 1.8	< 2.0	—	Cadmium
EPA 6010 CLP	< 2.5	< 5.0	—	Chromium
EPA 7196 CLP	< 20	< 20	—	Hexavalent Chromium
EPA 6010 CLP	< 4.1	4.8	—	Copper
EPA 7421 CLP	< 1.3	2.2	—	Lead
EPA 6010 CLP	< 2.4	< 5.0	—	Nickel
EPA 6010 CLP	< 3.0	< 4.0	—	Vanadium
TEPH				
8015 (M) CA DHS LUFT	8400	5300	4000	TPH
Volatile Organics				
EPA 8240 CLP	< 3	6	4	1,2-Dichloroethane
	540	320	280	Benzene
	80	52	37	Toluene
	< 3	6	4	Ethylbenzene
	70	30	17	Total Xylenes
	300	200	300	TIC
Semivolatile Organics				
EPA 8270 CLP	84	Tr < 10	Tr < 10	Naphthalene
	11	< 10	< 10	2-Methylnaphthalene
	100	100	80	TIC
EDB				
EPA 504	< 0.020	< 0.020	—	Ethylene Dibromide

* Data not yet validated for CLP deliverables
TPH Total Petroleum Hydrocarbons
TIC Tentatively Identified Compounds (reflects highest TIC concentration in sample)
Tr Trace

TABLE 4-48

Groundwater Chemical Analyses for MW-20S
(Aquifer 1)

Analysis	Concentration (µg/L)				Compound
	09/25/90	01/17/91	05/01/91*	Duplicate 05/01/91*	
Metals					
EPA 7060 CLP	7.2	5.3	2.3	3.5	Arsenic
EPA 6010 CLP	69.5	183	—	—	Barium
EPA 6010 CLP	< 1.8	< 2.0	—	—	Cadmium
EPA 6010 CLP	< 2.5	< 5.0	—	—	Chromium
EPA 7196 CLP	< 20	< 20	—	—	Hexavalent Chromium
EPA 6010 CLP	< 4.0	6.7	—	—	Copper
EPA 7421 CLP	< 1.3	1.5	—	—	Lead
EPA 6010 CLP	8.5 J	< 5.0	—	—	Nickel
EPA 6010 CLP	< 3.0	< 4.0	—	—	Vanadium
TEPH					
8015 (M) CA DHS LUFT	1000	1700	680	660	TPH
Volatile Organics					
EPA 8240 CLP	—	< 20 UJ	39	120	Acetone
	< 20 J	29	< 1	< 1	Carbon Disulfide
	< 1	1	< 1	< 1	1,1,2,2-Tetrachloroethane
	5	11	4	9	Benzene
	4	7	< 2	4	Toluene
	3	39	8	10	Ethylbenzene
	1	3	2	3	Total Xylenes
	50	80	20	40	TIC
Semivolatile Organics					
EPA 8270 CLP	< 10	12	< 10	< 10	Naphthalene
	20	80	30	30	TIC
EDB					
EPA 504	< 0.020	< 0.020	—	—	Ethylene Dibromide

* Data not yet validated for CLP deliverables

TPH Total Petroleum Hydrocarbons

TIC Tentatively Identified Compounds (reflects highest TIC concentration in sample)

J Estimated

UJ Estimated nondetect

TABLE 4-49

Groundwater Chemical Analyses for MW-21S
(Aquifer 1)

Analysis	Concentration (µg/L) 09/26/90	01/16/91	05/03/91*	Compound
Metals				
EPA 7060 CLP	7.3	2.4	2.7	Arsenic
EPA 6010 CLP	40.1	39.7	—	Barium
EPA 6010 CLP	< 1.8	< 2.0	—	Cadmium
EPA 6010 CLP	< 2.5	< 5.0	—	Chromium
EPA 7196 CLP	< 20	< 20	—	Hexavalent Chromium
EPA 6010 CLP	< 4.1	21.8	—	Copper
EPA 7421 CLP	< 1.3	1.6	—	Lead
EPA 6010 CLP	12.6 J	12.0	—	Nickel
EPA 6010 CLP	< 3.0	< 4.0	—	Vanadium
TEPH				
EPA 8015 (A)	< 500	< 500	< 500	TPH
Volatile Organics				
EPA 8240 CLP	< 1 - < 20	< 1 - < 20	< 1 - < 20	TCL
	20	ND	ND	TIC
Semivolatile Organics				
EPA 8270 CLP	< 10 - < 50	< 10 - < 50	< 10 - < 50	TCL
	10	ND	20	TIC
EDB				
EPA 504	< 0.020	< 0.020	—	Ethylene Dibromide

* Data not yet validated for CLP deliverables
ND Nondetected
TPH Total Petroleum Hydrocarbons
TCL Target Compound List
TIC Tentatively Identified Compounds (reflects highest TIC concentration in sample)
J Estimated

TABLE 4-50

Groundwater Chemical Analyses for MW-22S (Aquifer 1)

Analysis	Concentration (µg/L) 08/29/90	09/27/90	01/18/91	05/02/91*	Compound
Metals					
EPA 7060 CLP	6.5	< 7.2	6.9	3.6	Arsenic
EPA 6010 CLP	118	126	120	—	Barium
EPA 6010 CLP	< 3.0	2.4	< 2.0	—	Cadmium
EPA 6010 CLP	< 4.0	< 2.5	< 5.0	—	Chromium
EPA 7196 CLP	---	< 20	---	---	Hexavalent Chromium
EPA 6010 CLP	< 6.0	< 4.1	< 3.0	—	Copper
EPA 7421 CLP	3.4	< 1.3	< 1.0	---	Lead
EPA 6010 CLP	24.0	< 2.4	< 5.0	---	Nickel
EPA 6010 CLP	3.0	< 3.0	< 4.0	—	Vanadium
TEPH					
EPA 8015	< 500	< 500	< 500	< 500	TPH
Volatile Organics					
EPA 8240 CLP	< 5 - < 10	< 1 - < 20	< 1 - < 20	< 1 - < 20	TCL
	ND	20	10	ND	TIC
Semivolatile Organics					
EPA 8270 CLP	< 10 - < 50	< 10 - < 50	< 10 - < 50	< 10 - < 50	TCL
	ND	200	100	ND	TIC
EDB					
EPA 504	< 0.050	< 0.020	< 0.020	—	Ethylene Dibromide

* Data not yet validated for CLP deliverables

ND Nondetected

TPH Total Petroleum Hydrocarbons

TCL Target Compound List

TIC Tentatively Identified Compounds (reflects highest TIC concentration in sample)

TABLE 4-51

Groundwater Chemical Analyses for MW-25S (Aquifer 1)

Analysis	Concentration (µg/L) 08/28/90	09/28/90	01/14/91	04/30/91*	Compound
Metals					
EPA 7060 CLP	2.2 UJ	< 1.7	< 2.0	< 1.3	Arsenic
EPA 6010 CLP	124 J	52.1	31.3	—	Barium
EPA 6010 CLP	< 2.9	2.5	< 2.0	—	Cadmium
EPA 6010 CLP	< 2.8	< 2.5	< 5.0	—	Chromium
EPA 7196 CLP	—	< 20	< 20	—	Hexavalent Chromium
EPA 6010 CLP	< 7.4	4.5	5.4	—	Copper
EPA 7421 CLP	< 11.0	< 1.3	1.9	—	Lead
EPA 6010 CLP	< 21.6	< 2.4	< 5.0	—	Nickel
EPA 6010 CLP	9.5 J	< 3.0	< 4.0	—	Vanadium
TEPH					
8015 (M) CA DHS LUFT	200	< 500	< 500	< 500	TPH
Volatile Organics					
EPA 8240 CLP	< 5 - < 10	< 1 - < 20	< 1 - < 20	< 1 - < 20	TCL
	20	ND	ND	10	TIC
Semivolatile Organics					
EPA 8270 CLP	< 10 - < 50	< 10 - < 50	< 10 - < 50	< 10 - < 50	TCL
	47	30	ND	10	TIC
EDB					
EPA 504	< 0.050	< 0.020	< 0.020	—	Ethylene Dibromide

* Data not yet validated for CLP deliverables
ND Nondetected
TPH Total Petroleum Hydrocarbons
TIC Tentatively Identified Compounds (reflects highest TIC concentration in sample)
J Estimated
UJ Estimated nondetect

TABLE 4-52

Groundwater Chemical Analyses for MW-26S (Aquifer 1)

Analysis	Concentration (µg/L) 06/26/90	09/25/90	01/16/91	05/01/91*	Compound
Metals					
EPA 7060 CLP	17.6 UJ	27.3	3.2	1.4	Arsenic
EPA 6010 CLP	729	868	345	—	Barium
EPA 6010 CLP	< 2.9	< 1.8	< 2.0	—	Cadmium
EPA 6010 CLP	< 2.8	< 2.5	< 5.0	—	Chromium
EPA 7196 CLP	—	< 20	< 20	—	Hexavalent Chromium
EPA 6010 CLP	< 7.4	< 4.0	4.8	—	Copper
EPA 7421 CLP	< 2.2	3.0	1.2	—	Lead
EPA 6010 CLP	< 21.6	22.2 J	15.0	—	Nickel
EPA 6010 CLP	3.0 J	5.6	< 4.0	—	Vanadium
TEPH					
8015 (M) CA DHS LUFT	4400	9200	12,000	1,700	TPH
Volatile Organics					
EPA 8240 CLP		9	< 1	< 1	1,2-Dichloroethane
	720	21 J	49	4	Benzene
	73	310	6	< 2	Toluene
	14	15	2	< 1	Ethylbenzene
	28	49	5	< 1	Total Xylenes
	390	300	60	40	TIC
Semivolatile Organics					
EPA 8270 CLP	< 10	33	< 10	<10	Naphthalene
	210	100	40	20	TIC
EDB					
EPA 504	< 0.050	< 0.020	< 0.020	—	Ethylene Dibromide

* Data not yet validated for CLP deliverables

TPH Total Petroleum Hydrocarbons

TIC Tentatively Identified Compounds (reflects highest TIC concentration in sample)

J Estimated

UJ Estimated nondetect

TABLE 4-53

Groundwater Chemical Analyses for MW-27S
(Aquifer 1)

Analysis	Concentration (µg/L) 01/15/91	04/30/91*	Compound
Metals			
EPA 7060 CLP	< 2.0	1.9	Arsenic
EPA 6010 CLP	39.2	---	Barium
EPA 6010 CLP	< 2.0	—	Cadmium
EPA 6010 CLP	< 5.0	—	Chromium
EPA 7196 CLP	< 20	---	Hexavalent Chromium
EPA 6010 CLP	6.7	---	Copper
EPA 7421 CLP	2.0	—	Lead
EPA 6010 CLP	< 5.0	---	Nickel
EPA 6010 CLP	< 4.0	—	Vanadium
TEPH			
8015 (M) CA DHS LUFT	< 500	3,700	TPH
Volatile Organics			
EPA 8240 CLP	< 1	63	Benzene
	<2	47	Toluene
	<1	150	Ethylbenzene
	<1	55	Xylenes (Total)
	ND	50	TIC
Semivolatile Organics			
EPA 8270 CLP	< 10	54	Naphthalene
	ND	60	TIC
EDB			
EPA 504	< 0.020	—	Ethylene Dibromide

* Data not yet validated for CLP deliverables

ND Nondetected

TPH Total Petroleum Hydrocarbons

TIC Tentatively Identified Compounds (reflects highest TIC concentration in sample)

TABLE 4-54

Groundwater Chemical Analyses for MW-28S
(Aquifer 1)

Analysis	Concentration (µg/L) 01/15/91	05/01/91*	Duplicate 05/01/91*	Compound
Metals				
EPA 7060 CLP	< 2.0	1.3	< 1.3	Arsenic
EPA 6010 CLP	283	—	—	Barium
EPA 6010 CLP	< 2.0	—	—	Cadmium
EPA 6010 CLP	< 5.0	—	—	Chromium
EPA 7196 CLP	< 20	—	—	Hexavalent Chromium
EPA 6010 CLP	5.4	—	—	Copper
EPA 7421 CLP	2.0	—	—	Lead
EPA 6010 CLP	< 5.0	—	—	Nickel
EPA 6010 CLP	< 4.0	—	—	Vanadium
TPH				
8015 (M) CA DHS LUFT	1,400	870	760	TPH
Volatile Organics				
EPA 8240 CLP	110	35	73	Benzene
	27	9	18	Toluene
	16	6	14	Ethylbenzene
	29	12	23	Total Xylenes
	< 1	< 1	1	1,2-Dichloroethane
	50	30	50	TIC
Semivolatile Organics				
EPA 8270 CLP	< 10 - < 50	< 10 - < 50	< 10 - < 50	TLC
	20	30	30	TIC
EDB				
EPA 504	< 0.020	—	—	Ethylene Dibromide

* Data not yet validated for CLP deliverables

TPH Total Petroleum Hydrocarbons

TCL Target Compound List

TIC Tentatively Identified Compounds (reflects highest TIC concentration in sample)

TABLE 4-55

Groundwater Chemical Analyses for MW-29S
(Aquifer 1)

Analysis	Concentration (µg/L) 01/15/91	04/30/91*	Compound
Metals			
EPA 7060 CLP	< 2.0	< 1.3	Arsenic
EPA 6010 CLP	23.7	—	Barium
EPA 6010 CLP	< 2.0	—	Cadmium
EPA 6010 CLP	< 5.0	—	Chromium
EPA 7196 CLP	< 20	—	Hexavalent Chromium
EPA 6010 CLP	6.0	—	Copper
EPA 7421 CLP	6.0	—	Lead
EPA 6010 CLP	20.3	—	Nickel
EPA 6010 CLP	< 4.0	—	Vanadium
TPH			
8015 (M) CA DHS LUFT	< 500	2000	TPH
Volatile Organics			
EPA 8240 CLP	2	40	Benzene
	< 2	4	Toluene
	< 1	3	Xylenes (Total)
	30	200	TIC
Semivolatile Organics			
EPA 8270 CLP	< 10 - < 50	< 10 - < 50	TCL
	200	10	TIC
EDB			
EPA 504	< 0.020	—	Ethylene Dibromide

* Data not yet validated for CLP deliverables
TPH Total Petroleum Hydrocarbons
TCL Target Compound List
TIC Tentatively Identified Compounds (reflects highest TIC concentration in sample)

TABLE 4-56

Groundwater Chemical Analyses for MW-30S
(Aquifer 1)

Analysis	Concentration (µg/L) 01/15/91	05/03/91*	Duplicate 05/03/91*	Compound
Metals				
EPA 7060 CLP	< 2.0	1.8	1.7	Arsenic
EPA 6010 CLP	29.0	—	—	Barium
EPA 6010 CLP	< 2.0	—	—	Cadmium
EPA 6010 CLP	< 5.0	—	—	Chromium
EPA 7196 CLP	< 20	—	—	Hexavalent Chromium
EPA 6010 CLP	6.0	—	—	Copper
EPA 7421 CLP	2.2	—	—	Lead
EPA 6010 CLP	7.7	—	—	Nickel
EPA 6010 CLP	< 4.0	—	—	Vanadium
TEPH				
8015 (M) CA DHS LUFT	< 500	< 500	< 500	TPH
Volatile Organics				
EPA 8240 CLP	3	< 1	< 1	Benzene
	60	ND	ND	TIC
Semivolatile Organics				
EPA 8270 CLP	< 10 - < 50	< 10 - < 50	< 10 - < 50	TCL
	ND	20	50	TIC
EDB				
EPA 504	< 0.020	—	—	Ethylene Dibromide

* Data not yet validated for CLP deliverables
ND Nondetected
TPH Total Petroleum Hydrocarbons
TCL Target Compound List
TIC Tentatively Identified Compounds (reflects highest TIC concentration in sample)

TABLE 4-57

Groundwater Chemical Analyses for MW-32S (Aquifer 1)

Analysis	Concentration (µg/L) 01/16/91	05/01/91*	Compound
Metals			
EPA 7060 CLP	< 2.0	< 1.3	Arsenic
EPA 6010 CLP	413	—	Barium
EPA 6010 CLP	< 2.0	—	Cadmium
EPA 6010 CLP	< 5.0	—	Chromium
EPA 7196 CLP	< 20	—	Hexavalent Chromium
EPA 6010 CLP	6.0	—	Copper
EPA 7421 CLP	1.6	—	Lead
EPA 6010 CLP	< 5.0	—	Nickel
EPA 6010 CLP	< 4.0	—	Vanadium
TPH			
8015 (M) CA DHS LUFT	880	< 500	TPH
Volatile Organics			
EPA 8240 CLP	58	4	Benzene
	7	< 2	Toluene
	3	< 1	Ethylbenzene
	6	< 1	Total Xylenes
	80	10	TIC
Semivolatile Organics			
EPA 8270 CLP	< 10 - < 50	< 10 - < 50	TCL
	30	10	TIC
EDB			
EPA 504	< 0.020	—	Ethylene Dibromide

* Data not yet validated for CLP deliverables
TPH Total Petroleum Hydrocarbons
TCL Target Compound List
TIC Tentatively Identified Compounds (reflects highest TIC concentration in sample)

TABLE 4-58

Groundwater Chemical Analyses for MW-34S
(Aquifer 1)

Analysis	Concentration (µg/L) 01/16/91	05/01/91*	Compound
Metals			
EPA 7060 CLP	2.4	2.3	Arsenic
EPA 6010 CLP	20.8	—	Barium
EPA 6010 CLP	< 2.0	—	Cadmium
EPA 6010 CLP	< 5.0	—	Chromium
EPA 7196 CLP	< 20	—	Hexavalent Chromium
EPA 6010 CLP	6.7	—	Copper
EPA 7421 CLP	1.3	—	Lead
EPA 6010 CLP	31.1	—	Nickel
EPA 6010 CLP	< 4.0	—	Vanadium
TEPH			
8015 (M) CA DHS LUFT	< 500	< 500	TPH
Volatile Organics			
EPA 8240 CLP	< 1 - < 20	< 1 - < 20	TCL
Semivolatile Organics			
EPA 8270 CLP	< 10 - < 50	< 10 - < 50	TCL
	ND	60	TIC
EDB			
EPA 504	< 0.020	—	Ethylene Dibromide

* Data not yet validated for CLP deliverables
ND Nondetected
TPH Total Petroleum Hydrocarbons
TCL Target Compound List
TIC Tentatively Identified Compounds (reflects highest TIC concentration in sample)

The only two exceptions to this general decline occurred in MW-26S and MW-29S. MW-26S showed an increase from 9,200 to 12,000 µg/l in January 1991. MW-29S went from nondetect to 2,000 µg/l in May 1991.

TEPH concentrations in the two Ultramar gas station monitoring wells sampled during the May 1991 sampling event, ULTM-MW-9 and ULTM-MW-10 located off-site to the southwest, were detected at 7,200 and 3,500 µg/l, respectively.

4.2.3.2 VOC Analyses

Volatile organic compounds (VOCs) detected in the Aquifer 1 monitoring wells consisted mainly of benzene, toluene, ethylbenzene, and xylenes (BTEX). 1,2-dichloroethane (DCA) was only detected in a few wells at near detection limit levels.

BTEX concentrations detected in January and May 1991 in MW-6S, MW-27S, MW-28S, and MW-32S located around the Main Waste Pit, followed the same declining trend observed for TPH. BTEX were not detected in MW-21S, MW-22S, and MW-25S during any of the sampling events, substantiating the use of these wells to define the western and southern boundaries of the main waste pit plume. 1,2-dichloroethane (DCA) was only detected in MW-28S at 1 µg/l in May 1991.

BTEX concentrations also show the same general decline observed for TPH in MW-18S, MW-19S, MW-20S, and MW-26S located in the southern portion of the site. Except for ethylbenzene and xylenes detected in MW-18S at 1 and 3 µg/l respectively in October 1990, and benzene detected in MW-30S at 3 µg/l in January 1991, BTEX compounds in these two wells were below detection limits in all other sampling events, confirming their value as control points to define the southeast boundary of the southern plume. As with TPH, no BTEX compounds were found in MW-34S in any of the sampling events.

DCA was detected in the south only in MW-19S and MW-26S. DCA in MW-19S went from nondetect in October 1990 to 6 µg/l in January 1991 to 4 µg/l in May 1991. DCA was detected in MW-26S at 9 µg/l in October 1991, but was below detection limits in January and May 1991. Two other VOCs, Carbon disulfide and 1,1,2,2-tetrachloroethane were detected in MW-20S at 29 and 1 µg/l respectively in January 1991, but were not dected in May 1991. Acetone was also detected in MW-20S at 39 µg/l and 120 µg/l in January and May 1991 respectively. However, acetone has commonly been reported as a laboratory contaminant.

Ethylene Dibromide was not measured in any well at the detection limit of 0.02 µg/l.

Benzene was the only VOC detected in Aquifer 1 above federal and state MCLs during each sampling event. The wells in which benzene was detected above MCLs in May 1991 include MW-28S, and MW-32S near the Main Waste Pit, MW-27S northeast of the Main Waste Pit, and MW-19S, MW-20S, MW-26S, MW-29S, and MW-32S located in the southwest area of the site.

4.2.3.3 SVOC Analyses

SVOCs in monitoring wells around the Main Waste Pit were limited to MW-27S, which showed an increase from nondetect to 54 µg/l of naphthalene in May 1991, reflecting the upward trends of TEPH and BTEX concentrations in this well.

SVOCs predominantely detected in monitoring wells located in the southern portion of the site included naphthalene and 2-methylnaphthalene. Bis(2-ethylhexyl)phthalate was only detected in MW-18S at 17 µg/l in May 1991, and was determined to be a laboratory contaminant during data validation. Naphthalene was detected in MW-19S, MW-20S, and MW-26S at concentrations ranging from below detection limits to 84 µg/l in October 1990 and January 1991, but had declined to trace or below detection limit levels for all wells by May 1991. Similarly, 2-methylnaphthalene was detected in MW-8S and MW-19S (46 and 11 µg/l, respectively) in October 1990, but was not dected in January and May 1991 in either of the wells.

4.2.3.4 Inorganic Analyses (metals)

Except for arsenic, all metals analyzed for were detected at normal levels in all sampling events. Cadmium, chromium, hexevalent chromium, and vanadium were not detected in any of the Aquifer 1 wells at their respective detection limits of 1.8 ppb, 2.5 ppb, and 20 ppb. Arsenic was detected at 316 µg/l in MW-8S in October 1990. However, this value was later flagged as estimated during data validation. Because of this result, arsenic was the only metal which continued to be tested for in the May 1991 sampling event. Arsenic was found to be below detection limit (<1.3 µg/l) in 6 of the 14 Aquifer 1 wells tested and, except for MW-19S (11.5 µg/l) in the southern plume, was below 3.6 µg/l in all other wells.

4.2.4 Aquifer 2 Analytical Results

The results of chemical analyses performed on groundwater samples collected from Aquifer 2 monitoring wells are presented in Tables 4-59 to 4-66.

TABLE 4-59

Groundwater Chemical Analyses for MW-16D
(Aquifer 2)

Analysis	Concentration (µg/L) 10/02/90	Compound
Metals		
EPA 7060 CLP	< 1.7	Arsenic
EPA 6010 CLP	15.1	Barium
EPA 6010 CLP	11.4	Cadmium
EPA 6010 CLP	< 2.5	Chromium
EPA 7196 CLP	< 20	Hexavalent Chromium
EPA 6010 CLP	9.1	Copper
EPA 7421 CLP	< 1.3	Lead
EPA 6010 CLP	34.5	Nickel
EPA 6010 CLP	31.8	Vanadium
Volatile Organics		
EPA 8240 CLP	< 1 - < 20	TCL
Semivolatile Organics		
EPA 8270 CLP	< 10 - < 50	TCL
EDB		
EPA 504	< 0.020	Ethylene Dibromide

TCL Target Compound List

TABLE 4-60

Groundwater Chemical Analyses for MW-22D
(Aquifer 2)

Analysis	Concentration (µg/L) 09/27/90	01/18/91	05/02/91*	Compound
Metals				
EPA 7060 CLP	< 1.7	< 2.0	< 1.3	Arsenic
EPA 6010 CLP	42.2	57.5	—	Barium
EPA 6010 CLP	1.9	< 2.0	—	Cadmium
EPA 6010 CLP	< 2.5	< 5.0	—	Chromium
EPA 7196 CLP	< 20	—	—	Hexavalent Chromium
EPA 6010 CLP	4.5	8.6 J	—	Copper
EPA 7421 CLP	< 1.3	< 1.0	—	Lead
EPA 6010 CLP	6.7	< 5.0	—	Nickel
EPA 6010 CLP	3.5	4.8	—	Vanadium
Fuel Hydrocarbons				
8015 (M) CA DHS LUFT	< 500	< 500	< 500	TPH
Volatile Organics				
EPA 8240 CLP	< 1 - < 20	< 1 - < 20	< 1 - < 20	TCL
Semivolatile Organics				
EPA 8270 CLP	< 10 - < 50	< 10 - < 50	< 10 - < 50	TCL
	ND	40	ND	TIC
EDB				
EPA 504	< 0.020	< 0.020	—	Ethylene Dibromide

* Data not yet validated for CLP deliverables
ND Nondetected
TPH Total Petroleum Hydrocarbons
TCL Target Compound List
TIC Tentatively Identified Compounds (reflects highest TIC concentration in sample)
J Estimated

TABLE 4-61

Groundwater Chemical Analyses for MW-23D
(Aquifer 2)

Analysis	Concentration (µg/L)					Compound
	08/29/90	09/27/90	Duplicate 9/27/90	01/18/91	05/02/91*	
Metals						
EPA 7060 CLP	< 2.0	< 1.7	< 1.7	< 2.0	< 1.3	Arsenic
EPA 6010 CLP	82.2	71.3	71.3	78.5	—	Barium
EPA 6010 CLP	< 3.0	1.8	< 1.8	3.4	—	Cadmium
EPA 6010 CLP	3.0	< 2.5	< 2.5	6.0	—	Chromium
EPA 7196 CLP	—	< 20	< 20	—	—	Hexavalent Chromium
EPA 6010 CLP	3.0	< 4.1	4.5	3.7 J	—	Copper
EPA 7421 CLP	2.0	< 1.3	< 1.3	< 1.0	—	Lead
EPA 6010 CLP	24.0	6.4 J	6.4 J	12.1	—	Nickel
EPA 6010 CLP	3.8	< 3.0	< 3.0	9.3	—	Vanadium
Fuel Hydrocarbons						
8015 (M) CA DHS LUFT	< 500	< 500	< 500	< 500	< 500	TPH
Volatile Organics						
EPA 8240 CLP	< 5 - < 10	< 1 - < 20	< 1 - < 20	< 1 - < 20	< 1 - < 20	TCL
Semivolatile Organics						
EPA 8270 CLP	< 10 - < 50	< 10- < 50	< 10- < 50	< 10- < 50	< 10- < 50	TCL
	8.4	90	ND	70	ND	TIC
EDB						
EPA 504	< 0.050	< 0.020	< 0.020	< 0.020	—	Ethylene Dibromide

* Data not yet validated for CLP deliverables
ND Nondetected
TPH Total Petroleum Hydrocarbons
TCL Target Compound List
TIC Tentatively Identified Compounds (reflects highest TIC concentration in sample)
J Estimated

TABLE 4-62

Groundwater Chemical Analyses for MW-24D (Aquifer 2)

Analysis	Concentration (µg/L) 08/28/90	09/25/90	01/16/91	05/02/91*	Compound
Metals					
EPA 7060 CLP	< 2.0 UJ	< 1.7	< 2.0	< 1.3	Arsenic
EPA 6010 CLP	59.1	51.2	44.6	—	Barium
EPA 6010 CLP	< 2.9	< 1.8	< 2.0	—	Cadmium
EPA 6010 CLP	4.4	< 2.5	< 5.0	—	Chromium
EPA 7196 CLP	—	< 20	< 20	—	Hexavalent Chromium
EPA 6010 CLP	12.1	6.0 J	6.0	—	Copper
EPA 7421 CLP	5.7	3.4	1.2	—	Lead
EPA 6010 CLP	< 21.6	12.6 J	9.0	—	Nickel
EPA 6010 CLP	8.3 J	4.9	< 4.0	—	Vanadium
Fuel Hydrocarbons					
8015 (M) CA DHS LUFT	< 500	< 500	< 500	< 500	TPH
Volatile Organics					
EPA 8240 CLP	< 5 - < 10	< 1 - < 20	< 1 - < 20	< 1 - < 20	TCL
Semivolatile Organics					
EPA 8270 CLP	< 10 - < 50	< 10 - < 50	< 10 - < 50	< 10 - < 50	TCL
	ND	30	8	ND	TIC
EDB					
EPA 504	< 0.050	< 0.020	< 0.020	—	Ethylene Dibromide

* Data not yet validated for CLP deliverables

ND Nondetected

TPH Total Petroleum Hydrocarbons

TCL Target Compound List

TIC Tentatively Identified Compounds (reflects highest TIC concentration in sample)

J Estimated

UJ Estimated nondetect

TABLE 4-63

Groundwater Chemical Analyses for MW-25D (Aquifer 2)

Analysis	Concentration (µg/L) 08/28/90	09/28/90	01/16/91	04/30/91*	Compound
Metals					
EPA 7060 CLP	< 2.0 UJ	< 1.7	< 2.0	2.6	Arsenic
EPA 6010 CLP	149	20.3	23.8	—	Barium
EPA 6010 CLP	< 2.9	2.7	< 2.0	—	Cadmium
EPA 6010 CLP	38.3	4.5	< 5.0	—	Chromium
EPA 7196 CLP	-	< 20	< 20	—	Hexavalent Chromium
EPA 6010 CLP	< 7.4	5.7	7.9	—	Copper
EPA 7421 CLP	< 2.2	< 1.3	2.1	—	Lead
EPA 6010 CLP	< 21.6	16.7 J	19.7	—	Nickel
EPA 6010 CLP	< 1.9	5.3	< 4.0	—	Vanadium
TEPH					
8015 CA DHS LUFT	420	< 500	< 500	< 500	TPH
Volatile Organics					
EPA 8240 CLP	46	< 20	< 20 UJ	< 20	Acetone
	53	< 20	28 J	40	2-Butanone (MEK)
	24	3	4	11	Benzene
	7.2	< 2	< 2	3	Toluene
	25	3	< 1	5	Ethylbenzene
	31	1	2	12	Total Xylenes
	< 5	< 1	1	< 1	Chlorobenzene
	39	ND	ND	8	TIC
Semivolatile Organics					
EPA 8270 CLP	11	< 10	< 10	< 10	Naphthalene
	50	40	ND	100	TIC
EDB					
EPA 504	< 0.050	< 0.020	< 0.020		Ethylene Dibromide

* Data not yet validated for CLP deliverables

ND Nondetected

TPH Total Petroleum Hydrocarbons

TIC Tentatively Identified Compounds (reflects highest TIC concentration in sample)

J Estimated

UJ Estimated nondetect

TABLE 4-64

Groundwater Chemical Analyses for MW-29D
(Aquifer 2)

Analysis	Concentration (µg/L) 01/15/91	Concentration (µg/L) 04/30/91*	Compound
Metals			
EPA 7060 CLP	< 2.0	1.4	Arsenic
EPA 6010 CLP	18.8	—	Barium
EPA 6010 CLP	< 2.0	—	Cadmium
EPA 6010 CLP	< 5.0	—	Chromium
EPA 7196 CLP	30	—	Hexavalent Chromium
EPA 6010 CLP	4.8	—	Copper
EPA 7421 CLP	1.8	—	Lead
EPA 6010 CLP	19.3	—	Nickel
EPA 6010 CLP	< 4.0	—	Vanadium
TEPH			
8015 (M) CA DHS LUFT	< 500	< 500	TPH
Volatile Organics			
EPA 8240 CLP	21	< 1	Carbon Disulfide
	< 20	140	Acetone
	< 20 R	40	2-Butanone (MEK)
	ND	10	TIC
Semivolatile Organics			
EPA 8270 CLP	< 10 - < 50	< 10 - < 50	TCL
	ND	20	TIC
EDB			
EPA 504	< 0.020	—	Ethylene Dibromide

* Data not yet validated for CLP deliverables
ND Nondetected
TPH Total Petroleum Hydrocarbons
TCL Target Compound List
TIC Tentatively Identified Compounds (reflects highest TIC concentration in sample)
R Unusable

TABLE 4-65

Groundwater Chemical Analyses for MW-31D
(Aquifer 2)

Analysis	Concentration (µg/L) 01/15/91	Duplicate 01/15/91	05/02/91*	Compound
Metals				
EPA 7060 CLP	< 2.0	< 2.0	1.5	Arsenic
EPA 6010 CLP	22.8	20.7	—	Barium
EPA 6010 CLP	< 2.0	< 2.0	—	Cadmium
EPA 6010 CLP	7.5	5.4	—	Chromium
EPA 7196 CLP	< 20	< 20	—	Hexavalent Chromium
EPA 6010 CLP	6.7	8.5	—	Copper
EPA 7421 CLP	1.5	2.2	—	Lead
EPA 6010 CLP	23.7	26.1	—	Nickel
EPA 6010 CLP	< 4.0	< 4.0	—	Vanadium
TEPH				
8015 (M) CA DHS LUFT	< 500	< 500	< 500	TPH
Volatile Organics				
EPA 8240 CLP	< 1 - < 20	< 1 - < 20	< 1 - < 20	TCL
Semivolatile Organics				
EPA 8270 CLP	< 10 - < 50	< 10 - < 50	< 10 - < 50	TCL
	ND	80	ND	TIC
EDB				
EPA 504	< 0.020	< 0.020	—	Ethylene Dibromide

* Data not yet validated for CLP deliverables
ND Nondetected
TPH Total Petroleum Hydrocarbons
TCL Target Compound List
TIC Tentatively Identified Compounds (reflects highest TIC concentration in sample)

TABLE 4-66

Groundwater Chemical Analyses for MW-33D
(Aquifer 2)

Analysis	Concentration (µg/L)		Compound
	01/15/91	05/02/91*	
Metals			
EPA 7060 CLP	< 2.0	< 1 3	Arsenic
EPA 6010 CLP	24.8	—	Barium
EPA 6010 CLP	< 2.0	—	Cadmium
EPA 6010 CLP	< 5.0	—	Chromium
EPA 7196 CLP	< 20	—	Hexavalent Chromium
EPA 6010 CLP	7.9	—	Copper
EPA 7421 CLP	1.9	—	Lead
EPA 6010 CLP	8.4	—	Nickel
EPA 6010 CLP	< 4.0	—	Vanadium
TEPH			
8015 (M) CA DHS LUFT	< 500	< 500	TPH
Volatile Organics			
EPA 8240 CLP	< 1 - < 20	< 1 - < 20	TCL
Semivolatile Organics			
EPA 8027 CLP	< 10 - < 50	< 10 - < 50	TCL
EDB			
EPA 504	< 0.020	—	Ethylene Dibromide

* Data not yet validated for CLP deliverables
ND Nondetected
TPH Total Petroleum Hydrocarbons
TCL Target Compound List

The Aquifer 2 wells cover three general areas of the site:

- Far northern end of the facility (MW-16D)
- Area north and west of the Main Waste Pit (MW-22D, MW-23D, MW-24D, MW-33D)
- Area south of the Main Waste Pit (MW-25D, MW-29D, MW-31D)

4.2.4.1 TPH Analyses

TPH was below detection limits in all monitoring wells sampled during all four RI sampling events.

4.2.4.2 VOC Analyses

VOCs were only detected in two wells, MW-25D and MW-29D, and included BTEX, acetone, 2-butanone (MEK) and carbon disulfide.

BTEX compounds were detected only in MW-25D at very low levels. Benzene levels ranged from an initial high of 24 µg/l in August 1990, down to 3 and 4 µg/l in October 1990 and January 1991 respectively, and increasing to 11 µg/l by May 1991 event. Toluene, ethylbenzene and xylenes concentrations in this well exhibited a similar trend during the sampling period, with the highest levels observed back in August 1990 at 7.2, 25 and 31 µg/l respectively.

2-butanone (MEK) was detected in MW-25D at a high of 53 µg/l in August 1990 and at 40 µg/l in both MW-25D and MW-29D in May 1991. Acetone was detected in MW-23D at 140 µg/l in May 1991, but was not detected in MW-25D since August 1990 when it was reported at 46 µg/l. Acetone was determined to be a laboratory contaminant as a result of data validation. Carbon disulfide was detected only in MW-29D at 21 µg/l in January 1991 but was not detected in May 1991.

MW-25S, in Aquifer 1 at the same location of MW-25D, showed no chemical constituents.

4.2.4.3 SVOC Analyses

Only minor levels of tentatively identified SVOCs were detected in MW-22D, MW-23D, MW-24D, MW-31D and MW-33D.

4.2.4.4 Inorganic Analyses (metals)

Concentrations of all metals were reported within normal levels for all Aquifer 2 wells. The highest level of arsenic was detected in MW-25D at 2.6 µg/l in May 1991. Hexavalent chromium was only detected in MW-29D at a concentration of 30 µg/l.

4.2.5 Private Well Water Analyses

The private wells selected for sampling are:

PW-3	PW-23	PW-48
PW-11	PW-30	
PW-18	PW-45	

The onsite production well was also sampled on December 4, 1990 and is included in this data set. The analysis results are summarized and presented in Table 4-67. This table indicates unimpacted water in all private wells selected except PW-11, which is approximately 2/3-mile upgradient.

4.2.6 Historic Groundwater Quality Data

Texaco has been conducting groundwater monitoring activities at the Fillmore facility since 1983. The groundwater program has been conducted in cooperation with the RWQCB.

4.2.6.1 Regional Water Quality

Previous investigations of regional water quality in the vicinity of the Fillmore site show variable concentrations of total dissolved solids (TDS) in the ground and surface waters. These concentrations typically ranged from 1,100 to 1,400 mg/L TDS of calcium-magnesium sulfate, tending toward sodium sulfate composition in some locations.

4.2.6.2 Site Water Quality

The water quality constituents that have been monitored in groundwater samples acquired at the Fillmore facility include both organic and inorganic compounds. The organic compounds include phenols (total), BTEX, three halogenated VOCs (1,2-dichlorobenzene, 1,3-dichlorobenzene, and 1,4-dichlorobenzene), and organic lead. The inorganic compounds consisted of lead (total and dissolved) and TDS.

TABLE 4-67

Private Well Laboratory Analysis Results
(µg/L)

Well Sampled	Date Sampled	EDB EPA 504	Volatile Organics EPA 8240 CLP	Semivolatile Organics EPA 8270 CLP	TEPH EPA 8015(M) CA DHS LUFT	Metals
PW-3	10/03/90	ND	ND	ND	ND	Background
PW-18	10/04/90	ND	ND	ND	ND	Background
PW-23	10/03/90	ND	ND	ND	ND	Background
PW-48	10/03/90	ND	ND	ND	ND	Background
PW-11	12/12/90	ND	ND	50 / TIC	ND	Background
PW-30	12/12/90	ND	ND	ND	ND	Background
PW-45	10/18/90	ND	ND	ND	ND	Background
PW-45 (Duplicate)	10/18/90	ND	ND	ND	ND	Background
Onsite production well	12/03/90	ND	ND	ND	ND	Background

ND No compounds in method target compound list were detected at following detection limits: EDB (< 0.002), VOA (< 1 to < 20), SVOA (< 10 to < 50) and TPH (< 500).

TIC Tentatively Identified Compounds (reflects highest TIC concentration in sample)

A total of 17 monitoring wells and 2 piezometers were drilled and completed at the Fillmore facility between July 1983 and January 1988. These wells, constructed by both TriHydro and Radian, were completed in four separate phases. The final phase, Phase 4, called for the routine sampling of all Phase 1 through Phase 4 wells and piezometer P-2. During the latest investigation work, from mid 1990 through mid 1991, 20 more monitoring wells were drilled and completed at the site.

Tables 4-68 and 4-69 illustrate the results of organic and inorganic groundwater quality data acquired from pre-RI wells MW-1 through MW-17 and piezometer P-2. Table 4-68 provides a comprehensive overview of historical analtical data on BTEX in groundwater, reflecting groundwater monitoring that has occurred since 1986 and has been conducted by Radian, TriHydro and ENSR. Based on these tables, the following is a historical list of wells in which organic compounds have exceeded regulatory threshold levels:

MW-1S	MW-5D	MW-9S	MW-15S	MW-25D	MW-29S	ULTM-MW-10
MW-2S	MW-6S	MW-10P	MW-17S	MW-26S	MW-32S	
MW-3S	MW-7S	MW-12S	MW-19S	MW-27S	P-2S	
MW-4S	MW-8S	MW-14S	MW-20S	MW-28S	ULTM-MW-9	

The data in Table 4-68 reveal several things about chemical constituents in groundwater at this facility:

1. First, it appears that the most widespread occurrence of chemical constituents above MCLs is for benzene. Benzene is a common refined petroleum fraction and it has one of the lowest MCLs for petroleum constituents. Therefore it is reasonable to use benzene as an indicator in assessing any present and past contamination.

2. The benzene data from late 1990 through mid-1991, as well as prior samplings in wells that were dry in 1990, indicate the presence of two distinct constituent plumes in Aquifer 1, the "water table aquifer." One seems to be related to the MWP and is confined to its vicinity. The other occurs in the south and southwest part of the facility and may extend offsite to the west and be in communication with another well documented plume occurring below the Ultramar gas station to the southwest.

3. Organic constituents in Aquifer 2 (confined and below Aquifer 1 in the south) were detected in only one well. These constituents were found close to the Aquifer 1 southern, but not below it. In addition, wells drilled during Phase II of the RI specifically to examine Aquifer 2 below the southern plume, did not detect any constituents.

TABLE 4-68
Texaco Fillmore RI/FS
Historical Volatile Organics Groundwater Analytical Data
Aquifer I

Monitoring Well ID	Sampling Date	Analytical Results (mg/l)				Analytical Method	QA/QC Level
		Benzene	Ethylbenzene	Toluene	Xylenes		
MW-1S	07-jan-86	0.00550	0.00120	0.00120		EPA 602	non CLP *
	15-jan-86	0.01100	0.00090	0.00110		EPA 602	
	21-jan-86	0.02400	ND	ND		EPA 602	
	28-jan-86	0.01000	0.00360	0.00450		EPA 602	
	28-jan-86	0.00470	ND	ND		EPA 624	
	06-feb-86	0.00830	ND	0.00280		EPA 602	
	11-feb-86	0.01180	ND	0.00056		EPA 602	
	28-feb-86	0.00790	0.0014	ND		EPA 602	
	28-feb-86	0.00500	ND	ND		EPA 624	
	18-mar-86	0.00440	0.00140	0.00140		EPA 602	
	24-mar-86	0.00390	ND	ND		EPA 602	
	31-mar-86	0.00480	0.00170	0.00130		EPA 602	
	31-mar-86	ND	ND	ND		EPA 624	
	09-apr-86	0.01010	ND	0.00320		EPA 602	
	30-apr-86	0.00430	0.01100	0.00660		EPA 602	
	30-apr-86	ND	ND	ND		EPA 624	
	30-may-86	0.01100	ND	0.00330		EPA 602	
	30-jun-86	0.00290	0.00090	0.00060		EPA 602	
	30-jul-86	0.00410	0.00066	0.00071		EPA 602	
	21-may-86	0.00490	0.00100	0.00440		EPA 624	
	21-may-87	0.0049	0.001	0.0044	0.003	EPA 602	"
MW-2S	07-jan-86	1.30000	0.13000	0.17000		EPA 602	non CLP *
	15-jan-86	1.40000	0.13000	0.17000		EPA 602	
	21-jan-86	1.80000	0.15000	0.20000		EPA 602	
	28-jan-86	1.50000	0.13000	0.7000		EPA 602	
	28-jan-86	2.40000	ND	0.06500		EPA 624	
	06-feb-86	1.90000	0.17000	0.20000		EPA 602	
	11-feb-86	5.79200	0.12600	0.23100		EPA 602	
	28-feb-86	0.17000	0.05400	0.02200		EPA 602	
	28-feb-86	0.14000	ND	ND		EPA 624	
	18-mar-86	0.20000	0.03800	0.01800		EPA 602	
	24-mar-86	0.17000	ND	0.01800		EPA 602	
	31-mar-86	0.21000	ND	0.02000		EPA 602	
	31-mar-86	0.18100	ND	ND		EPA 624	
	09-apr-86	0.34800	ND	ND		EPA 602	
	30-apr-86	0.37000	0.03700	0.04100		EPA 602	
	30-apr-86	0.30000	ND	0.03100		EPA 624	
	30-may-86	0.45000	0.03700	0.04500		EPA 602	
	30-may-86	0.07600	ND	0.00500		EPA 624	
	30-jun-86	0.38000	0.02800	0.04900		EPA 602	
	30-jun-86	0.37000	ND	ND		EPA 624	
	30-jul-86	0.32000	0.04000	0.02600		EPA 602	
	30-jul-86	0.28000	ND	0.02300		EPA 624	
	20-may-87	0.651	0.062	0.102	0.057	EPA 602	
	29-jul-87	1.660	0.030	0.118	0.050	EPA 503.1	
	22-sep-87	0.037	0.074	0.153	0.020	EPA 602	
	02-dec-87	0.120	0.006	0.002	0.003	EPA 602	
	16-feb-88	0.926	0.185	0.107	0.974	EPA 602	
	17-may-88	0.240	0.010	0.014	<0.010	NA	
	24-aug-88	1.000	0.045	0.070	0.030	NA	
	15-nov-88	0.240	<0.005	<0.025	<0.025	EPA 624	

ND Not Detected
NA Laboratory reports not available
* Data extracted from previous site investigations and quarterly sampling reports by Radian and Trihydro. Data not validated for QA/QC

TABLE 4-68 (cont.)
Texaco Fillmore RI/FS
Historical Volatile Organics Groundwater Analytical Data
Aquifer I

Monitoring Well ID	Sampling Date	Analytical Results (mg/l)				Analytical Method	QA/QC Level
		Benzene	Ethylbenzene	Toluene	Xylenes		
MW-2S	21-feb-89	0.038	<0.005	0.005	0.005	EPA 624	non CLP *
(cont.)	22-may-89	0.210	<0.005	0.011	0.005	EPA 624	
	10-aug-89	0.031	<0.001	<0.001	<0.001	EPA 624	
MW-3S	07-jan-86	0.08800	ND	0.09200		EPA 602	non CLP *
	15-jan-86	0.13000	ND	0.03900		EPA 602	
	21-jan-86	0.13000	0.03300	0.05900		EPA 602	
	28-jan-86	0.16000	0.03900	0.07100		EPA 602	
	28-jan-86	ND	ND	0.02700		EPA 624	
	06-feb-86	0.09800	0.01000	0.03300		EPA 602	
	11-feb-86	0.36000	ND	0.03540		EPA 602	
	28-feb-86	0.22000	0.04700	0.04800		EPA 602	
	28-feb-86	0.24000	ND	0.01400		EPA 624	
	18-mar-86	0.34800	0.06400	0.05800		EPA 602	
	24-mar-86	0.31000	ND	0.06200		EPA 602	
	31-mar-86	0.29000	0.05000	0.05000		EPA 602	
	31-mar-86	0.16000	ND	ND		EPA 624	
	09-apr-86	0.53800	ND	0.05110		EPA 602	
	30-apr-86	0.29000	0.04900	0.07800		EPA 602	
	30-apr-86	0.17000	ND	ND		EPA 624	
	30-may-86	0.12000	0.01500	0.02700		EPA 602	
	30-may-86	0.13000	ND	0.00900		EPA 624	
	30-jun-86	0.15000	ND	0.03300		EPA 602	
	30-jun-86	0.23000	ND	ND		EPA 624	
	30-jul-86	0.14000	0.02900	0.01700		EPA 602	
	30-jul-86	0.21000	ND	ND		EPA 624	
	21-may-87	0.139	<0.0001	0.011	<0.0001	EPA 602	
	30-jul-87	0.186	0.0010	0.009	0.004	EPA 503.1	
	23-sep-87	0.103	0.021	0.019	0.044	EPA 602	
	02-dec-87	0.026	0.010	0.025	0.012	EPA 602	
	16-feb-88	0.326	<0.001	0.196	<0.001	EPA 602	
	17-may-88	0.140	0.005	0.019	<0.010	NA	
	24-aug-88	0.160	<0.020	0.032	<0.020	NA	
	16-nov-88	0.170	<0.025	<0.025	<0.025	EPA 624	
	22-feb-89	0.150	<0.005	0.019	<0.005	EPA 624	
	23-may-89	0.089	<0.005	0.013	<0.005	EPA 624	
	11-aug-89	0.140	0.013	<0.001	0.005	EPA 624	
MW-4S	07-jan-86	0.00060	0.00080	ND		EPA 602	non CLP *
	15-jan-86	ND	ND	0.01300		EPA 602	
	21-jan-86	ND	ND	ND		EPA 602	
	28-jan-86	ND	0.00400	0.00340		EPA 602	
	28-jan-86	ND	ND	ND		EPA 624	
	06-feb-86	ND	ND	ND		EPA 602	
	11-feb-86	0.00082	ND	ND		EPA 602	
	28-feb-86	0.00230	ND	ND		EPA 602	
	28-feb-86	ND	ND	ND		EPA 624	
	18-mar-86	ND	0.00390	0.00270		EPA 602	
	24-mar-86	0.00050	0.00590	0.00350		EPA 602	
	31-mar-86	ND	ND	ND		EPA 602	
	31-mar-86	ND	ND	ND		EPA 624	
	09-apr-86	ND	ND	ND		EPA 602	
	30-apr-86	ND	ND	0.00490		EPA 602	

ND Not Detected
NA Laboratory reports not available
* Data extracted from previous site investigations and quarterly sampling reports by Radian and Trihydro. Data not validated for QA/QC

TABLE 4-68 (cont.)
Texaco Fillmore RI/FS
Historical Volatile Organics Groundwater Analytical Data
Aquifer I

Monitoring Well ID	Sampling Date	Analytical Results (mg/l)				Analytical Method	QA/QC Level
		Benzene	Ethylbenzene	Toluene	Xylenes		
MW-4S (cont.)	30-apr-86	ND	ND	ND		EPA 624	non CLP *
	30-may-86	ND	ND	ND		EPA 602	
	30-jun-86	ND	ND	ND		EPA 602	
	30-jul-86	ND	ND	ND		EPA 602	
	21-may-87	0.0007	<0.0001	0.0004	0.001	EPA 602	
	30-jul-87	<0.0005	<0.0005	<0.0005	<0.0005	EPA 503.1	
	22-sep-87	<0.001	0.007	<0.001	0.005	EPA 602	
	01-dec-87	<0.001	0.008	0.008	<0.001	EPA 602	
	15-feb-88	0.004	<0.001	<0.001	<0.001	EPA 602	
	17-may-88	<0.005	0.005	0.006	<0.001	EPA 602	
	23-aug-88	<0.001	<0.001	<0.001	<0.001	NA	
	15-nov-88	<0.005	<0.005	<0.005	<0.005	EPA 624	
	21-feb-89	<0.005	<0.005	<0.005	<0.005	EPA 624	
	22-may-89	<0.005	<0.005	<0.005	<0.005	EPA 624	
	10-aug-89	<0.001	<0.001	<0.001	<0.001	EPA 624	
	09-nov-89	<0.001	<0.001	<0.001	<0.001	NA	
	18-feb-90	<0.005	<0.005	<0.005	<0.005	EPA 624	
	28-may-90	<0.005	<0.005	<0.005	<0.005	EPA 602	
MW-6S	07-jan-86	1.50000	0.05500	0.15000		EPA 602	non CLP *
	15-jan-86	1.60000	0.06000	0.14000		EPA 602	
	21-jan-86	2.00000	0.08000	0.18000		EPA 602	
	28-jan-86	1.80000	0.05400	0.15000		EPA 602	
	28-jan-86	1.90000	ND	0.14000		EPA 624	
	06-feb-86	ND	ND	ND		EPA 602	
	11-feb-86	3.78100	ND	0.15400		EPA 602	
	28-feb-86	2.40000	ND	0.07500		EPA 602	
	28-feb-86	1.40000	ND	0.05600		EPA 624	
	18-mar-86	2.20000	0.04500	0.05100		EPA 602	
	24-mar-86	1.30000	ND	0.02900		EPA 602	
	31-mar-86	0.83000	0.01700	0.01400		EPA 602	
	31-mar-86	0.23000	ND	ND		EPA 624	
	09-apr-86	0.83000	ND	ND		EPA 602	
	30-apr-86	0.01100	ND	0.00510		EPA 602	
	30-apr-86	ND	ND	ND		EPA 624	
	30-may-86	0.58000	0.01700	0.02200		EPA 602	
	30-may-86	0.33000	ND	0.01200		EPA 624	
	30-jun-86	1.50000	ND	ND		EPA 602	
	30-jun-86	1.00000	ND	0.05700		EPA 624	
	30-jul-86	1.50000	ND	ND		EPA 602	
	30-jul-86	1.50000	ND	0.06400		EPA 624	
	20-may-87	0.0039	<0.0001	<0.0001	0.006	EPA 602	
	29-jul-87	<0.0005	<0.0005	<0.0005	<0.0005	EPA 503.1	
	22-sep-87	0.003	0.055	0.018	0.072	EPA 602	
	02-dec-87	0.024	0.025	0.008	0.005	EPA 602	
	16-feb-88	<0.001	<0.001	<0.001	<0.001	EPA 602	
	17-may-88	0.240	0.011	0.010	<0.01	NA	
	24-aug-88	0.78	<0.001	0.0023	<0.001	NA	
	16-nov-88	0.420	<0.025	<0.025	<0.025	EPA 624	
	22-feb-89	0.410	<0.010	0.017	<0.010	EPA 624	
	22-may-89	0.660	<0.010	0.021	<0.010	EPA 624	
	10-aug-89	0.440	<0.005	<0.005	<0.005	EPA 624	
	09-nov-89	0.500	<0.005	0.021	0.009	NA	
	18-feb-90	0.280	<0.01	<0.01	<0.01	EPA 624	
	28-may-90	0.083	0.002	0.005	<0.005	EPA 602	

ND Not Detected
NA Laboratory reports not available
* Data extracted from previous site investigations and quarterly sampling reports by Radian and Trihydro. Data not validated for QA/QC

TABLE 4-68 (cont.)
Texaco Fillmore RI/FS
Historical Volatile Organics Groundwater Analytical Data
Aquifer I

Monitoring Well ID	Sampling Date	Analytical Results (mg/l)				Analytical Method	QA/QC Level
		Benzene	Ethylbenzene	Toluene	Xylenes		
MW-6S (cont.)	25-sep-90	0.020	<0.001	<0.002	<0.001	EPA 624	CLP Validated
	18-jan-91	<0.001	<0.001	<0.002	<0.001	EPA 624	
	3-may-91	<0.001	<0.001	<0.002	<0.001	EPA 624	CLP **
MW-7S	07-jan-86	0.19000	0.05800	0.06600		EPA 602	non CLP *
	15-jan-86	0.23000	0.04700	0.13000		EPA 602	
	21-jan-86	0.18000	ND	0.12000		EPA 602	
	28-jan-86	0.19000	0.4500	0.12000		EPA 602	
	28-jan-86	0.51800	ND	ND		EPA 624	
	06-feb-86	0.33000	0.07500	0.17000		EPA 602	
	11-feb-86	3.85900	4.30400	3.15800		EPA 602	
	28-feb-86	0.42000	0.07900	0.16000		EPA 602	
	28-feb-86	0.50000	ND	0.08900		EPA 624	
	18-mar-86	0.33000	0.05600	0.12000		EPA 602	
	24-mar-86	0.41000	ND	0.14000		EPA 602	
	31-mar-86	0.42000	0.08000	0.17000		EPA 602	
	31-mar-86	0.35000	ND	0.08400		EPA 624	
	09-apr-86	1.18500	ND	0.13500		EPA 602	
	30-apr-86	0.43000	0.06100	0.17000		EPA 602	
	30-apr-86	0.36000	ND	0.07700		EPA 624	
	30-may-86	0.12000	ND	0.04500		EPA 602	"
	30-may-86	0.07000	ND	0.01500		EPA 624	
	30-jun-86	0.18000	ND	0.07000		EPA 602	
	30-jun-86	0.38000	ND	ND		EPA 624	
	30-jul-86	0.12000	ND	0.04200		EPA 602	
	30-jul-86	0.34000	ND	0.11000		EPA 624	
	21-may-87	0.277	0.287	0.585	<0.0001	EPA 602	
	29-jul-87	0.348	0.136	0.019	0.056	EPA 503.1	
	22-sep-87	0.013	0.002	<0.001	<0.001	EPA 602	
	01-dec-87	0.005	0.014	0.015	0.023	EPA 602	
	16-feb-88	<0.001	<0.001	<0.001	0.016	EPA 602	
	17-may-88	0.270	<0.020	0.095	0.045	NA	
	24-aug-88	0.110	<0.001	0.036	0.011	NA	
	16-nov-88	0.260	<0.025	<0.025	<0.025	EPA 624	
	22-feb-89	0.290	<0.010	0.093	0.034	EPA 624	
	23-may-89	0.290	0.007	0.075	0.016	EPA 624	
	11-aug-89	0.320	0.096	<0.005	0.044	EPA 624	
	10-nov-89	0.230	<0.0025	0.070	0.018	EPA 624	
MW-8S	30-apr-86	0.29000	0.06500	0.14000		EPA 602	non CLP *
	30-apr-86	0.33000	ND	0.07700		EPA 624	
	30-may-86	0.11000	0.02000	0.04900		EPA 602	
	30-jun-86	0.16000	ND	0.06200		EPA 602	
	30-jul-86	0.14000	0.02900	0.04900		EPA 602	
	19-may-87	0.288	0.041	0.106	0.077	EPA 602	
	29-jul-87	0.439	0.194	0.029	0.013	EPA 503.1	
	22-sep-87	0.349	0.075	0.158	0.144	EPA 602	
	01-dec-87	0.274	1.660	0.200	0.717	EPA 602	
	16-feb-88	<0.001	<0.001	<0.001	<0.001	EPA 602	
	17-may-88	0.260	<0.020	0.074	<0.040	NA	
	24-aug-88	0.250	0.0062	0.081	0.038	NA	
	16-nov-88	0.200	<0.025	<0.025	<0.025	EPA 624	
	21-feb-89	0.330	<0.010	0.097	0.044	EPA 624	
	23-may-89	0.340	<0.005	0.085	0.053	EPA 624	
	11-aug-89	0.270	0.082	0.049	0.050	EPA 624	

ND Not Detected
NA Laboratory reports not available
* Data extracted from previous site investigations and quarterly sampling reports by Radian and Trihydro. Data not validated for QA/QC
** CLP validation in progress

TABLE 4-68 (cont.)
Texaco Fillmore RI/FS
Historical Volatile Organics Groundwater Analytical Data
Aquifer I

Monitoring Well ID	Sampling Date	Analytical Results (mg/l)				Analytical Method	QA/QC Level
		Benzene	Ethylbenzene	Toluene	Xylenes		
MW-8S (cont.)	10-nov-89	0.330	<0.0025	0.100	0.025	NA	non CLP *
	19-feb-90	0.400	<0.025	0.130	0.054	EPA 624	
	29-may-90	0.340	<0.005	<0.005	0.001	EPA 602	
	04-oct-90	0.230	0.006	0.074	0.025	EPA 624	CLP Validated
MW-9S	30-apr-86	0.00870	0.1200	0.01600		EPA 602	non CLP *
	30-apr-86	0.02600	ND	ND		EPA 624	
	30-may-86	0.01400	0.01000	0.00840		EPA 602	
	30-jun-86	0.01400	0.00990	0.01100		EPA 602	
	30-jul-86	0.00240	0.00240	0.00160		EPA 602	
	19-may-87	0.080	0.036	0.072	0.058	EPA 602	
	30-jul-87	<0.0005	<0.0005	<0.0005	<0.0005	EPA 503.1	
	22-sep-87	0.018	0.036	0.045	0.069	EPA 602	
	02-dec-87	0.028	0.142	0.078	0.220	EPA 602	
	16-feb-88	0.066	<0.001	<0.001	<0.001	EPA 602	
	17-may-88	0.019	<0.005	0.011	0.012	NA	
	24-aug-88	0.015	0.0023	0.0084	0.009	NA	
	16-nov-88	0.016	<0.005	0.0081	<0.005	EPA 624	
	22-feb-89	0.016	<0.005	0.012	0.012	EPA 624	
	23-may-89	0.015	<0.005	0.009	0.010	EPA 624	
	11-aug-89	0.038	0.011	0.015	0.012	EPA 624	**
	10-nov-89	0.019	<0.0025	0.010	0.007	NA	
	18-feb-90	0.017	<0.005	<0.005	<0.005	EPA 624	
	29-may-90	0.026	0.0072	0.0073	0.0055	EPA 602	
MW-11S	30-apr-86	ND	ND	ND		EPA 602	non CLP *
	30-apr-86	ND	ND	ND		EPA 624	
	30-may-86	ND	ND	ND		EPA 602	
	30-jun-86	0.00100	ND	ND		EPA 602	non CLP *
	30-jul-86	ND	ND	ND		EPA 602	
	19-may-87	0.0007	<0.0001	0.0008	0.006	EPA 602	
	18-feb-90	<0.005	<0.005	<0.005	<0.005	EPA 624	
	03-oct-90	<0.001	<0.001	<0.002	<0.001	EPA 624	CLP Validated
MW-12S	20-may-87	0.0005	<0.0001	<0.0001	0.001	EPA 602	non CLP *
	30-jul-87	<0.0005	<0.0005	<0.0005	<0.0005	EPA 503.1	
	22-sep-87	0.006	<0.001	0.007	<0.001	EPA 602	
	02-dec-87	<0.001	<0.001	<0.001	<0.001	EPA 602	
	16-feb-88	0.002	<0.001	0.002	<0.001	EPA 602	
	18-may-88	<0.0005	<0.0005	<0.0005	<0.001	NA	
	23-aug-88	<0.001	<0.001	<0.001	<0.001	NA	
	15-nov-88	<0.005	<0.005	<0.005	<0.005	EPA 624	
	21-feb-89	<0.005	0.0098	0.020	0.083	EPA 624	
	22-may-89	<0.005	<0.005	<0.005	<0.005	EPA 624	
	10-aug-89	<0.001	<0.001	<0.001	<0.001	EPA 624	
MW-14S	20-may-87	0.227	0.014	0.020	0.041	EPA 602	non CLP *
	31-jul-87	<0.0005	<0.0005	<0.0005	<0.0005	EPA 503.1	
	22-sep-87	0.004	<0.001	0.024	<0.001	EPA 602	
	02-dec-87	0.017	0.019	0.007	0.172	EPA 602	
	16-feb-88	0.036	<0.001	<0.001	<0.001	EPA 602	
	17-may-88	0.029	<0.005	<0.0005	<0.01	NA	
	23-aug-88	0.051	<0.001	<0.001	<0.001	NA	
	15-nov-88	0.027	0.0061	<0.005	<0.005	EPA 624	
	21-feb-89	<0.005	<0.005	<0.005	<0.005	EPA 624	
	22-may-89	0.005	<0.005	<0.005	<0.005	EPA 624	
	10-aug-89	0.008	<0.001	<0.001	<0.001	EPA 624	
	09-nov-89	<0.001	<0.001	<0.001	<0.001	NA	

ND Not Detected
NA Laboratory reports not available
* Data extracted from previous site investigations and quarterly sampling reports by Radian and Trihydro. Data not validated for QA/QC
** CLP validation in progress

TABLE 4-68 (cont.)
Texaco Fillmore RI/FS
Historical Volatile Organics Groundwater Analytical Data
Aquifer I

Monitoring Well ID	Sampling Date	Analytical Results (mg/l)				Analytical Method	QA/QC Level
		Benzene	Ethylbenzene	Toluene	Xylenes		
MW-15S	20-may-87	0.0010	<0.0001	0.0002	0.028	EPA 602	non CLP *
	31-jul-87	<0.0005	<0.0005	<0.0005	<0.0005	EPA 503.1	
	01-dec-87	<0.001	0.003	0.002	<0.001	EPA 602	
	15-feb-88	0.025	0.006	<0.001	<0.008	EPA 602	
	17-may-88	<0.0005	<0.0005	<0.0005	<0.001	NA	
	23-aug-88	<0.001	<0.001	<0.001	<0.001	NA	
	15-nov-88	<0.005	<0.005	<0.005	<0.005	EPA 624	
MW-17S	16-feb-88	2.63	0.395	<0.001	1.119	EPA 602	non CLP *
	17-may-88	1.20	0.022	0.100	0.049	NA	
	24-aug-88	1.20	0.012	0.120	0.067	NA	
	16-nov-88	1.70	<0.050	0.110	<0.050	EPA 624	
	22-feb-89	0.96	<0.050	0.085	<0.050	EPA 624	
	23-may-89	1.20	0.012	0.093	0.077	EPA 624	
	11-aug-89	1.60	<0.010	<0.010	<0.010	EPA 624	
	10-nov-89	1.40	<0.010	0.081	0.022	NA	
	19-feb-90	1.40	<0.050	0.098	<0.050	EPA 624	
	19-feb-90 dup.	1.50	<0.050	0.100	<0.050	NA	
	29-may-90	1.20	0.014	0.091	0.048	EPA 602	
MW-18S	26-sep-90	<0.001	0.001	<0.002	0.003	EPA 624	CLP Validated
	17-jan-91	<0.001	<0.001	<0.002	<0.001	EPA 624	"
	03-may-91	<0.001	<0.001	<0.002	<0.001	EPA 624	CLP **
MW-19S	26-sep-90	0.540	<0.003	0.080	0.070	EPA 624	CLP Validated
	17-jan-91	0.320	0.006	0.052	0.030	EPA 624	
	01-may-91	0.280	0.004	0.037	0.017	EPA 624	CLP **
MW-20S	19-feb-90	1.50	<0.050	0.100	<0.050	EPA 624	non CLP *
	25-sep-90	0.005	0.003	0.004	0.001	EPA 624	CLP Validated
	17-jan-91	0.011	0.039	0.007	0.003	EPA 624	
	01-may-91	0.004	0.008	<0.002	0.002	EPA 624	CLP **
	01-may-91 dup.	0.009	0.010	0.004	0.003	EPA 624	
MW-21S	26-sep-90	<0.001	<0.001	<0.002	<0.001	EPA 624	CLP Validated
	16-jan-91	<0.001	<0.001	<0.002	<0.001	EPA 624	
	03-may-91	<0.001	<0.001	<0.002	<0.001	EPA 624	CLP **
MW-22S	29-aug-90	<0.005	<0.005	<0.005	<0.005	EPA 624	CLP Validated
	27-sep-90	<0.001	<0.001	<0.002	<0.001	EPA 624	
	18-jan-91	<0.001	<0.001	<0.002	<0.001	EPA 624	
	02-may-91	<0.001	<0.001	<0.002	<0.001	EPA 624	CLP **
MW-25S	28-aug-90	<0.005	<0.005	<0.005	<0.005	EPA 624	CLP Validated
	28-sep-90	<0.001	<0.001	<0.002	<0.001	EPA 624	
	14-jan-91	<0.001	<0.001	<0.002	<0.001	EPA 624	
	30-apr-91	<0.001	<0.001	<0.002	<0.001	EPA 624	CLP **
MW-26S	28-aug-90	0.720	0.014	0.073	0.028	EPA 624	CLP Validated
	25-sep-90	0.021	0.015	0.110	0.049	EPA 624	
	16-jan-91	0.049	0.002	0.006	0.005	EPA 624	
	01-may-91	0.004	<0.001	<0.002	<0.001	EPA 624	CLP **
MW-27S	14-jan-91	<0.001	<0.001	<0.002	<0.001	EPA 624	CLP Validated
	30-apr-91	0.063	0.150	0.047	0.055	EPA 624	CLP **
MW-28S	15-jan-91	0.110	0.016	0.027	0.029	EPA 624	CLP Validated
	01-may-91	0.035	0.006	0.009	0.012	EPA 624	CLP **
	01-may-91 dup.	0.073	0.014	0.018	0.023	EPA 624	
MW-29S	15-jan-91	0.002	<0.001	<0.002	<0.001	EPA 624	CLP Validated
	30-apr-91	0.040	<0.001	0.004	0.003	EPA 624	CLP **

ND Not Detected
NA Laboratory reports not available
* Data extracted from previous site investigations and quarterly sampling reports by Radian and Trihydro. Data not validated for QA/QC
** CLP validation in progress

TABLE 4-68 (cont.)
Texaco Fillmore RI/FS
Historical Volatile Organics Groundwater Analytical Data
Aquifer I

Monitoring Well ID	Sampling Date	Analytical Results (mg/l)				Analytical Method	QA/QC Level
		Benzene	Ethylbenzene	Toluene	Xylenes		
MW-30S	15-jan-91	0.003	<0.001	<0.002	<0.001	EPA 624	CLP Validated
	03-may-91	<0.001	<0.001	<0.002	<0.001	EPA 624	CLP **
	03-may-91 dup.	<0.001	<0.001	<0.002	<0.001	EPA 624	
MW-32S	16-jan-91	0.058	0.003	0.007	0.006	EPA 624	CLP Validated
	01-may-91	0.004	<0.001	<0.002	<0.001	EPA 624	CLP **
MW-34S	16-jan-91	<0.001	<0.001	<0.002	<0.001	EPA 624	CLP Validated
	01-may-91	<0.001	<0.001	<0.002	<0.001	EPA 624	CLP **
P-2S	21-may-87	2.317	0.796	0.611	0.515	EPA 602	non CLP *
	30-jul-87	3.740	0.706	0.421	0.145	EPA 503.1	
	02-dec-87	0.884	0.285	1.30	0.363	EPA 602	
	16-feb-88	1.10	0.275	0.798	1.30	EPA 602	
	18-may-88	1.50	0.20	0.41	0.40	NA	
	24-aug-88	1.10	0.34	0.32	0.24	NA	
	16-nov-88	1.50	0.40	0.39	0.16	EPA 624	
	22-feb-89	1.30	0.50	0.42	0.28	EPA 624	
	23-may-89	0.54	0.35	0.31	0.53	EPA 624	
	11-aug-89	1.40	0.34	0.40	0.43	EPA 624	
	10-nov-89	1.50	0.56	0.43	0.33	NA	
	19-feb-90	1.50	0.51	0.44	0.33	EPA 624	
	29-may-90	1.10	0.430	0.310	0.210	EPA 602	
ULTM-MW-9	01-may-91	0.280	0.026	0.082	0.023	EPA 624	CLP **
ULTM-MW-10	01-may-91	0.054	0.005	0.028	0.013	EPA 624	CLP **

ND Not Detected
NA Laboratory reports not available
* Data extracted from previous site investigations and quarterly sampling reports by Radian and Trihydro. Data not validated for QA/QC
** CLP validation in progress

TABLE 4-68 (cont.)
Texaco Fillmore RI/FS
Historical Volatile Organics Groundwater Analytical Data
Aquifer II

Monitoring Well ID	Sampling Date	Analytical Results (mg/l)				Analytical Method	QA/QC Level
		Benzene	Ethylbenzene	Toluene	Xylenes		
MW-5D	07-jan-86	ND	0.00060	0.00040		EPA 602	non CLP *
	15-jan-86	ND	ND	ND		EPA 602	
	21-jan-86	ND	ND	ND		EPA 602	
	28-jan-86	ND	0.00400	0.00340		EPA 602	
	28-jan-86	ND	ND	ND		EPA 624	
	06-feb-86	0.33000	0.07500	0.17000		EPA 602	
	11-feb-86	0.00279	ND	0.00058		EPA 602	
	28-feb-86	ND	ND	0.00540		EPA 602	
	28-feb-86	ND	ND	ND		EPA 624	
	18-mar-86	0.00110	ND	ND		EPA 602	
	24-mar-86	ND	ND	ND		EPA 602	
	31-mar-86	ND	ND	ND		EPA 602	
	31-mar-86	ND	ND	ND		EPA 624	
	09-apr-86	ND	ND	ND		EPA 602	
	30-apr-86	ND	ND	ND		EPA 602	
	30-apr-86	ND	ND	ND		EPA 624	
	30-may-86	ND	ND	0.00230		EPA 602	
	30-jun-86	ND	ND	ND		EPA 602	
	30-jul-86	ND	0.00120	0.00110		EPA 602	
	21-may-87	0.0007	0.0001	0.0002	0.0003	EPA 602	
	30-jul-87	<0.0005	<0.0005	<0.0005	<0.0005	EPA 503.1	"
MW-16D	17-feb-88	<0.001	<0.001	<0.001	<0.001	EPA 602	non CLP *
	17-may-88	<0.0005	<0.0005	<0.0005	<0.001	NA	
	24-aug-88	<0.001	<0.001	<0.001	<0.001	NA	
	15-nov-88	<0.005	<0.005	<0.005	<0.005	EPA 624	
	21-feb-89	<0.005	<0.005	<0.005	<0.005	EPA 624	
	22-may-89	<0.005	<0.005	<0.005	<0.005	EPA 624	
	10-aug-89	<0.001	<0.001	<0.001	<0.001	EPA 624	
	10-nov-89	<0.001	<0.001	<0.001	<0.001	NA	
	19-feb-90	<0.005	<0.005	<0.005	<0.005	EPA 624	
	29-may-90	<0.005	<0.005	<0.005	<0.005	EPA 602	
	02-oct-90	<0.001	<0.001	<0.002	<0.001	EPA 624	CLP Validated
MW-22D	27-sep-90	<0.001	<0.001	<0.002	<0.001	EPA 624	CLP Validated
	18-jan-91	<0.001	<0.001	<0.002	<0.001	EPA 624	
	02-may-91	<0.001	<0.001	<0.002	<0.001	EPA 624	CLP **
MW-23D	29-aug-90	<0.005	<0.005	<0.005	<0.005	EPA 624	CLP Validated
	27-sep-90	<0.001	<0.001	<0.002	<0.001	EPA 624	
	27-sep-90 dup.	<0.001	<0.001	<0.002	<0.001	EPA 624	
	18-jan-91	<0.001	<0.001	<0.002	<0.001	EPA 624	
	02-may-91	<0.001	<0.001	<0.002	<0.001	EPA 624	CLP **
MW-24D	28-aug-90	<0.005	<0.005	<0.005	<0.005	EPA 624	CLP Validated
	25-sep-90	<0.001	<0.001	<0.002	<0.001	EPA 624	
	16-jan-91	<0.001	<0.001	<0.002	<0.001	EPA 624	
	02-may-91	<0.001	<0.001	<0.002	<0.001	EPA 624	CLP **
MW-25D	28-aug-90	0.024	0.025	0.0072	0.031	EPA 624	CLP Validated
	28-sep-90	0.003	0.003	<0.002	0.001	EPA 624	
	16-jan-91	0.004	0.001	<0.002	0.002	EPA 624	
	30-apr-91	0.011	0.005	0.003	0.012	EPA 624	CLP **
MW-29D	15-jan-91	<0.001	<0.001	<0.002	<0.001	EPA 624	CLP Validated
	30-apr-91	<0.001	<0.001	<0.002	<0.001	EPA 624	CLP **
MW-31D	15-jan-91	<0.001	<0.001	<0.002	<0.001	EPA 624	CLP Validated
	15-jan-91 dup.	<0.001	<0.001	<0.002	<0.001	EPA 624	
	02-may-91	<0.001	<0.001	<0.002	<0.001	EPA 624	CLP **
MW-33D	15-jan-91	<0.001	<0.001	<0.002	<0.001	EPA 624	CLP Validated
	02-may-91	<0.001	<0.001	<0.002	<0.001	EPA 624	CLP **

ND Not Detected
NA Laboratory reports not available
* Data extracted from previous site investigations and quarterly sampling reports by Radian and Trihydro. Data not validated for QA/QC
** CLP validation in progress

TABLE 4-68 (cont.)
Texaco Fillmore RI/FS
Historical Volatile Organics Groundwater Analytical Data
Perched Zone

Monitoring Well ID	Sampling Date	Analytical Results (mg/l)				Analytical Method	QA/QC Level
		Benzene	Ethylbenzene	Toluene	Xylenes		
MW-10P	30-apr-86	0.01900	0.01400	0.02800		EPA 602	non CLP *
	30-apr-86	0.03500	ND	ND		EPA 624	
	30-may-86	0.02400	0.00810	0.00870		EPA 602	
	30-jun-86	0.01800	ND	0.01600		EPA 602	
	30-jul-86	0.01600	ND	0.01300		EPA 602	
	19-may-87	0.0037	<0.0001	0.017	<0.0001	EPA 602	
	18-feb-90	0.010	<0.005	<0.005	<0.005	EPA 624	
	03-oct-90	0.009	<0.001	0.004	0.004	EPA 624	CLP Validated
	17-jan-91	0.010	<0.001	<0.002	0.003	EPA 624	
	01-may-91	0.019	<0.001	0.008	0.003	EPA 624	CLP **
MW-13P	20-may-87	<0.0001	0.0087	0.0087	0.006	EPA 602	non CLP *
	30-jul-87	<0.0005	<0.0005	<0.0005	<0.0005	EPA 503.1	
	18-feb-90	<0.005	<0.005	<0.005	<0.005	EPA 624	

ND Not Detected
NA Laboratory reports not available
* Data extracted from previous site investigations and quarterly sampling reports by Radian and Trihydro. Data not validated for QA/QC
** CLP validation in progress

TABLE 4-69

Inorganic Groundwater Quality Data
Texaco Facility, Fillmore, California
January 1986 - May 1990

Well		Lead						Total Dissolved Solids	
		Total		Dissolved		Organic			
		mg/L	Date	mg/L	Date	mg/L	Date	mg/L	Date
MW-1S		.020	05/21/87	No Data		No Data		959*	05/21/87
MW-2S	Low High	< .01 < .1	02/16/88 05/20/87	< .01*	07/29/87	No Data		704*	05/20/87
MW-3S	Low High	< .01 .03	02/16/88 05/21/87	< .01*	07/30/87	No Data		638*	05/21/87
MW-4S	Low High	< .01 .410	12/02/87 05/21/87	.01*	07/30/87	< .1	05/21/87	1416*	05/21/87
MW-5D	Low High	.40 .64	07/30/87 05/21/87	.020*	07/30/87	< .10		1679*	05/21/87
MW-6S	Low High	< .01 < .1	02/16/88 05/20/87	.01*	07/29/87	No Data		621*	05/20/87
MW-7S	Low High	< .01 .270	02/16/87 05/21/87	.01*	07/29/87	< .1*	05/21/87	1654*	05/21/87
MW-8S	Low High	< .01 < .1	02/16/88 05/19/87	< .01*	07/29/87	No Data		1471*	05/19/87
MW-9S	Low High	< .01 .03	02/16/88 07/30/87	< .01*	07/30/87	No Data		744*	05/19/87
MW-10P	Low High	< .1*	05/20/87	No Data		No Data		126*	05/20/87
MW-11S	Low High	.03*	05/21/87	No Data		No Data		1267*	05/21/87
MW-12S	Low High	< .010 .02	02/12/87 05/20/87	010*	07/30/87	No Data		972*	05/20/87

* Only sample taken in this time period.

TABLE 4-69 (Cont.)

Well		Lead						Total Dissolved Solids	
		Total		Dissolved		Organic			
		mg/L	Date	mg/L	Date	mg/L	Date	mg/L	Date
MW-13P	Low High	.010 .010	05/21/87 07/30/87	.01*	07/30/87	No Data		960*	05/21/87
MW-14S	Low High	< .01 .02	02/15/88 07/31/87	.01*	07/31/87	No Data		783*	05/20/87
MW-15S	Low High	< .01 .02	02/15/87 05/20/87	.01*	07/31/87	No Data		800*	05/20/87
MW-16D	Low High	.022*	02/17/87	No Data		No Data		No Data	
MW-S17	Low High	< .01*	02/16/88	No Data		No Data		No Data	
P-2S	Low High	< .01 .25	02/16/88 07/30/87	< .010*	07/30/87	No Data		639*	05/21/89

* Only sample taken in this time period.

Historical plots of benzene concentrations over time, as determined by EPA methods 602 and 624/8240 (volatile organics), are presented in Figures 4-59 through 4-96,\ for all monitoring wells related to the facility (MW-1 through MW-34 and P-2) and the onsite production well. Laboratory analysis results reported below the detection limit were plotted as zero regardless of the actual detection limit.

The following monitoring wells represent the MWP plume and its limits in Aquifer 1:

Plume:	MW-1S	(Figure 4-61)
	MW-2S	(Figure 4-62)
	MW-3S	(Figure 4-63)
	MW-6S	(Figure 4-65)
	MW-14S	(Figure 4-71)
	MW-27S	(Figure 4-81)
	MW-28S	(Figure 4-82)
	MW-32S	(Figure 4-85)
Boundary:	MW-15S	(Figure 4-72)
	MW-21S	(Figure 4-77)
	MW-22S	(Figure 4-78)
	MW-25S	(Figure 4-79)

Except for MW-1, all of the plume wells can be characterized over time as highly variable but with a probable trend to lower concentrations in later samplings. This is in reasonable agreement with the removal of large quantities of contaminant source material in the first three quarters of 1986.

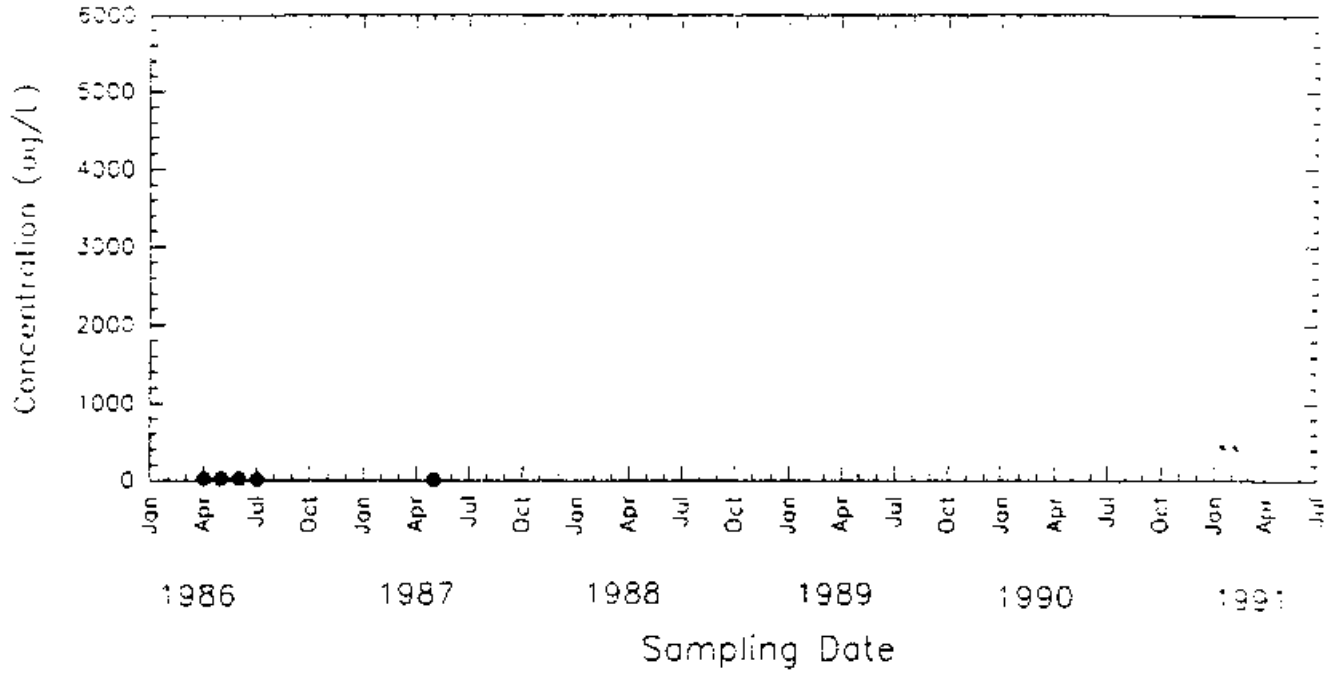
The monitoring wells which define the plume in Aquifer 1 in the southern section of the facility include the following:

Plume:	MW-7S	(Figure 4-66)
	MW-8S	(Figure 4-67)
	MW-9S	(Figure 4-68)
	MW-17S*	(Figure 4-73)
	MW-19S	(Figure 4-75)
	MW-20S	(Figure 4-76)
	MW-26S*	(Figure 4-80)
	MW-29S	(Figure 4-83)
	MW-34S	(Figure 4-86)

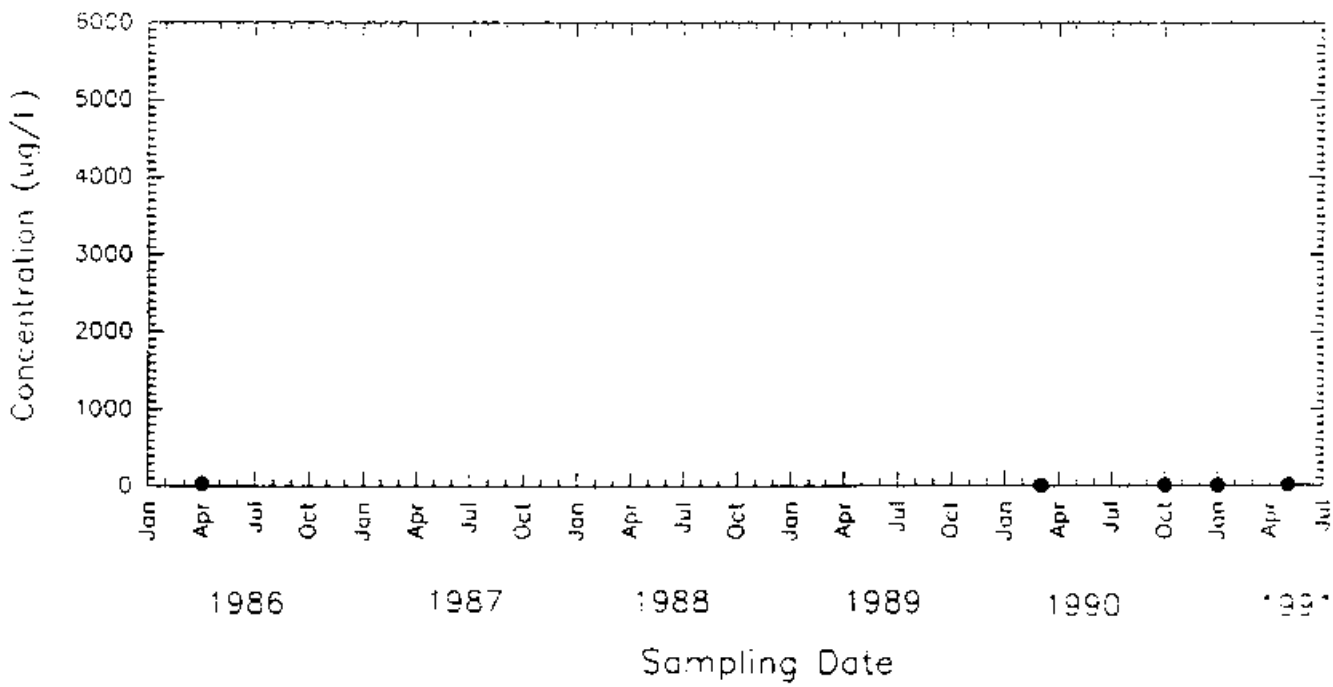
FIGURE 4-59

Benzene Concentrations for Texaco Monitoring Well MW-10P Perched Zone

EPA Method 602



EPA Method 624

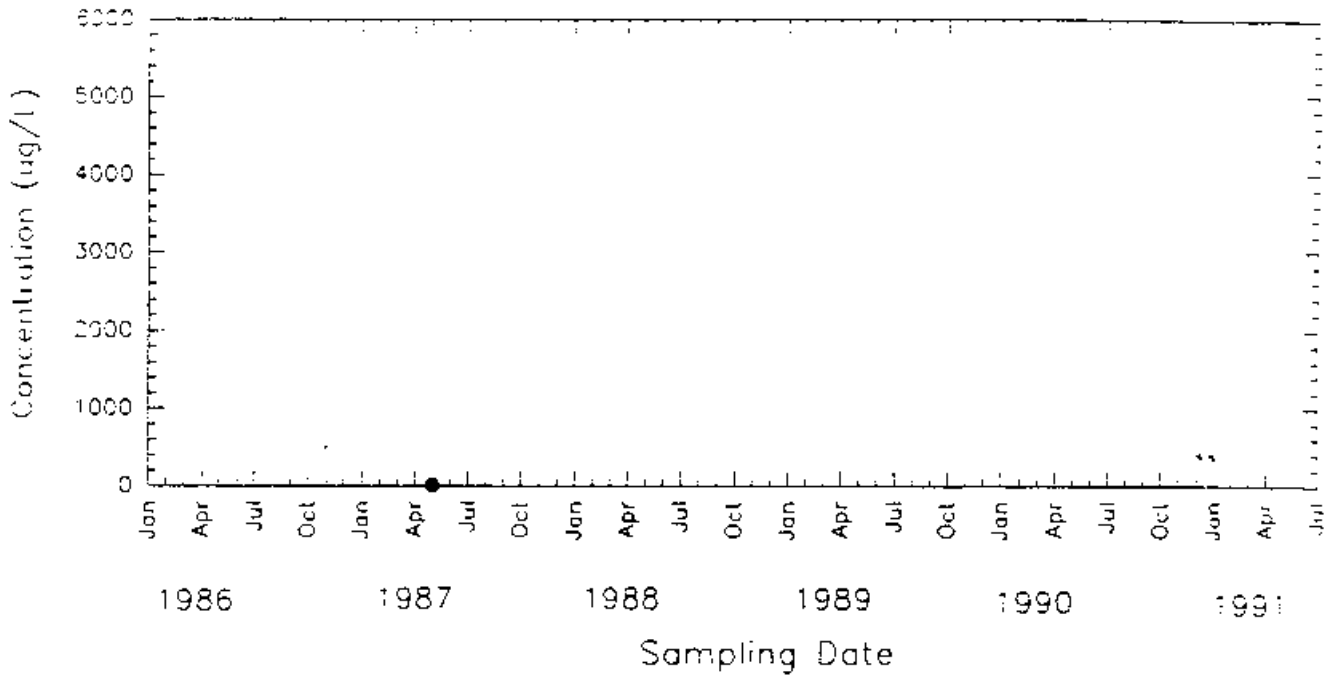


Scale Reflects long term fluctuations, refer to specific tables for specific values

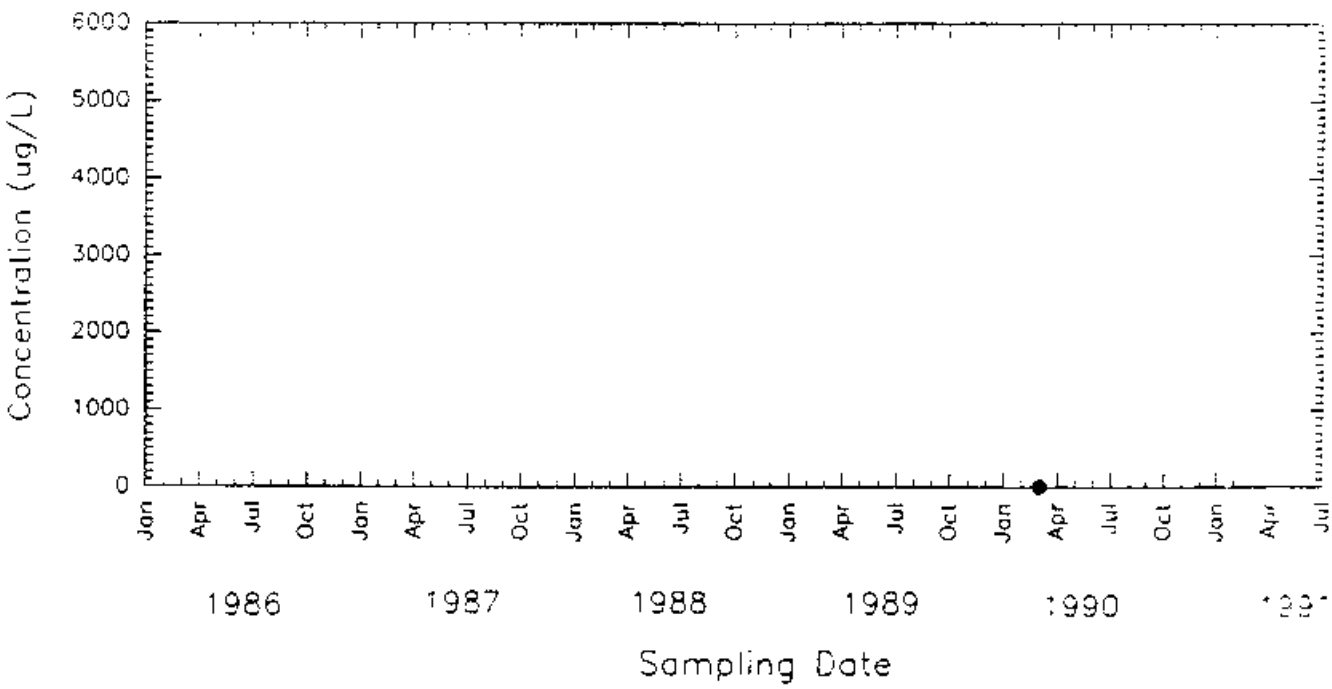
FIGURE 4-60

Benzene Concentrations for Texaco Monitoring Well MW-13P Perched Zone

EPA Method 602



EPA Method 624

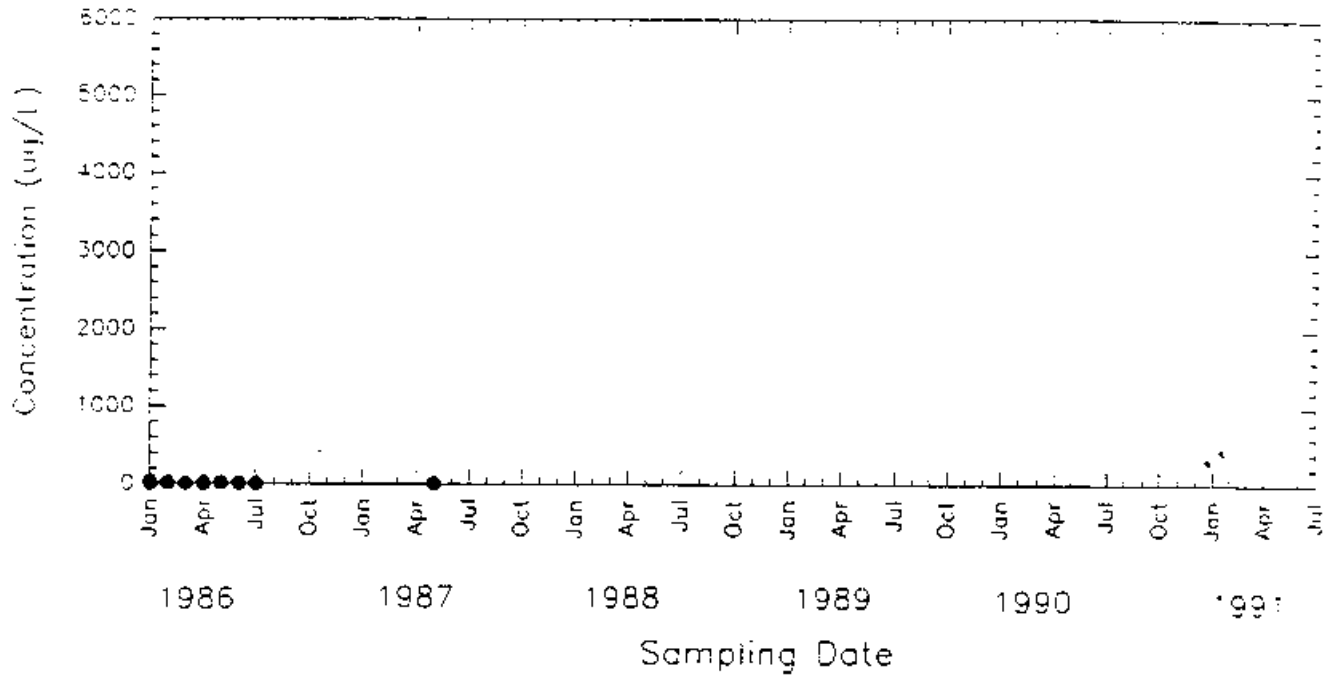


Scale Reflects long term fluctuations, refer to specific tables for specfic values

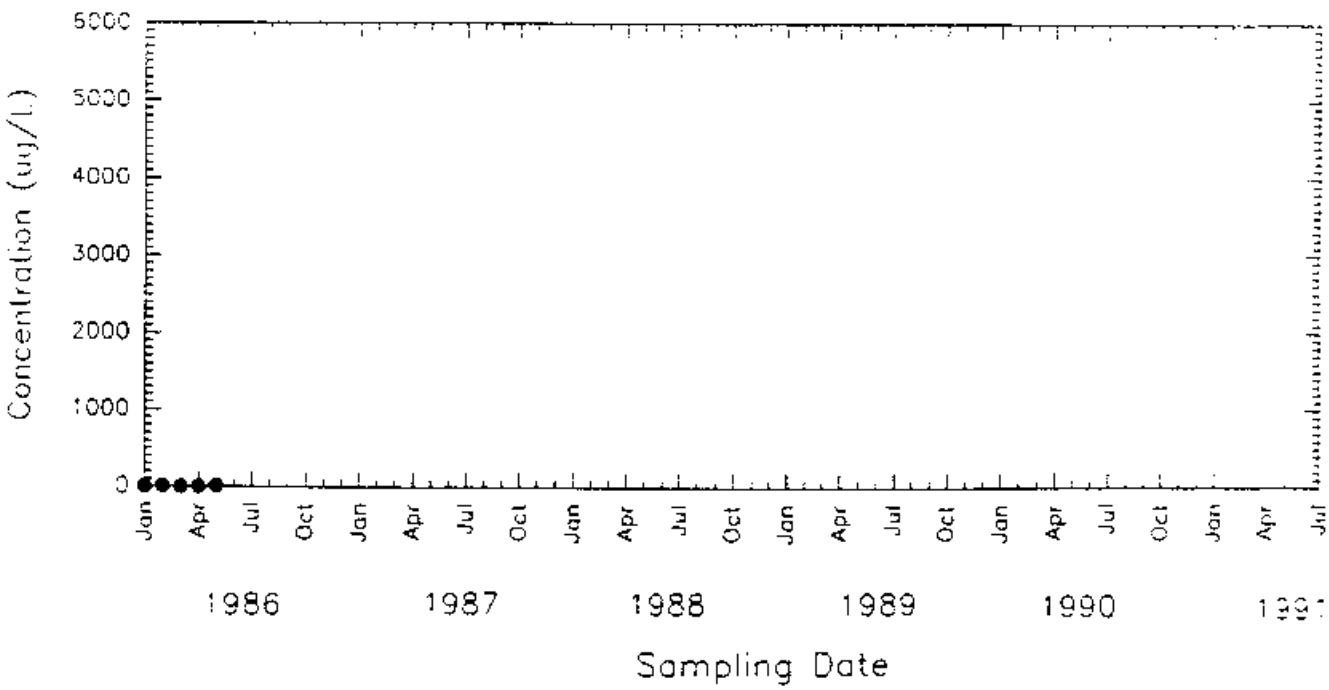
FIGURE 4-61

Benzene Concentrations for Texaco Monitoring Well MW-1S Aquifer # 1

EPA Method 602



EPA Method 624

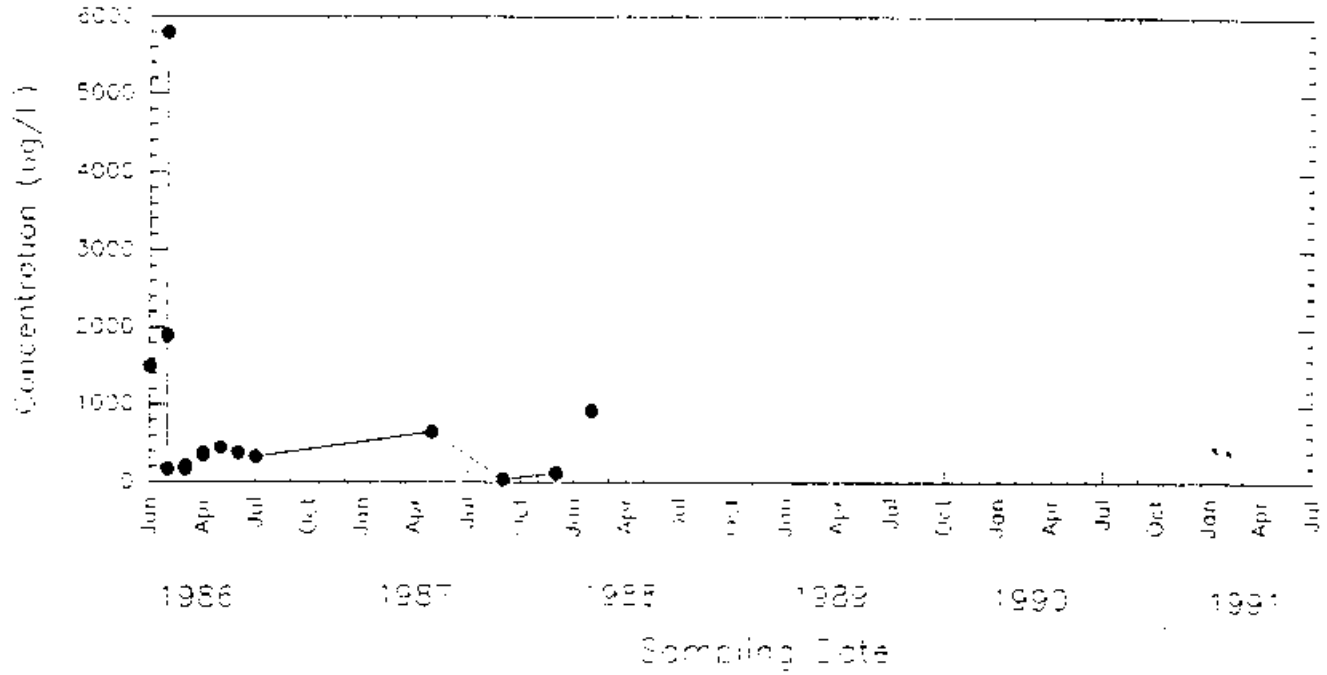


Scale Reflects long term fluctuations, refer to specific tables for specfic values

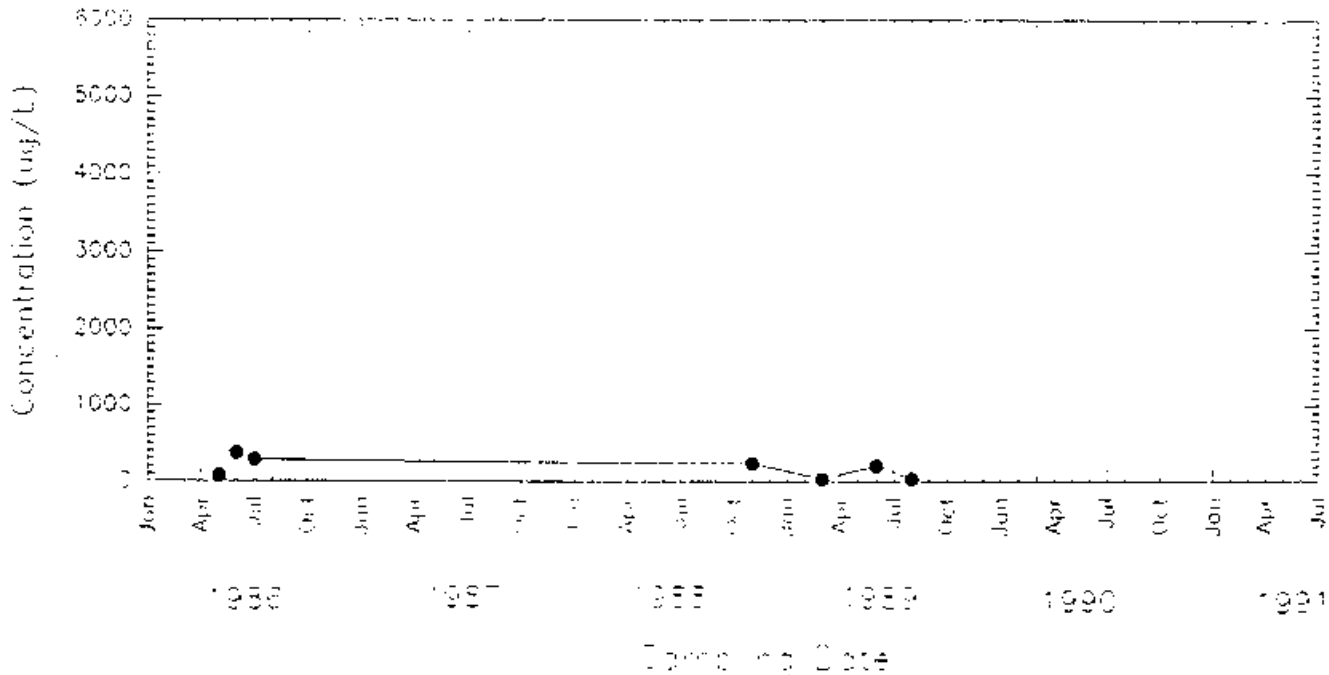
FIGURE 4-62

Benzene Concentrations for Texaco Monitoring Well
MW-2S Aquifer = 1

EPA Method 602



EPA Method 624

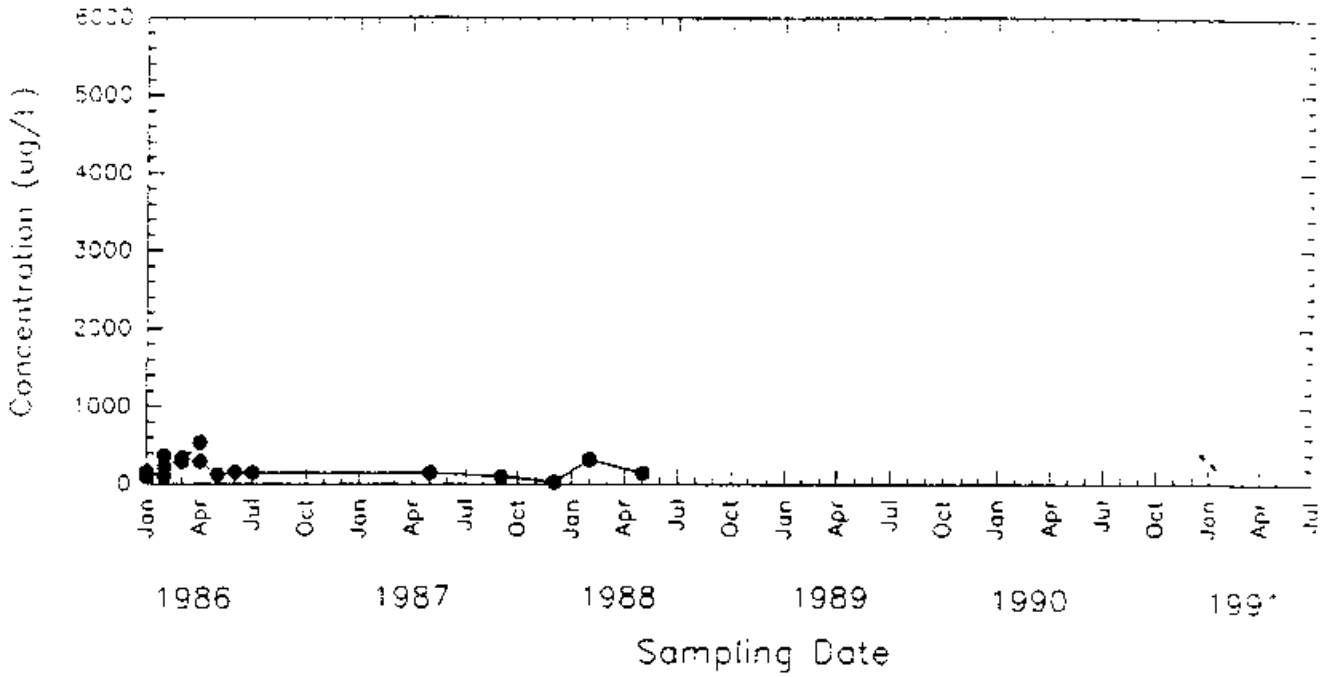


Scale Reflects long term fluctuations refer to specific tables for specific values

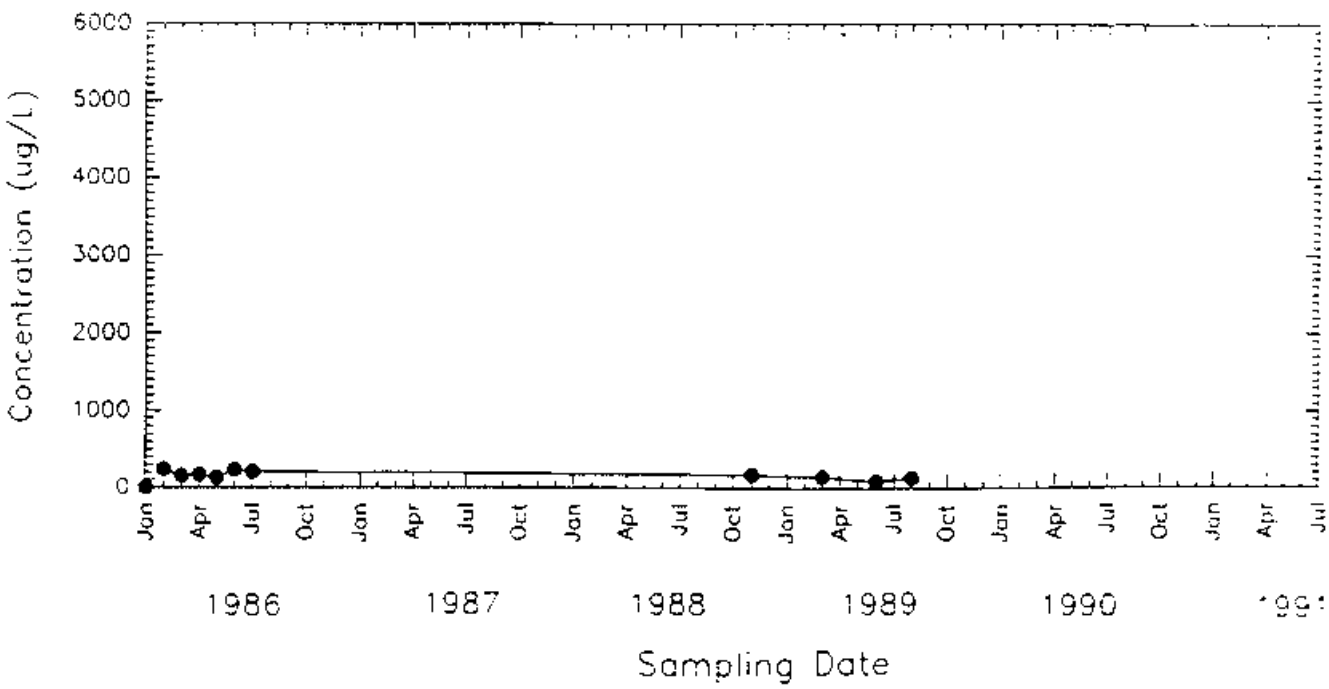
FIGURE 4-63

Benzene Concentrations for Texaco Monitoring Well MW-3S Aquifer # 1

EPA Method 602



EPA Method 624



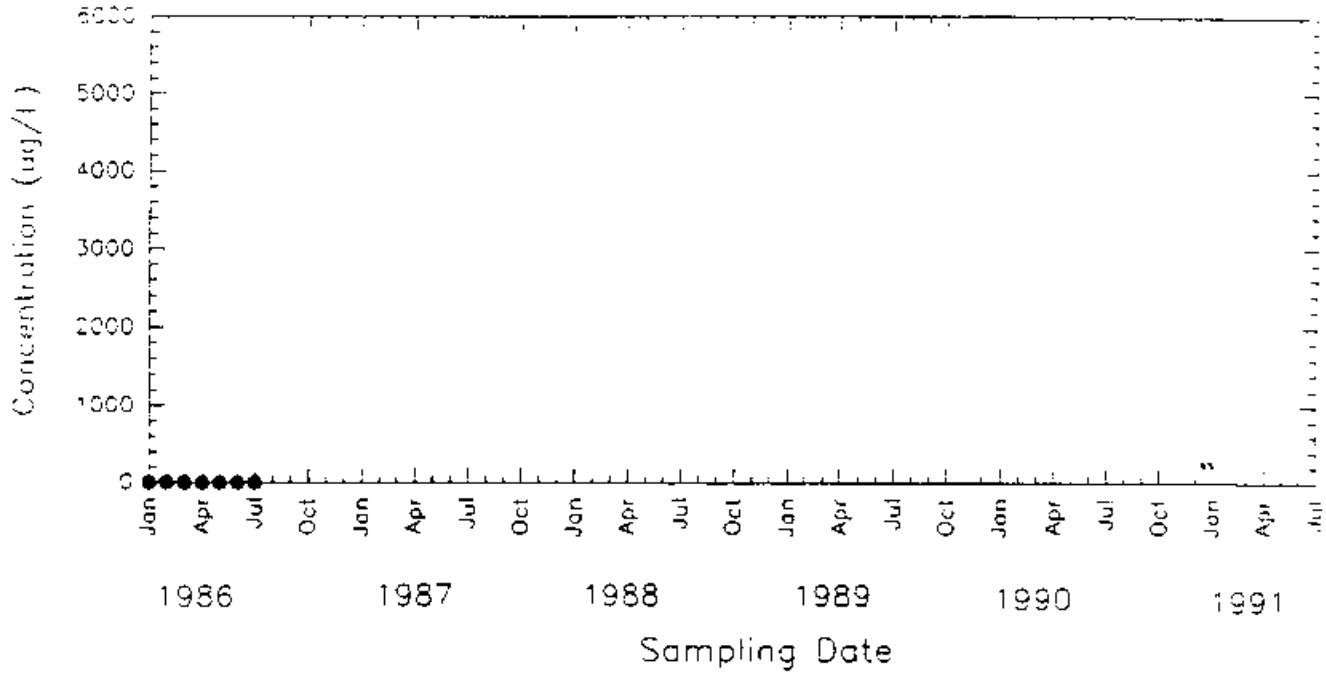
Scale Reflects long term fluctuations, refer to specific tables for specfic values

Texaco Fillmore Remedial Investigation, June 1991

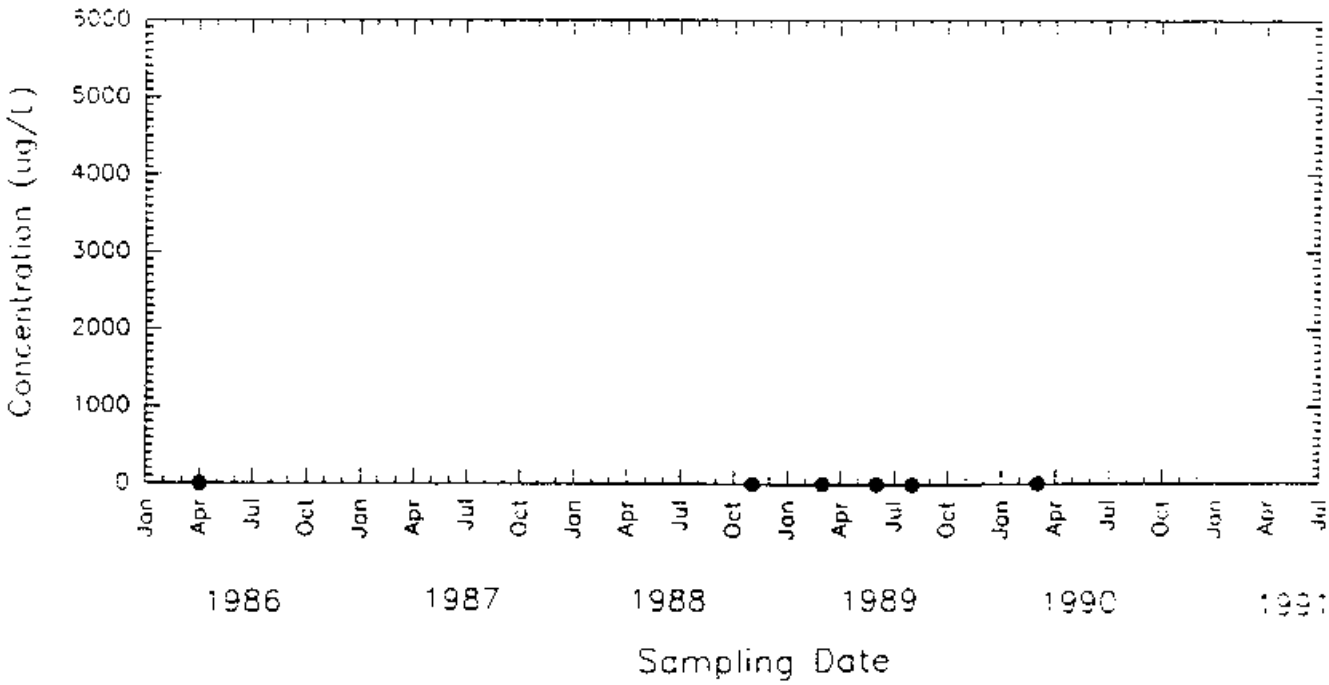
FIGURE 4-64

Benzene Concentrations for Texaco Monitoring Well MW-4S Aquifer # 1

EPA Method 602



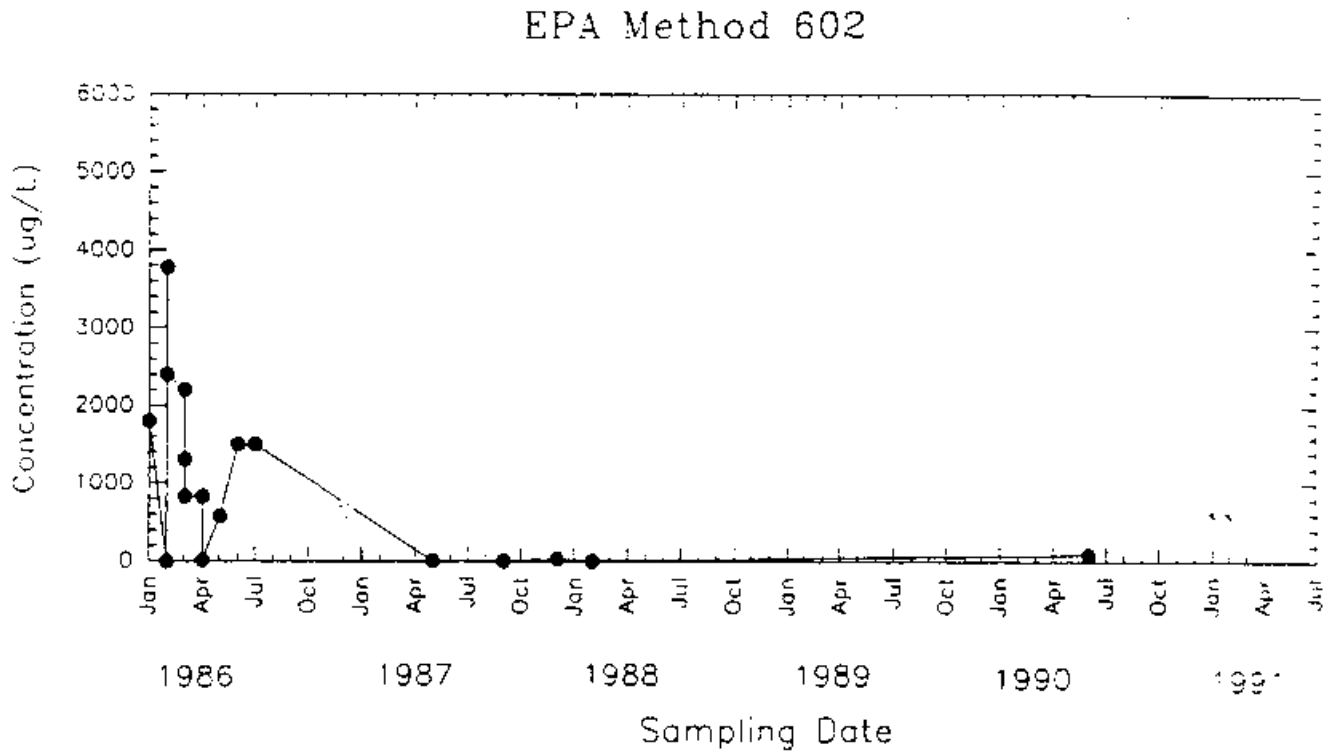
EPA Method 624

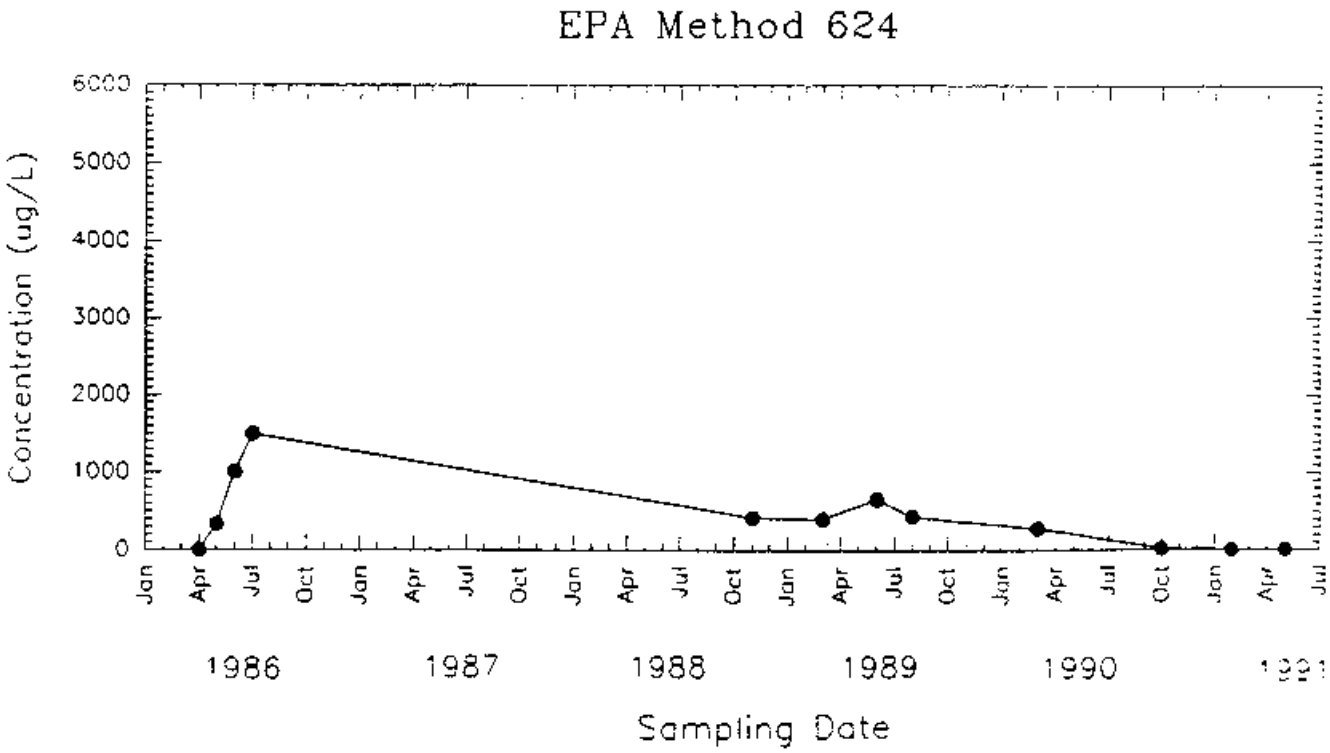


Scale Reflects long term fluctuations, refer to specific tables for specfic values

FIGURE 4-65

Benzene Concentrations for Texaco Monitoring Well MW-6S Aquifer # 1

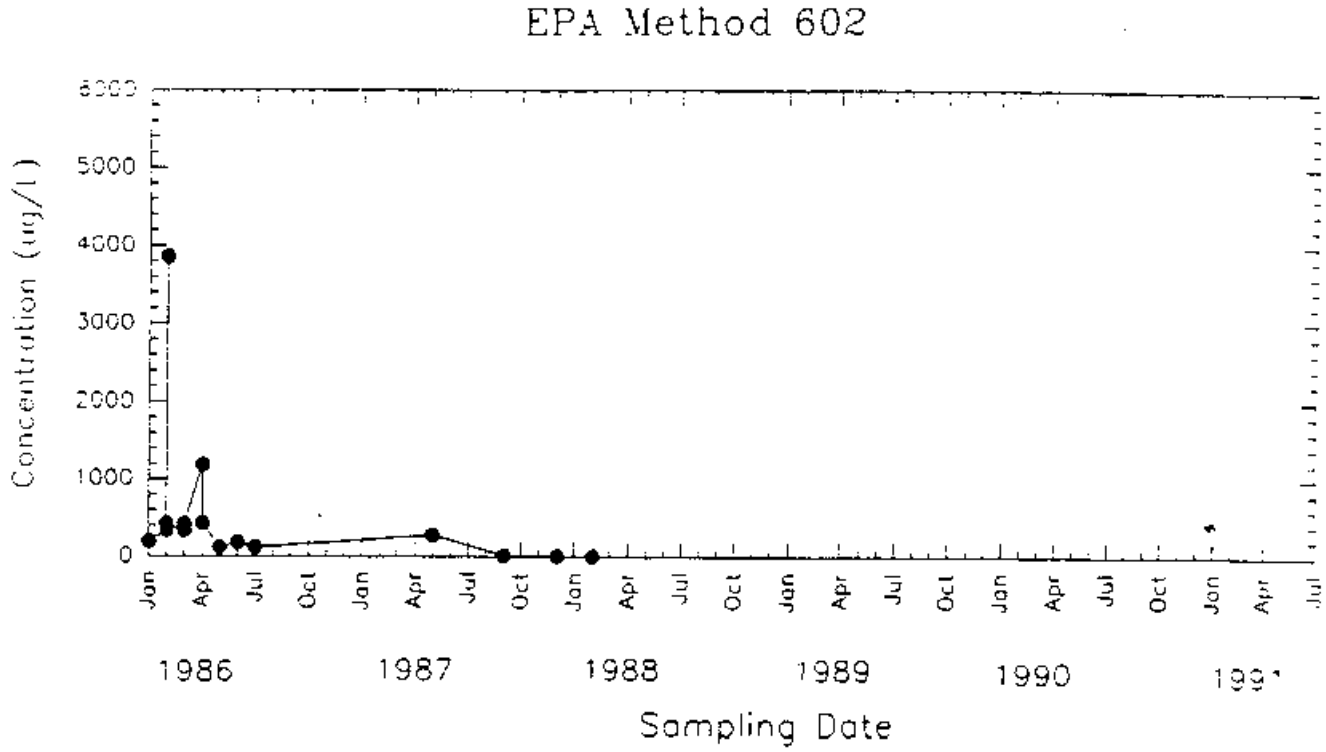


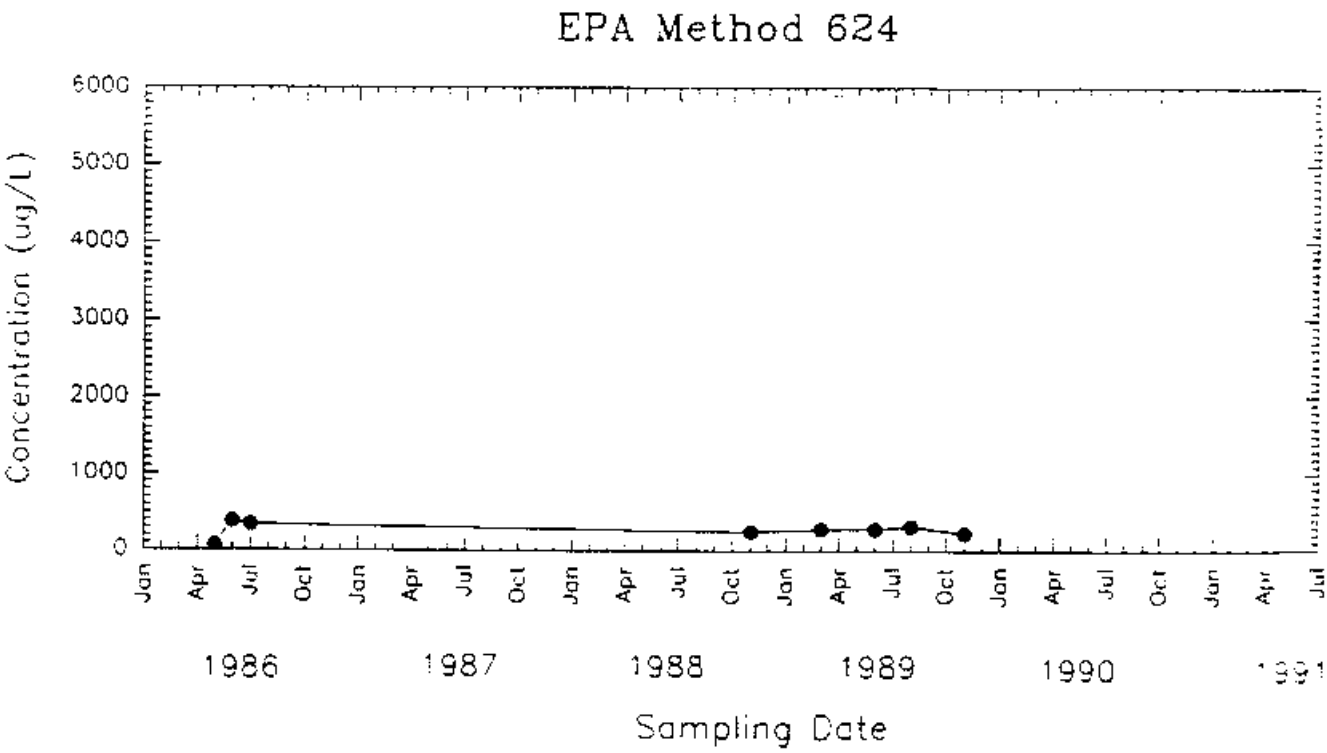


Scale Reflects long term fluctuations, refer to specific tables for specific values

FIGURE 4-66

Benzene Concentrations for Texaco Monitoring Well MW-7S Aquifer # 1



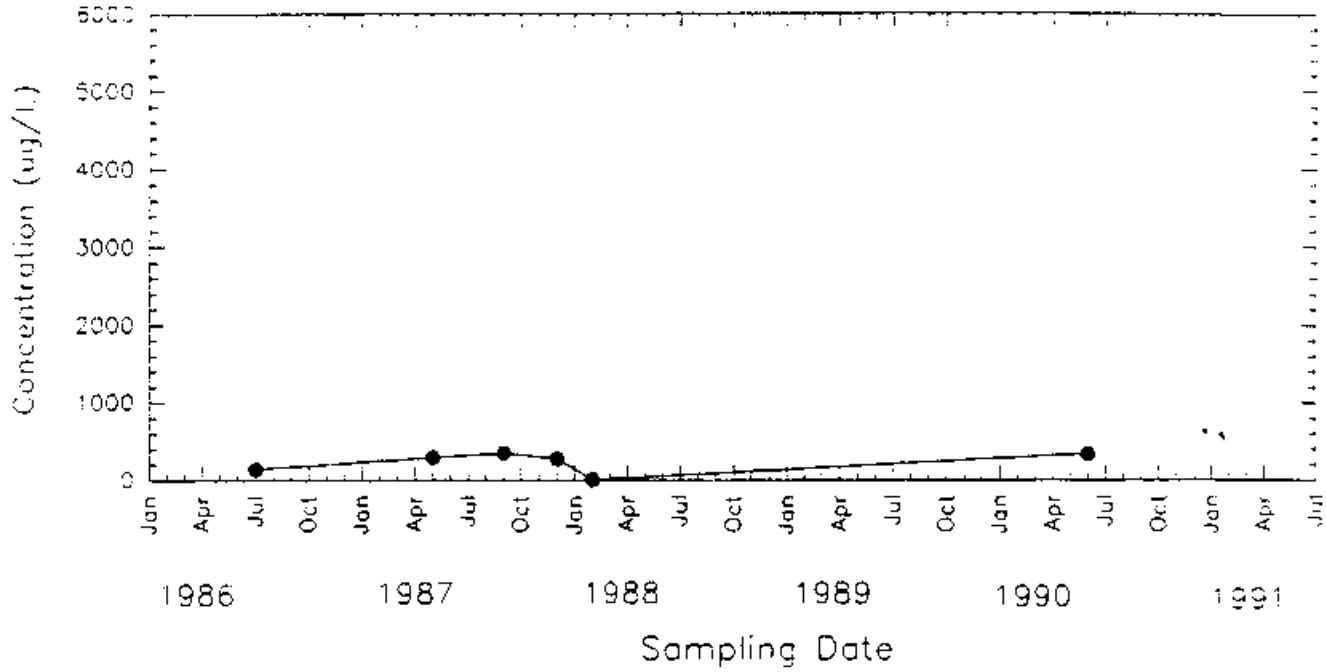


Scale Reflects long term fluctuations, refer to specific tables for specfic values

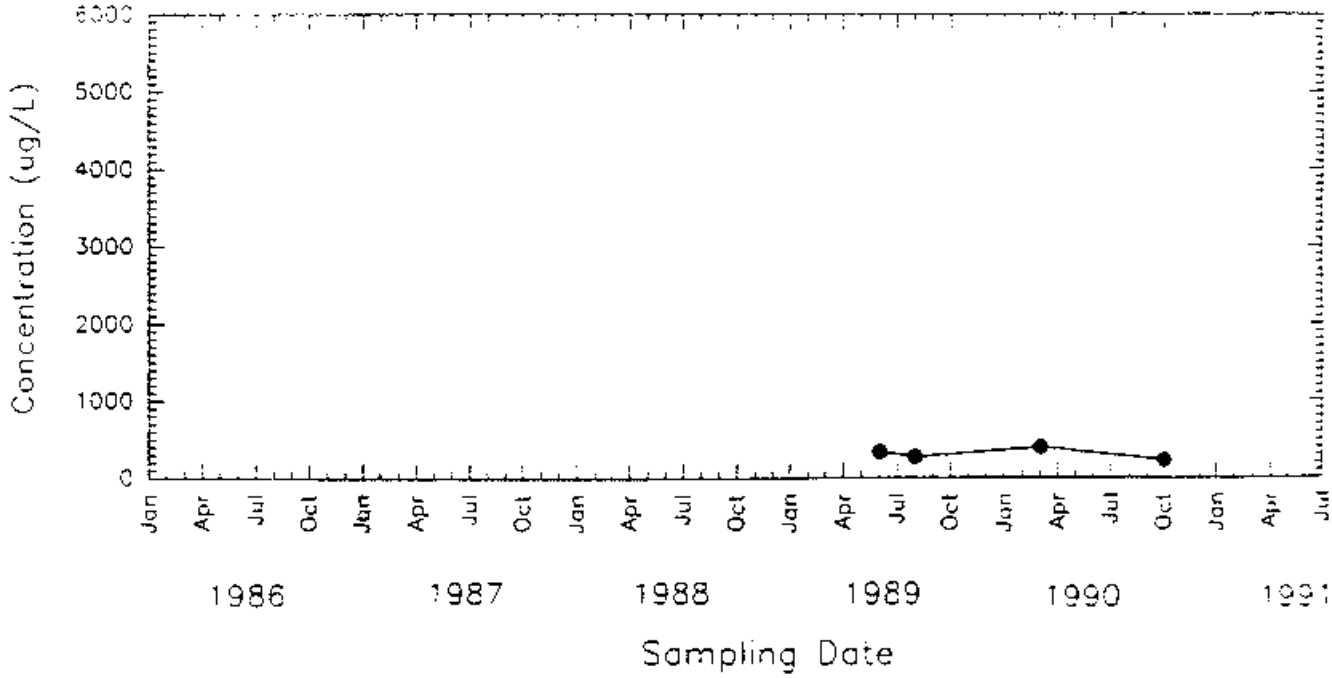
FIGURE 4-67

Benzene Concentrations for Texaco Monitoring Well MW-8S Aquifer # 1

EPA Method 602



EPA Method 624

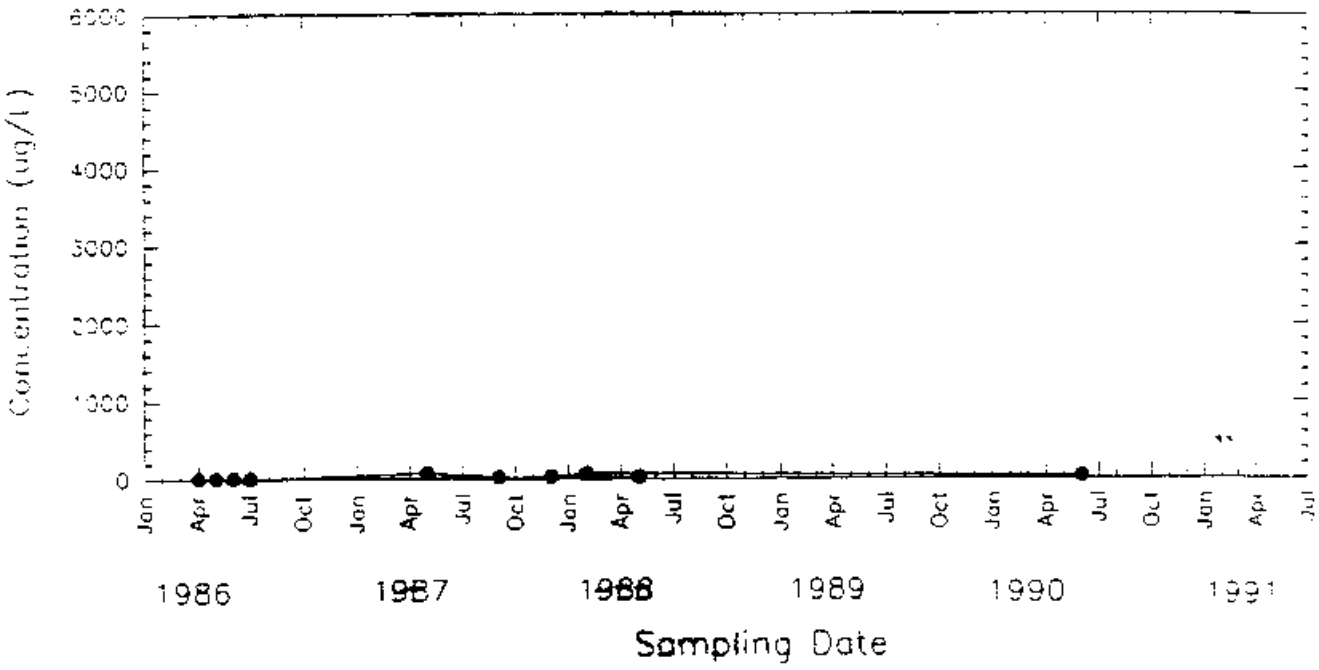


Scale Reflects long term fluctuations, refer to specific tables for specific values

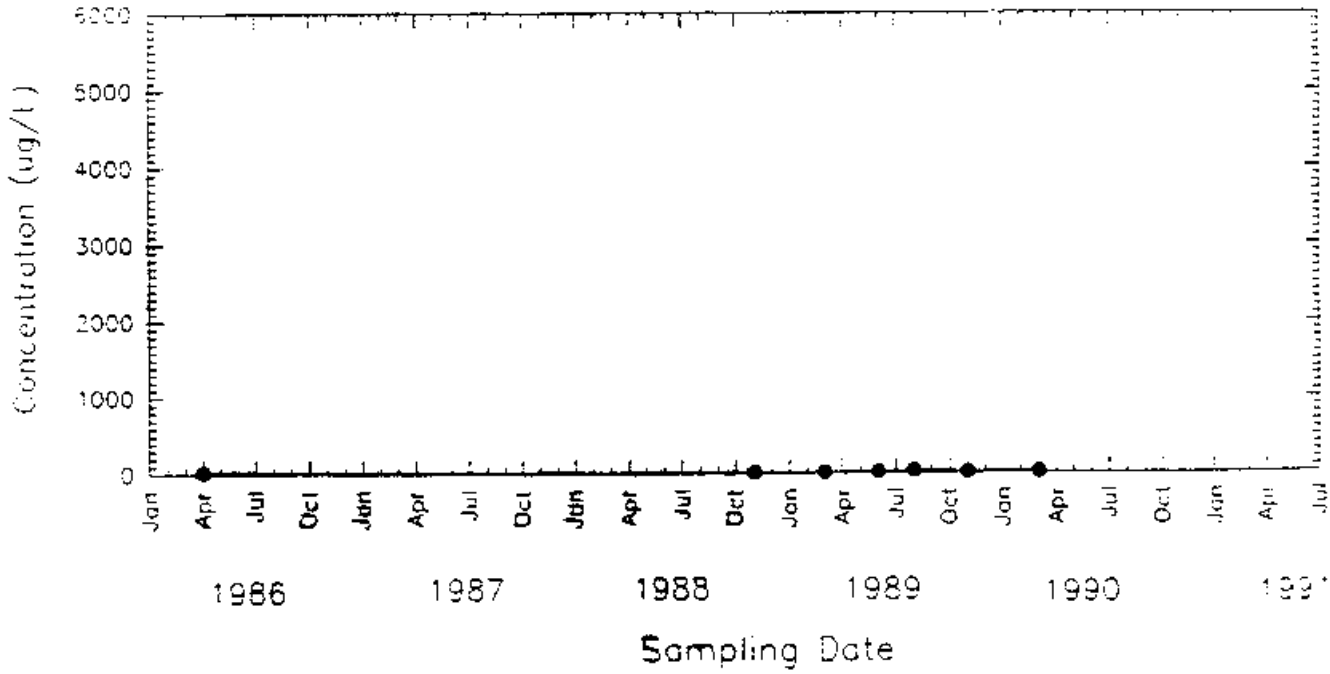
FIGURE 4-68

Benzene Concentrations for Texaco Monitoring Well MW-9S Aquifer = 1

EPA Method 602



EPA Method 624

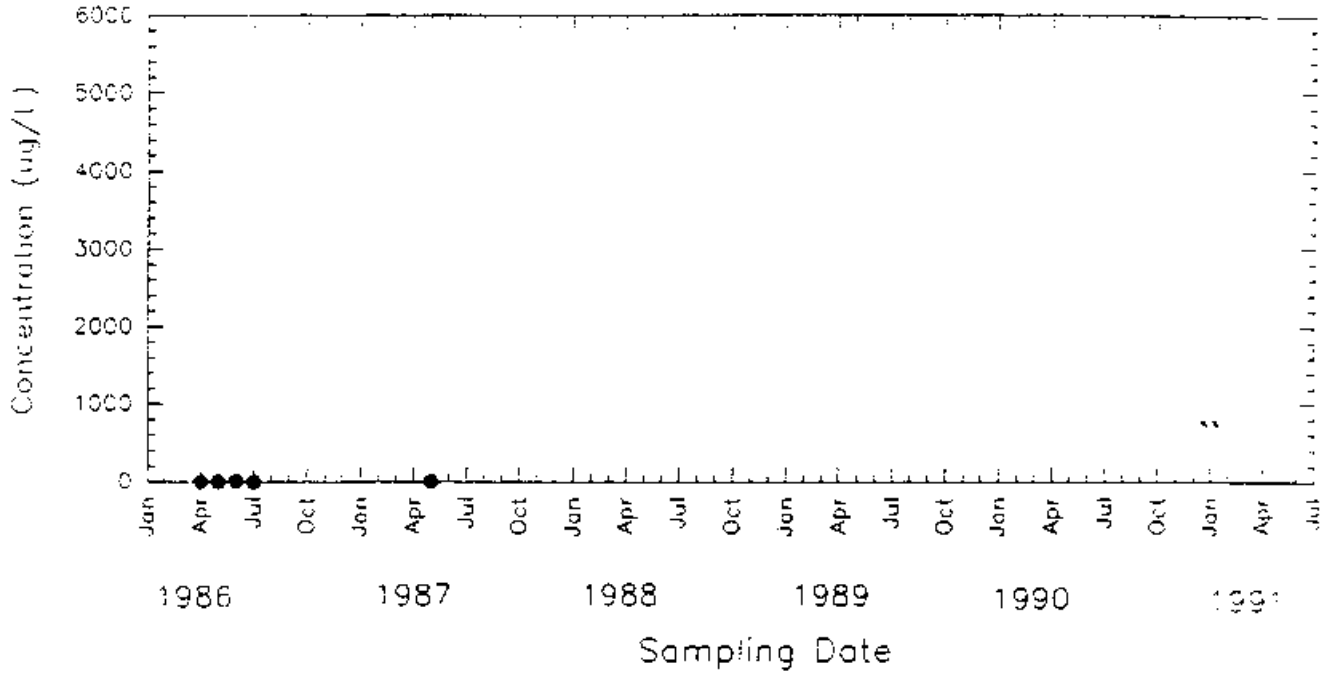


Scale Reflects long term fluctuations, refer to specific tables for specific values

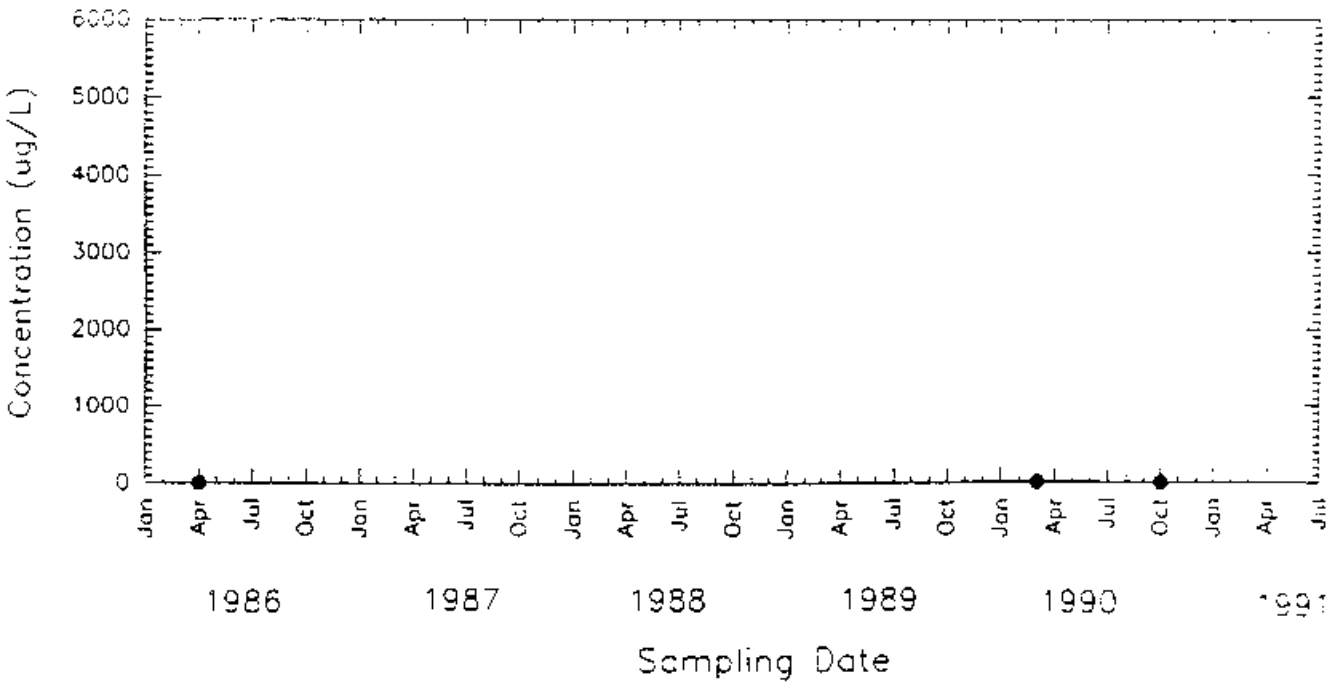
FIGURE 4-69

Benzene Concentrations for Texaco Monitoring Well MW-11S Aquifer # 1

EPA Method 602



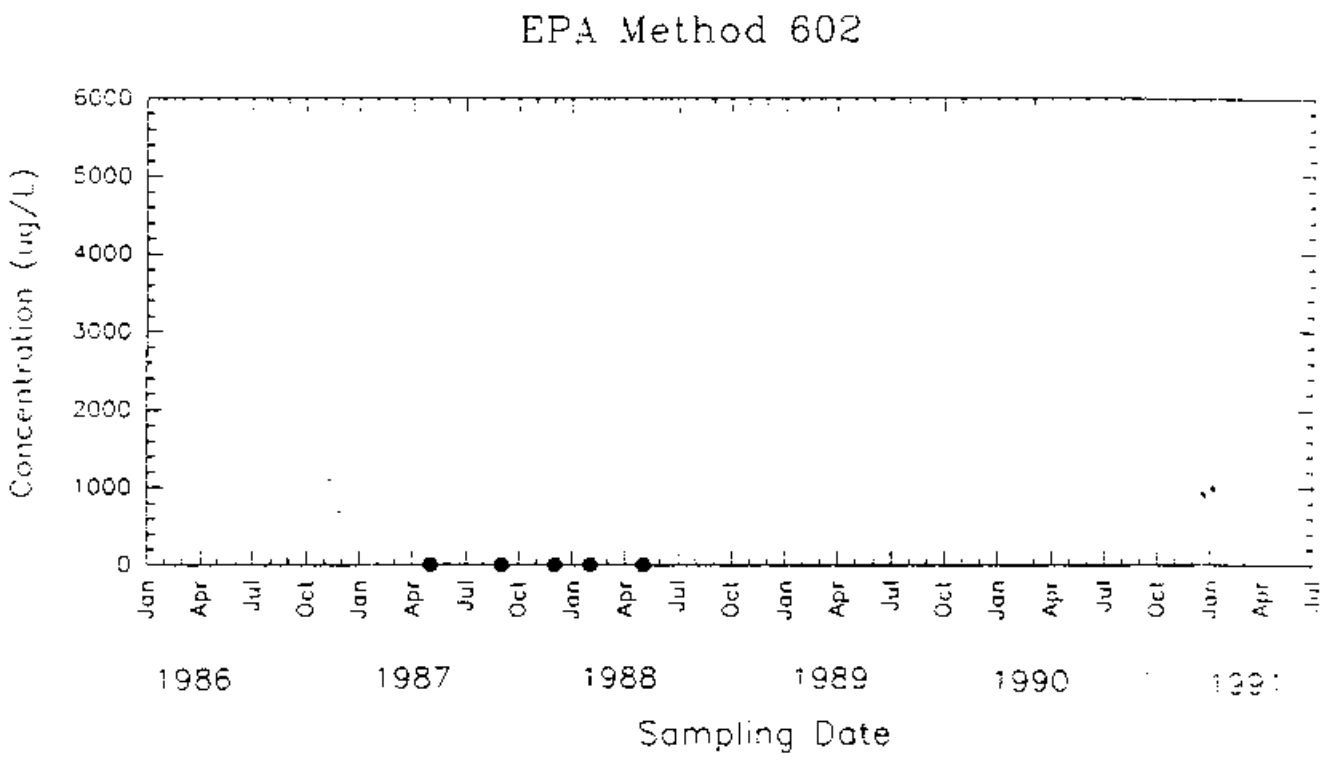
EPA Method 624

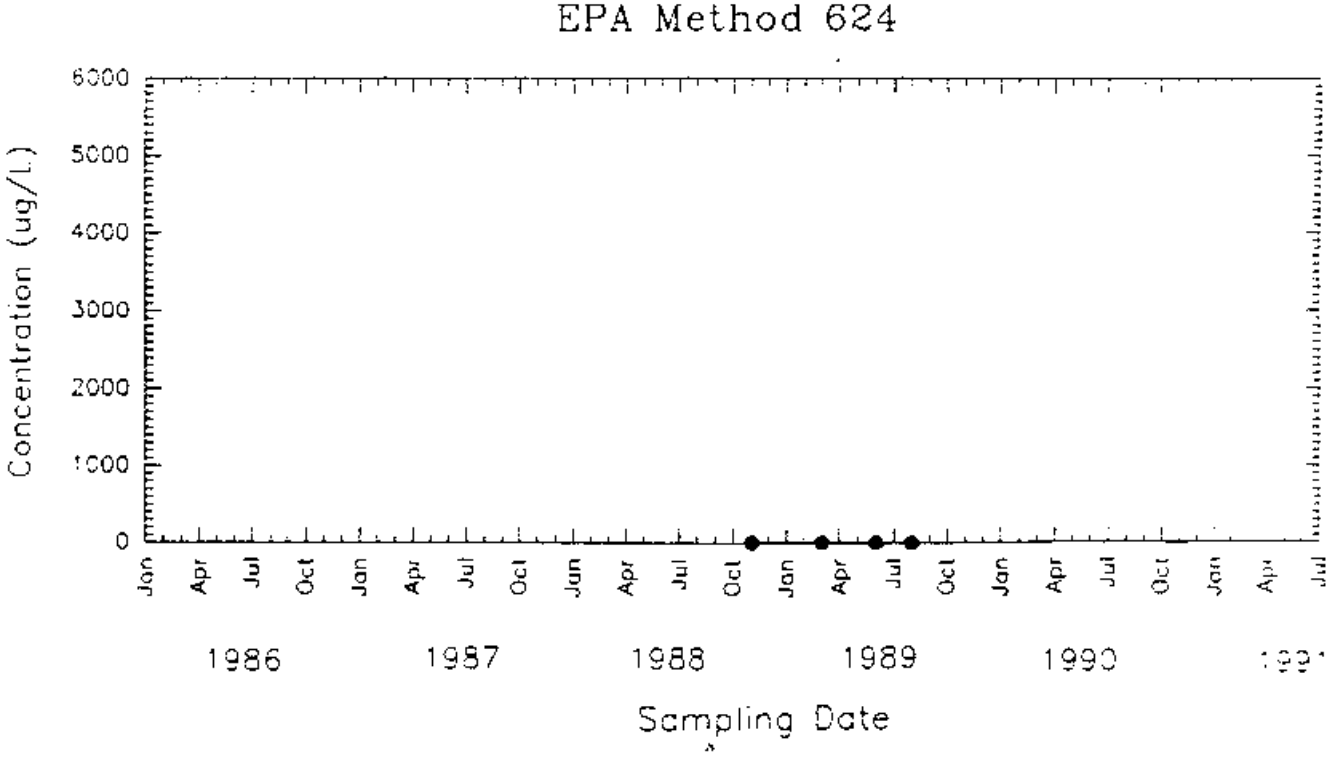


Scale Reflects long term fluctuations, refer to specific tables for specfic values

FIGURE 4-70

Benzene Concentrations for Texaco Monitoring Well MW-12S Aquifer # 1

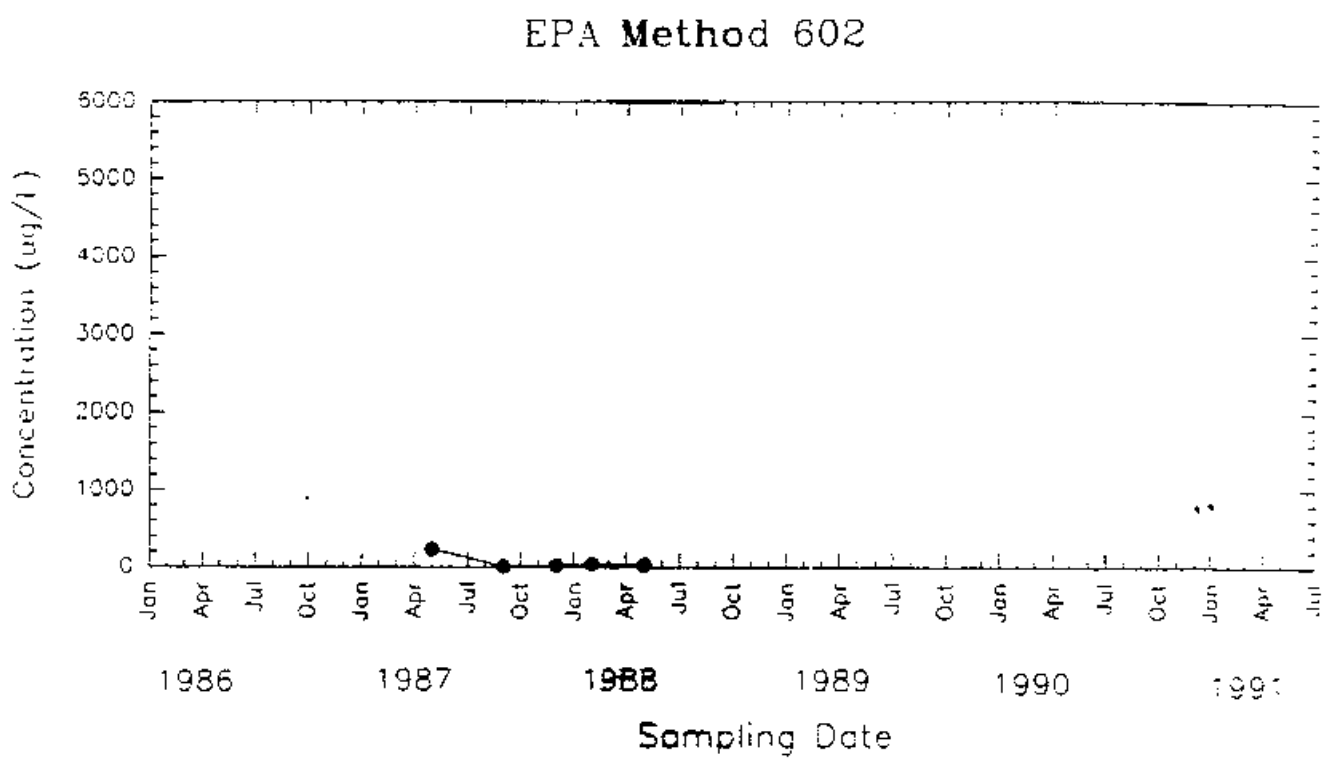


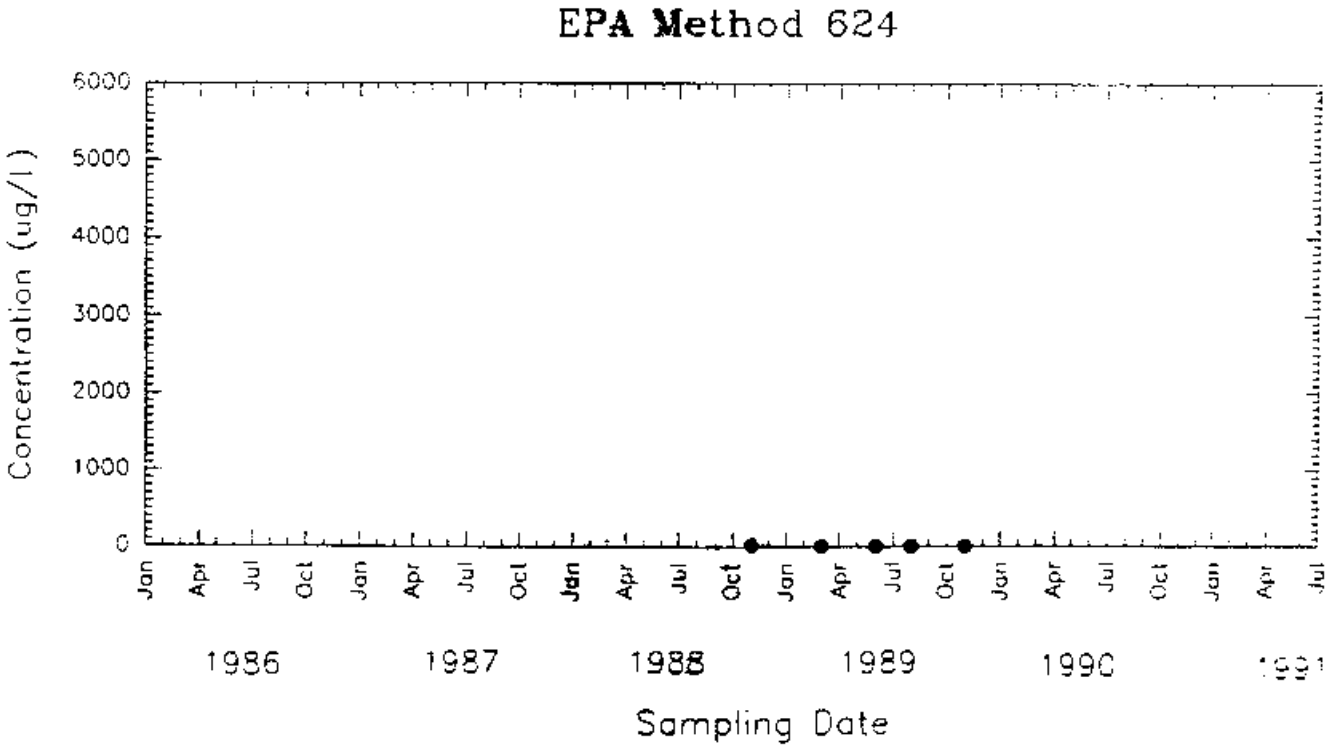


Scale Reflects long term fluctuations, refer to specific tables for specfic values

FIGURE 4-71

Benzene Concentrations for Texaco Monitoring Well MW-14S Aquifer # 1



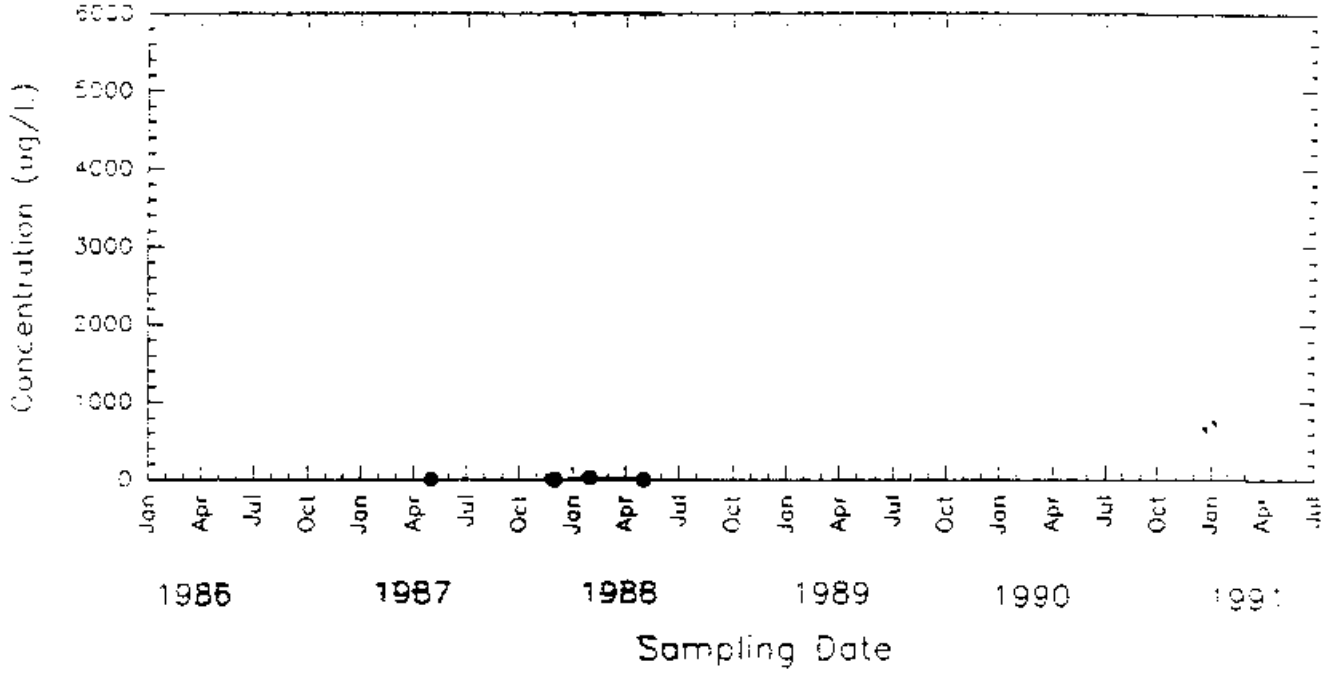


Scale Reflects long term fluctuations, refer to specific tables for specfic values

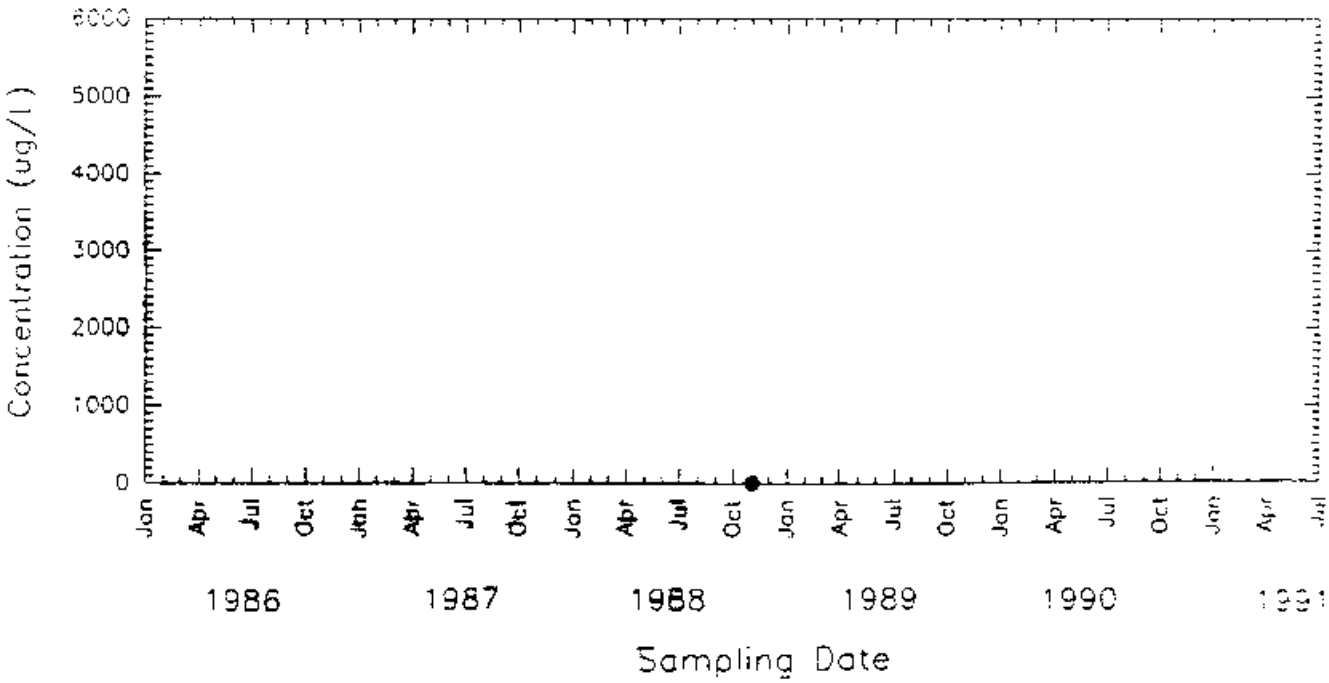
FIGURE 4-72

Benzene Concentrations for Texaco Monitoring Well MW-15S Aquifer # 1

EPA Method 602



EPA Method 624

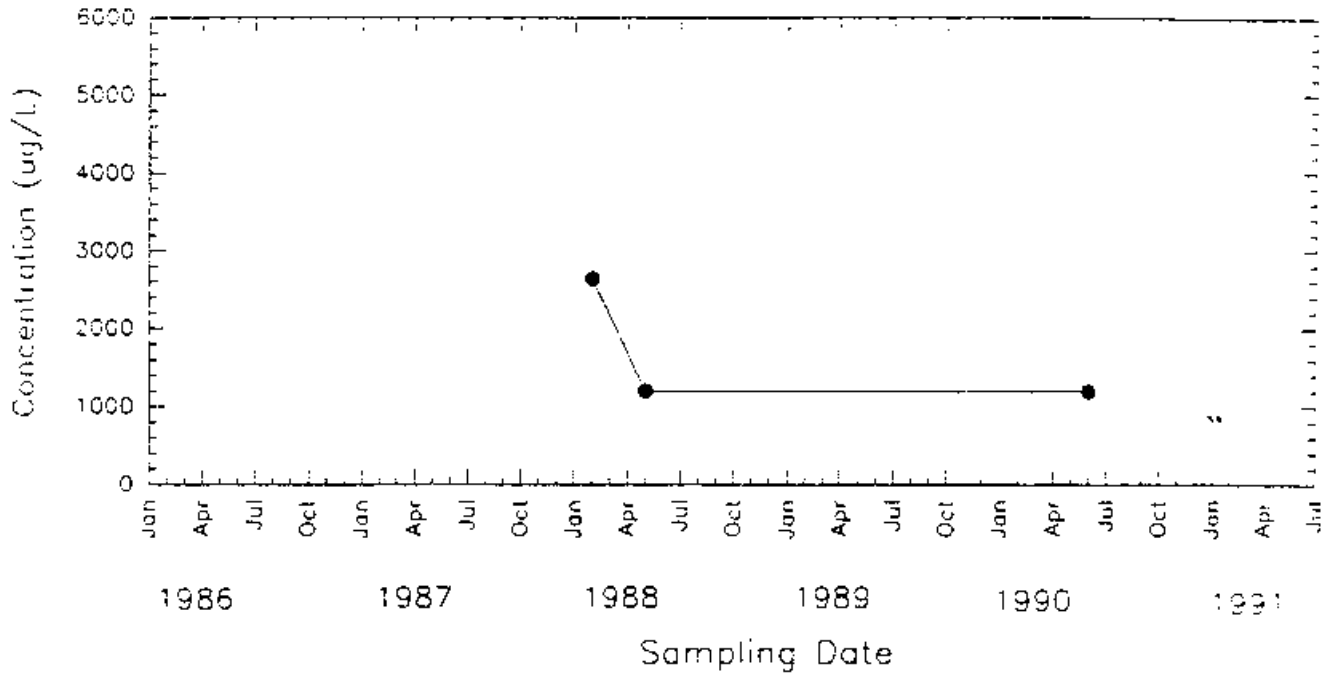


Scale Reflects long term fluctuations, refer to specific tables for specific values

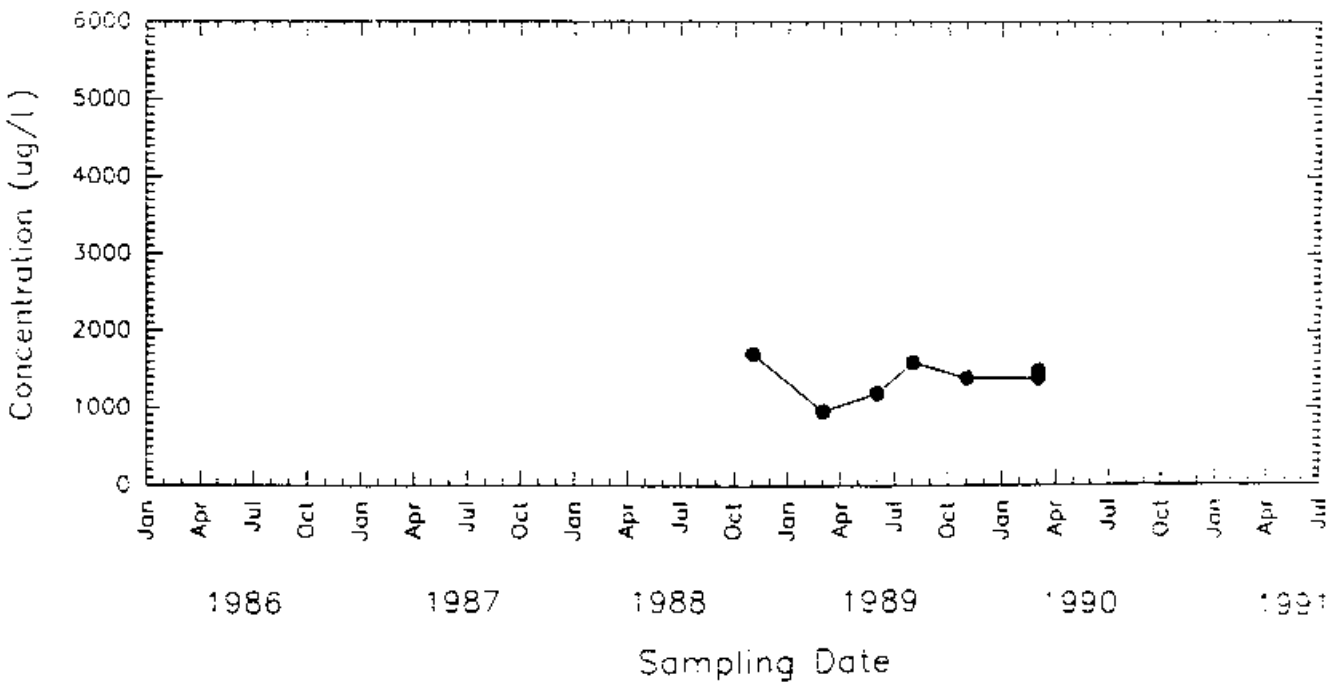
FIGURE 4-73

Benzene Concentrations for Texaco Monitoring Well MW-17S Aquifer # 1

EPA Method 602



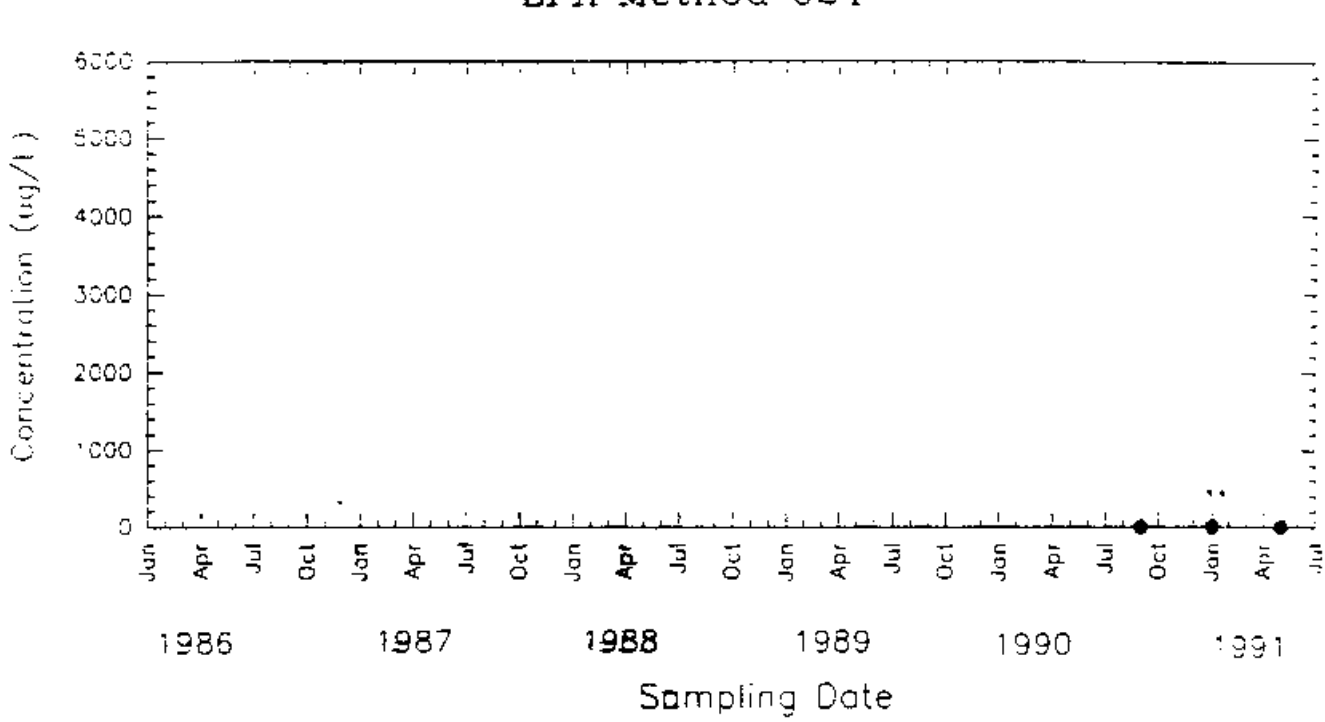
EPA Method 624



Scale Reflects long term fluctuations, refer to specific tables for specific values

FIGURE 4-74

Benzene Concentrations for Texaco Monitoring Well MW-18S Aquifer # 1

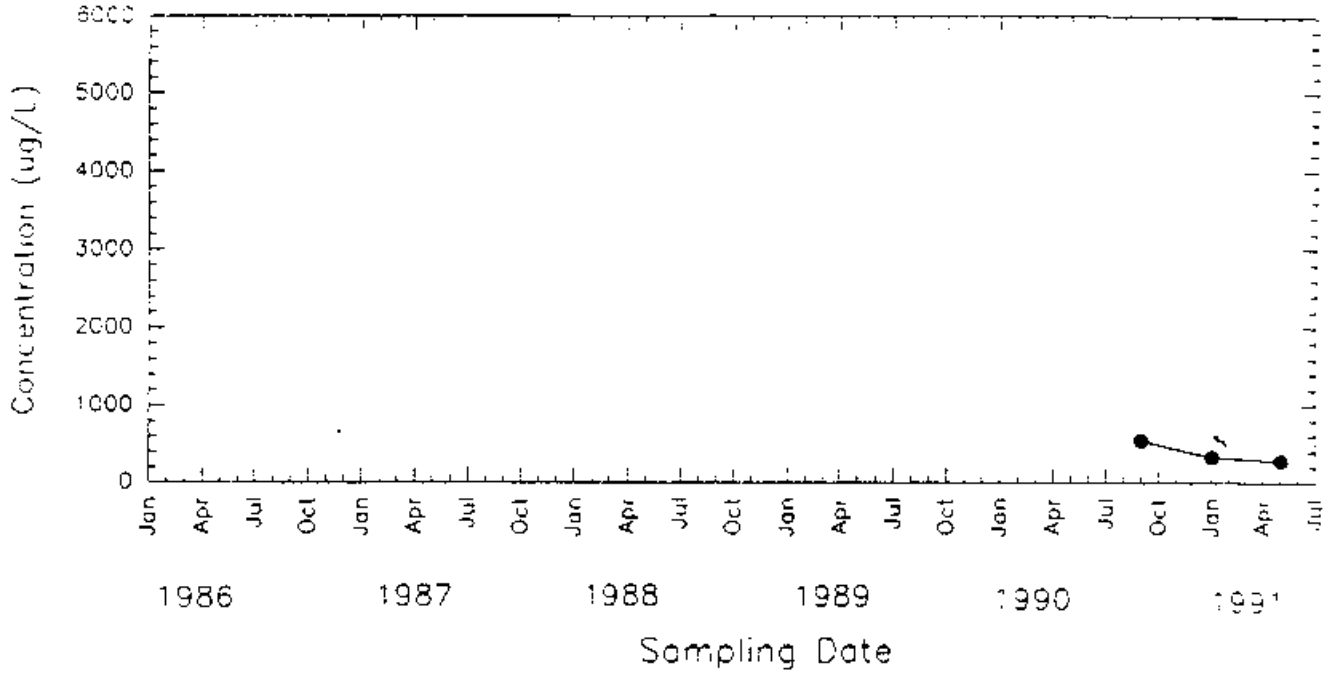


Scale Reflects long term fluctuations, refer to specific tables for specfic values

FIGURE 4-75

Benzene Concentrations for Texaco Monitoring Well MW-19S Aquifer # 1

EPA Method 624

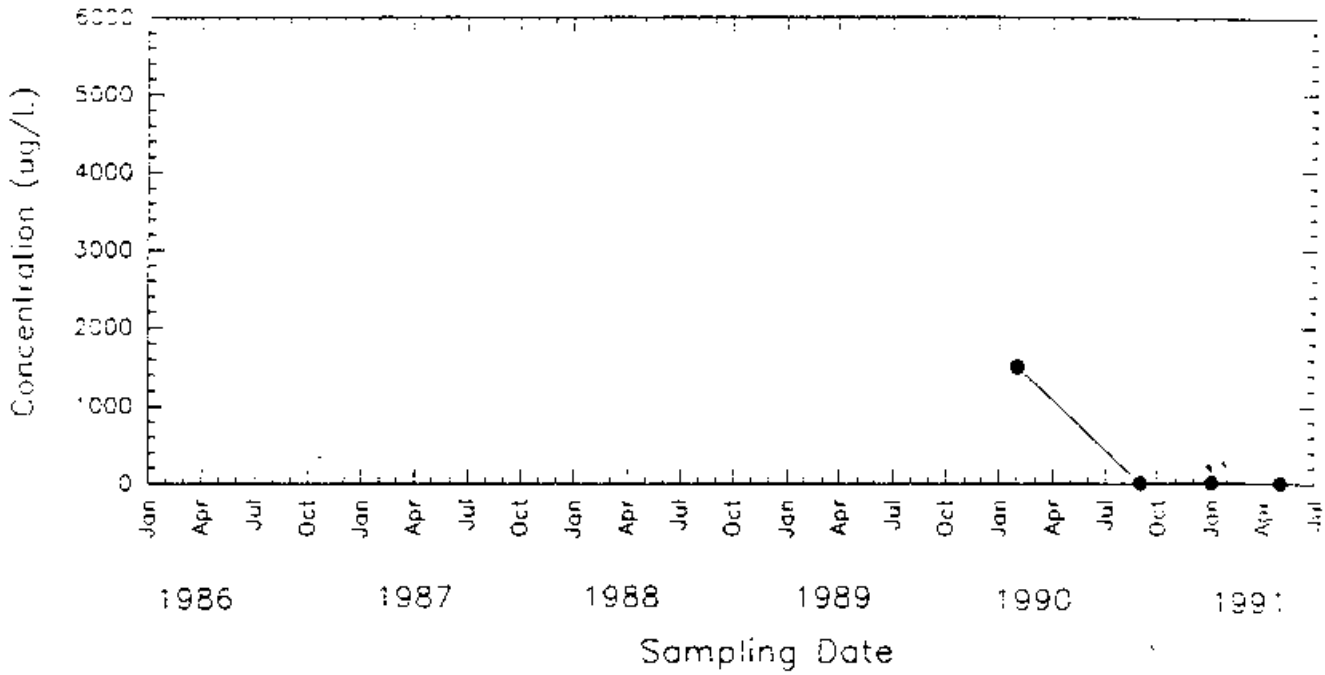


Scale Reflects long term fluctuations, refer to specific tables for specfic values

FIGURE 4-76

Benzene Concentrations for Texaco Monitoring Well MW-20S Aquifer # 1

EPA Method 624

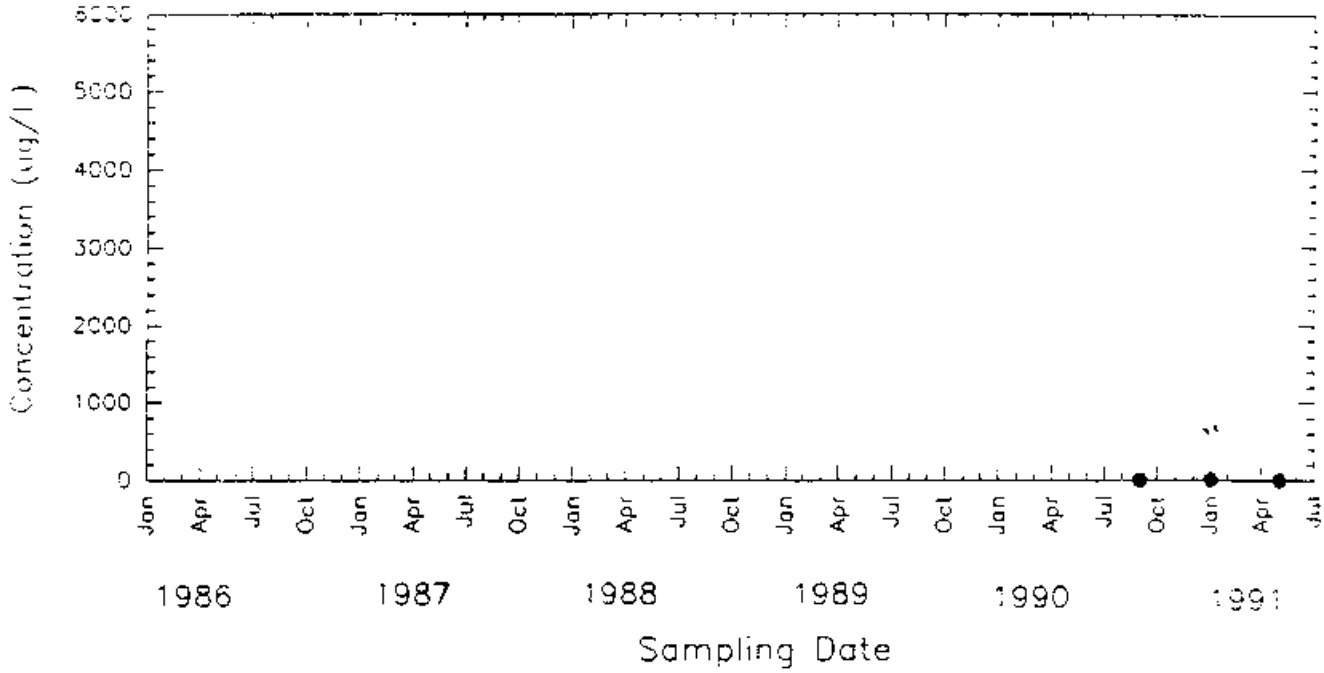


Scale Reflects long term fluctuations. refer to specific tables for specfic values

FIGURE 4-77

Benzene Concentrations for Texaco Monitoring Well MW-21S Aquifer # 1

EPA Method 624

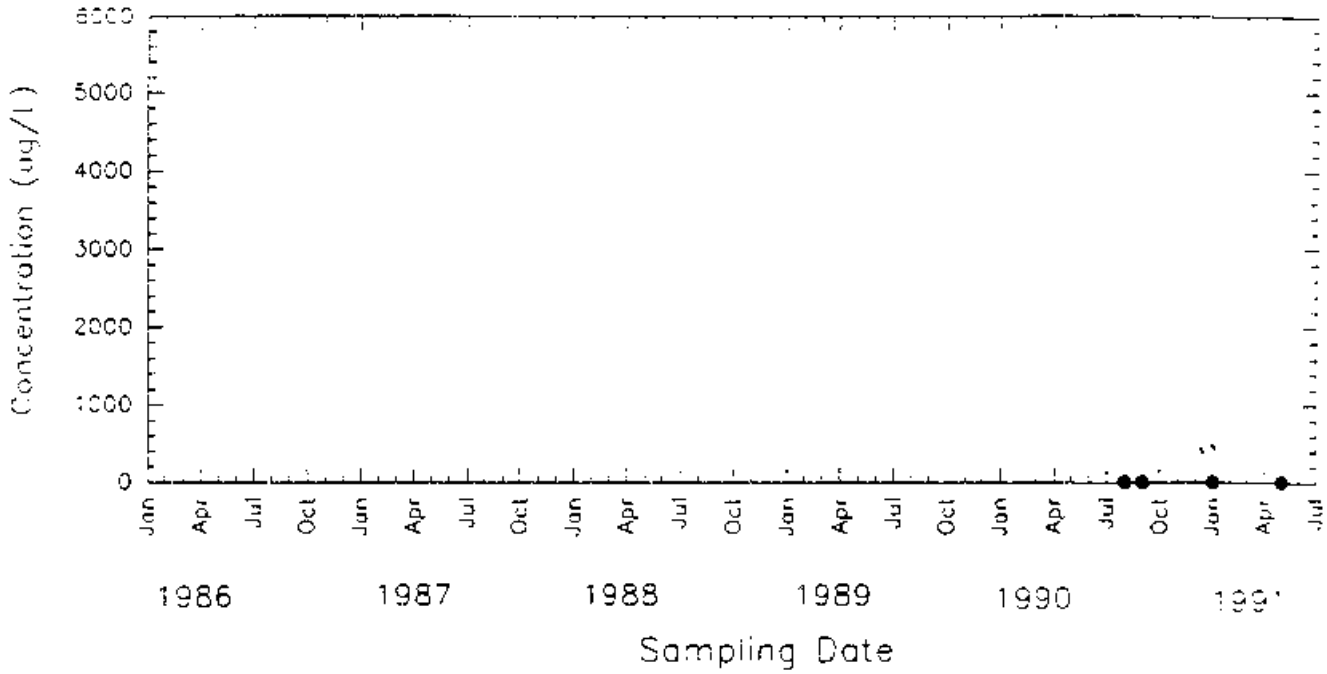


Scale Reflects long term fluctuations, refer to specific tables for specific values

FIGURE 4-78

Benzene Concentrations for Texaco Monitoring Well MW-22S Aquifer # 1

EPA Method 624

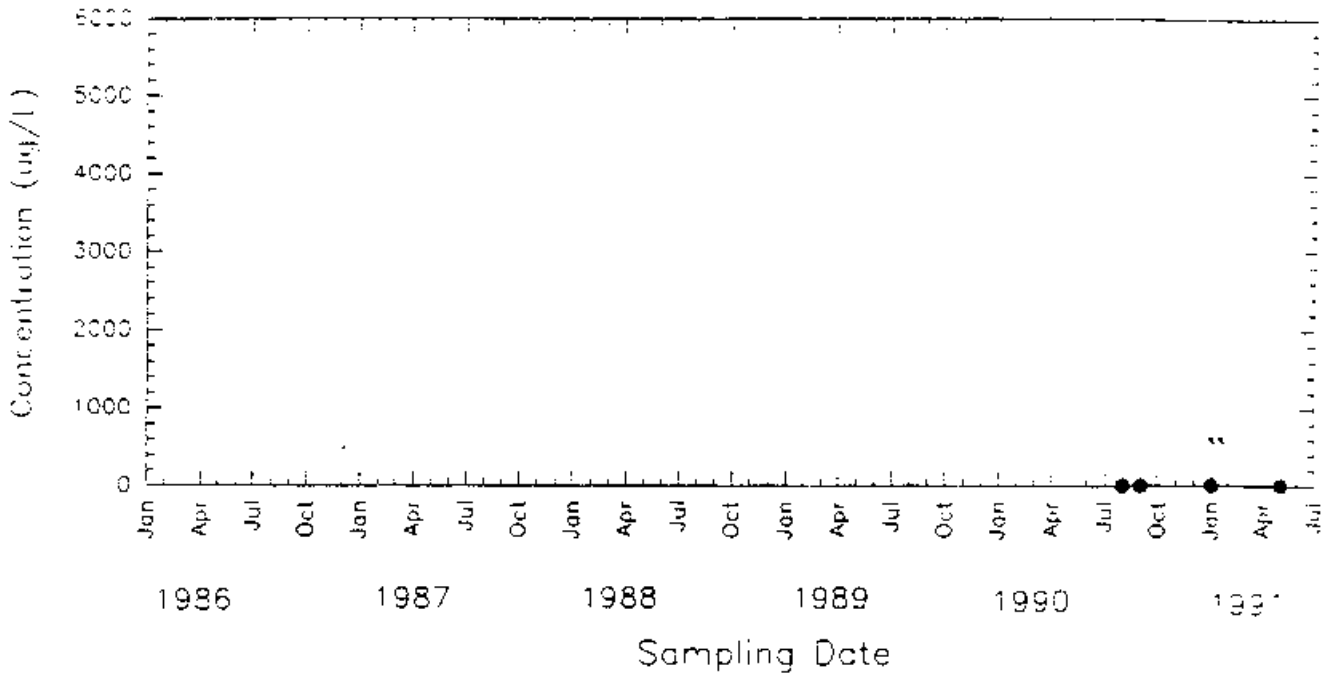


Scale Reflects long term fluctuations, refer to specific tables for specfic values

FIGURE 4-79

Benzene Concentrations for Texaco Monitoring Well MW-25S Aquifer # 1

EPA Method 624

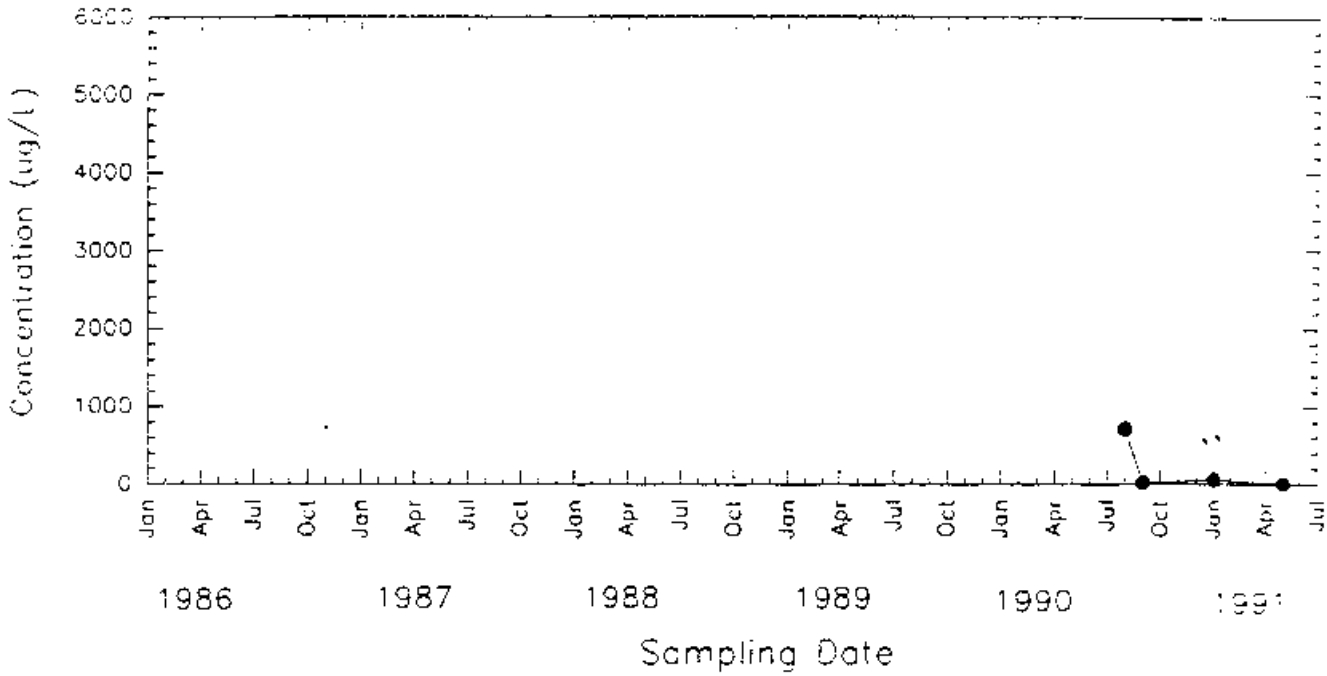


Scale Reflects long term fluctuations, refer to specific tables for specific values

FIGURE 4-80

Benzene Concentrations for Texaco Monitoring Well MW-26S Aquifer # 1

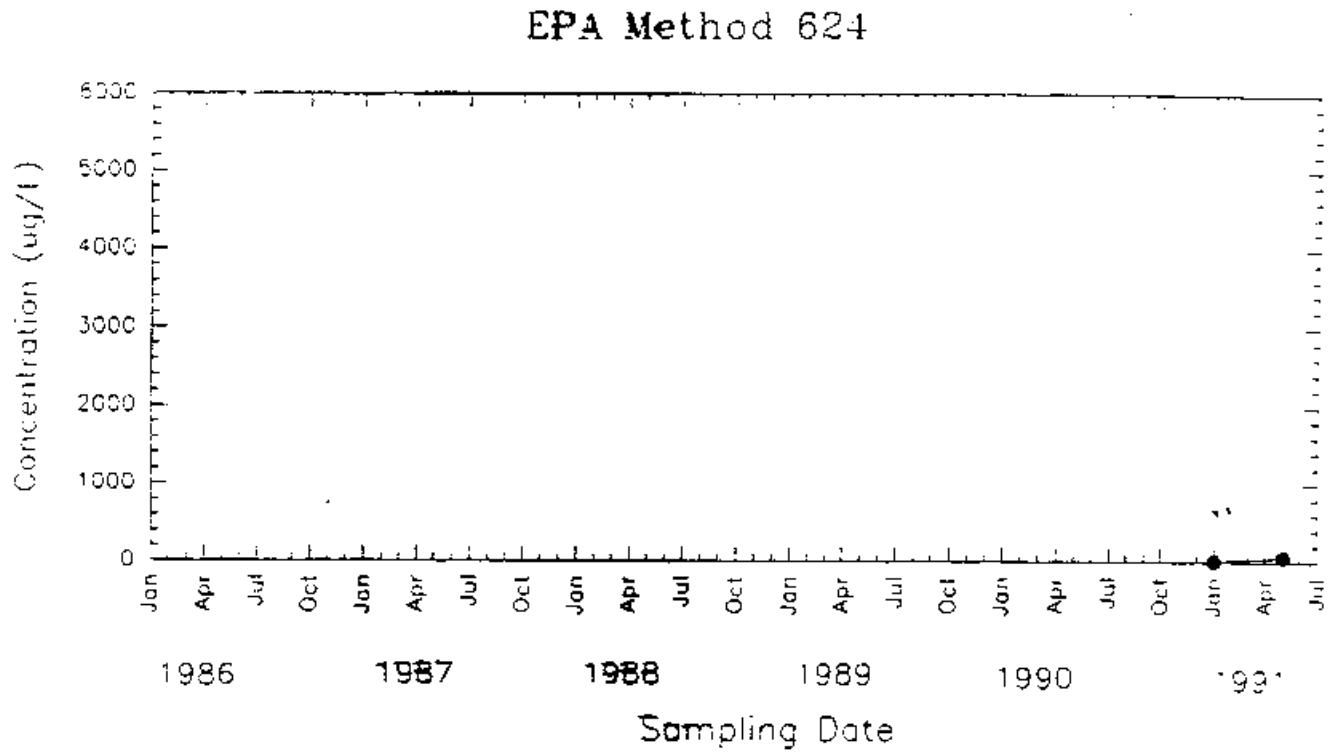
EPA Method 624



Scale Reflects long term fluctuations, refer to specific tables for specific values

FIGURE 4-81

Benzene Concentrations for Texaco Monitoring Well MW-27S Aquifer # 1

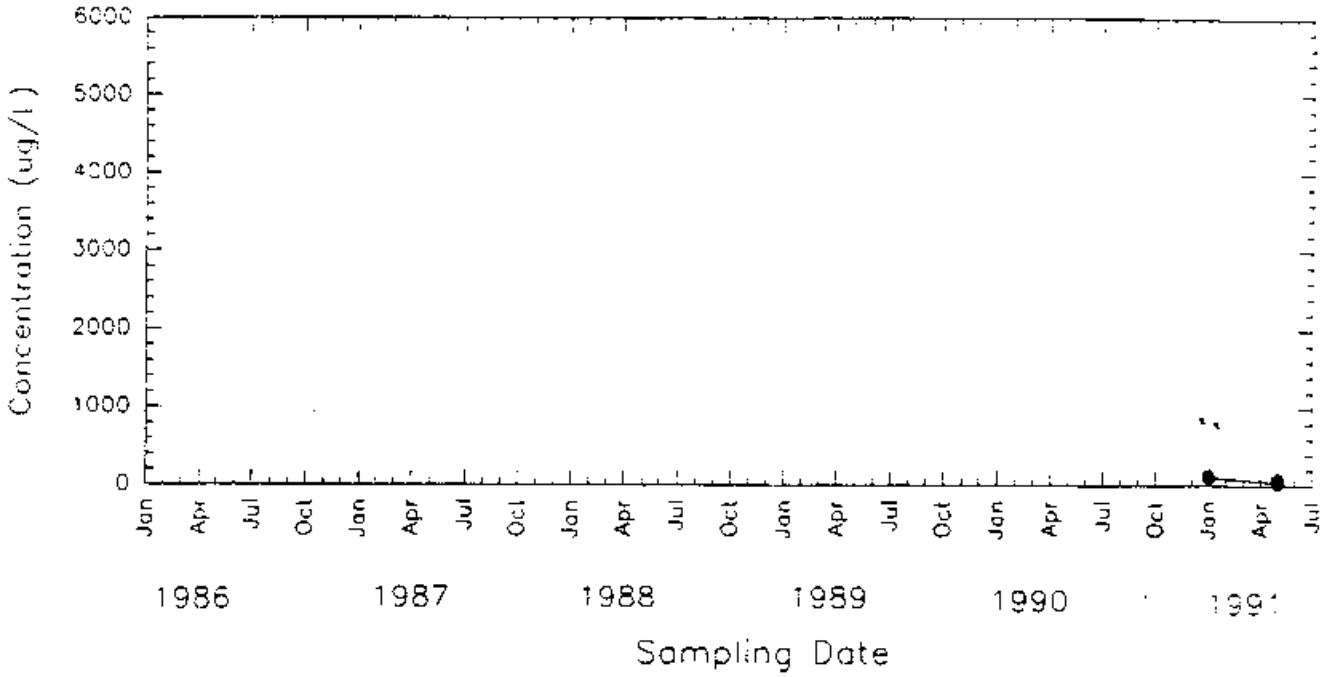


Scale Reflects long term fluctuations, refer to specific tables for specfic values

FIGURE 4-82

Benzene Concentrations for Texaco Monitoring Well MW-28S Aquifer # 1

EPA Method 624

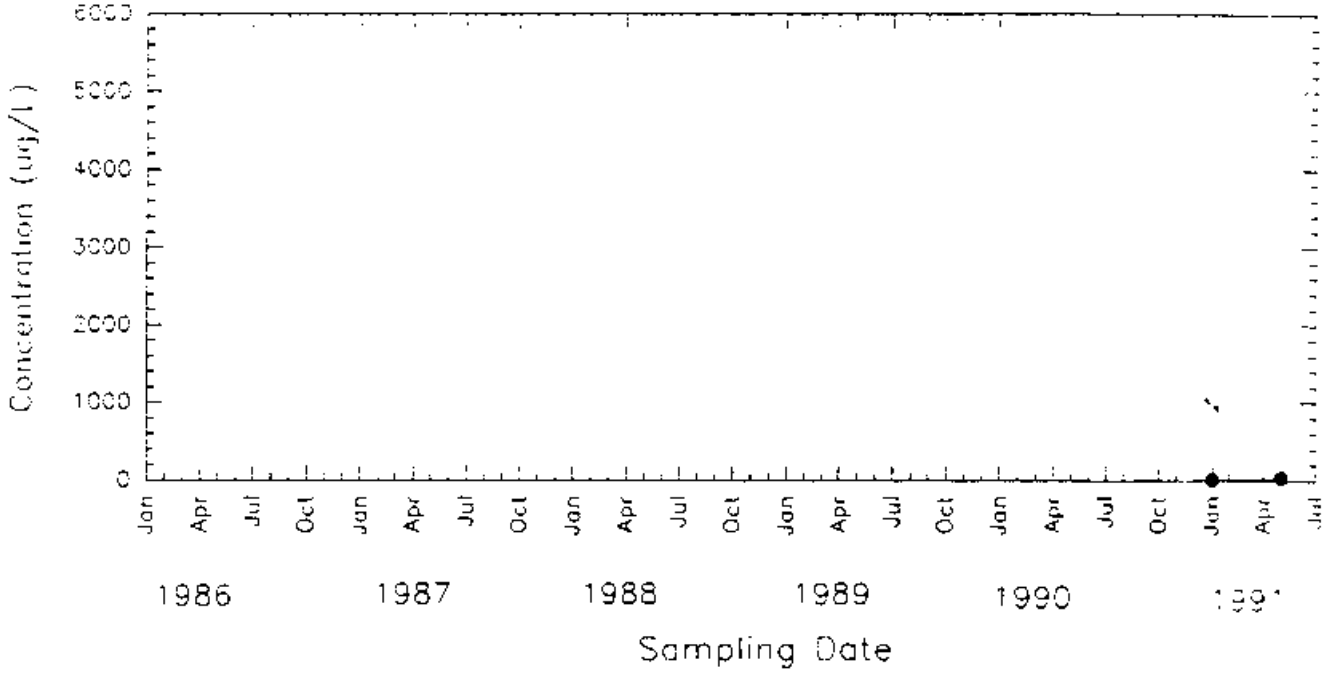


Scale Reflects long term fluctuations, refer to specific tables for specfic values

FIGURE 4-83

Benzene Concentrations for Texaco Monitoring Well MW-29S Aquifer # 1

EPA Method 624

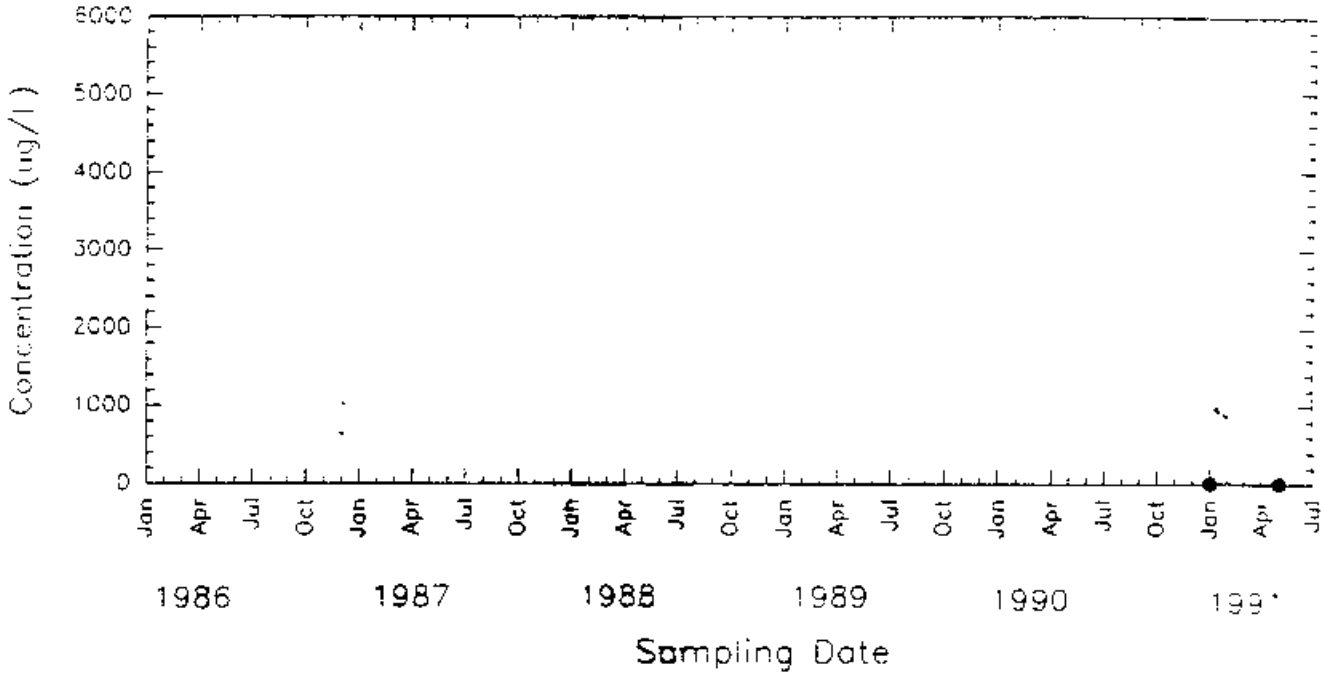


Scale Reflects long term fluctuations, refer to specific tables for specific values

FIGURE 4-84

Benzene Concentrations for Texaco Monitoring Well MW-30S Aquifer # 1

EPA Method 624

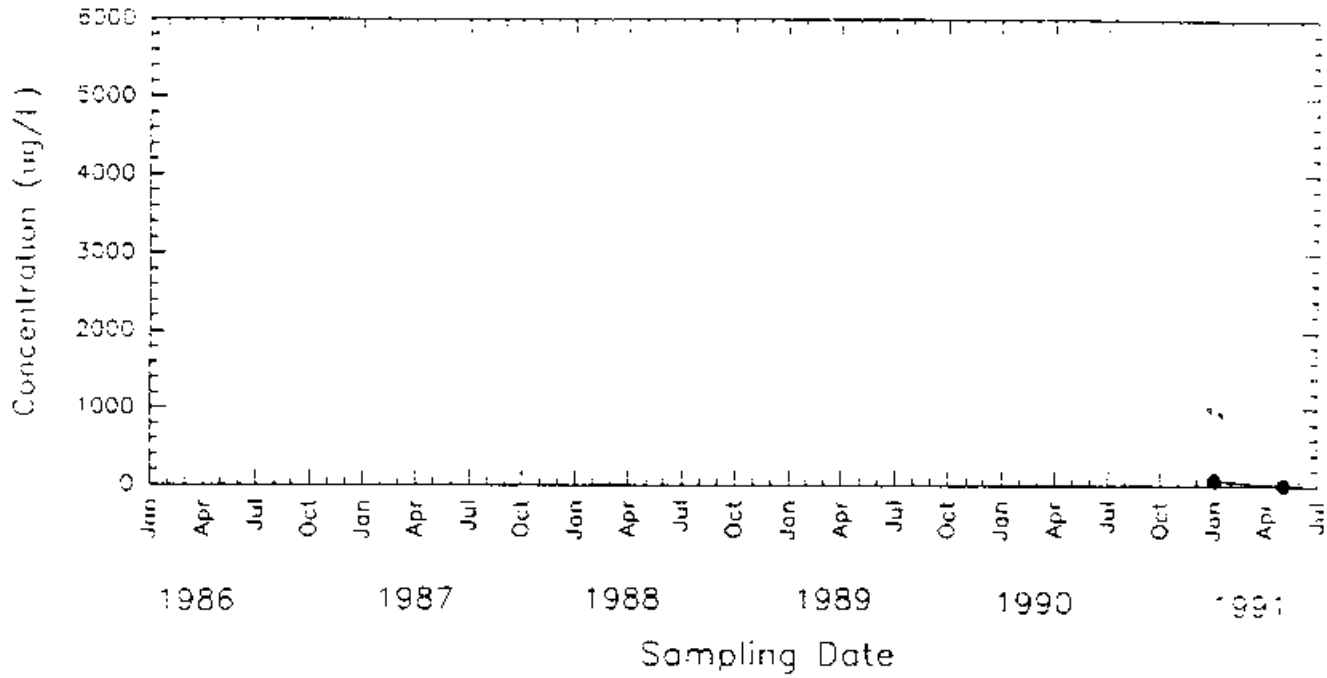


Scale Reflects long term fluctuations, refer to specific tables for epecfic values

FIGURE 4-85

Benzene Concentrations for Texaco Monitoring Well MW-32S Aquifer # 1

EPA Method 624

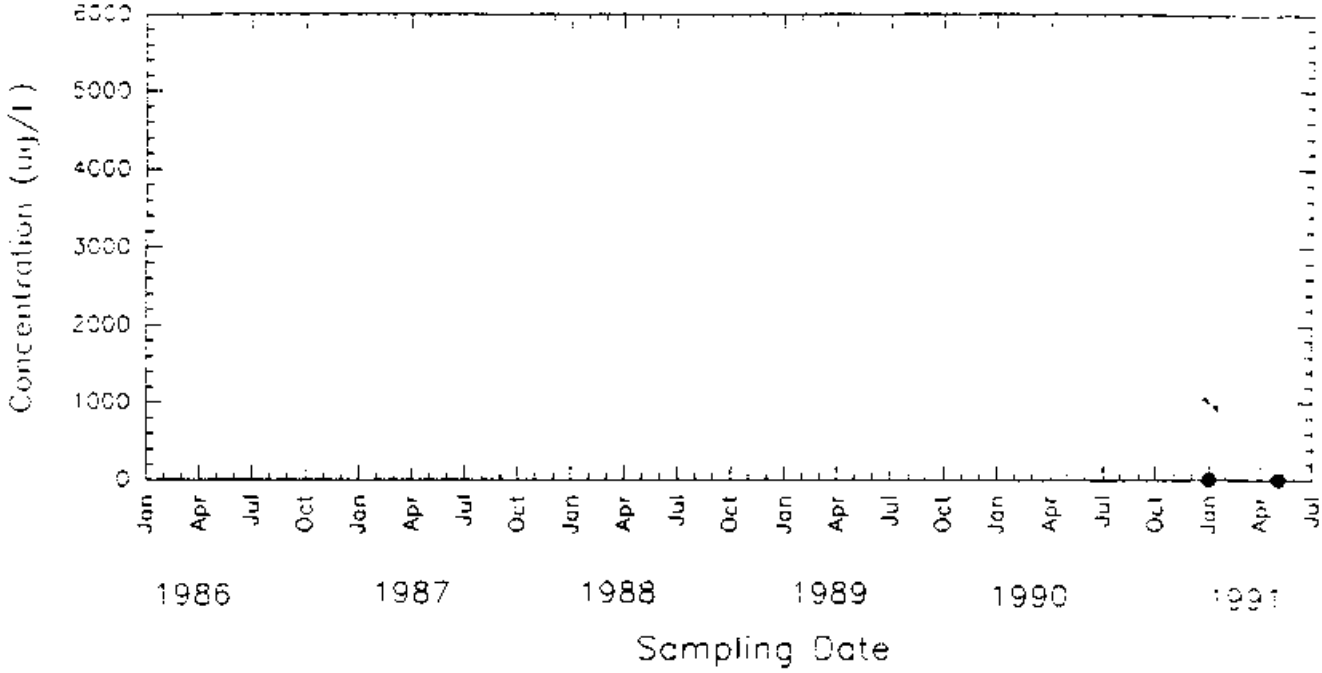


Scale Reflects long term fluctuations. refer to specific tables for specfic values

FIGURE 4-86

Benzene Concentrations for Texaco Monitoring Well MW-34S Aquifer # 1

EPA Method 624

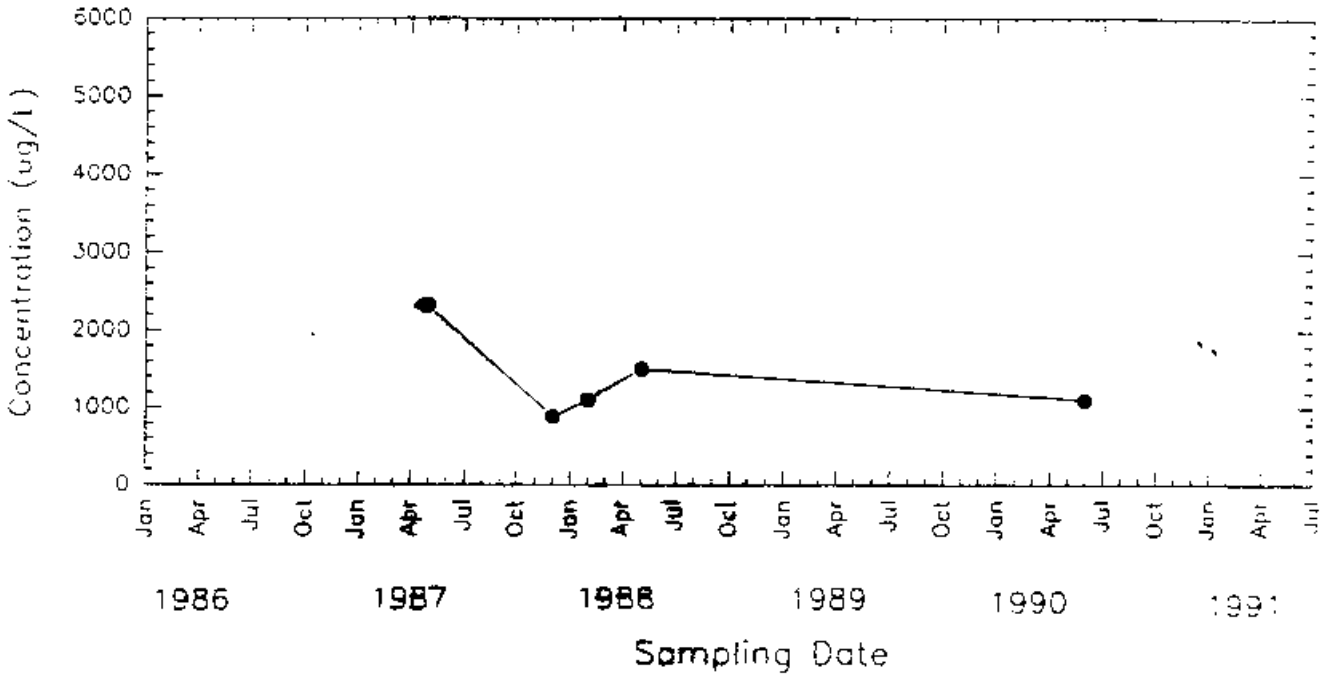


Scale Reflects long term fluctuations, refer to specific tables for specfic values

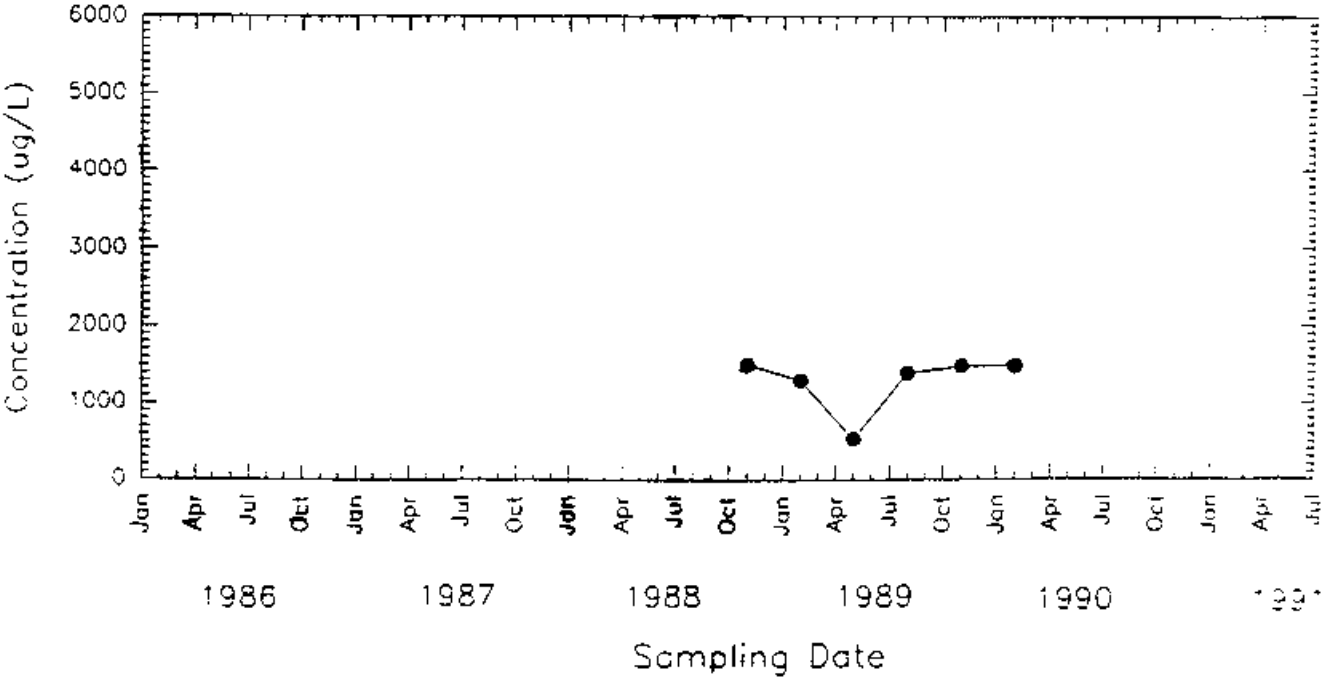
FIGURE 4-87

Benzene Concentrations for Texaco Monitoring Well MW-P-2S Aquifer # 1

EPA Method 602



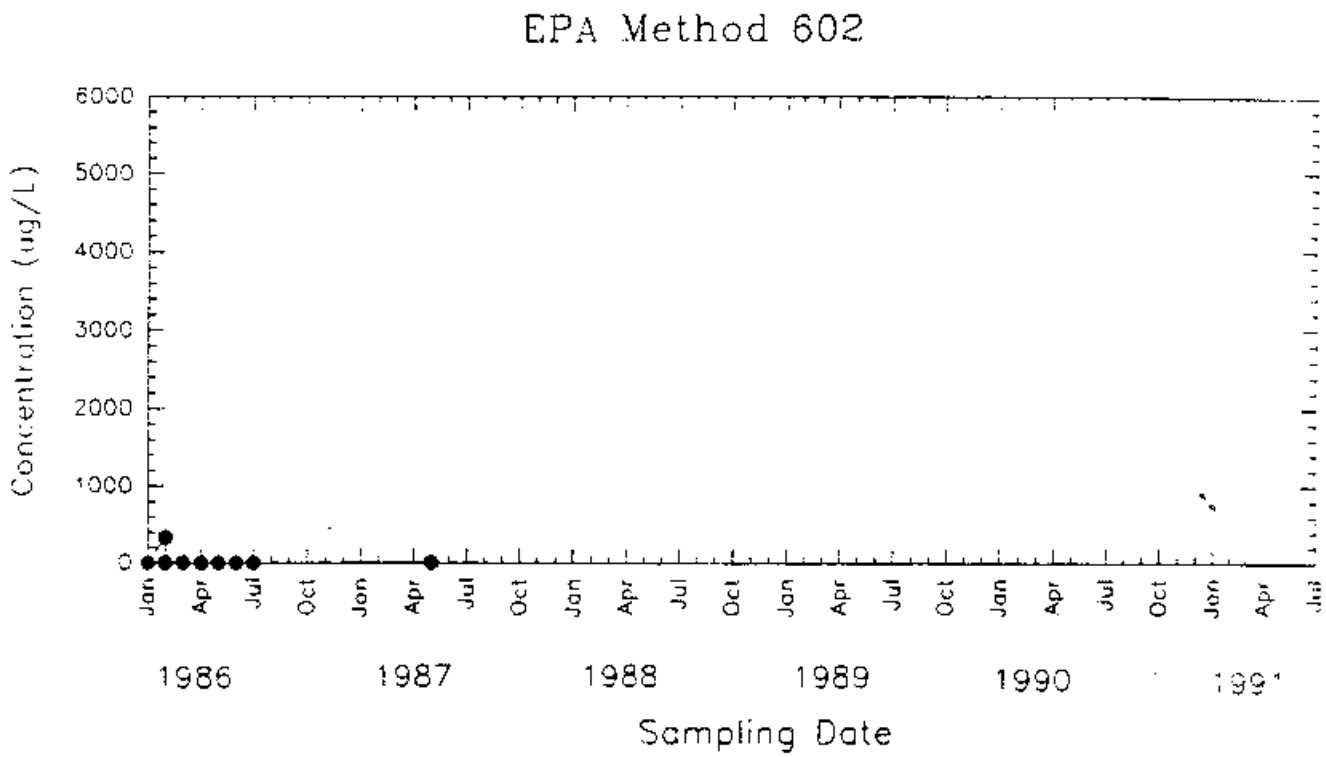
EPA Method 624

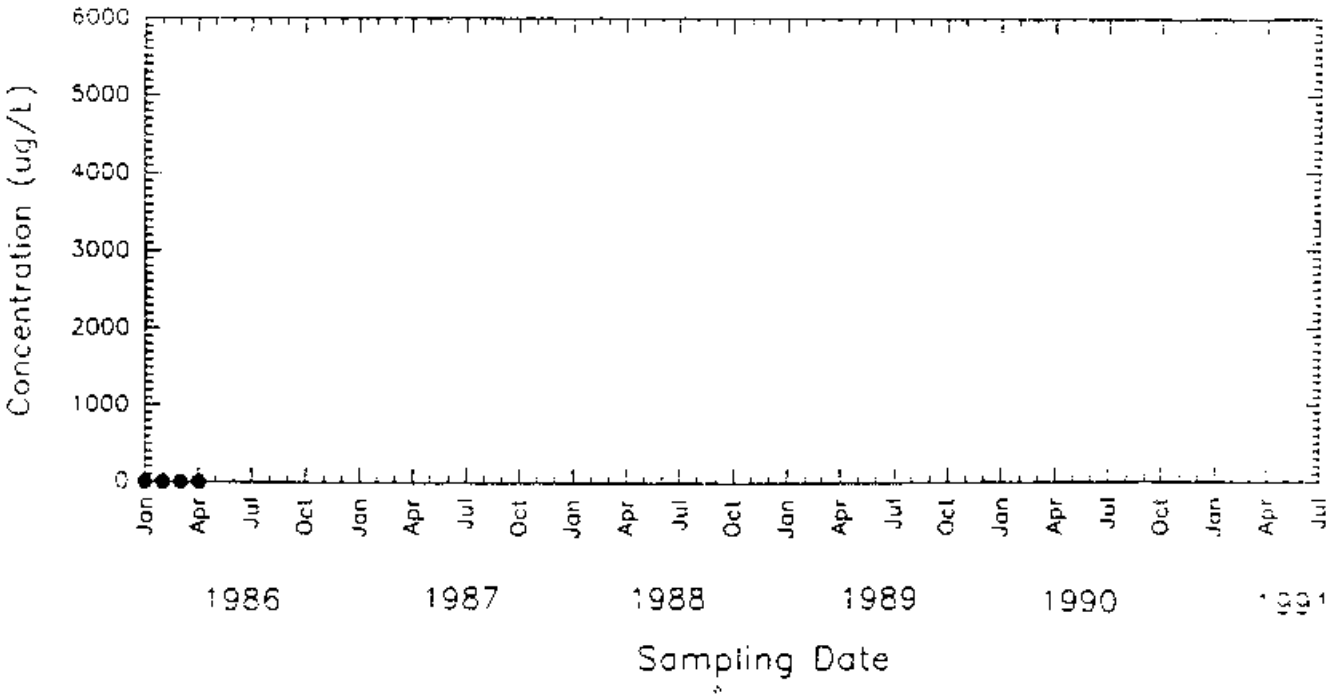


Scale Reflects long term fluctuations. refer to specific tables for specfic values

FIGURE 4-88

Benzene Concentrations for Texaco Monitoring Well MW-5D Aquifer # 2

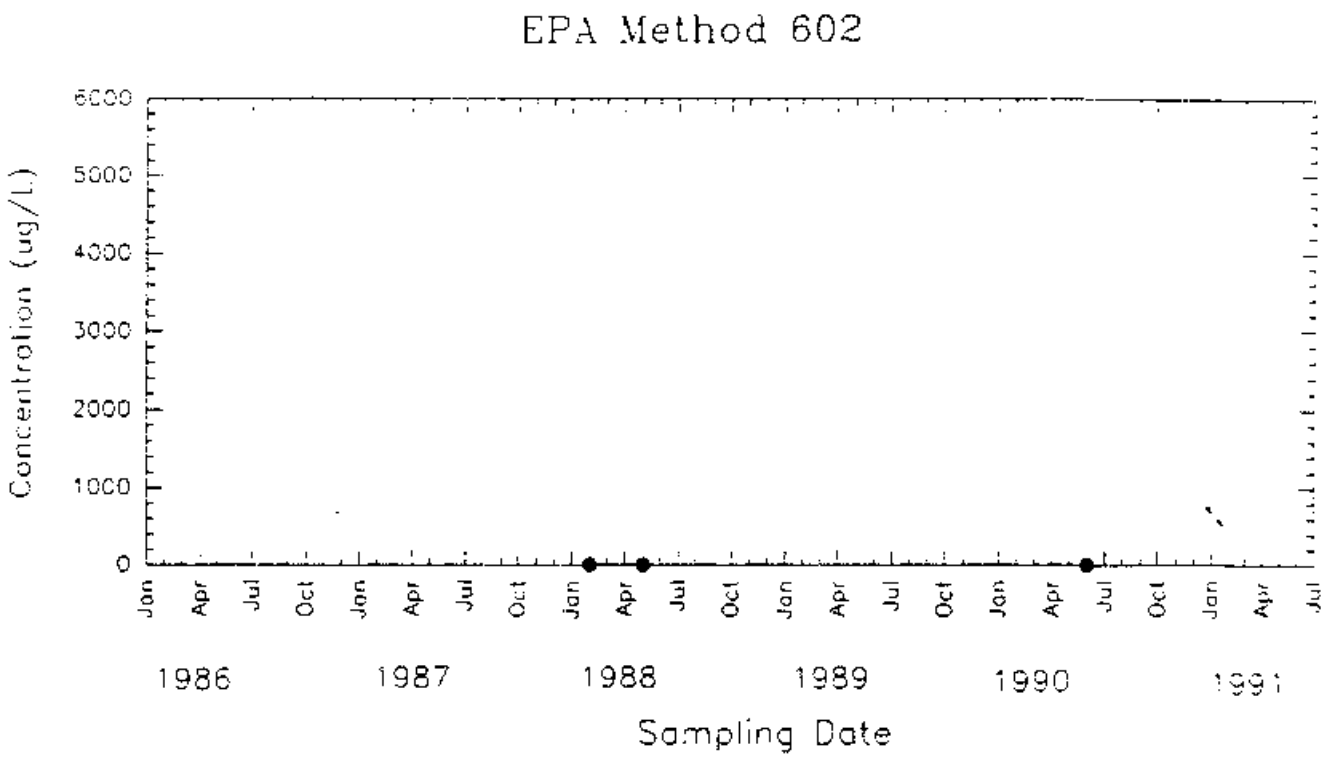


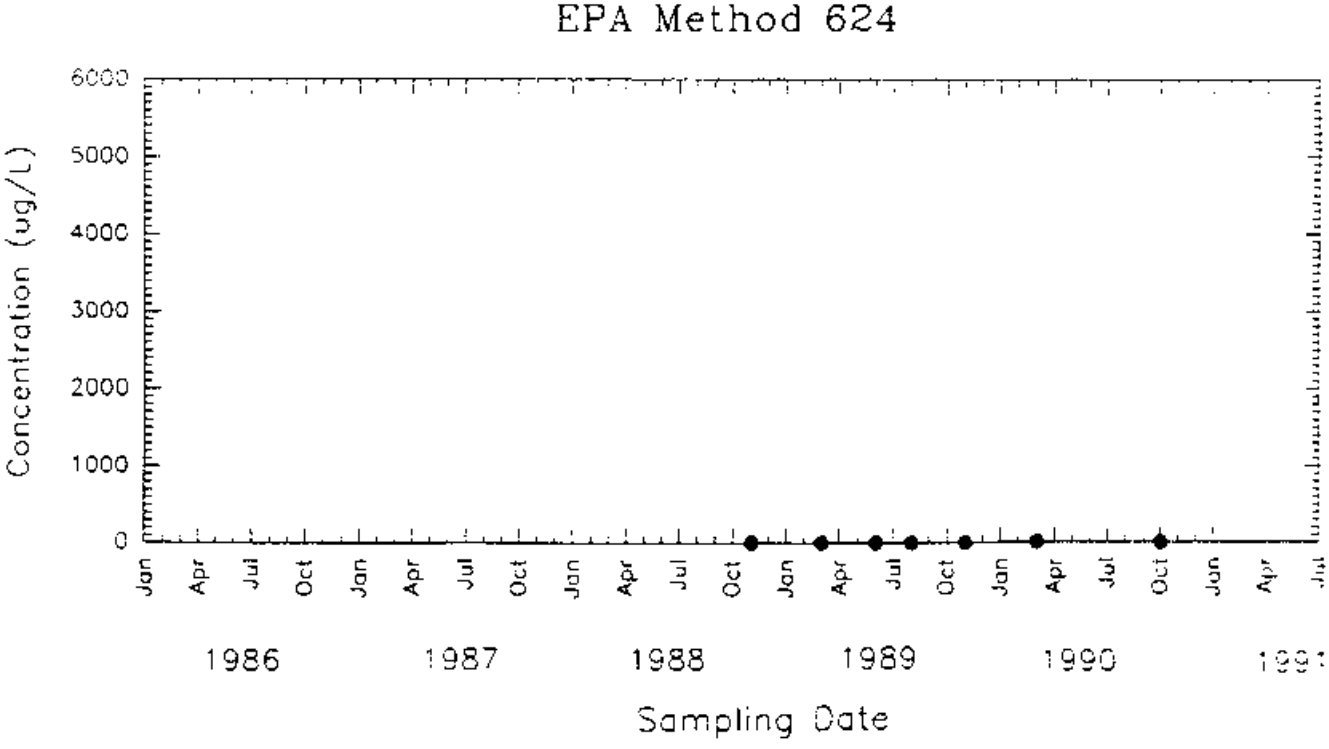


Scale Reflects long term fluctuations, refer to specific tables for specfic values

FIGURE 4-89

Benzene Concentrations for Texaco Monitoring Well MW-16D Aquifer # 2



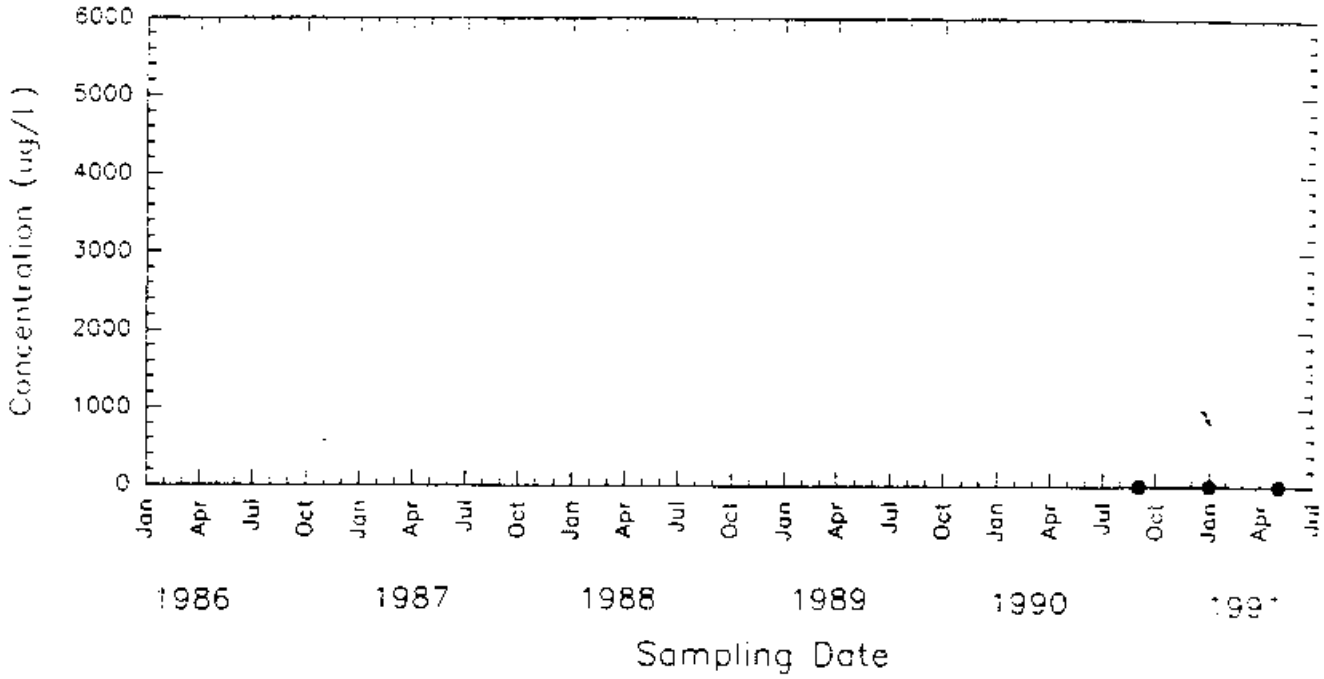


Scale Reflects long term fluctuations. refer to specific tables for specfic values

FIGURE 4-90

Benzene Concentrations for Texaco Monitoring Well MW-22D Aquifer # 2

EPA Method 624

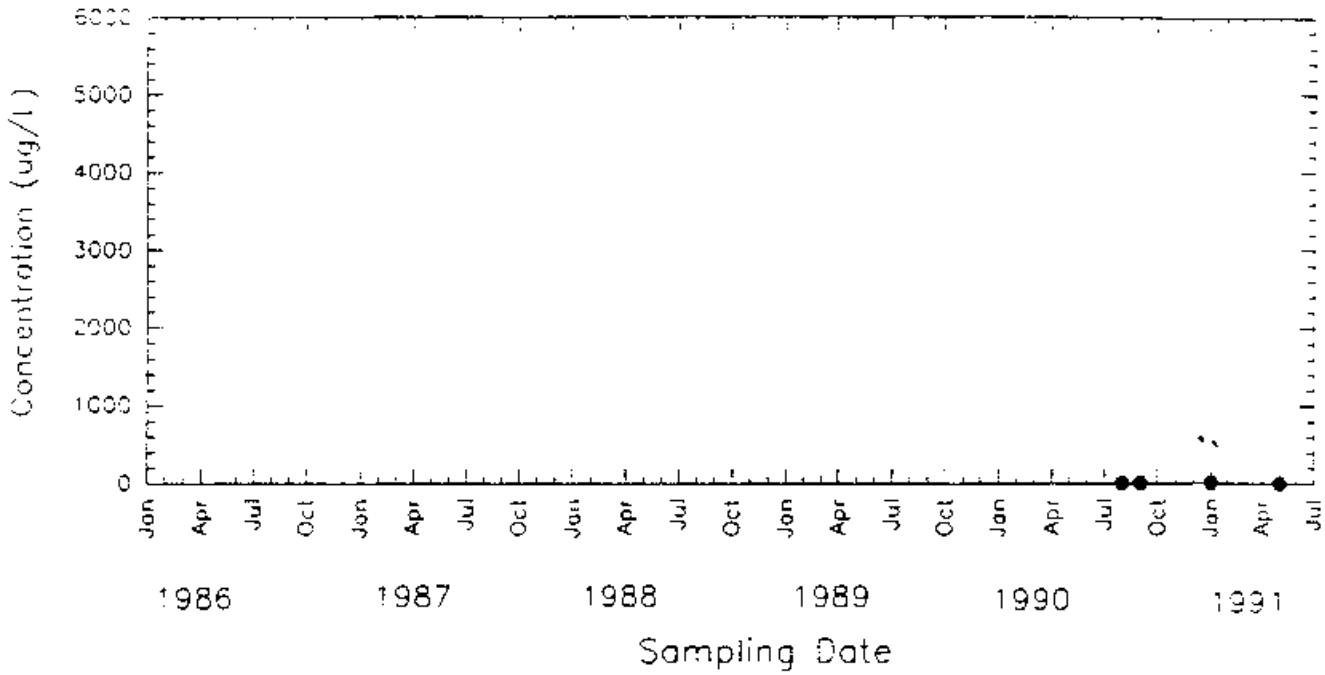


Scale Reflects long term fluctuations, refer to specific tables for specfic values

FIGURE 4-91

Benzene Concentrations for Texaco Monitoring Well MW-23D Aquifer # 2

EPA Method 624

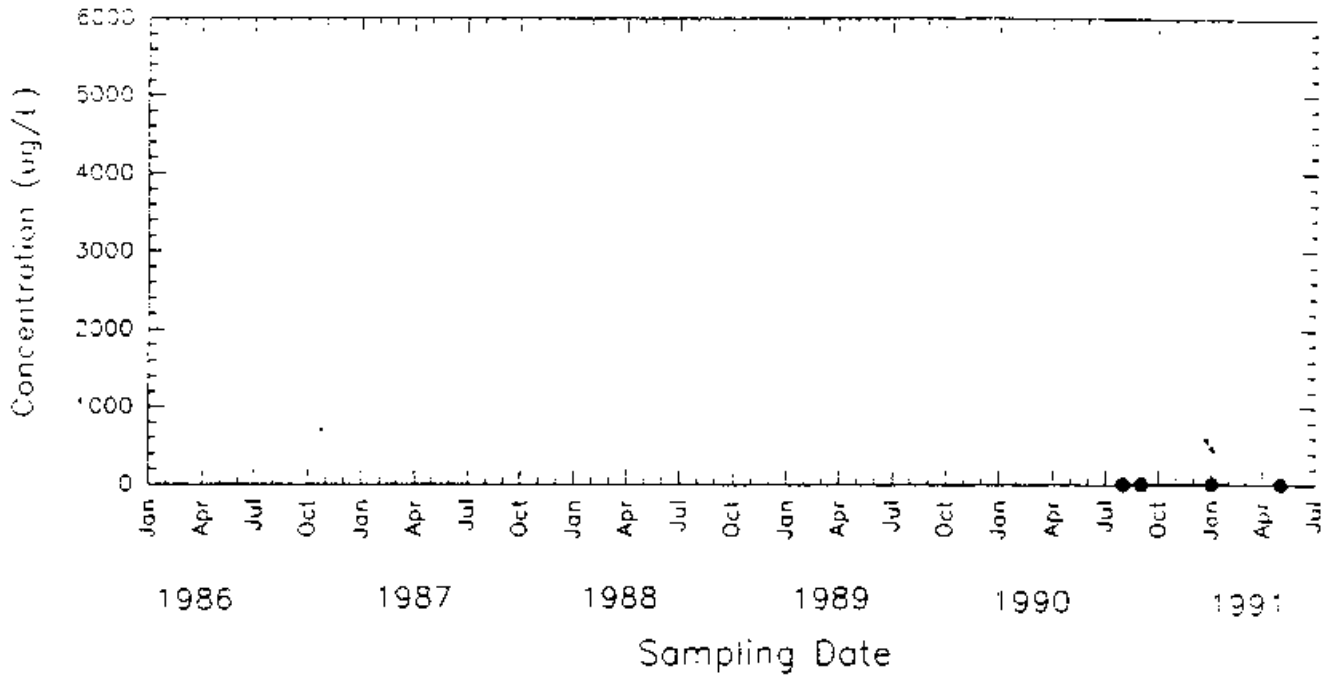


Scale Reflects long term fluctuations, refer to specific tables for specfic values

FIGURE 4-92

Benzene Concentrations for Texaco Monitoring Well MW-24D Aquifer # 2

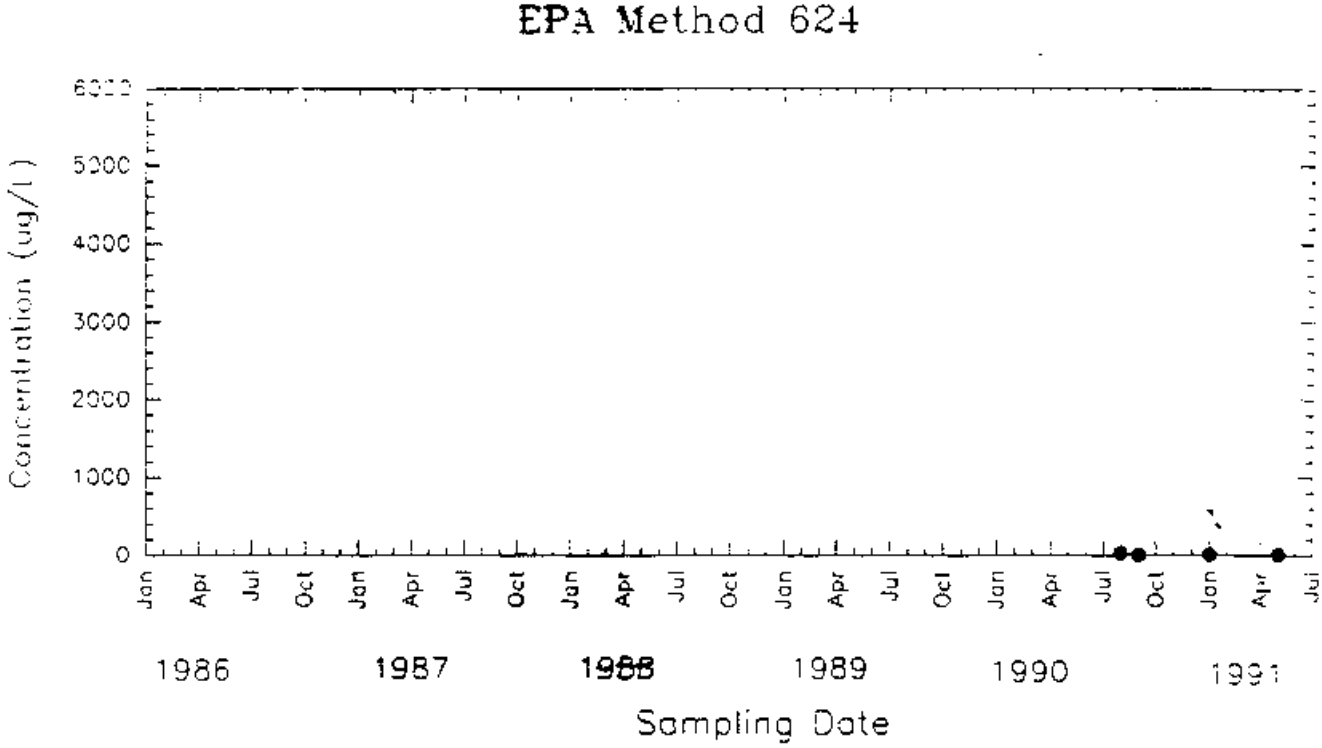
EPA Method 624



Scale Reflects long term fluctuations, refer to specific tables for specfic values

FIGURE 4-93

Benzene Concentrations for Texaco Monitoring Well MW-25D Aquifer # 2

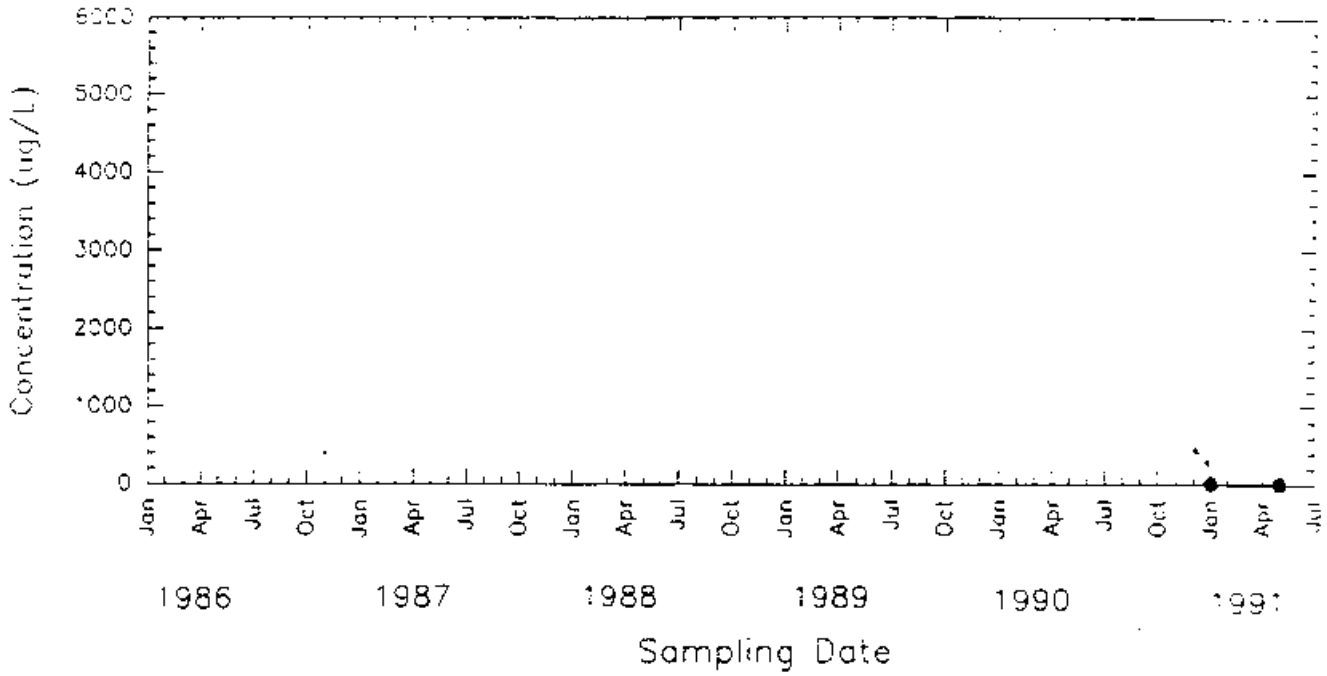


Scale Reflects long term fluctuations, refer to specific tables for specfic values

FIGURE 4-94

Benzene Concentrations for Texaco Monitoring Well MW-29D Aquifer # 2

EPA Method 624

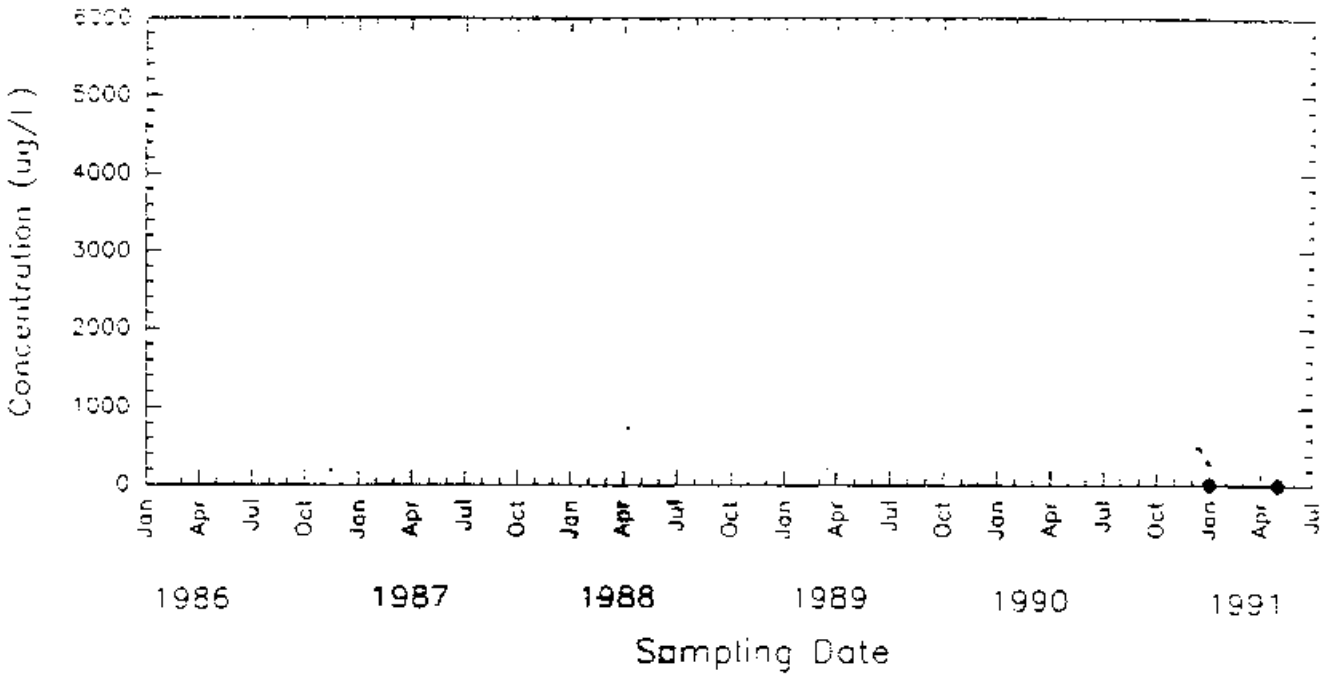


Scale Reflects long term fluctuations, refer to specific tables for specific values

FIGURE 4-95

Benzene Concentrations for Texaco Monitoring Well MW-31D Aquifer # 2

EPA Method 624

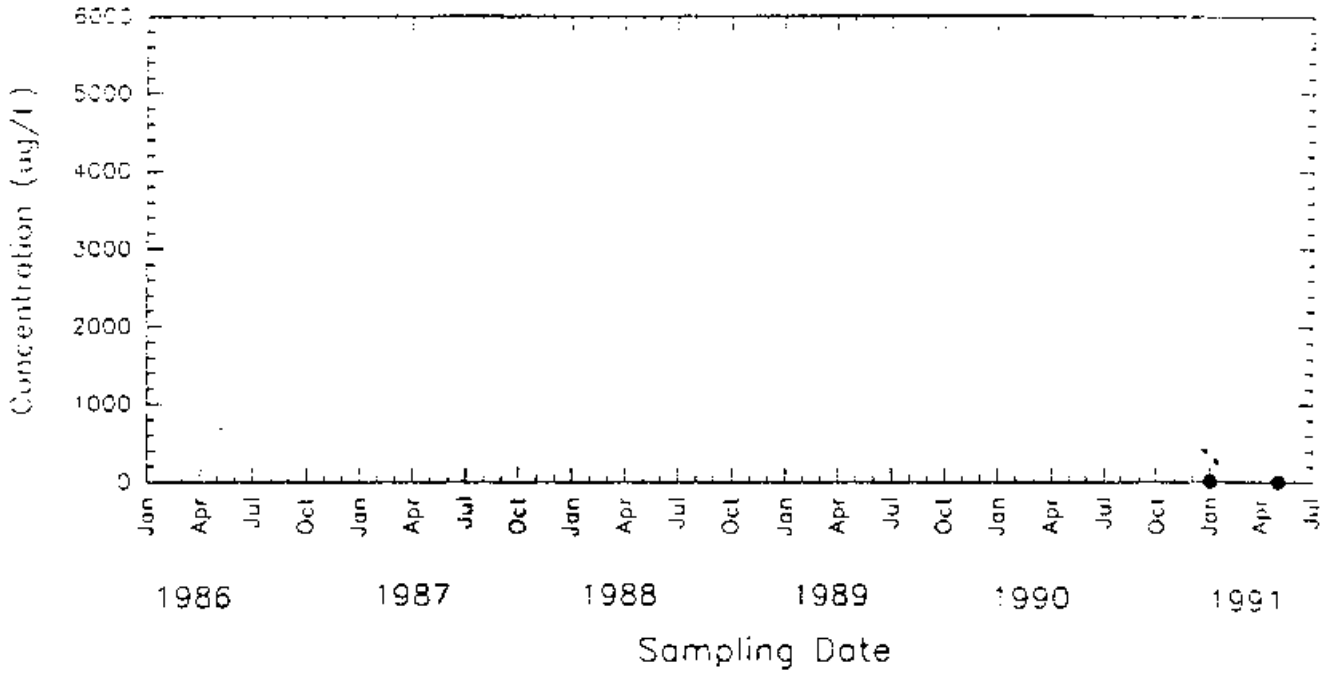


Scale Reflects long term fluctuations, refer to specific tables for specific values

FIGURE 4-96

Benzene Concentrations for Texaco Monitoring Well MW-33D Aquifer # 2

EPA Method 624



Scale Reflects long term fluctuations, refer to specific tables for specfic values

Boundary:	MW-4S	(Figure 4-64)
	MW-11S	(Figure 4-69)
	MW-12S	(Figure 4-70)
	MW-18S	(Figure 4-74)
	MW-25S	(Figure 4-79)
	MW-30S	(Figure 4-84)

Note: MW-17S and MW-26S are located in essentially the same spot and MW-26S concentrations could be looked at as later values for MW-17S which is now dry.

As with the MWP plume, there is a large variation in concentrations with time. However, a decreasing trend only seems apparent for wells MW-9S, MW-17S, MW-19S, and MW-26S. Wells MW-7S and MW-8S do not seem to show similar decreasing trends, but appear to vary around a 200 to 400 µg/l range of benzene. Similarly, well MW-20S appears to vary around a 5 to 10 µg/l range of benzene.

4.2.7 Offsite Contamination - Ultramar Station 751

Approximately 400 feet southwest of the Texaco Fillmore facility, the Ultramar Station 751 gas station has been investigating contaminated soil and groundwater on and around its facility. Three recent reports, dated 10/03/90, 11/02/90, and 02/19/91 have been made available for comparison with data from the Texaco facility. The data from these reports are contained in Appendix H. These reports contain several categories of data and conclusions which are of interest to the RI/FS process at the Texaco facility.

- Groundwater elevations from July 1987 to present.
- Groundwater chemistry from June 1986 to present.
- Subsurface soil chemistry from a March 1990 drilling and installation of three groundwater monitoring wells.

4.2.7.1 Groundwater Elevation and Gradients

Prior to March 1990, gradients were reported at the Ultramar station as being toward the southeast. In March, June, and September 1990, the gradient was reported as being toward the northeast. This is in marked contrast with gradients measured at the Texaco facility over the same general time period.

To resolve this apparent conflict, the wells at the Ultramar station were surveyed into the Texaco net and water levels were measured at these wells in May 1991 at the same time as the Texaco wells. In addition, water samples were taken from the Ultramar wells for analysis under the Texaco site CLP guidelines.

Apparently the previous surveying of the Ultramar wells had been in error and their reported gradients, particularly to the northeast, were not accurate. When included in the Texaco site grid, the Ultramar wells agree with the westerly gradients observed in Aquifer 1 (Plate 3-11).

4.2.7.2 Groundwater Analyses Results

The Ultramar station has had groundwater contamination since at least 1986, which appears to be due to gasoline release. However, analyses in March 1990 indicated considerable amounts of olefinic hydrocarbons which are not common in gasoline releases. An offsite source was proposed as the source of these compounds. Appendix H presents a historical summary of groundwater analytical results at the Ultramar station. These results reflect sampling conducted by Ultramar as part of their quarterly groundwater monitoring program.

Sampling by ENSR of two Ultramar wells, ULTM-MW-9 and ULTM-MW-10, occurred in May 1991. Tables 4-70 and 4-71 present the results of chemical analyses of the samples taken from these wells. High levels of benzene were detected in these samples: ULTM-MW-9 had benzene at 280 µg/l, while ULTM-MW-10 had benzene at 54 µg/l.

Figures 4-97 through 4-105 are plots of benzene concentrations over time for the Ultramar wells.

4.2.7.3 Soil Analyses Results

Soil contamination with TPH and BTXE was found mainly at depths of 45 feet or more below the surface both on and off the Ultramar station site.

4.2.8 Summary and Conclusions

To obtain a representative picture of the chemical constituents present at the Texaco Fillmore site, it is necessary to look at more than any one instant in time. It is also necessary to keep in mind that large amounts of waste material were removed from the facility during 1986. In addition, as the previous section notes, the Ultramar service station about 400 feet southwest of the facility also has a petroleum product contamination problem.

TABLE 4-70

Groundwater Chemical Analyses for Ultramar MW-9
(Aquifer 1)

Analysis	Concentration (µg/L) 05/01/91	Compound
Metals		
EPA 7060 CLP	3.8	Arsenic
EPA 6010 CLP	---	Barium
EPA 6010 CLP	---	Cadmium
EPA 6010 CLP	---	Chromium
EPA 7196 CLP	---	Hexavalent Chromium
EPA 6010 CLP	---	Copper
EPA 7421 CLP	---	Lead
EPA 6010 CLP	---	Nickel
EPA 6010 CLP	---	Vanadium
TEPH		
8015 (M) CA DHS LUFT	7200	TPH
Volatile Organics		
EPA 8240 CLP	280	Benzene
	5	1,2-Dichloroethane
	82	Toluene
	26	Ethylbenzene
	23	Xylenes (Total)
	200	TIC
Semivolatile Organics		
EPA 8027 CLP	31	Bis(2-ethylhexyl)phthalate
	23	Naphthalene
	100	TIC

* Data not yet validated for CLP deliverables

TPH Total Petroleum Hydrocarbons

TIC Tentatively Identified Compounds (reflects highest TIC concentration in sample)

TABLE 4-71

Groundwater Chemical Analyses for Ultramar MW-10 (Aquifer 1)

Analysis	Concentration (µg/L) 05/01/91	Compound
Metals		
EPA 7060 CLP	< 1.3	Arsenic
EPA 6010 CLP	--	Barium
EPA 6010 CLP	--	Cadmium
EPA 6010 CLP	--	Chromium
EPA 7196 CLP	--	Hexavalent Chromium
EPA 6010 CLP	--	Copper
EPA 7421 CLP	--	Lead
EPA 6010 CLP	--	Nickel
EPA 6010 CLP	--	Vanadium
TEPH		
8015 (M) CA DHS LUFT	3.00	TPH
Volatile Organics		
EPA 8240 CLP	16	Acetone
	16	Carbon Disulfide
	1	1,2-Dichloroethane
	54	Benzene
	28	Toluene
	5	Ethylbenzene
	13	Xylenes (Total)
	60	TIC
Semivolatile Organics		
EPA 8027 CLP	Tr < 10	Bis(2-ethylhexyl)phthalate
	Tr < 10	Naphthalene
	70	TIC

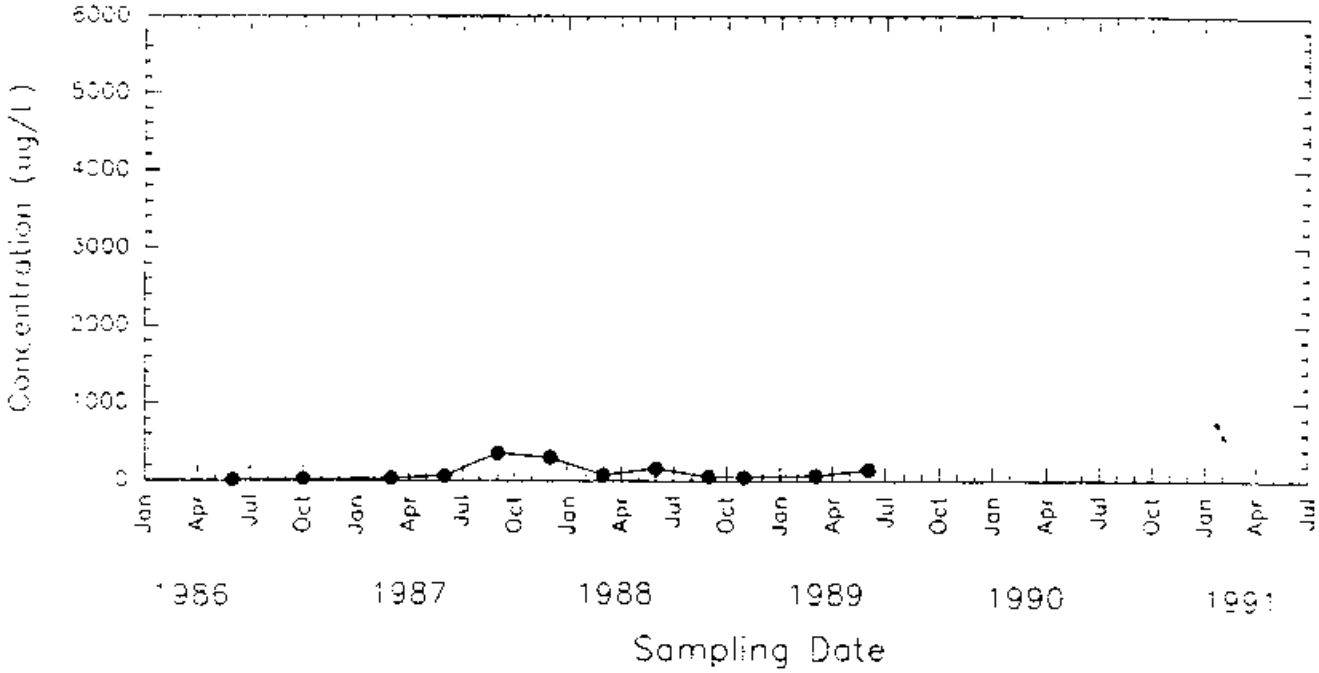
* Data not yet validated for CLP deliverables
TPH Total Petroleum Hydrocarbons
TIC Tentatively Identified Compounds (reflects highest TIC concentration in sample)
Tr Trace

FIGURE 4-97

Benzene Concentrations for Ultramar Monitoring Well

ULT-MW-2 Aquifer # 1

EPA Method 602



Source: Ultramar Station 751 Groundwater Sampling Report, First Quarter 1991

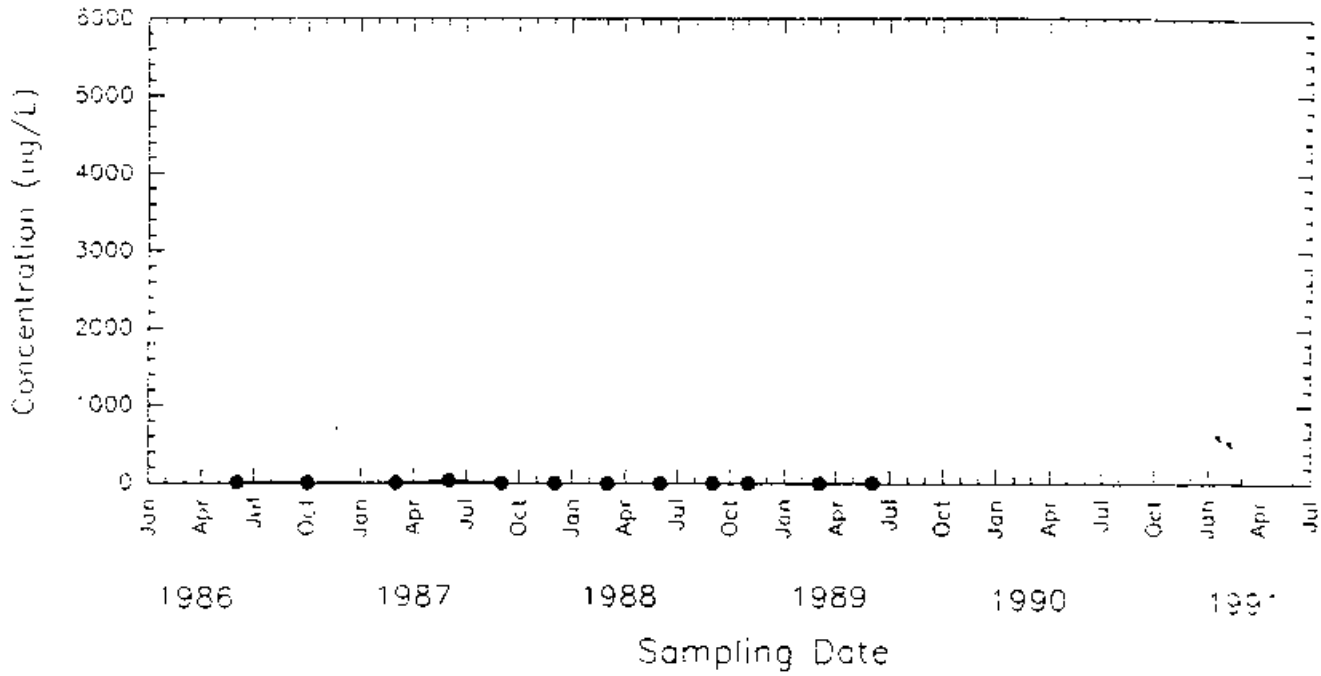
Scale Reflects long term fluctuations, refer to specific tables for specific values

FIGURE 4-98

Benzene Concentrations for Ultramar Monitoring Well

ULT-MW-3 Aquifer # 1

EPA Method 602



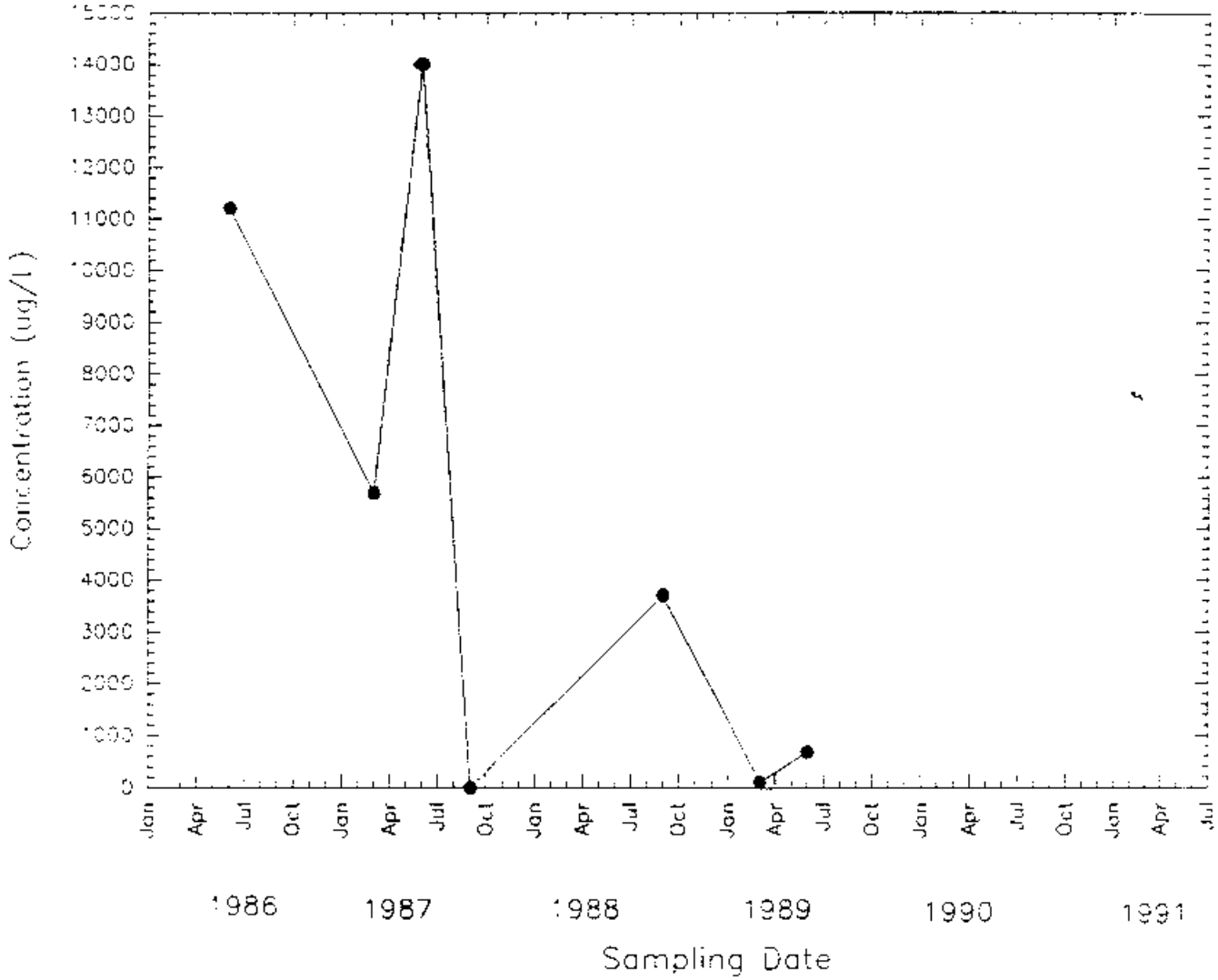
Source: Ultramar Station 751 Groundwater Sampling Report, First Quarter 1991

Scale Reflects long term fluctuations, refer to specific tables for specific values

FIGURE 4-99

Benzene Concentrations for Ultramar Monitoring Well ULTM-MW-5 Aquifer # 1

EPA Method 602



Source: Ultramar Station 751 Groundwater Sampling Report, First Quarter 1991

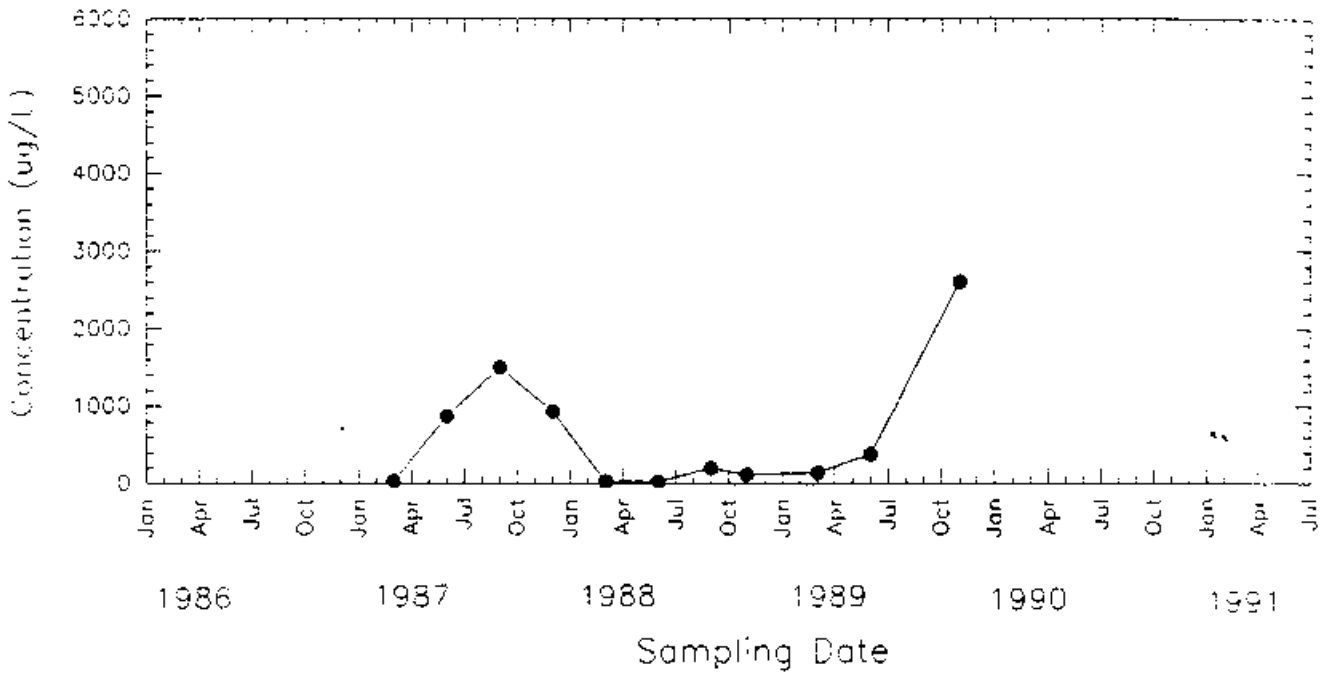
Scale Reflects long term fluctuations, refer to specific tables for specific values

FIGURE 4-100

Benzene Concentrations for Ultramar Monitoring Well

ULT-MW-6 Aquifer # 1

EPA Method 602



Source: Ultramar Station 751Groundwater Sampling Report, First Quarter 1991

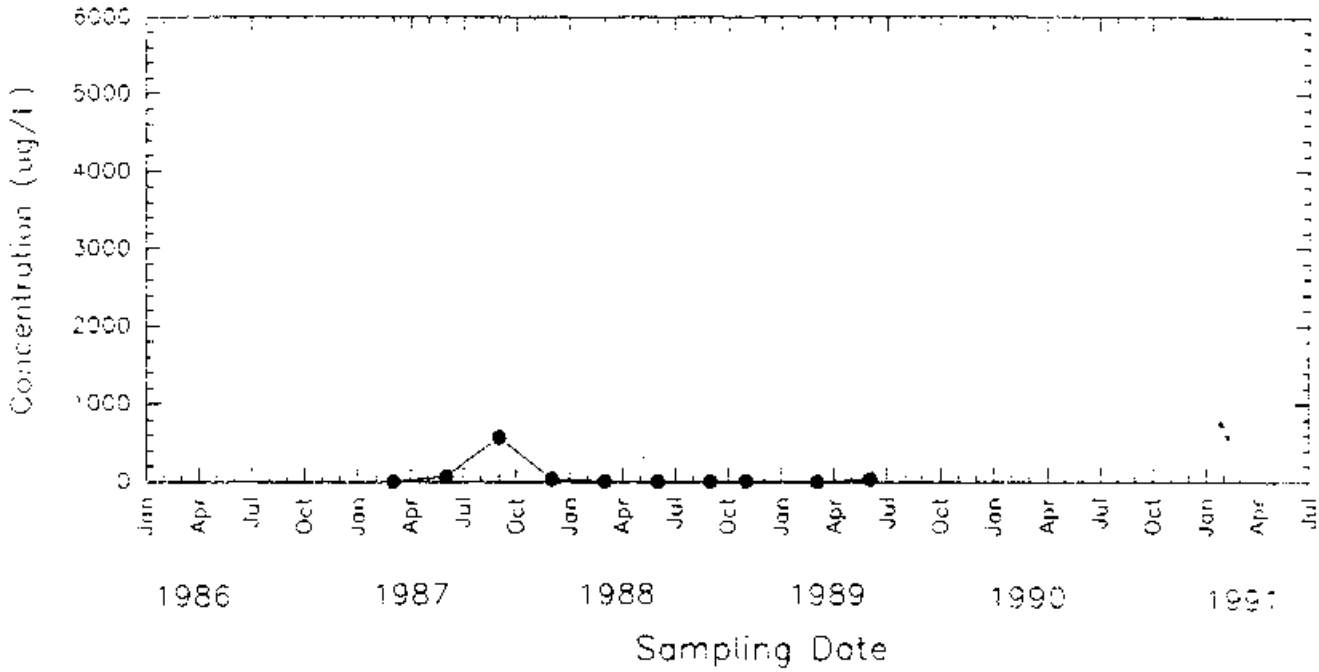
Scale Reflects long term fluctuations, refer to specific tables for specific values

FIGURE 4-101

Benzene Concentrations for Ultramar Monitoring Well

ULT-MW-7 Aquifer # 1

EPA Method 602



Source: Ultramar Station 751 Groundwater Sampling Report, First Quarter 1991

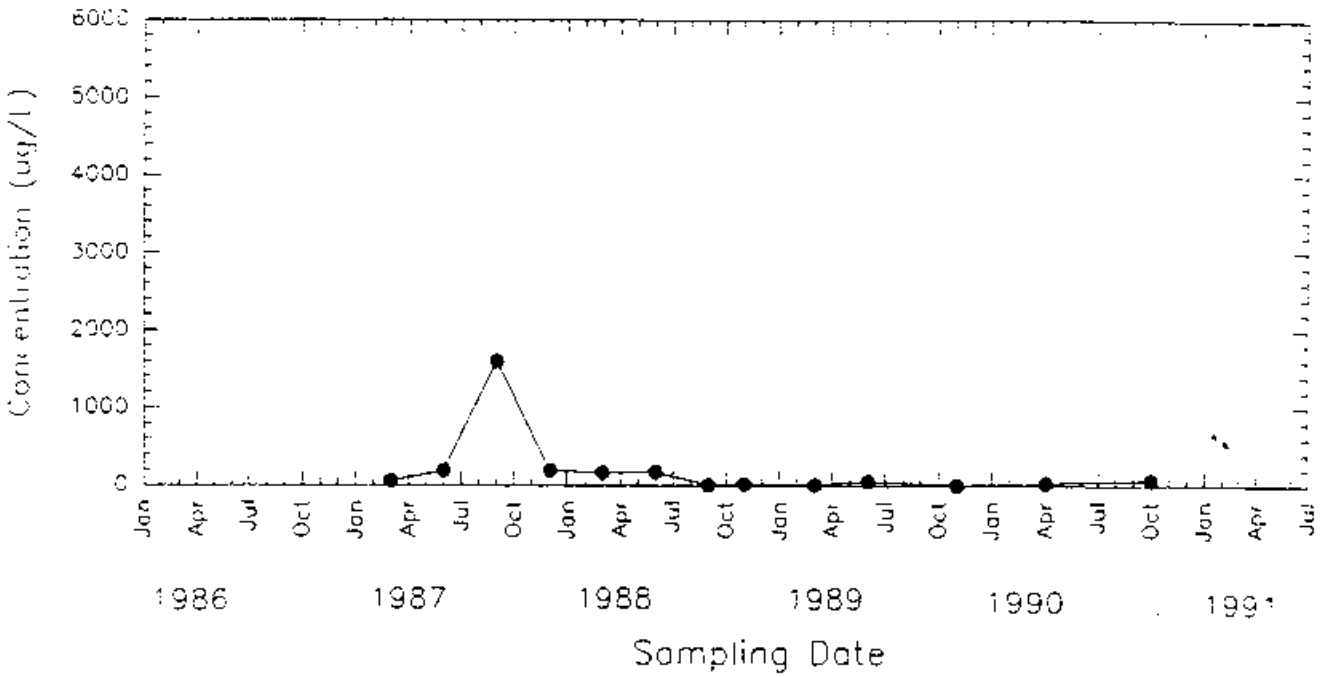
Scale Reflects long term fluctuations, refer to specific tables for specific values

FIGURE 4-102

Benzene Concentrations for Ultramar Monitoring Well

ULT-MW-8 Aquifer # 1

EPA Method 602



Source: Ultramar Station 751 Groundwater Sampling Report, First Quarter 1991

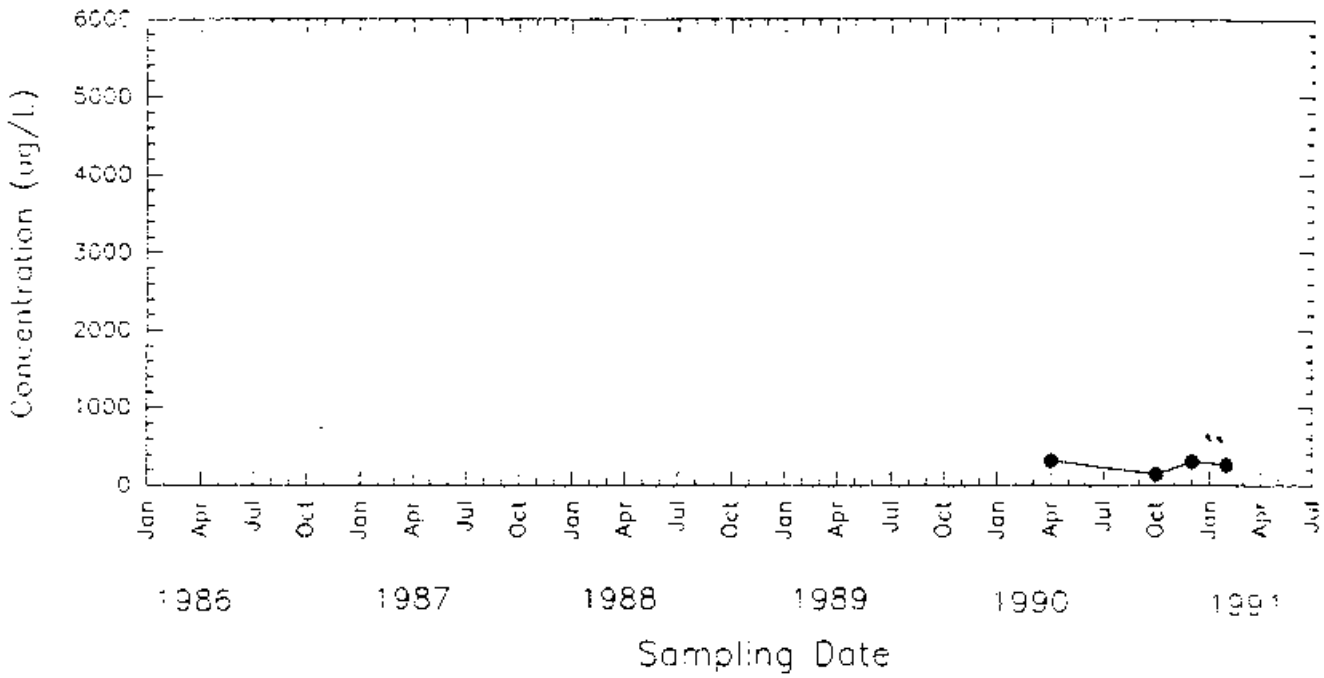
Scale Reflects long term fluctuations, refer to specific tables for specific values

FIGURE 4-103

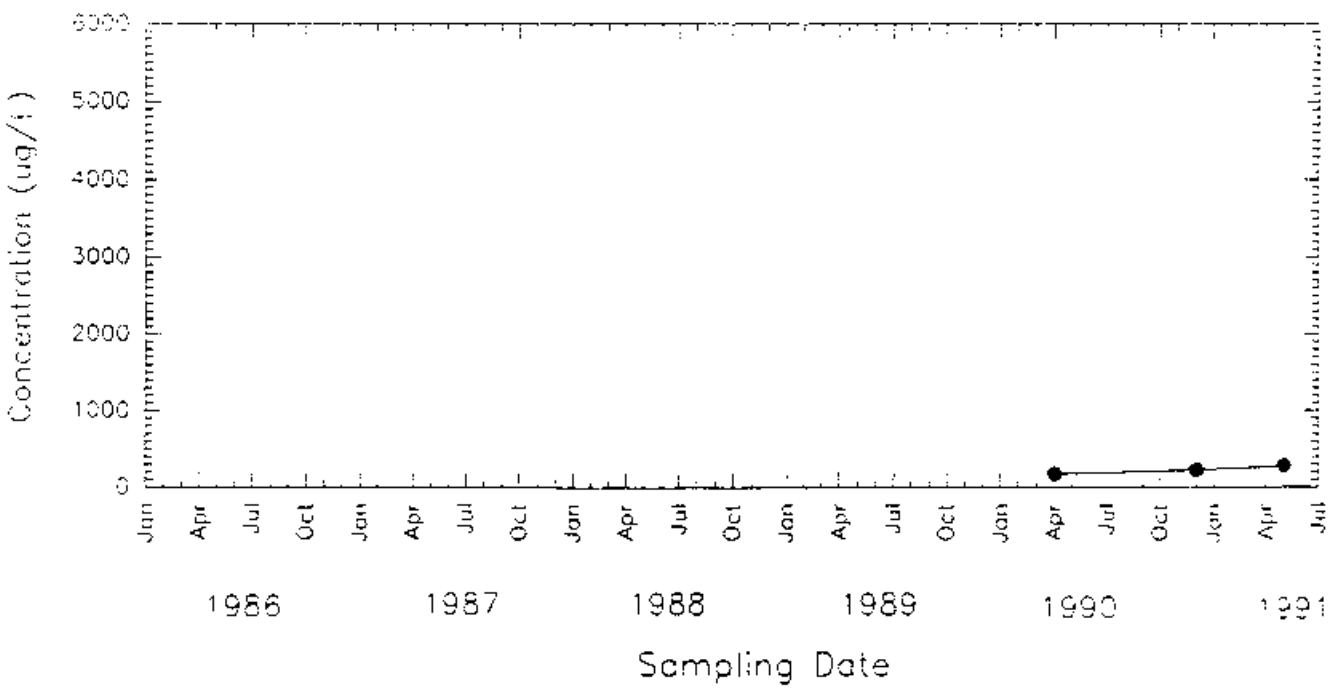
Benzene Concentrations for Ultramar Monitoring Well

ULTM-MW-9 Aquifer # 1

EPA Method 602



EPA Method 624

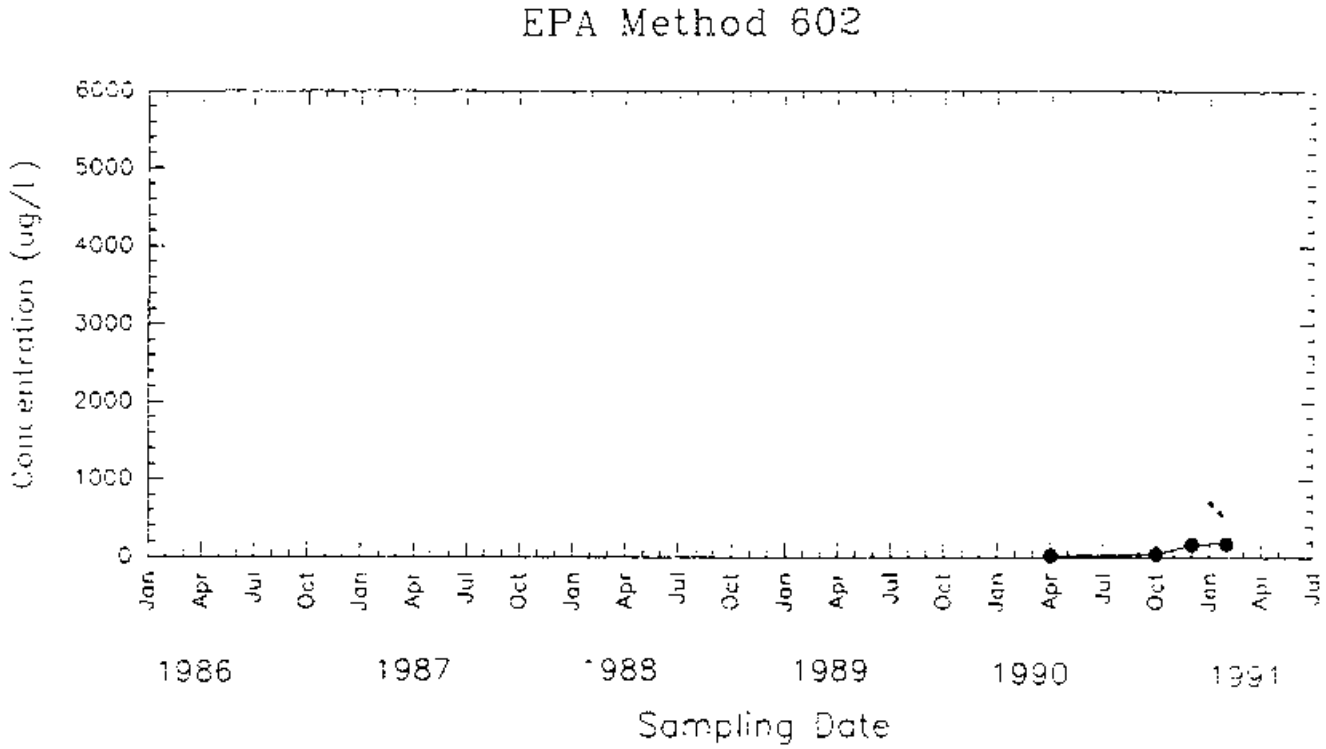


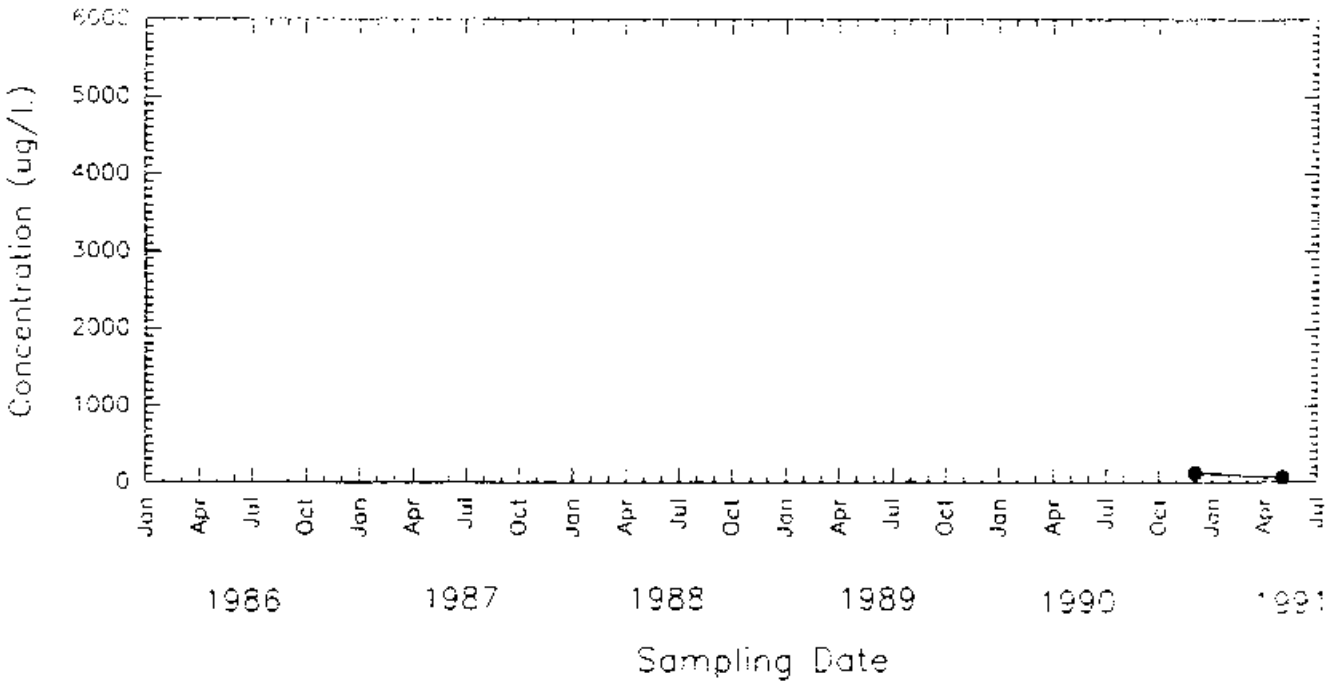
Source: Ultramar Station 751 Groundwater Sampling Report, First Quarter 1991

Scale Reflects long term fluctuations, refer to specific tables for specific values

FIGURE 4-104

Benzene Concentrations for Ultramar Monitoring Well ULTM-MW-10 Aquifer # 1



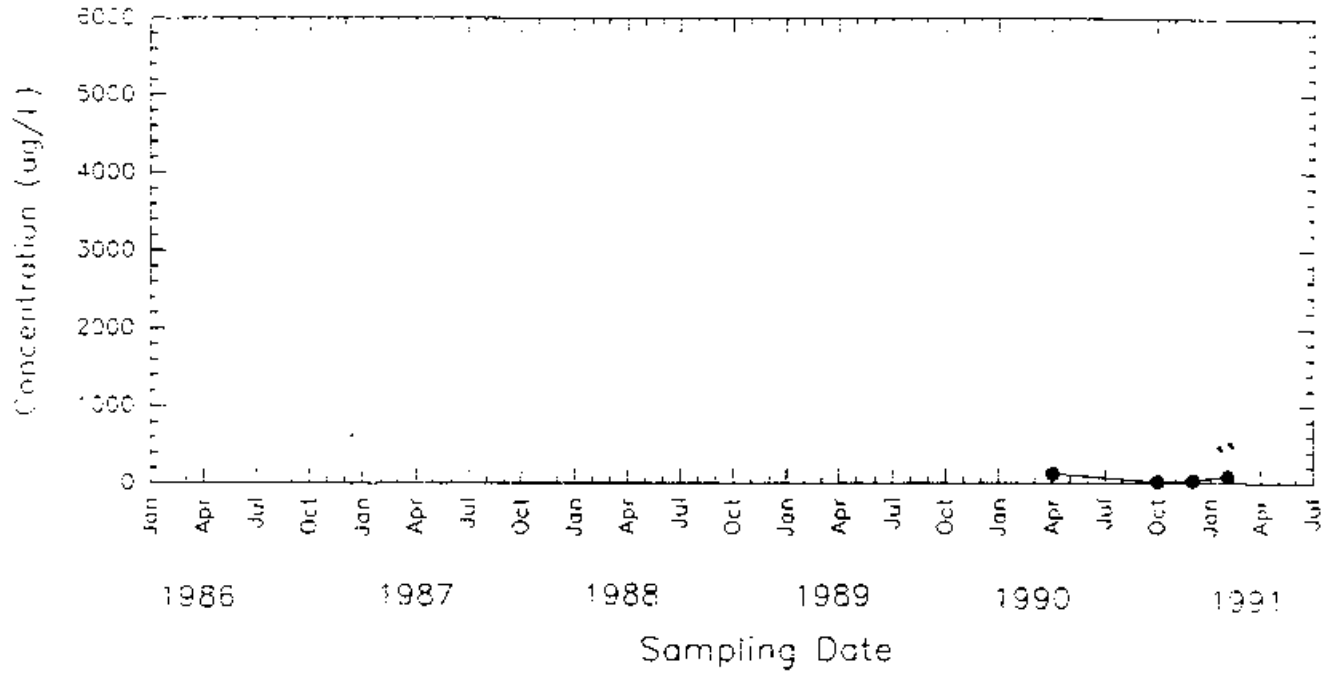


Source: Ultramar Station 761 Groundwater Sampling Report, First Quarter 1991
Scale Reflects long term fluctuations. refer to specific tables for specfic values

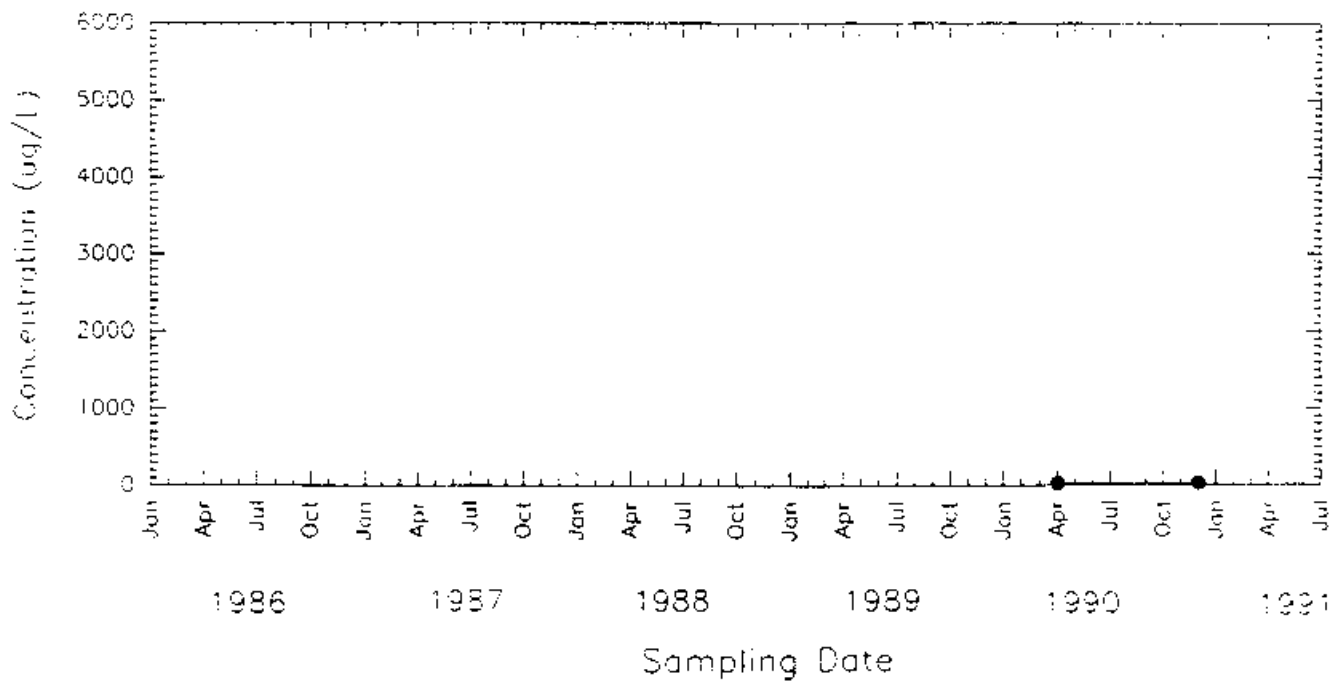
FIGURE 4-105

Benzene Concentrations for Ultramar Monitoring Well ULTM-MW-11 Aquifer # 1

EPA Method 602



EPA Method 624



Source: Ultramar Station 751 Groundwater Sampling Report, First Quarter 1991
Scale Reflects long term fluctuations, refer to specific tables for specific values

4.2.8.1 Perched Zone

The perched zone water is very limited in horizontal distribution, occurring in scattered spots above the shallow fine-grained unit. The only well completed in perched groundwater which is not dry is MW-10P. This well shows hydrocarbon-impacted water, but there is so little water in this zone that during the September/October 1990 sampling event, the well was bailed dry after only 4 gallons were removed.

4.2.8.2 Aquifer 1

The only groundwater impacted to any degree by petroleum hydrocarbons on the facility has been observed in this unconfined water table aquifer. As discussed in a previous section, two distinct plumes of benzene appear to be present in the groundwater. Plates 4-4 through 4-6 present interpretations of the benzene plumes based on the sampling events conducted in September/October 1990, January 1991, and May 1991. To overcome the fact that a number of wells on facility are dry due to falling water levels, it may also be useful to look at averages of benzene concentrations over the period of 1987 to 1990 (after removal of contaminated waste). Each well location has different numbers of benzene analysis during that period, but a reasonably coherent picture emerges. Table 4-72 shows the number of analyses averaged and the time covered for each well.

Plate 4-7 gives a picture based on the time-averaged concentrations of the two benzene plumes in Aquifer 1, one in the vicinity of the main waste pit and the other in the southwestern portion of the facility. Both plumes appear to extend offsite to the west and each is seen to be better delineated after sampling and analysis of Phase II wells.

The MWP plume is apparently of much smaller extent than the southern plume. The horizontal boundaries are more restricted and the saturated thickness of the aquifer (see Plate 3-7 on Aquifer 1 saturated thickness) is much less as it pinches down to the north.

The southern plume is larger and more complicated. The southwesterly boundary is mingled with the plume from the Ultramar service station. It may not be possible to distinguish how much of this joint plume is due to which source.

TABLE 4-72

Average Benzene Concentrations for Aquifer 1 Monitoring Wells 1987-1990

Monitoring Well Designation	Average Benzene Concentrations (ppb)	Number of Data Points Used for Average	Time of Sampling
MW-1	5	1	05/21/87
MW-2	468	11	05/21/87 to 08/10/89
MW-3	141	11	05/21/87 to 08/10/89
MW-4	< 1	8	05/21/87 to 02/18/90
MW-6	252	13	05/21/87 to 09/30/90
MW-7	198	11	05/21/87 to 08/10/89
MW-8	279	13	05/21/87 to 09/30/90
MW-9	27	12	05/21/87 to 02/18/90
MW-11	< 1	3	05/21/87 to 02/18/90
MW-12	1	8	05/21/87 to 08/10/89
MW-14	44	9	05/21/87 to 08/10/89
MW-15	4	6	05/21/87 to 11/15/88
MW-17/ MW-26 [a]	1,263	10	02/16/88 to 08/10/89 08/28/90 to 09/25/90
MW-18	< 1	1	09/26/90
MW-19	540	1	09/26/90
MW-20	5	1	09/25/90
MW-21	< 1	1	09/26/90
MW-22S	< 1	2	08/29/90 to 09/27/90
MW-25S	< 1	2	08/30/90 to 09/28/90
P-2	1,535	11	05/21/87 to 02/18/90

Note: Benzene values reported as less than the MCL (1 ppb) were calculated as zero data points. Values reported as less than 5 ppb were not included as members of the data set since it cannot be determined if their value would be greater than or less than the MCL.

[a] Monitoring wells 17 and 26 are located adjacent to each other and have been sampled sequentially; therefore, benzene concentrations for these two wells were averaged together.

It is important to note the historical trend in benzene concentrations indicated by these three plume maps. First, concentrations in the 1990 and 1991 samplings are much lower than the average plume plots prior to those times. In particular, the peak values in each plume can be seen to drop from over 1,000 ppb to less than 100 in the MWP plume and less than 300 in the southern plume.

4.2.8.3 Aquifer 2

In this confined aquifer during the 1990 samplings, only the most southerly of the wells (MW-25D) showed the presence of petroleum hydrocarbons. However, due to the unexpected existence of this separate aquifer, coverage of the facility and probable petroleum hydrocarbon-impacted areas with wells screened in Aquifer 2 were inadequate to define the presence of chemical constituents in that aquifer. Three additional wells were installed in Phase II in December 1990 to supplement the data. The addition of these new wells in Phase II support the belief of limited petroleum hydrocarbon impact in Aquifer 2. Plates 4-1 through 4-3 present benzene results for Aquifer 2 sampling events conducted in September/October 1990, January 1991 and May 1991.

4.3 Surface Soil Chemical Analysis Results

4.3.1 Results of Surface Soil Chemical Analysis

Final laboratory results for the chemical analyses of all 36 surface soil samples collected are summarized in Tables 4-73 through 4-75.

All laboratory analyses were performed by Enseco-CRL in West Sacramento, California. However, duplicate metal analyses were inadvertently conducted on eight of the soil samples by Enseco-CRL in Garden Grove, California. These results are shown in parentheses in the tables. Additionally, the laboratory reported exceeding organic holding times for 16 of the soil samples. These locations were resampled. The replacement sample results are presented in the tables next to the original samples, and identified by a "90" added to the original sample ID number. All the data has been validated and flagged as appropriate according to the EPA Functional Guidelines.

TABLE 4-73
Surface Soil Sample Laboratory Results - Areas of No Past Activity - Background

Analytical Methods/ Constituents		Abbreviated Sample Number ("grid number" - "sample location")									
		2-BG1	8-BG1	9-BG1	13-BG1	20-BG1	36-BG1	41-BG1	42-BG1	43-BG1	47-BG1
Metals (mg/kg)											
7061	Arsenic	2.0	4.4	1.1	3.1	3.2	3.9 (4.4)	5.3 (4.8)	12.9	6.8	6.0
6010	Barium	112	132	101	109	155	222 (256)	206 (170)	334	251	108
6010	Cadmium	< .58	5.1	2.9	2.8	3.5	2.5 (1.5)	6.7 (4.7)	4.7	5.0	3.4
6010	Chromium	10.4 J	18.7	16.7 J	20.3	27.5 J	40.9 (19.6)	40.0 (15.1)	44.3	22.9 J	25.3 J
6010	Lead	5.4	54.5	17.8	56.0	33.3	761 (1330)	13.2 (8.5)	4290	3.2	5.4
6010	Copper	28.5	40.1	15.9	19.4	20.7	32.0 (15.5)	37.5 (22.0)	114	18.4	11.0
6010	Nickel	11.7	29.4	27.9	30.2	39.6	44.4 (32.3)	68.6 (40.9)	64.3	60.2	40.0
6010	Vanadium	19.4	45.6	36.1	41.3	65.5	103 (65.4)	93.5 (39.0)	126	76.8	53.7
	Org. Lead	< 1.0	< 1	< 1	< 1	< 1	3.3	< 1	108	< 1	< 1
7196	Hex. Chrome	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5

< value = Not detected at method reporting limit
( ) = Duplicate values
J = Estimated

TABLE 4-73 (cont.)
Surface Soil Sample Laboratory Results - Areas of No Past Activity - Background

Analytical Methods/ Constituents	Abbreviated Sample Number ("grid number" - "sample location")											
	2-BG1	6-BG1	6-BG901	9-BG1	13-BG1	13-BG901	20-BG1	36-BG1	41-BG1	42-BG1	43-BG1	47-BG1
Volatiles CLP (µg/kg)												
Methylene Chloride	4.0 J	37 J	2.7 UJ	34 J	160 J	7.8 U	8.7 J	25 U	14 U	73 J	2.0 J	13 J
Acetone	9.6 R	71 J	31	41 R	53 J	58	17 R	53 J	28 U	80 J	< 10 R	5.5 R
2-Butanone (MEK)	< 10 UJ	< 10	< 10 UJ	< 10 UJ	< 10 UJ	18 J	< 10 UJ	14	< 10	< 10 J	< 10 UJ	< 10 UJ
1,1,1-Trichloroethane	< 5	< 5	< 5	< 5	< 5 UJ	1.5 J	< 5	14	1.6 J	1.8 J	< 5	< 5
Trichloroethene	< 5	< 5	< 5	< 5	< 5 UJ	< 5	< 5	1.8 J	1.5 J	< 5 UJ	< 5	< 5
Benzene	< 5	1.6 J	< 5	10	2.0 J	< 5	1.6 J	2.1 J	1.2 J	16 J	1.5 J	3.9 J
Toluene	11	110 J	< 5	160	130 J	6.7	15	76	43	190 J	32	66
Ethylbenzene	< 5	< 5	< 5	2.7 J	< 5 UJ	< 5	< 5	3.6 J	3.7 J	< 5 UJ	< 5	< 5
Xylenes	4.2 J	1.7 J	< 5 UJ	15	< 5 UJ	1.1 J	1.3 J	14	13	7.9 J	5.5	6.7
Tetrachloroethene	< 5	< 5	< 5	3.7 J	< 5 UJ	< 5	< 5	< 5	< 5	2.0 J	1.4 J	1.2 J
Vinyl Acetate	< 10 UJ	< 10	< 10	< 10 UJ	< 10 UJ	< 10	< 10 UJ	< 10	< 10	33 J	< 10 UJ	< 10 UJ
2-Hexanone	< 10 UJ	< 10	< 10	< 10 UJ	< 10 UJ	< 10	< 10 UJ	< 10	< 10	4.9 J	< 10 UJ	< 10 UJ
Chlorobenzene	< 5	< 5	< 5	< 5	< 5 UJ	< 5	< 5	< 5	< 5	1.4 J	< 5	< 5
TIC	0	0	0	27	6.1	0	85	0	8.8	84	17	51
Semivolatiles CLP (µg/kg)												
Dimethyl phthalate	< 230	< 330	--	< 660	< 330	--	< 330	< 1600	< 330	< 20000	< 330	< 160 J
Phenanthrene	< 330	67 J	--	< 660	< 330	--	< 330	< 1600	< 330	< 20000	< 330	< 330
Chrysene	< 330	50 J	--	< 660	< 330	--	< 330	180 J	< 330	< 20000	< 330	< 330
bis(2-Ethylhexyl)-phthalate	34 J	400	--	< 660	< 330	--	< 330	< 1600	< 330	< 20000	< 330	73 J
TIC	53000	2400	--	10000	6300	--	94000	4900	6300	21000	40000	13000
EPA 504 Modified (µg/kg)												
EDB	< 5	< 5	--	< 5	< 5	--	< 5	< 5	< 5	< 5	< 5	< 5

< Value = Not detected at method reporting limit. Reporting limit sometimes higher due to matrix interferences.
U = Lab contaminant present at less than 10 times the associated blank concentration.
J = Estimated UJ = Estimated nondetect R = Unusable TIC = Highest Tentatively Identified Compound concentration

TABLE 4-74

Surface Soil Sample Laboratory Results
Areas of Suspected Past Activity

Analytical Methods/ Constituents		Abbreviated Sample Number ('grid number' - 'sample location')													
		WAXP-1	5-SU1	11-SU1	11-SU1-D	16-SU1	21-SU1	23-SU1	26-SU1	30-SU1	32-SU1	33-SU1	39-SU1	39-SU1-D	46-SU1
Metals (mg/kg)															
7061	Arsenic	6.6	5.0 (4.8)	14.4	11.8	3.4 (3.1)	3.4 (2.9)	12.3	6.1 (5.5)	4.5	2.9	18.0	7.2	9.0	5.5
6010	Barium	227	162 (126)	432	417	139 (94)	220 (117)	532	129 (102)	133	224	294	195	195	290
6010	Cadmium	6.2	3.2 (2.9)	6.2	5.4	3.6 (3.0)	7.5 (3.3)	5.8	2.0 (2.0)	4.3	1.8	3.8	7.4	8.2	4.7
6010	Chromium	48.0	23.6 (13.4)	35.5	29.0	22.0 (10.0)	48.8 (9.7)	20.8	21.3 (10.1)	26.4	15.6	53.6	28.8 J	29.0 J	26.1 J
6010	Lead	363	180 (14.9)	315	234	181 (107)	224 (12.1)	36.4	6.1 (ND)	516	95.4	286	49.0	51.8	68.3
6010	Copper	68.6	16.3 (14.3)	32.3	26.0	15.8 (9.7)	33.4 (9.7)	21.4	15.0 (9.6)	34.9	20.2	307	36.9	36.6	25.2
6010	Nickel	49.4	35.3 (51.0)	51.8	44.6	38.9 (23.6)	70.7 (27.6)	38.4	50.4 (39.1)	43.4	14.1	52.0	63.5	59.7	58.9
6010	Vanadium	135	61.8 (53.7)	91.0	73.9	59.0 (28.0)	130 (29.7)	58.2	55.2 (37.8)	78.2	34.1	75.9	85.4	83.2	83.4
	Org. Lead	2.7	< 1	1.3	1.7	< 1	< 1	< 1	< 1	46.7	< 1	73.1	< 1	< 1	< 1
7196	Hex. Chrome	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5

< Value = Not detected at method reporting limit
( ) = Duplicate values
J = Estimated

TABLE 4-74 (cont.)
Surface Soil Sample Laboratory Results - Areas of Suspected Past Activity

Analytical Methods/ Constituents	Abbreviated Sample Number ("grid number" - "sample location")											
	WAXP-1	WAXP-901	S-SU1	11-SU1	11-SU901	11-SU1-D	11-SU901-D	16-SU1	21-SU1	23-SU1	23-SU901	26-SU1
Volatiles CLP (µg/kg)												
Methylene Chloride	32 J	8.5	16	83 J	5.5	230 U	3.8 J	18	13	83	18	19
Acetone	89 J	22 J	20	100 J	< 10 R	190 J	< 10 R	34 U	< 10	77 J	19 J	14 U
1,1,1-Trichloroethane	2.5 UJ	< 5	1.7 J	< 5 UJ	< 5	< 25 UJ	< 5	3.6 J	< 5	< 5 UJ	< 5	5.7
Toluene	3.5 J	3.5 J	22	210 J	1.0 J	900 J	1.7 J	36	14	150 J	1.6 J	26
Xylenes	2.1 J	< 5	< 5	5.6 J	< 5	14 J	< 5	1.3 J	< 5	1.2 J	< 5	< 5
2-Butanone (MEK)	27 J	< 10 UJ	< 10	24 J	< 10 UJ	63 J	< 10 UJ	< 10	< 10	< 10 UJ	< 10 UJ	< 10
Benzene	< 5 UJ	< 5	< 5	4.3 J	< 5	12 J	< 5	< 5	< 5	1.3 J	< 5	< 5
Ethylbenzene	< 5 UJ	< 5	< 5	1.3 J	< 5	< 25 UJ	< 5	< 5	< 5	< 5 UJ	< 5	< 5
TIC	0	0	5	11	0	0	0	0	0	6.1	7.5	11
Semivolatiles CLP (µg/kg)												
Phenanthrene	< 3300	--	< 660	160 J	--	360 J	--	< 660	< 660	< 2600	--	< 1600
Pyrene	< 3300	--	< 660	210 J	--	370 J	--	< 660	< 660	< 2600	--	< 1600
Benzo(a)anthracene	< 3300	--	< 660	< 1300	--	300 J	--	< 660	< 660	< 2600	--	< 1600
Chrysene	< 3300	--	< 660	740 J	--	900 J	--	< 660	< 660	520 J	--	< 1600
Benzo(b)fluoranthene	< 3300	--	< 660	< 1300	--	440 J	--	< 660	< 660	< 2600	--	< 1600
TIC	5700	--	2000	7900	--	4600	--	1200	2800	3800	--	20000
EPA 504 Modified (µg/kg)												
EDB	< 5	--	< 5	< 5	--	< 5	--	< 5	< 5	< 5	--	< 5

< Value = Not detected at method reporting limit. Reporting limit sometimes higher due to matrix interferences.
U = Lab contaminant present at less than 10 times the associated blank concentration.
J = Estimated UJ = Estimated nondetect R = Unusable TIC = Highest Tentatively Identified Compound concentration

Table 4-74 (cont.)
Surface Soil Sample Laboratory Results - Areas of Suspected Past Activity

Analytical Methods/ Constituents	Abbreviated Sample Number ('grid number' - 'sample location')								
	30-SU1	30-SU901	32-SU1	32-SU901	33-SU1	33-SU901	39-SU1	39-SU1-D	46-SU1
Volatiles CLP (µg/kg)									
Methylene Chloride	75 U	6.1 U	32 U	1.7 J	170 J	4.3 J	140 J	87 U	25 U
Acetone	200 J	87	21 J	2.7 J	65 J	30 J	450 R	240 J	49 U
Toluene	490 J	3.8 J	56 J	< 5	180 J	2.1 J	550	180	180
Xylenes	5.8 J	< 5 UJ	1.6 J	< 5	2.4 J	< 5	< 25	16	15
2-Butanone (MEK)	< 50 UJ	36 J	< 10 UJ	< 10 UJ	< 10 UJ	< 10 UJ	< 50 UJ	36 J	< 25
Benzene	5.1 J	< 5	< 5 UJ	< 5	4.4 J	< 5	20 J	23	11 J
Ethylbenzene	< 25 UJ	< 5	< 5 UJ	< 5	< 5 UJ	< 5	< 25	3.7 J	< 12
Vinyl Acetate	< 50 UJ	< 10	< 10 UJ	< 10	< 10 UJ	< 10	< 50 UJ	110	< 25
Tetrachloroethene	< 25 UJ	< 5	< 5 UJ	< 5	< 5 UJ	< 5	< 25	3.7 J	4.2 J
TIC	0	37	11	0	12	16	1800	750	0
Semivolatiles CLP (µg/kg)									
Phenanthrene	< 2600	--	61 J	--	430 J	--	< 3300	< 660	< 1600
Pyrene	< 2600	--	< 330	--	530 J	--	< 330	< 660	< 1600
Chrysene	< 2600	--	130 J	--	< 3300	--	< 3300	150 J	< 1600
bis(2-Ethylhexyl)-phthalate	< 2600	--	34 J	--	350 J	--	< 3300	< 660	< 1600
Benzo(b)fluoranthene	< 2600	--	35 J	--	< 3300	--	< 3300	< 660	< 1600
Benzo(a)pyrene	< 2600	--	37 J	--	< 3300	--	< 3300	< 660	< 1600
Indeno(1,2,3-cd)pyrene	< 2600	--	< 330	--	330 J	--	< 3300	< 660	< 1600
Benzo(g,h,i)perylene	< 2600	--	< 330	--	360 J	--	< 3300	< 660	< 1600
TIC	7700	--	900	--	5900	--	18000	13000	10000
EPA 504 Modified (µg/kg)									
EDB	< 5	--	< 5	--	< 5	--	< 5	< 5	< 5

< Value = Not detected at method reporting limit. Reporting limit sometimes higher due to matrix interferences.
U = Lab contaminent present at less than 10 times the associated blank concentration.
J = Estimated UJ = Estimated nondetect R = Unusable TIC = Highest Tentatively Identified Compound concentration

TABLE 4-75

Surface Soil Sample Laboratory Results for Metals
Known Waste Disposal Areas

Analytical Methods/ Constituents		Abbreviated Sample Number ("grid number" - "sample location")									
		MWP-1	MWP-2	1-KN1	1-KN901	6-KN1	6-KN901	6-KN1-D	6-KN901-D	19-KN1	19-KN901
Metals (mg/kg)											
7061	Arsenic	4.5	6.0	6.4	--	4.1	--	2.8	--	7.2	--
6010	Barium	189	200	243	--	144	--	161	--	258	--
6010	Cadmium	5.7	7.4	6.4	--	4.6	--	2.8	--	7.0	--
6010	Chromium	45.7	47.4	27.0	--	35.9	--	18.2	--	36.4	--
6010	Lead	54.7	302	88.0	--	11.8	--	57.1	--	48.8	--
6010	Copper	36.1	38.8	28.3	--	26.4	--	18.1	--	27.6	--
6010	Nickel	54.2	47.1	52.6	--	51.0	--	22.9	--	70.7	--
6010	Vanadium	125	135	93.4	--	93.1	--	39.2	--	132	--
	Org. Lead	< 1	< 1	< 1	<1	< 1	< 1	< 1	< 1	< 1	< 1
7196	Hex. Chrome	< 5	< 5	< 5	--	< 5	--	< 5	--	< 5	--

< Value = Not detected at method reporting limit.
( ) = Duplicate value

TABLE 4-75 (cont.)

Surface Soil Sample Laboratory Results
Known Waste Disposal Areas

Analytical Methods/ Constituents	Abbreviated Sample Number ("grid number" - "sample location")										
	MWP-1	MWP-901	MWP-2	MWP-902	1-KN1	1-KN901	6-KN1	6-KN901	6-KN1-D	6-KN901-D	19-KN1
Volatiles CLP (µg/kg)											
Methylene Chloride	17 J	< 5	13 J	1.6 UJ	7.2	--	9.9	--	9.5	--	7.5
Acetone	45 J	< 10	24 J	20	6.0 J	--	20 R	--	6.7 R	--	12 R
2-Butanone (MEK)	< 10 UJ	< 10 UJ	< 10 UJ	< 10 UJ	12	--	82 J	--	23 J	--	40 J
Trichloroethene	1.9 J	< 5	1.2 J	< 5	< 5	--	< 5	--	< 5	--	< 5
Toluene	32 J	< 5	21 J	< 5	51	--	190	--	31	--	150
Ethylbenzene	< 5 UJ	< 5	< 5 UJ	< 5	< 5	--	7.7	--	< 5	--	< 5
Xylenes	1.4 J	< 5 UJ	1.3 J	< 5 UJ	2.0 J	--	29	--	1.9 J	--	< 5
TIC	0	6.7	0	5.9	0	--	52	--	0	--	0
Semivolatiles CLP (µg/kg)											
2-Methylnaphthalene	< 3300	--	< 3300	--	51 J	< 330	< 330	< 660	< 330	< 1300	< 330
Phenanthrene	< 3300	--	< 3300	--	59 J	< 330	75 J	< 660	76 J	< 1300	< 330
Pyrene	< 3300	--	330 J	--	< 330	< 330	44 J	88 J	59 J	250 J	< 330
Benzo(a)anthracene	< 3300	--	< 3300	--	< 330	< 330	< 330	< 660	60 J	< 1300	< 330
Chrysene	760 J	--	2400 J	--	< 330	< 330	330 J	360 J	< 330	800 J	< 330
bis(2-Ethylhexyl)-phthalate	< 3300	--	< 3300	--	< 3300	49 J	< 330	< 660	890	< 1300	< 330
Benzo(a)pyrene	3300	--	< 3300	--	< 330	< 330	< 330	100 J	< 330	< 1300	< 330
TIC	6300	--	6300	--	1700	10000	1500	71000	16000	53000	1800
EPA 504 Modified (µg/kg)											
EDB	<5	--	< 5	--	< 5	< 5	< 5	< 5	< 5	< 5	< 5

< Value = Not detected at method reporting limit. Reporting limit sometimes higher due to matrix interferences.
U = Lab contaminant present at less than 10 times the associated blank concentration.
J = Estimated UJ = Estimated non-detect R = Unusable TIC = Highest Tentatively Identified Compound concentration

TABLE 4-75 (cont.)

Surface Soil Sample Laboratory Results for Metals
Known Waste Disposal Areas

Analytical Methods/ Constituents		Abbreviated Sample Number ("grid number" - "sample location")									
		24-KN1	24-KN901	24-KN2	24-KN2-D	31-KN1	31-KN901	34-KN1	34-KN901	49-KN1	49-KN901
Metals (mg/kg)											
7061	Arsenic	6.7	--	5.7 (4.1)	3.4 (3.8)	3.8	--	4.4	--	5.7	--
6010	Barium	220	--	118 (85.7)	116 (88.6)	169	--	238	--	176	--
6010	Cadmium	5.4	--	1.9 (1.7)	1.9 (2.4)	4.4	--	5.1	--	4.1	--
6010	Chromium	30.9	--	45.8 (26.9)	48.7 (25.5)	29.5	--	37.1	--	31.1	--
6010	Lead	68.9	--	4.6 (ND)	4.2 (ND)	344	--	14.4	--	19.6	--
6010	Copper	25.5	--	34.5 (27.3)	35.0 (26.2)	28.8	--	26.7	--	54.5	--
6010	Nickel	53.9	--	65.2 (54.3)	68.6 (57.9)	42.5	--	82.2	--	48.4	--
6010	Vanadium	106	--	110 (82.9)	126 (75.6)	75.9	--	114	--	75.7	--
	Org. Lead	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
7196	Hex. Chrome	< 5	--	< 5	< 5	< 5	--	< 5	--	< 5	--

< Value = Not detected at method reporting limit
( ) = Duplicate value

TABLE 4-75 (cont.)
Surface Soil Sample Laboratory Results
Known Waste Disposal Areas

Analytical Methods/ Constituents	Abbreviated Sample Number ("grid number" - "sample location")										
	19-KN901	24-KN1	24-KN901	24-KN2	24-KN2-D	31-KN1	31-KN901	34-KN1	34-KN901	49-KN1	49-KN901
Volatiles CLP (µg/kg)											
Methylene Chloride	--	8.7	--	4.9 U	4.3 U	19	--	15 J	--	22	--
Acetone	--	11	--	32 U	73 J	77	--	36 J	--	3.7 U	--
2-Butanone (MEK)	--	33	--	< 10	6.0 J	< 10	--	12 J	--	< 10	--
Trichloroethene	--	< 5	--	< 5	< 5	< 5	--	< 5 J	--	< 5	--
Toluene	--	160	--	2.5 J	4.0 J	170	--	89 J	--	270	--
Ethylbenzene	--	< 5	--	< 5	< 5	5.2	--	< 5	--	10	--
Xylenes	--	< 5	--	2.8 J	3.4 J	21	--	< 5 UJ	--	41	--
TIC	--	0	--	0	23	17	--	0	--	88	--
Semivolatiles CLP (µg/kg)											
2-Methylnaphthalene	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330
Phenanthrene	< 330	< 330	110 J	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330
Pyrene	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330
Benzo(a)anthracene	< 330	85 J	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330
Chrysene	< 330	< 330	450	53 J	160 J	< 330	38 J	< 330	< 330	< 330	61 J
bis(2-Ethylhexyl)-phthalate	49 J	< 330	140 J	200 J	250 J	< 330	55 J	< 330	< 330	< 330	< 330
Benzo(b)fluoranthene	< 330	< 330	93 J	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330
Benzo(a)pyrene	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	< 330	250 J
TIC	12000	1900	1700	1300	14000	3300	38000	8300	4200	92000	77000
EPA 504 Modified (µg/kg)											
EDB	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5

< Value = Not detected at method reporting limit. Reporting limit sometimes higher due to matrix interferences.
U = Lab contaminant present at less than 10 times the associated blank concentration.
J = Estimated UJ = Estimated nondetect R = Unusable TIC = Highest Tentatively Identified Compound concentration

4.3.1.1 Chemical Analyses

All surface soil samples were submitted for analysis as stipulated in the Texaco Fillmore QAPP (ENSR Doc 6600-035-130). This included the following analyses:

- Arsenic (CLP EPA 7061)
- Barium, Cadmium, Chromium, Copper, Nickel, and Vanadium (CLP EPA 6010)
- Hexavalent Chromium (CLP EPA 7196)
- Lead (CLP EPA 7421)
- Volatile Organics (CLP EPA 8240)
- Semivolatile Organics (CLP EPA 8270)
- Ethylene Dibromide (EPA 504).

Copies of laboratory reports for these samples were provided in Appendix A of the "Surface Soils RI Report" (ENSR Document No. 6600-047-40) and are not duplicated for this report.

4.3.1.2 Inorganic Analyses (metals)

Except for lead, metal concentrations were found to be consistently at or near normal levels throughout the facility, whether the samples were collected from areas of no known past activity (background), areas of suspected past activity, or known waste disposal areas. Total lead concentrations ranging from 180 mg/kg to 516 mg/kg were detected in eight of the 14 samples from the areas of suspected past activity (Table 4-74), but exceeded 70 mg/kg in only two of the 10 samples from background areas (Table 4073) and two of the 12 samples from known waste disposal areas (Table 4-75). Concentrations of most metals were typically higher than average at two background locations (TF-36-S-BG1-1 and TF-42-S-BG1-1) and three suspected locations (TF-S-WAXP-1-1, TF-11-S-SU1-1, and TF-33-S-SU1-1). Both background samples were taken within grid areas where a tarry substance was observed nearby.

Organic lead was detected in only seven of the 36 soil samples; none of these samples were from known waste disposal areas. There appears to be a fair correlation between the total lead and the organic lead concentrations in the seven soil samples that showed detectable amounts of organic lead. This correlation is particularly obvious in background sample TF-42-S-BG1-1.

Hexavalent chromium was not detected in any of the 36 surface soil samples.

Concentrations of volatile and semivolatile organics were found to be consistently low to below detection limits throughout the facility. Concentrations exceeded 1 ppm for only one analyte in one of the 36 samples analyzed (2.4 ppm chrysene in TF-S-MWP-2-1). However, this value was flagged as estimated during data validation because it was found to be below the detection limit. As with metals, the frequency and concentrations of volatile and semivolatile organics seem to be slightly higher in areas of suspected past activity than in areas of no past activity or the known waste disposal areas.

Four of the volatiles detected (methylene chloride, acetone, 2-butanone, and toluene) are known common laboratory contaminants. Concentrations of less than 5 times the reporting limit for these constituents are considered a potential of laboratory contamination as indicated in the analytical reports. However, toluene has also been identified in other samples and media as being present at the site. The same applies to the semivolatile organic bis(2-ethylhexyl)phthalate, which was detected in seven samples.

The organic compounds detected at the facility are known for traditional use as solvents for waxes, resins or oils, fuel additives, or fumigation. Samples TF-11-S-SU1-1 and TF-11-S-SU1-1-D (former tank area) contained most of the volatile and semivolatile organics. Organics were also found, although to a lesser extent, in samples TF-23-S-SU1-1 (existing tank area), TF-30-S-SU1-1 (former tank area), and TF-39-S-SU1-1 (former refinery area). EDB was not detected in any of the 36 surface soil samples analyzed. Results of all resampled locations were consistently equal to or lower than the original samples.

Analytical results for all the equipment rinsate samples, including those collected during resampling indicated concentrations of metals and organics well below average levels. Therefore, cross-contamination of the samples through the sampling equipment is considered negligible.

4.3.2 Results of Surface Soil Sieve Analysis

The results of the particle size distribution analysis (PM_{10}) are presented in Table 4-76. The percentage of PM_{10} particles in all surface soil samples ranged from 7 percent to 52 percent. These results are provided to assist EPA in conducting the risk assessment.

TABLE 4-76

Surface Soil Sample Sieve Results (PM_{10})
ASTM 422

Areas of No Past Activity - Background												
Sample ID	2-BG1	8-BG1	9-BG1	13-BG1	20-BG1	36-BG1	41-BG1	42-BG1	43-BG1	47-BG1		
PM10 (%w)	7	9	19	31	29	24	34	7	30	9		
Areas of Suspected Past Activity												
Sample ID	WAXP-1	5-SU1	11-SU1	16-SU1	21-SU1	23-SU1	26-SU1	30-SU1	32-SU1	33-SU1	39-SU1	46-SU1
PM10 (%w)	15	22	19	8	9	9	14	19	9	15	52	30
Known Waste Disposal Areas												
Sample ID	MWP-1	MWP-2	1-KN1	6-KN1	19-KN1	24-KN1	24-KN2	31-KN1	34-KN1	49-KN1		
PM10 (%w)	21	16	10	32	20	22	12	33	24	35		

4.3.3 Summary and Conclusions

With few exceptions, the concentrations of metals, VOCs and semivolatile organics found throughout the facility are very low to below method detection limits and well within normal levels.

- Hexavalent chromium was not detected in any of the samples analyzed.
- EDB was not detected in any of the samples analyzed.
- Organic lead was detected in only seven of 44 samples, including resampling.
- Chrysene was detected in the MWP and in pit 6. Pyrene was detected in one sample from the MWP.
- Metal levels were fairly consistent throughout the facility. Lead was high in one background sample.
- Volatile organics were detected in grid areas 30, 36, 42, and at the former refinery area (grid area 39). Smaller amounts of volatile organics were also detected in the former tank area, existing tank area, and in the waste pits.

The significance of the above findings wil be better determined based on the results of the EPA Risk Assessment.

4.4 Soil Gas

A total of 299 soil gas sampling locations in Traverse I and II as shown in Plate 4-8 were sampled by TriHydro during Phase I of a two-phase soil gas survey conducted in August 1990 as part of the RI. Air samples were also collected from five permanent air wells (including one background well) during Phase II of the survey and analyzed by EPA method TO-14 modified to speciate specific volatile organic compounds present in soil gas. These air wells are also shown in Plate 4-8. These locations were not surveyed soil and their positions in the map are only approximate.

Appendix I reproduces the results of the soil gas investigation reported by Tryhidro. TriHydro's Soil Gas RI/FS Investigation Report (previously submitted to EPA and not included in this report) presents these results in detail along with their conclusions and recommendations. The purpose of this section is to incorporate these results into the RI

Report and to evaluate the extent to which they correlate with organic constituents observed in other media.

4.4.1 Summary of Soil Gas Survey Field Sampling Results

Soil gas measurements as ppmv Benzene reported by TriHydro ranged from below the detection limit (0.5) to 2,330 ppmv for Traverse I and from below the detection limit to 3,870 ppmv for Traverse II. The average measurement of soil gas concentrations was 112 ppmv in the traverses and 6.1 ppmv at background locations sampled. The highest concentrations were measured southeast of the Main Waste Pit in Traverse II.

4.4.2 Summary of Air Well Sampling Results

Air samples from the background air well contained trace levels of BTEX, 1,1,1-trichloroethane, 1,2,4-trimethylbenzene, and 1,3,5-trimethylbenzene. Total BTEX concentrations in air samples collected from the other four wells ranged from 3.19 to 153.2 ppb. The highest benzene concentration was detected in air well AW-2 (140 ppb).

Other volatiles identified in air well samples included 4-ethylbenzene, 1,1,1-trichloroethane, 1,2,4-trimethylbenzene, and 1,3,5-trimethylbenzene.

4.4.3 Relationship of Soil Gas Survey Results to Other Media

The primary consideration used to select data to evaluate the relationship of the soil gas measurements to other media results was that samples had to be collected within 20 feet of a soil gas sample locations. This determination was made based on two major reasons:

- There is sufficient evidence in the technical literature which suggests that a significant relationship has been observed between soil gas sample points and soil or groundwater samples analyzed in the laboratory within a distance of five feet, but that this significance drops rather dramatically as this distance increases. (Marks, B.J., and M. Singh. "Comparison of Soil-Gas, Soil, and Groundwater Contaminant Levels of Benzene and Toluene", Hazardous Materials Control. Vol. 3(6):40-46, 1990).

- The soil gas sampling points were typically spaced by TriHydro at 20 feet intervals making this distance an appropriate radiuous of influence for each point.

Based on the above criteria, soil gas measurements were compared to surface and subsurface soil sampling results. Because groundwater at the site is at depths ranging from 60-130 feet below the depth of soil gas measurements, is appears implausible that soil gas measurements would be predictive of VOC levels in groundwater.

Based on the available data, correlations were performed by pairing Phase I soil gas measurements with the following surface and subsurface soil results:

- Total VOC concentrations as determined by EPA 8240 CLP analyses in surface soil samples.
- BTEX only concentrations as determined by EPA 8240 CLP analyses in surface soil samples.
- BTEX only concentrations as determined by EPA 8240 CLP in subsurface soil samples from soil gas boreholes
- TPH concentrations as determined by EPA Method 8015 modified in subsurface soil samples from exploratory and monitoring well boreholes.

In addition, total VOC concentrations detected in samples from the Phase II air wells were compared to the Phase I soil gas measurements, in order to evaluate the correlation between soil gas field measurements and laboratory analyses results.

These relationships were examined quantitatively by calculating correlation coefficients and conducting linear regression analysis. Linear regression analyses, correlation coefficient calculations, and coefficient of determination calculations for data sets were conducted using the calculational procedures outlined in Steel and Torrie (Principles and procedures of statistics. 2nd Edition. McGraw-Hill Publishers, Inc. San Francisco, CA., 1980)

4.4.4 Comparison of Soil Gas Measurements and Surface Soil Sampling Results

The following surface soil samples met the 20 feet distance criteria and were selected for correlation with soil gas measurements:

- TF-5-S-SU-1-1
- TF-6-S-KN-1-1
- TF-11-S-SU-1-1
- TF-S-WAX-P-1-1
- TF-1-S-KN-1-1

Total CLP VOC and BTEX only results were paired with soil gas measurements collected at sample locations within 20 feet of the above samples. Figures 4-106 and 4-107 are scatter plots of these data pairs, developed using CLP-volatiles and CLP-BTEX data, respectively. The coefficient of determination for these comparisons were 0.144 and 0.110, respectively.

4.4.5 Comparison of Soil Gas Measurements and Subsurface Soil Sampling Results

A total of 18 eploration and monitoring well boreholes are located in the region encompassed by the two traverse grids of the Phase I soil gas investigation. Four of these boreholes (SG-BH-1, SG-BH-2, SG-BH-3, SG-BH-4) were specifically drilled in areas of suspected highest soil gas. All soil samples from these boreholes were analyzed by EPA 8240 CLP to characterize the type and concentration of volatile organic compounds present.

All soil samples from the remaining 14 boreholes were analyzed by EPA 8015 for TPH and, for some samples, by EPA Method 8240 CLP. These boreholes include:

- P3-BH-2 and P3-BH-4 from Pit 3
- P4-BH-1, P4-BH-2, P4-BH-3, P4-BH-4, P4-BH-5, P4-BH-6 from Pit 4
- SP-BH-2 from the suspected pit (Pit 9)
- MW-25D, MW-25S, MW-9025

Average TPH and BTEX concentrations were calculated for each borehole using data from soil samples collected within 20 feet of the surface. These data were paired with soil gas measurements collected at sample points within 20 feet of each borehole location.

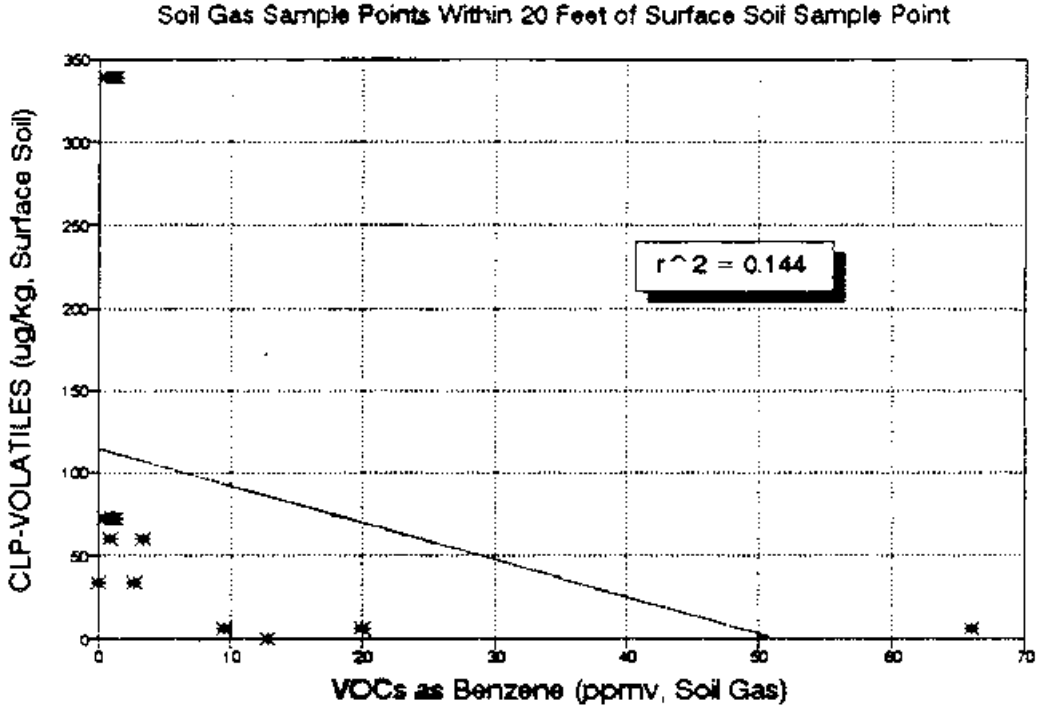
A scatter plot of the soil gas borehole data is presented in Figure 4-108. The coefficient of determination for the comparison of soil gas measurements with average BTEX concentrations in the first 20 feet is 0.134. A scatter plot of the TPH data is presented in Figure 4-109. The coefficient of determination for the comparison of Phase I soil gas measurements with average TPH concentrations in the first 20 feet is 0.004.

4.4.6 Comparison of Soil Gas Measurements and Air Well Sampling Results

Total VOC concentrations from the Phase II air wells (AW-2 to AW-5) were paired with soil gas measurements collected at sample points within 20 feet of each air wells. A scatter plot of the air well VOC data is presented in Figure 4-110. Linear regression suggests that Phase I soil gas measurements are inversely proportional to Phase II air well results. The coefficient

FIGURE 4-106

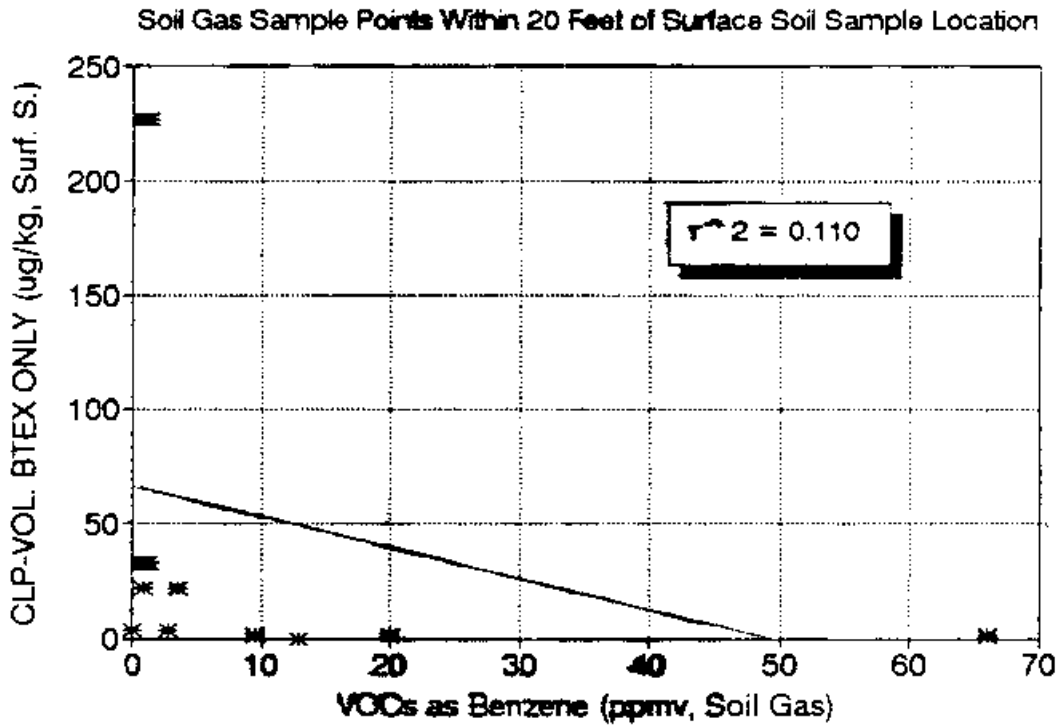
Surface Soil vs. Soil Gas Data
CLP-Volatiles Concentration



Texaco Fillmore Remedial Investigation, June 1991

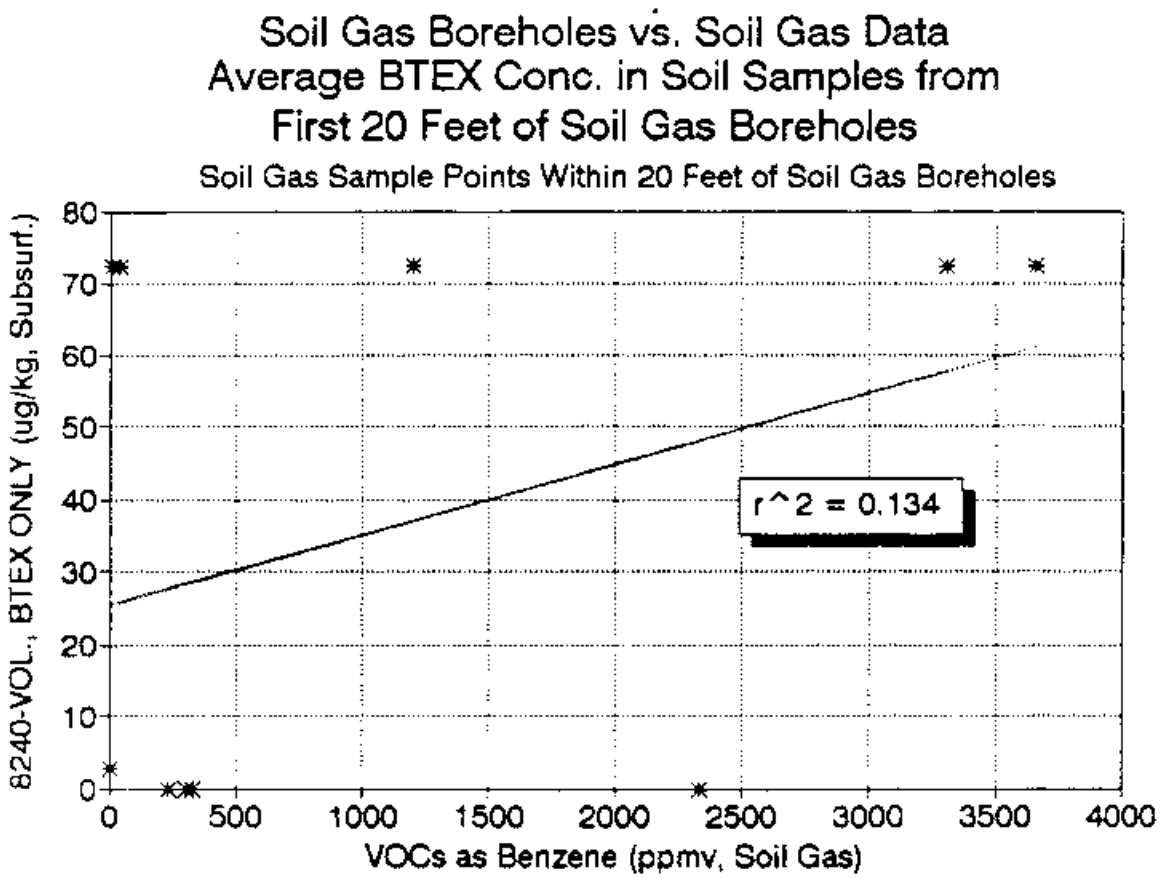
FIGURE 4-107

Surface Soil Vs. Soil Gas Data
CLP-BTEX Conc. vs. VOCs as Benzene



Texaco Fillmore Remedial Investigation, June 1991

FIGURE 4-108

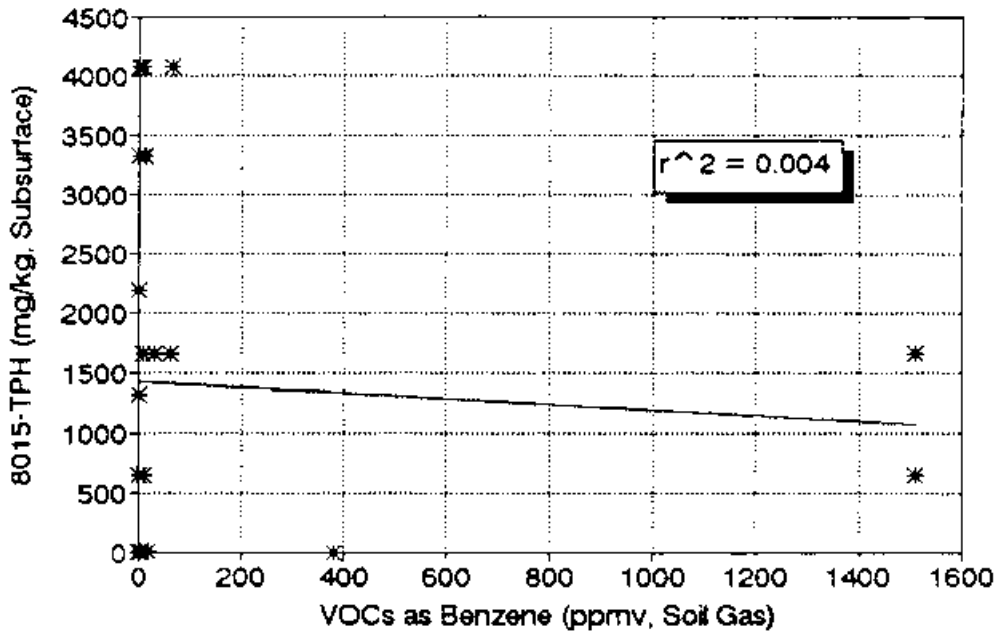


Texaco Fillmore Remedial Investigation, June 1991

FIGURE 4-109

Subsurface Boreholes vs. Soil Gas Data
Avg. TPH Conc., 1ST 20 FT. of Borehole

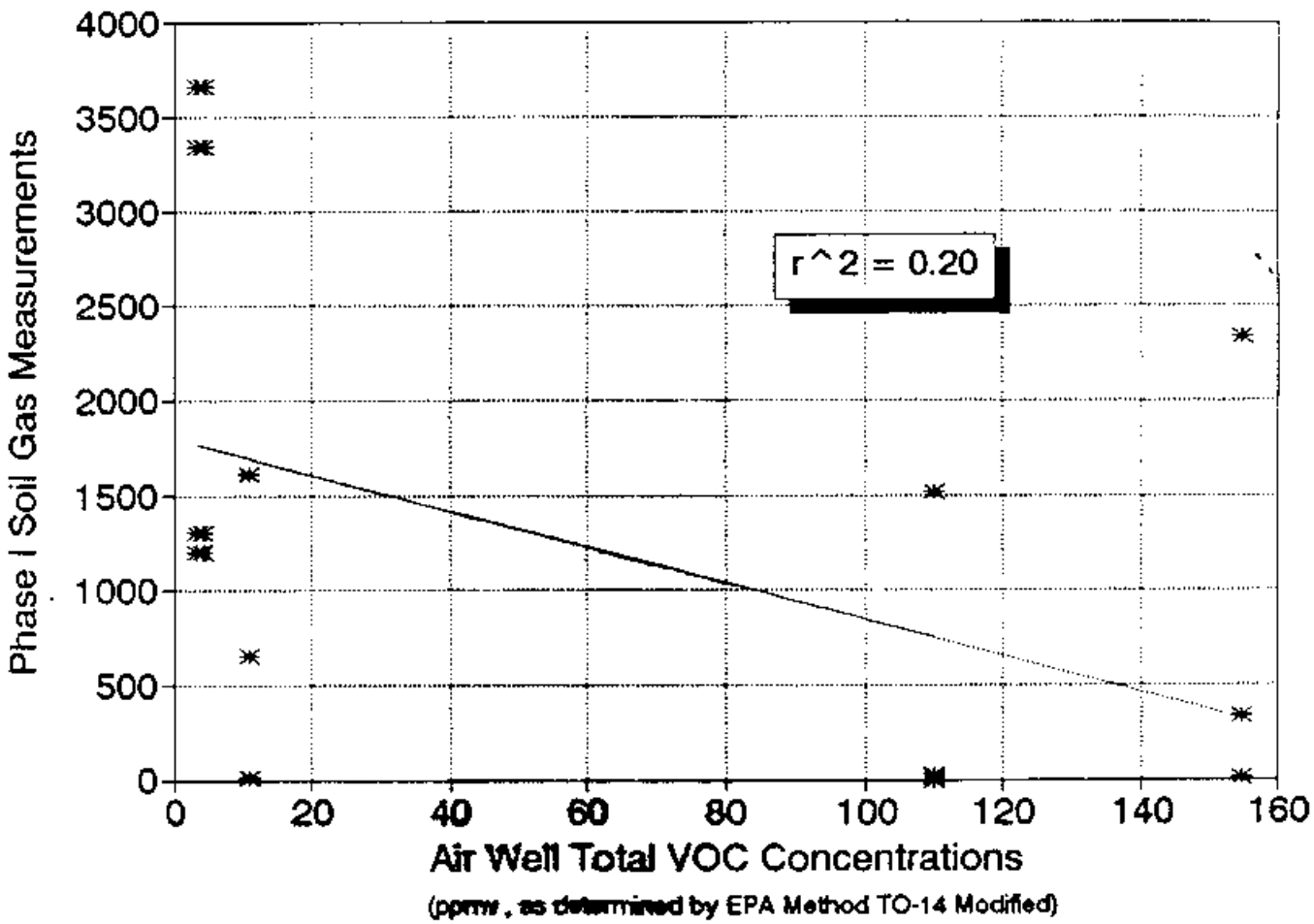
Soil Gas Sample Points Within 20 Feet of Subsurface Boreholes



Texaco Fillmore Remedial Investigation, June 1991

FIGURE 4-110

Relationship Between Phase I Soil Gas Measurements and Phase II Air Well Results



of determination for the comparision of Phase I soil gas measurements and the air well data was 0.20.

4.4.7 Conclusions

Based on the correlation calculations and linear regression analyses presented above, there appears to be no quantitative relationship between soil gas levels detected by Tryhidro in the subsurface environment and concentrations of TPH and VOCs, particularly BTEX, detected in surface and subsurface sample laboratory analyses. Furthermore, no correlation could be established between soil gas field measurements and VOC analyses of soil gas samples in the laboratory.

These results suggest that, although an effective qualitative screening tool to define the extent of soil vapor, soil gas field measurements are not predictive of concentration distributions of petroleum hydrocarbons in soils at the Texaco Facility.

A comparison between the VOCs identified in the soil gas investigation and VOCs identified in other media is presented in Table 4-89 (Section 4.8). Three specific volatiles - 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, and 4-ethyl toluene - detected in the air well samples were not encountered in any other media. 1,1,1-trichloroethane was also encountered in some surface soil samples while BTEX compounds were encountered in all other media.

4.5 Surface Water/Stream Sediments

As discussed in Section 2.2.4, four sediment samples were collected during the RI field work, with two samples collected upstream and two downstream of the facility. In addition, surface water sampling was conducted during a period of heavy rainfall in the latter part of February 1991. Eleven water samples were collected from seven sampling locations along the Pole Creek drainage basin.

4.5.1 Chemical Analysis

All surface water and stream sediment samples were submitted for analysis as stipulated in the Texaco Fillmore QAPP (ENSR Doc 6600-035-130). This included the following analyses:

- Arsenic (CLP EPA 7061)
- Barium, Cadmium, Chromium, Copper, Nickel, and Vanadium (CLP EPA 6010)
- Hexavalent Chromium (CLP EPA 7196)

- Lead (CLP EPA 7421)
- Volatile Organics (CLP EPA 8240)
- Semivolatile Organics (CLP EPA 8270)
- Ethylene Dibromide (EPA 504) (ENSECO method for stream sediment samples)
- pH (EPA 9040) (surface water samples only)

Copies of laboratory reports for the surface water sampling are provided in Appendix A. Laboratory reports for the stream sediment sampling were provided in Appendix A of the "Surface Water and Stream Sediment Remeidal Investigation Report" (ENSR Document No. 6600-047-100) and are not duplicated for this report.

4.5.2 Results of Surface Water Analyses

Surface water analytical results are presented in Table 4-77 and are discussed below.

4.5.2.1 Organic Compounds

None of the laboratory indicator parameters established in the QAPP for the Texaco Fillmore RI were detected in any of the surface water samples analyzed.

Styrene was the only volatile organic compound detected. Styrene was detected at trace levels ranging from 6.0 to 14.0 µg/l in eight of the nine samples analyzed and was not detected only in the upstream sample at location A. Styrene is commonly used to make polymers and copolymers, polystyrene plastics, and rubbers and is not believed to be associated with refinery operations. Styrene was not detected in any of the surface and subsurface soil samples collected and analyzed as part of the Texaco Fillmore RI.

The only semivolatile compound detected was diethylphthalate at an unquantifiable trace level and only in the sample at location G. No other semivolatile organic compounds were detected in any of the samples. Diethylphthalate was also not detected in any of the surface and subsurface soil samples collected and analyzed as part of the Texaco Fillmore RI, and is potentially a laboratory contaminant.

4.5.2.2 Metals

With the exception of total chromium, all of the metals tested were either below detection limits (hexavalent chromium, lead, and cadmium) or of similar concentrations in both the upstream and downstream surface water samples.

TABLE 4-77

Texaco Fillmore RI/FS
Surface Water Analytical Results
Pole Creek - March 2 and 5, 1991

Location		A			B				C	D	E		F				G		
Sample ID No.		TF-C-A1-W-B1	TF-C-A1-W-B1	TF-C-K1-W-B1	TF-C-B1-W-B1	TF-C-I1-W-B1	TF-C-J1-W-B1	TF-C-I1-W-B1	TF-C-C1-W-B1	TF-C-D1-W-B1	TF-C-E1-W-B1	TF-C-E1-W-B1	TF-C-F1-W-B1	TF-C-H1-W-B1	TF-C-F1-W-B1	TF-C-H1-W-B1	TF-C-G1-W-B1	TF-C-G1-W-B1	Trip Blank
Sampling Date		3/2/91	3/5/91	3/5/91	3/2/91	3/2/91	3/5/91	3/5/91	3/2/91	3/2/91	3/2/91	3/5/91	3/2/91	3/2/91	3/5/91	3/5/91	3/2/91	3/5/91	3/2/91
Analytical Method	Compound																		
Metal Analysis (µg/l)																			
EPA 7060	Arsenic	2.4	NA	NA	2.0	2.2	NA	NA	2.2	2.2	2.6	NA	2.1	2.1	NA	NA	1.7	NA	NA
EPA 6010	Barium	229	NA	NA	242	215	NA	NA	227	248	234	NA	234	220	NA	NA	232	NA	NA
EPA 6010	Cadmium	<2.0	NA	NA	<2.0	<2.0	NA	NA	<2.0	<2.0	<2.0	NA	<2.0	<2.0	NA	NA	<2.0	NA	NA
EPA 6010	Chromium (tot.)	<3.0	NA	NA	3.9	6.0	NA	NA	5.0	<3.0	4.3	NA	5.0	3.9	NA	NA	4.3	NA	NA
EPA 7196	Chromium (VI)	NA	<20	<20	NA	NA	<20	<20	NA	NA	NA	<20	NA	NA	<20	<20	NA	<20	NA
EPA 6010	Copper	<3.0	NA	NA	4.8	<3.0	NA	NA	<3.0	6.8	<3.0	NA	<3.0	<3.0	NA	NA	<3.0	NA	NA
EPA 7421	Lead	<5.0	NA	NA	<5.0	<5.0	NA	NA	<5.0	<5.0	<5.0	NA	<5.0	<5.0	NA	NA	<5.0	NA	NA
EPA 6010	Nickel	13.6	NA	NA	15.1	15.1	NA	NA	17.5	18.5	17.0	NA	17.5	16.0	NA	NA	14.6	NA	NA
EPA 6010	Vanadium	6.8	NA	NA	7.7	7.7	NA	NA	8.1	9.5	9.5	NA	9.0	8.3	NA	NA	7.7	NA	NA
Organic Analysis (µg/l)																			
EPA 504	EDB	<0.017	NA	NA	<0.017	<0.017	NA	NA	<0.017	<0.017	<0.017	NA	<.0017	<.0017	NA	NA	<.0017	NA	NA
EPA 8240	Styrene	<1	NA	NA	11	11	NA	NA	11	6	9	NA	12	12	NA	NA	<14	NA	<1
EPA 8240	Other TCL VOCs	<1-<20	NA	NA	<1-<20	<10-<20	NA	NA	<1-<20	<1-<10	<1-<10	NA	<1-<20	<1-<20	NA	NA	<1-<20	NA	<1-<20
EPA 8270	Diethylphthalate	<10	NA	<10	<10	<10	<10	NA	<10	<10	<10	NA	<10	<10	NA	NA	TR	NA	NA
EPA 8270	Other TCL SVOCs	<10-<50	NA	<10-<50	<10-<50	<10-<50	<10-<50	NA	<10-<50	<10-<50	<10-<50	NA	<10-<50	<10-<50	NA	NA	<10-<50	NA	NA
EPA 8270	SVOC TIC	0	NA	0	0	0	8	NA	0	0	0	NA	0	0	NA	NA	0	NA	NA
General Chemistry																			
EPA 9040	pH	8.23	NA	8.21	8.26	8.22	8.26	8.21	8.21	8.24	8.28	NA	8.23	8.20	NA	NA	8.21	NA	NA

NA = Method not run
TIC = Highest Tentatively Identified Compound concentration
TCL = Target Compound List
TR = Trace

Chromium was not detected in the northernmost upstream sampling location A, and the southernmost downstream sampling location D. Chromium was detected at each sampling location between locations A and D at levels slightly above detection limits ranging from 3.9 to 6.0 µg/l.

4.5.3 Results of Stream Sediment Chemical Analyses

Stream sediment sample results are presented in Table 4-78 and discussed below.

4.5.3.1 Organic Compounds

Styrene was detected in the downstream samples at one to two times the detection limit (5.6 and 8.8 µg/kg). These findings are consistent with the surface water sample results. Trichloroethene (TCE) was detected in similar concentrations in the upstream and downstream samples, and may be related to some minor application of TCE upstream of the facility in the residences adjacent to Pole Creek.

Acetone and toluene are both noted in laboratory reports to be common laboratory contaminants. Analytical results for acetone were flagged as estimated during data validation due to minor calibration problems. All toluene concentrations reported were flagged as estimated by the laboratory because they are below the reporting limits.

Except for Dimethyl phthalate, with the highest reported levels (2500 µg/kg), the other four semivolatile organic compounds detected are noted to be estimated concentrations only and well below detection limits. Dimethyl phthalate, also detected at trace levels in the surface water samples, is commonly used as an insect repellent and is listed as a discontinued pesticide (Farm Chemicals Handbook 1990).

Benzoic acid is used as a preservative (Merck Index, 1983) and a plant growth regulator (Farm Chemicals Handbook 1990). Chrysene and pyrene are both listed as derivatives of coal tar (Merck Index, 1983). While these compounds are hydrocarbons or possible hydrocarbons by-products which could be expected to occur at the Texaco Fillmore facility, it is also possible that they could be the result of past pesticide use in the area.

Bis(2-ethylhexyl)-phthalate is noted on the laboratory report to be a common laboratory contaminant (commonly used for vacuum pump lubricant (Merck Index, 1983)).

TABLE 4-78

Texaco Fillmore RI
Creek Sediment Analytical Results
Pole Creek - July 24, 1990

Location		1A		1D	
Sample ID No.		TF-C-A1-S-B1	TF-C-A1-S-B2	TF-C-D1-S-B1	TF-C-D1-S-B2
Analytical Method	**Compound**				
Metal Analysis (µg/kg)					
EPA 7050	Arsenic	4.1	5.8	3.3	3.3
EPA 6010	Barium	181	148	154	158
EPA 6010	Cadmium	5.6	5.5	3.7	4.1
EPA 6010	Chromium (total)	21.5	21.5	22.6	21.8
EPA 7196	Chromium (VI)	< 1000	< 1000	< 1000	< 1000
EPA 6010	Copper	36.6	41.4	35	32.7
EPA 7421	Lead	4.2	5.2	19	25
EPA 6010	Nickel	27.9	35.8	32.2	34
EPA 6010	Vanadium	53.7	54.1	41.2	43.2
Flame AA	Organic Lead	< 1000	< 1000	< 1000	< 1000
Organic Analysis (µg/kg)					
Enseco	EDB	< 1	< 1	< 1	< 1
EPA 8240	Acetone	11 J	23 J	100 J	150 J
EPA 8240	Trichloroethene	22	27	27	23
EPA 8240	Toluene	1.2 J	1.4 J	2.3 J	1.6 J
EPA 8240	Styrene	< 5	< 5	5.6	8.8
EPA 8240	Other TCL VOCs	< 5 - < 10	< 5 - < 10	< 5 - < 10	< 5 - < 10
EPA 8240	VOC TIC	5.4	17	7.2	8.9
EPA 8270	Pyrene	< 660	< 660	68 J	< 660
EPA 8270	Benzoic Acid	< 3200	< 3200	300 J	420 J
EPA 8270	Dimethyl Phthalate	< 660	< 660	2500	2300
EPA 8270	Chrysene	< 660	< 660	110 J	100 J
EPA 8270	bis(2-ethylhexyl)-phthalate	< 660	< 660	130 J	95 J
EPA 8270	Other TCL SVOCs	< 660 - < 3200	< 660 - < 3200	< 660 - < 3200	< 660 - < 3200
EPA 8270	SVOC TIC	1500	1600	5800	2900

TCL = Target Compound List
TIC = Highest Tentatively Identified Compound concentration

4.5.3.2 Metals

Except for total lead, all metals tested were either below detection limits or showed similar concentrations in both the upstream and downstream samples. Organic lead and hexavalent chromium were not detected in any of the samples. Lead concentrations in the downstream samples were 4 to 5 times higher than in the upstream samples (4.2 and 5.2 mg/kg versus 19 and 25 mg/kg respectively). The 19 mg/kg downstream level was erroneously reported as 919 mg/kg in the Draft RI report.

While it is possible that these levels could be attributed to the Texaco Fillmore facility based on some high lead levels results in surface soil samples from two locations, a number of other sources could have contributed to the presence of lead in the stream sediment samples, including:

- Surface runoff into Pole Creek from the streets of Fillmore
- Urban runoff
- The railroad bridge and State Highway 126 which cross Pole Creek between the upstream and downstream sampling points.

The mean concentration of lead which can be expected in the soils of the conterminous United States is estimated as 16 mg/kg based on a population of 1,319 samples (USGS Professional Paper 1270, 1984).

4.5.4 Summary and Conclusions

Two organic compounds, styrene and diethylphthalate, were detected in the surface water samples. Diethylphthalate was not detected in samples from any other media and is not believed to be related to the Texaco Fillmore site. Styrene was detected in both surface water and stream sediment samples downstream of the facility. However, this compound is also not believed to be associated with refinery operations. Styrene, the semivolatile compounds and lead detected downstream of the facility may have come from the facility or other sources nearby.

All other organic and metal concentrations detected were consistent in both the upstream and downstream locations. The above discussion suggests that Pole Creek has not been impacted by the Texaco Fillmore facility. The significance of the surface water and stream sediment sample results will be better determined based on the results of the EPA Risk Assessment.

4.6 Ambient Air

4.6.1 Chemical Analysis Results

Metal Analysis

Results of the metals analysis are provided in Table 4-79. The results expressed in Table 4-79 are not blank corrected. Blank values of metals results are provided in Table 4-80.

These preliminary data demonstrate that ambient concentrations of target metal compounds are all below 0.2 $\mu g/m^3$; the highest concentrations are associated with copper and total lead. A qualitative review of these data reveals that on Day 2, there was an order of magnitude increase in lead levels from Upwind 1 to Downwind 2, and approximately three-fold increase in the concentration of copper from Upwind 1 to Downwind 2. Notably, the limit of detection reported for this sample is roughly one order of magnitude greater than that reported for other lead analyses. Again, all these concentrations, when not blank corrected, are in the submicrogram level. A qualitative review of these data indicate good correlation between primary and collocated sites in all cases.

4.6.2 Semivolatile Analysis

Results of the semivolatile analysis are provided in Table 4-81. These values are not blank corrected. Blank values are provided in Table 4-82. With the exception of naphthalene and 2-methyl naphthalene, all semivolatile target compounds were present in the ambient air below limits of detection. All concentrations of detected compounds are in the submicrogram concentration range. The highest detected concentration is for naphthalene at 0.631 $\mu g/lm^3$ on Day 1 at Downwind 2. On the same day the upwind samplers reported concentrations of 0.613, and Downwind 1 reported concentrations of 0.578. These data indicate that a naphthalene source may be present upwind of the facility. On Day 1, ENSR field personnel noted the distinct smell of a barbecue upwind of the facility. A qualitative review of these data indicate good correlation between primary and collocated sites.

4.6.3 Volatile Analysis

Results of the VOC analyses and GC/MS scans are provided in Table 4-83. These values are not blank corrected. The blank values are provided in Table 4-84. Of the five compounds in the VOC list, 1,2-dibromoethane was not detected at any site on any day. The predominant VOCs were toluene and total xylene. The highest level of toluene detected was 18.0 ppb at Downwind 1. The matching data for the collocated sample is 16.0 ppb.

TABLE 4-79

TEXACO FILLMORE AMBIENT CONCENTRATIONS
METALS (uG/M3)

	Dn1	Dn1c	Dn2	Up1	Up1c
Arsenic					
Day 1	<0.002	<0.001	<0.001	<0.002	<0.001
Day 2	<0.004	<0.004	<0.002	<0.002	<0.004
Day 3	<0.002	<0.002	<0.001	<0.001	<0.001
Barium					
Day 1	0.043	0.039	0.038	0.045	0.039
Day 2	0.034	0.029	0.036	0.027	0.032
Day 3	0.026	0.023	0.025	0.023	0.021
Cadmium					
Day 1	<0.002	<0.001	<0.001	<0.002	<0.001
Day 2	<0.002	<0.002	<0.002	<0.002	<0.002
Day 3	<0.002	<0.002	<0.001	<0.001	<0.001
Chromium					
Day 1	0.021	0.018	0.017	0.025	0.021
Day 2	0.015	0.014	0.016	0.015	0.018
Day 3	0.012	0.013	0.010	0.010	0.009
Copper					
Day 1	0.068	0.104	0.049	0.045	0.059
Day 2	0.057	0.054	0.133	0.048	0.037
Day 3	0.043	0.065	0.068	0.055	0.042
Lead					
Day 1	0.013	0.011	0.010	0.011	0.009
Day 2	0.018	0.005	0.127	0.010	0.009
Day 3	0.008	0.007	0.025	0.012	0.009
Nickel					
Day 1	0.020	0.017	0.017	0.021	0.024
Day 2	0.015	<0.015	<0.015	<0.017	0.015
Day 3	0.013	0.015	0.015	0.012	<0.010
Vanadium					
Day 1	<0.003	<0.002	<0.002	<0.003	<0.002
Day 2	<0.004	<0.004	<0.004	<0.004	<0.004
Day 3	<0.003	<0.003	0.003	0.003	0.003

'<' indicates concentrations below the detection limit.

TABLE 4-80

TEXACO FILLMORE AMBIENT CONCENTRATIONS
Metals Blank values (uG/Sample)

	Dn1	Dn1c	Dn2	Up1	Up1c
Arsenic					
Day 1	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Day 2	<0.00200	<0.00200	<0.00100	<0.00100	<0.00200
Day 3	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100
Barium					
Day 1	0.00700	0.00700	0.00700	0.00700	0.00700
Day 2	0.00700	0.00700	0.00700	0.00700	0.00700
Day 3	0.00700	0.00700	0.00700	0.00700	0.00700
Cadmium					
Day 1	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Day 2	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100
Day 3	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100
Chromium					
Day 1	0.00770	0.00770	0.00770	0.00770	0.00770
Day 2	0.00770	0.00770	0.00770	0.00770	0.00770
Day 3	0.00770	0.00770	0.00770	0.00770	0.00770
Copper					
Day 1	0.00270	0.00270	0.00270	0.00270	0.00270
Day 2	0.00270	0.00270	0.00270	0.00270	0.00270
Day 3	0.00270	0.00270	0.00270	0.00270	0.00270
Lead					
Day 1	0.00054	0.00054	0.00054	0.00054	0.00054
Day 2	0.00054	0.00054	0.00054	0.00054	0.00054
Day 3	0.00054	0.00054	0.00054	0.00054	0.00054
Nickel					
Day 1	0.00980	0.00980	0.00980	0.00980	0.00980
Day 2	0.00980	0.00980	0.00980	0.00980	0.00980
Day 3	0.00980	0.00980	0.00980	0.00980	0.00980
Vanadium					
Day 1	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100
Day 2	<0.00200	<0.00200	<0.00200	<0.00200	<0.00200
Day 3	<0.00200	<0.00200	<0.00200	<0.00200	<0.00200

TABLE 4-81

TEXACO FILLMORE AMBIENT CONCENTRATIONS
Semivolatiles (ug/m³)

	Dn1	Dn1c	Dn2	Up1	Up1c
2,4-Dimethylphenol					
Day 1	<0.263	<0.218	<0.225	<0.279	<0.256
Day 2	<0.152	<0.149	<0.181	<0.178	<0.191
Day 3	<0.130	<0.135	<0.118	<0.129	<0.135
Naphthalene					
Day 1	0.578	0.544	0.631	0.613	0.615
Day 2	0.395	0.386	0.524	0.462	0.515
Day 3	0.350	0.352	0.354	0.322	0.337
2-Methylnaphthalene					
Day 1	0.042	0.041	0.068	0.047	0.049
Day 2	0.029	0.027	0.052	0.034	0.042
Day 3	0.017	0.020	0.040	0.022	0.020
2-Chloronaphthalene					
Day 1	<0.263	<0.218	<0.225	<0.279	<0.256
Day 2	<0.152	<0.149	<0.181	<0.178	<0.191
Day 3	<0.130	<0.135	<0.118	<0.129	<0.135
Acenaphthylene					
Day 1	<0.263	<0.218	<0.225	<0.279	<0.256
Day 2	<0.152	<0.149	<0.181	<0.178	<0.191
Day 3	<0.130	<0.135	<0.118	<0.129	<0.135
Acenaphthene					
Day 1	<0.263	<0.218	<0.225	<0.279	<0.256
Day 2	<0.152	<0.149	<0.181	<0.178	<0.191
Day 3	<0.130	<0.135	<0.118	<0.129	<0.135
Phenanthrene					
Day 1	<0.263	<0.218	<0.225	<0.279	<0.256
Day 2	<0.152	<0.149	<0.181	<0.178	<0.191
Day 3	<0.130	<0.135	<0.118	<0.129	<0.135

"<" indicates concentrations below the limit of detection.

TABLE 4-81 (cont.)

TEXACO FILLMORE AMBIENT CONCENTRATIONS
Semivolatiles (ug/m³)

	Dn1	Dn1c	Dn2	Up1	Up1c
Anthracene					
Day 1	<0.263	<0.218	<0.225	<0.279	<0.256
Day 2	<0.152	<0.149	<0.181	<0.178	<0.191
Day 3	<0.130	<0.135	<0.118	<0.129	<0.135
Fluoranthene					
Day 1	<0.263	<0.218	<0.225	<0.279	<0.256
Day 2	<0.152	<0.149	<0.181	<0.178	<0.191
Day 3	<0.130	<0.135	<0.118	<0.129	<0.135
Pyrene					
Day 1	<0.263	<0.218	<0.225	<0.279	<0.256
Day 2	<0.152	<0.149	<0.181	<0.178	<0.191
Day 3	<0.130	<0.135	<0.118	<0.129	<0.135
Benzo(a)anthracene					
Day 1	<0.263	<0.218	<0.225	<0.279	<0.256
Day 2	<0.152	<0.149	<0.181	<0.178	<0.191
Day 3	<0.130	<0.135	<0.118	<0.129	<0.135
Chrysene					
Day 1	<0.263	<0.218	<0.225	<0.279	<0.256
Day 2	<0.152	<0.149	<0.181	<0.178	<0.191
Day 3	<0.130	<0.135	<0.118	<0.129	<0.135
Benzo(b)fluoranthene					
Day 1	<0.263	<0.218	<0.225	<0.279	<0.256
Day 2	<0.152	<0.149	<0.181	<0.178	<0.191
Day 3	<0.130	<0.135	<0.118	<0.129	<0.135
Benzo(k)fluoranthene					
Day 1	<0.263	<0.218	<0.225	<0.279	<0.256
Day 2	<0.152	<0.149	<0.181	<0.178	<0.191
Day 3	<0.130	<0.135	<0.118	<0.129	<0.135

"<" indicates concentrations below the limit of detection.

TABLE 4-81 (cont.)

TEXACO FILLMORE AMBIENT CONCENTRATIONS
Semivolatiles (ug/m³)

	Dn1	Dn1c	Dn2	Up1	Up1c
Benzo(a)pyrene					
Day 1	<0.263	<0.218	<0.225	<0.279	<0.256
Day 2	<0.152	<0.149	<0.181	<0.178	<0.191
Day 3	<0.130	<0.135	<0.118	<0.129	<0.135
Indeno(1,2,3-cd)pyrene					
Day 1	<0.263	<0.218	<0.225	<0.279	<0.256
Day 2	<0.152	<0.149	<0.181	<0.178	<0.191
Day 3	<0.130	<0.135	<0.118	<0.129	<0.135
Dibenz(a,h)anthracene					
Day 1	<0.263	<0.218	<0.225	<0.279	<0.256
Day 2	<0.152	<0.149	<0.181	<0.178	<0.191
Day 3	<0.130	<0.135	<0.118	<0.129	<0.135
Benzo(g,h,i)perylene					
Day 1	<0.263	<0.218	<0.225	<0.279	<0.256
Day 2	<0.152	<0.149	<0.181	<0.178	<0.191
Day 3	<0.130	<0.135	<0.118	<0.129	<0.135

"<" indicates concentrations below the limit of detection.

TABLE 4-82

TEXACO FILLMORE AMBIENT CONCENTRATIONS
Semivolatile Blank values (uG/Sample)

	Dn1	Dn1c	Dn2	Up1	Up1c
2,4-Dimethylphenol					
Day 1	<10	<10	<10	<10	<10
Day 2	<10	<10	<10	<10	<10
Day 3	<10	<10	<10	<10	<10
Naphthalene					
Day 1	18	18	18	18	18
Day 2	18	18	18	18	18
Day 3	18	18	18	18	18
2-Methylnaphthalene					
Day 1	<10	<10	<10	<10	<10
Day 2	<10	<10	<10	<10	<10
Day 3	<10	<10	<10	<10	<10
2-Chloronaphthalene					
Day 1	<10	<10	<10	<10	<10
Day 2	<10	<10	<10	<10	<10
Day 3	<10	<10	<10	<10	<10
Acenaphthylene					
Day 1	<10	<10	<10	<10	<10
Day 2	<10	<10	<10	<10	<10
Day 3	<10	<10	<10	<10	<10
Acenaphthene					
Day 1	<10	<10	<10	<10	<10
Day 2	<10	<10	<10	<10	<10
Day 3	<10	<10	<10	<10	<10
Phenanthrene					
Day 1	<10	<10	<10	<10	<10
Day 2	<10	<10	<10	<10	<10
Day 3	<10	<10	<10	<10	<10

TABLE 4-82 (cont.)

TEXACO FILLMORE AMBIENT CONCENTRATIONS
Semivolatile Blank values (uG/Sample)

	Dn1	Dn1c	Dn2	Up1	Up1c
Anthracene					
Day 1	<10	<10	<10	<10	<10
Day 2	<10	<10	<10	<10	<10
Day 3	<10	<10	<10	<10	<10
Fluoranthene					
Day 1	<10	<10	<10	<10	<10
Day 2	<10	<10	<10	<10	<10
Day 3	<10	<10	<10	<10	<10
Pyrene					
Day 1	<10	<10	<10	<10	<10
Day 2	<10	<10	<10	<10	<10
Day 3	<10	<10	<10	<10	<10
Benzo(a)anthracene					
Day 1	<10	<10	<10	<10	<10
Day 2	<10	<10	<10	<10	<10
Day 3	<10	<10	<10	<10	<10
Chrysene					
Day 1	<10	<10	<10	<10	<10
Day 2	<10	<10	<10	<10	<10
Day 3	<10	<10	<10	<10	<10
Benzo(b)fluoranthene					
Day 1	<10	<10	<10	<10	<10
Day 2	<10	<10	<10	<10	<10
Day 3	<10	<10	<10	<10	<10
Benzo(k)fluoranthene					
Day 1	<10	<10	<10	<10	<10
Day 2	<10	<10	<10	<10	<10
Day 3	<10	<10	<10	<10	<10

TABLE 4-82 (cont.)

TEXACO FILLMORE AMBIENT CONCENTRATIONS
Semivolatile Blank values (uG/Sample)

	Dn1	Dn1c	Dn2	Up1	Up1c
Benzo(a)pyrene					
Day 1	<10	<10	<10	<10	<10
Day 2	<10	<10	<10	<10	<10
Day 3	<10	<10	<10	<10	<10
Indeno(1,2,3-cd)pyrene					
Day 1	<10	<10	<10	<10	<10
Day 2	<10	<10	<10	<10	<10
Day 3	<10	<10	<10	<10	<10
Dibenz(a,h)anthracene					
Day 1	<10	<10	<10	<10	<10
Day 2	<10	<10	<10	<10	<10
Day 3	<10	<10	<10	<10	<10
Benzo(g,h,i)perylene					
Day 1	<10	<10	<10	<10	<10
Day 2	<10	<10	<10	<10	<10
Day 3	<10	<10	<10	<10	<10

TABLE 4-83

TEXACO FILLMORE AMBIENT CONCENTRATIONS
VOC/GCMS (ppB)

	Dn1	Dn1c	Dn2	Up1	Up1c
Benzene					
Day 1	0.96	0.98	1.40	0.45	1.00
Day 2	0.23	<0.20	0.24	0.64	<0.20
Day 3	0.35	<0.20	0.65	<0.20	0.54
Toluene					
Day 1	18.00	16.00	9.80	7.10	9.10
Day 2	6.30	4.10	5.00	6.30	6.40
Day 3	5.70	5.20	6.00	2.80	5.60
1,2-dibromoethane					
Day 1	<0.20	<0.20	<0.20	<0.20	<0.20
Day 2	<0.20	<0.20	<0.20	<0.20	<0.20
Day 3	<0.20	<0.20	<0.20	<0.20	<0.20
Ethylbenzene					
Day 1	0.77	0.78	0.75	0.57	0.59
Day 2	0.31	0.21	<0.20	0.37	0.31
Day 3	1.20	0.61	0.42	<0.20	0.53
Total Xylenes					
Day 1	4.10	3.00	4.00	2.70	3.30
Day 2	2.00	1.60	1.60	2.00	1.70
Day 3	3.00	2.40	2.30	0.75	3.90
Acetone					
Day 1	10.00	10.00	<10.00	<10.00	10.00
Day 2	<10.00	<10.00	<10.00	<10.00	<10.00
Day 3	<10.00	10.00	<10.00	<10.00	10.00
N,N-dimethyl Acetamide					
Day 1	100.00	200.00	200.00	200.00	200.00
Day 2	200.00	200.00	200.00	300.00	300.00
Day 3	70.00	100.00	100.00	200.00	100.00

TABLE 4-83 (cont.)

TEXACO FILLMORE AMBIENT CONCENTRATIONS
VOC/GCMS (ppB)

	Dn1	Dn1c	Dn2	Up1	Up1c
Phenol					
Day 1	60.00	40.00	50.00	50.00	60.00
Day 2	50.00	50.00	50.00	60.00	60.00
Day 3	30.00	30.00	70.00	30.00	100.00
Carbon Disulfide					
Day 1	<10.00	10.00	<10.00	<10.00	<10.00
Day 2	<10.00	<10.00	<10.00	<10.00	<10.00
Day 3	<10.00	<10.00	<10.00	<10.00	<10.00
Trichlorotrifluoroethane					
Day 1	<10.00	<10.00	<10.00	50.00	<10.00
Day 2	<10.00	<10.00	<10.00	<10.00	<10.00
Day 3	<10.00	<10.00	<10.00	<10.00	<10.00
C7 branched nitrogenated HC					
Day 1	<10.00	<10.00	<10.00	<10.00	<10.00
Day 2	<10.00	<10.00	<10.00	<10.00	<10.00
Day 3	<10.00	<10.00	<10.00	<10.00	<10.00
C4 oxygenated Hydrocarbon					
Day 1	<10.00	<10.00	<10.00	<10.00	<10.00
Day 2	<10.00	<10.00	<10.00	<10.00	<10.00
Day 3	<10.00	<10.00	<10.00	<10.00	10.00
C6 nitrogenated Alkane					
Day 1	<10.00	<10.00	<10.00	<10.00	<10.00
Day 2	<10.00	<10.00	<10.00	<10.00	<10.00
Day 3	<10.00	<10.00	<10.00	<10.00	100.00
C10 branched Alkane					
Day 1	<10.00	<10.00	<10.00	<10.00	<10.00
Day 2	<10.00	<10.00	<10.00	<10.00	<10.00
Day 3	<10.00	<10.00	<10.00	<10.00	10.00

TABLE 4-84

TEXACO FILLMORE AMBIENT CONCENTRATIONS
VOC/GCMS Blank Values (ppB)

	Dn1	Dn1c	Dn2	Up1	Up1c
Benzene					
Day 1	<0.20	<0.20	<0.20	<0.20	<0.20
Day 2	<0.20	<0.20	<0.20	<0.20	<0.20
Day 3	<0.20	<0.20	<0.20	<0.20	<0.20
Toluene					
Day 1	0.98	0.98	0.98	0.98	0.98
Day 2	0.81	0.81	0.81	0.81	0.81
Day 3	3.20	3.20	3.20	3.20	3.20
1,2-dibromoethane					
Day 1	<0.20	<0.20	<0.20	<0.20	<0.20
Day 2	<0.20	<0.20	<0.20	<0.20	<0.20
Day 3	<0.20	<0.20	<0.20	<0.20	<0.20
Ethylbenzene					
Day 1	<0.20	<0.20	<0.20	<0.20	<0.20
Day 2	<0.20	<0.20	<0.20	<0.20	<0.20
Day 3	<0.20	<0.20	<0.20	<0.20	<0.20
Total Xylenes					
Day 1	<0.20	<0.20	<0.20	<0.20	<0.20
Day 2	<0.20	<0.20	<0.20	<0.20	<0.20
Day 3	0.82	0.82	0.82	0.82	0.82
Acetone					
Day 1	<10.00	<10.00	<10.00	<10.00	<10.00
Day 2	<10.00	<10.00	<10.00	<10.00	<10.00
Day 3	<10.00	<10.00	<10.00	<10.00	<10.00
N,N-dimethyl Acetamide					
Day 1	50.00	50.00	50.00	50.00	50.00
Day 2	<10.00	<10.00	<10.00	<10.00	<10.00
Day 3	200.00	200.00	200.00	200.00	200.00

TABLE 4-84 (cont.)

TEXACO FILLMORE AMBIENT CONCENTRATIONS
VOC/GCMS Blank Values (ppB)

	Dn1	Dn1c	Dn2	Up1	Up1c
Phenol					
Day 1	30.00	30.00	30.00	30.00	30.00
Day 2	20.00	20.00	20.00	20.00	20.00
Day 3	60.00	60.00	60.00	60.00	60.00
Carbon Disulfide					
Day 1	<10.00	<10.00	<10.00	<10.00	<10.00
Day 2	<10.00	<10.00	<10.00	<10.00	<10.00
Day 3	<10.00	<10.00	<10.00	<10.00	<10.00
Trichlorotrifluoroethane					
Day 1	<10.00	<10.00	<10.00	<10.00	<10.00
Day 2	<10.00	<10.00	<10.00	<10.00	<10.00
Day 3	<10.00	<10.00	<10.00	<10.00	<10.00
C7 branched nitrogenated HC					
Day 1	<10.00	<10.00	<10.00	<10.00	<10.00
Day 2	30.00	30.00	30.00	30.00	30.00
Day 3	<10.00	<10.00	<10.00	<10.00	<10.00
C4 oxygenated Hydrocarbon					
Day 1	<10.00	<10.00	<10.00	<10.00	<10.00
Day 2	<10.00	<10.00	<10.00	<10.00	<10.00
Day 3	<10.00	<10.00	<10.00	<10.00	<10.00
C6 nitrogenated Alkane					
Day 1	<10.00	<10.00	<10.00	<10.00	<10.00
Day 2	<10.00	<10.00	<10.00	<10.00	<10.00
Day 3	<10.00	<10.00	<10.00	<10.00	<10.00
C10 branched Alkane					
Day 1	<10.00	<10.00	<10.00	<10.00	<10.00
Day 2	<10.00	<10.00	<10.00	<10.00	<10.00
Day 3	<10.00	<10.00	<10.00	<10.00	<10.00

4.6.4 Integrated Surface Sampling

Results of the semivolatile and volatile analyses for samples collected from the integrated surface sampler (ISS) are provided in Table 4-85 and 4-86, respectively. All semivolatile compounds were below the reporting limit.

Notable VOCs collected were toluene at 3.3 ppb and total xylene at 1.3 ppb. An occurrence of ethylbenzene was noted for the first ISS run but was not detected on the second run. All second run compounds found were lower than the first run.

Several compounds were found in the blank. They were toluene at 0.53 ppb, N, N-dimethyl acetamide at 90 ppb, and phenol at 20 ppb. These compounds were present in both ISS samples at more than double the reporting limits.

4.7 Data Validation

The review and validation of all data generated by the analytical laboratories followed the EPA Functional Guidelines (July 1988). The review and validation included all surface soil, subsurface soil, ground water, stream sediment and surface water samples, as well as equipment rinsate samples and trip blanks.

For organic analyses, the following analytical requirements were evaluated:

- holding times
- GC/MS tuning
- initial and continuing calibrations
- method blanks
- surrogate spike recoveries
- matrix spike/matrix spike duplicates
- field duplicates
- internal standards performance
- Target Compound List (TCL) compound identification
- compound quantification and reported detection limits
- tentatively identified compounds (TICs), and
- system performance.

TABLE 4-85

TEXACO FILLMORE AMBIENT CONCENTRATIONS

Semivolatile Values (uG/M3)

	ISS#1 (uG/M3)	ISS#2 (uG/M3)	ISS-Blank (uG)
2,4-Dimethylphenol Day 3	<1609	<1662	<10
Naphthalene Day 3	<1609	<1662	<10
2-Methylnaphthalene Day 3	<1609	<1662	<10
2-Chloronaphthalene Day 3	<1609	<1662	<10
Acenaphthylene Day 3	<1609	<1662	<10
Acenaphthene Day 3	<1609	<1662	<10
Phenanthrene Day 3	<1609	<1662	<10
Anthracene Day 3	<1609	<1662	<10
Fluoranthene Day 3	<1609	<1662	<10
Pyrene Day 3	<1609	<1662	<10
Benzo(a)anthracene Day 3	<1609	<1662	<10
Chrysene Day 3	<1609	<1662	<10
Benzo(b)fluoranthene Day 3	<1609	<1662	<10

TABLE 4-85 (cont.)

TEXACO FILLMORE AMBIENT CONCENTRATIONS

Semivolatile Values (uG/M3)

	ISS#1 (uG/M3)	ISS#2 (uG/M3)	ISS-Blank (uG)
Benzo(k)fluoranthene Day 3	< 1609	< 1662	< 10
Benzo(a)pyrene Day 3	< 1609	< 1662	< 10
Indeno(1,2,3-cd)pyrene Day 3	< 1609	< 1662	< 10
Dibenz(a,h)anthracene Day 3	< 1609	< 1662	< 10
Benzo(g,h,i)perylene Day 3	< 1609	< 1662	< 10

TABLE 4-86

TEXACO FILLMORE AMBIENT CONCENTRATIONS
VOC/GCMS Values (ppB)

	ISS#1	ISS#2	ISS Blank
Benzene			
Day 3	<0.20	<0.20	<0.20
Toluene			
Day 3	3.30	2.00	0.53
1,2-dibromoethane			
Day 3	<0.20	<0.20	<0.20
Ethylbenzene			
Day 3	0.47	<0.20	<0.20
Total Xylenes			
Day 3	1.30	0.88	<0.20
Acetone			
Day 3	10.00	<10.00	<10.00
N,N-dimethyl Acetamide			
Day 3	100.00	70.00	90.00
Phenol			
Day 3	40.00	30.00	20.00

For inorganic analyses, the following analytical requirements were evaluated:

- holding times
- initial and continuing calibration
- method blanks
- ICP interference check samples
- laboratory control samples
- duplicate samples
- matrix spike samples
- furnace atomic absorption QC
- ICP serial dilution
- sample result verification, and
- field duplicates.

On behalf of the EPA, CH2M Hill selected 10% of the laboratory data packages that would undergo full data validation. The batches selected, referenced by Enseco Incorporated or Analytical Technologies, Inc. laboratory project number, are as follows:

- **Volatile Organics**: Project Numbers 53976, 54490, 54553, 55062, 10045, plus one surface soil data batch.

- **Semivolatile Organics**: Project Numbers 53976, 54390, 54490, 54553, 55062, 7212, 10045, plus one surface soil data batch.

- **Inorganics**: Project Numbers 53976, 54204, 11468, 54490, 54553, 7234, 10045, plus one surface soil data batch.

All other laboratory data batches underwent a summary review, still following EPA Functional Guidelines, but not including the review of full raw data. This summary review and reporting format was reviewed and found acceptable by CH2M Hill.

All data validation reports are included as Appendix J. Reports are organized by laboratory project number; an index to the appendix provides cross-reference between laboratory sample identification numbers and Texaco Fillmore sample numbers.

4.7.1 Overall Precision and Accuracy

The overall assessment of precision and accuracy consisted of reviewing the results of matrix spike/matrix spike duplicate (MS/MSD) analyses, as well as field and laboratory duplicate analyses, per EPA Functional Guidelines.

Table 4-87 shows the number of characterization samples and the number of QA/QC samples analyzed by Contract Laboratory Procedure methods as part of the Texaco Fillmore Remedial Investigation. The table provides the percent of total characterization samples that had field or laboratory duplicate analysis or MS/MSD analysis conducted.

It is notable that for surface water and sediment samples no duplicate samples were collected. However, as discussed in Section 4.5, collocated surface water and sediment sampling occurred. These samples, although not exact duplicates, can be used as an indication of sample variability.

In addition to the MS/MSD analysis performed on the field samples, the analytical laboratories performed MS/MSD analysis on several laboratory blanks.

In general, the accuracy was within the appropriate QC limits. The indication of precision relative percent differences (RPD) for field duplicates was in several cases greater than 200%. Considering the accuracy and precision obtained with the MS/MSD, it is very probable that the poor precision of field duplicates was due to high soil matrix variability.

For additional information on individual field duplicate and MS/MSD analyses and the precision and accuracy of individual sampling batches, refer to Appendix J, Data Validation Reports.

4.7.2 Completeness

The overall assessment of completeness consisted of evaluating the number of useable data as compared to the total number of data for the project. Table 4-88 lists for each of the indicator compounds established for the RI the total number of samples analyzed for that compound, the number of samples qualified as unusable (as a result of data validation), and the percent of usable data.

For VOC analysis, results were flagged as unusable due to either gross exceedance of specified holding times or the laboratory's instruments being out of calibration. However, the latter did not affect any of the four VOC indicator parameters. Because the laboratory

TABLE 4-87

Percent of Samples that Underwent Duplicate and MS/MSD Analyses

Sampling Medium	# Samples Analyzed	# Duplicate Analyses	% Duplicate Analyses	# MS/MSD Analyses	% MS/MSD Analyses
VOA					
Subsurface Soil	210	17	8.1	11	5.2
Surface Soil	46	5	10.9	5	10.9
Groundwater	45	3	6.7	8	17.8
Surface Water/Stream Sediment	13	0	0	1	7.7
SVOA					
Subsurface Soil	162	9	5.6	9	5.6
Surface Soil	40	5	12.5	2	5.0
Groundwater	53	2	3.8	9	16.9
Surface Water/Stream Sediment	15	0	0	3	20.0
METALS					
Subsurface Soil	222	25	11.6	18	8.1
Surface Soil	36	4	11.1	2	5.6
Groundwater	63	17	27.0	14	22.2
Surface Water/Stream Sediment	4	0	0	0	0

TABLE 4-88

Percent Completeness of
Organic Indicator Compounds

Indicator Compound	# Samples Analyzed	# Results Flagged Unusable	% Usable Data
Benzene	371	2	99.46
Toluene	371	2	99.46
Xylene	371	5	98.65
Ethylbenzene	371	4	98.92
2,4-Dimethylphenol	254	10	96.06

exceeded holding times for some samples undergoing VOC analysis, a subsurface soil resampling program took place. The samples that had VOC results flagged as unusable during the initial sampling due to missed holding times were resampled and reanalyzed to produce usable data. If all of the results for samples with missed holding times had been replaced with the results of the resampling effort and did not remain in the data base, the percent completeness, or percent of usable data, would be even greater.

EDB was not analyzed using CLP procedures and therefore was not validated per EPA Functional Guidelines. As a result, the completeness of EDB has not been affected and stands at 100 percent.

For SVOC analysis, results were flagged as unusable due to low surrogate spike recoveries (less than 10 percent).

For metals analysis, no results were flagged as unusable due to data validation; metals are therefore not included in Table 4-88.

Although many data were flagged as estimated, the majority of these estimated results are usable because of the low concentrations detected in the samples with estimated results in relation to the threshold levels established for the indicator compounds.

4.7.3 Laboratory Errata

Upon reviewing and validating data packages received from the laboratories, several items arose which required clarification. These items are summarized below, with Appendix K containing supporting documentation.

- Erroneous organic lead value reported for sample TF-SS-MW25D-10 (laboratory ID 54204-2). The total lead value was erroneously reported as organic lead in the original report of October 4, 1990. The correct value shows organic lead as non-detect.

- Verification of Enseco Inc. detection limit for TCLP analysis for benzene. The Texaco Fillmore Field Sampling Plan listed a threshold level for benzene concentration in the TCLP extract at 11 µg/l. Due to the five-fold dilution performed on the TCLP extracts before volatile organic analysis, the normal laboratory reporting limit of 5 µg/l would be raised to 25 µg/l, which is above the threshold level. This problem was avoided by lowering the laboratory's reporting limit for benzene to 1 µg/l, which gives a reporting limit of 5 µg/l upon five-fold dilution. The laboratory provided copies of

method detection limits for the instruments being used for analysis of samples from Texaco Fillmore to verify their ability to detect 1.0 µg/l. Quantification of benzene at 1.0 µg/l was deemed valid based on the raw data evaluation criteria used in the analysis of volatiles by GC/MS. Analysts use two criteria to evaluate data to be reported: minimum area and minimum concentration. The minimum area represents the threshold at which enough of the analyte is present on-column to generate a spectrum and the compound can be positively identified. The BC/MS data system then calculates the concentration of the analyte using an algorithm stated in the Contract Laboratory Program Statement of Work.

- Confirmation of holding times for samples. Enseco provided a summary of sampling, leaching, preparation and analysis dates for volatile and semivolatile TCLP tests performed on soil samples collected from the Texaco Fillmore Site. This summary represents the most recent, confirmed compilation of holding times by Enseco, Inc.

- Amended data sheets. Analytical Technologies, Inc., provided amended data sheets for groundwater analytical results. Similarly, Enseco, Inc., provided amended volatile organic Form I analytical results for TCLP methodology reflecting their ability to detect benzene to 1 µg/l.

4.8 Summary of Nature and Extent of Chemical Constituents

The nature and extent of chemical constituents encountered in the various media investigated at the facility have been discussed in detail in this section. The analytical results were characterized by relatively low levels of essentially the same VOCs, semivolatile organics, and metals appearing consistently within the various media. Table 4-89 lists the specific VOCs, semivolatile organics, and metals identified in each media. The following is a summary of this section.

4.8.1 VOCs

Alkylbenzenes or the BTXE class (i.e., benzene, toluene, xylenes, ethylbenzene) represent the most predominant type of VOCs encountered at the facility. These constituents were detected in each media: subsurface soil, air, stream sediment, surface soil, and groundwater. These compounds, though found in relatively low concentrations, have the highest potential for offsite migration at the facility.

TABLE 4-89 Multimedia Matrix of Organic Compounds

REMEDIAL INVESTIGATION	AIR		SOIL GAS	SURFACE WATER & SEDIMENT		SURFACE SOIL			HYDROGEOLOGICAL			SUBSURFACE SOIL ORGANIC INDICATOR PARAMETERS								SUBSURFACE SOIL TCLP EPA 8240				SUBSURFACE SOIL TOTAL EPA 8240			
												DETECTED IN REGION:				ABOVE DESIGNATED THRESH. LIMIT IN REGION:				DETECTED IN REGION:				DETECTED IN REGION:			
VOLATILES	ISS	AMBIENT		SAMPLE POINT: UPSTR.	DWNSTR.	ACTIVITY: NONE	SUSPECT	KNOWN	AQUIFER: PERCHED	I	II	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
Acetone				X	X	X	X	X	X																		
Benzene			X			X	X		X	X	X	X	X				X			X(PB)	X(PB)	X(PB)	X(PB)	X(PB)	X(P)		
Ethylbenzene			X							X	X	X	X	X										X	X		
Phenol																								X	X		
Toluene	X		X	X	X	X	X	X	X	X	X	X	X														
Xylenes	X		X			X	X	X	X	X	X	X	X	X		X								X(P)	X(P)		
Methylene Chloride				X	X	X	X	X												X(PB)	X(PB)	X(PB)	X(PB)	X	X		
Styrene					X																			X(PB)	X(PB)		
Trichloroethylene				X	X																						
2-Butanone (MEK)						X	X	X			X													X			
1,1,1-Trichloroethane			X			X	X																				
Vinyl Acetate						X	X																				
4-Methyl-2-Pentanone										X																	
1,2-Dichloroethane										X																	
1,2,4-Trimethylbenzene			X																								
1,3,5-Trimethylbenzene			X																								
4-Ethyl Toluene			X																								
Various Hydrocarbons									X	X																	
Fuel Hydrocarbons									X	X																	
SEMI-VOLATILES																											
Naphthalene		X							X		X	X								X	X	X		X	X		
2-Methyl-1-Naphthalene		X							X		X									X	X	X					
Pyrene				X		X	X																				
Benzoic Acid				X																							
Dimethyl Phthalate				X			X																				
Chrysene				X		X	X																				
Bis(2-ethylhexyl) -phthalate				X		X	X													X(PB)	X(PB)						
Phenanthrene						X																					
Benzoanthracene																											
Benzo(b)fluoranthene						X																					
Benzo(a)pyrene																											
Indeno(1,2,3-cd)pyrene																											
Benzo(g,h,i)perylene						X																					
2,4-Dimethylphenol																											
2-methylphenol												X	X	X						X							
C6 - C22 Hydrocarbons									X	X																	

Air ISS samples collected above the MWP only contained concentrations of toluene (3.3 ppb) and total xylenes (1.3 ppb) near detection limits. All benzene concentrations in air samples were below limits of detection. The directional sampling did not show any significant difference in VOC concentrations up and down wind of activities at the Texaco Fillmore facility. Alkylbenzenes were detected frequently in subsurface soil samples collected from areas of known and suspected past activity, but exceeded designated TCLP benzene threshold values in only 7 of 142 samples.

Several VOCs, including styrene, vinyl acetate, 2-butanone (MEK), 4-methyl-2-pentanone (MIBK), 1,2-dichloroethane, 1,2,4- and 1,3,5-trimethylbenzene, and 4-ethyl toluene were limited to one or two media as discussed below.

Styrene was detected at very low concentrations in both surface water (6 to 14 µg/l) and stream sediment (5.6 to 8.8 µg/kg) samples collected in Pole Creek downstream of the facility. Styrene is non-persistent in the environment, relatively unstable and undergoes polymerization even at room temperature. It is commonly used to make polymers and copolymers, polystyrene plastics and rubbers and is not believed to be associated with refinery operations. Although many laboratory components may be composed of styrene polymers, styrene was not identified by the laboratory as a potential laboratory contaminant and there is no direct evidence to confirm this as a possible source. Styrene was not detected in any other media and not likely to have originated from the Texaco facility.

1,2,4- and 1,3,5-trimethylbenzene, and 4-ethyl toluene were detected in soil gas samples but were not present in any other media. Vinyl acetate and 2-butanone were only detected in a few surface soil samples.

Acetone and methylene chloride were detected frequently at slightly above detection limits. However, these chemicals were reported by the laboratory as very common laboratory contaminants and flagged as such numerous times as a result of the data validation process. It is unlikely that they have any relation to the Texaco facility.

Of all VOCs detected, only benzene in groundwater appears to present any level of concern at the facility, with concentrations above MCL in two possible plumes, the southern plume and MWP plume (refer to Section 4.0). Benzene is the only indicator parameter compound identified at the facility that exceeded a Federal MCL drinking water standard. Other alkylbenzene constituents detected in groundwater were detected at concentrations below their respective MCLs.

4.8.2 Semivolatiles

All semivolatile compounds detected are either laboratory contaminants, or possible hydrocarbons or degradation products which might be expected to occur at facilities similar to the Texaco Fillmore facility. No regulatory threshold values were exceeded by any of the identified semivolatile organic compounds.

Dimethyl phthalate was detected in a number of background surface soils at the facility at levels below the reporting limit, and had also the highest reported concentration of all semivolatile organic compounds detected in stream sediments. While dimethyl phthalate may have been transported to Pole Creek via soil erosion during seasonal precipitation, it is also a commonly used insect repellent and is listed as a discontinued pesticide (Farm Chemicals Handbook, 1990.) Considering the local agricultural practices in the Fillmore area, the latter could also be a source of dimethyl phthalate in stream sediments.

Benzoic acid was not detected in surface soil samples, but may form from the partial degradation or chemical conversion of other organic compounds identified at the Texaco Fillmore facility, such as a result of abiotic or biotic oxidation of some VOCs including ethylbenzene or toluene. The presence of benzoic acid in stream sediments is probably due to heightened levels of biological activity resulting from the seasonal presence of free water and leached nutrients. Microbial isolates, particularly bacteria, have been isolated and identified as capable of partially degrading semivolatile aromatic compounds.

One group of semivolatiles, naphthalene, and 2-methylnaphthalene was detected in the air, subsurface soil, and groundwater samples. Results of air samples collected from the directional up- and downwind sampling stations suggest that an offsite source of these two compounds was present during sampling. Their presence in subsurface soils and groundwater is indicative of the greater solubility and lower adsorptivity of these compounds relative to other semivolatile compounds detected at the facility.

A second group of semivolatiles, polyaromatic hydrocarbons (PAHs) and phthalate esters were detected in surface soil and stream sediment samples. PAHs, such as chrysene, pyrene, phenanthrene, and benzo(a)pyrene are present in surface soil and downstream stream sediment samples at low levels. Hydrophobic organics such as PAHs strongly adsorb to soil particles (primarily soil organic matter) and leaching losses (i.e., solution-phase movement) are likely to be minimal in terms of the overall soil mass balance. Concentrations in stream sediments are very likely due to soil movement via erosion from past rain events. PAHs with aromatic nuclei with four or more fused benzene rings are known to be particularly resistant to microbial degradation, and to date no microorganisms have been found that can

use these compounds as sole sources of carbon and energy. Co-metabolism may be an alternative. Considering the time interval of historical use at the facility, it is quite possible that an adapted microflora has currently developed to metabolize these unique PAHs. In terms of toxicity, it is known to the scientific community that benzo(a)pyrene presents a relatively high level of concern, chrysene and pyrene a medium level, and phenanthrene a low level. Bis(2-ethylhexyl) phthalate is the most persistent, least soluble of the phthalate esters. This compound is mid-range in terms of solubility and volatility, sorption is an important factor, and presents a relatively medium level of concern in terms of toxicity. A mechanism of soil transport must exist for this group of semivolatile compounds to be transported offsite.

The divarication of the above two groups is not surprising in light of similar physical and chemical properties within the groups. In any case, semivolatile compounds did not exceed an established regulatory concentration limit.

Since surface water flow at the Texaco Fillmore facility only occurs sporadically and does not feed into a permanent surface water body, the bioaccumulation in aquatic food chains of semivolatile compounds appear to be of low to no concern. Human exposure to these compounds would require direct inhalation or ingestion of soil or groundwater from the Texaco facility. Since detected semivolatile concentrations are low, public access to the facility is restricted, and no agriculture is practiced within the facility boundary, the potential for soil inhalation or ingestion by people appears to be very low.

4.8.3 Metals

Samples from all media were analyzed for several metals including arsenic, barium, cadmium, chromium, copper, lead, nickel and vanadium, to determine their concentrations and extent at the Texaco facility. Total levels for all the metals were found to be within background levels in surface and subsurface soil samples. Except for one shallow (<10 feet deep) sample where lead exceeded the FSP threshold, only barium and cadmium exceeded threshold levels of leachable (TCLP) concentrations. However, the random distribution of total concentrations for these metals throughout the facility suggests that these results are representative of a single background population. Therefore, the TCLP results for barium and cadmium are not considered to be attributed to past facility activities, but to naturally-occurring levels. Results from air samples indicate that metals do not appear to be transported offsite via suspended particulate material in ambient air. In groundwater, arsenic, barium, and cadmium each exceeded MCLs in only one well and each exceedance was in a different well.

4.8.4 Conclusions

Levels of VOCs, semivolatile organics, and metals detected at the Texaco Fillmore facility in ambient air, surface soils, and stream water and sediments at the facility and its vicinity do not initially appear to pose a concern. In addition, metal levels at the facility appear to be naturally-occurring. However, any conclusions to be drawn as to potential threat will be by the results of the risk assessment being conducted by EPA and CH2M Hill.

Alkylbenzene type VOCs (particularly benzene) and a few semivolatile organics (mainly naphthalene and 2-methyl-1-naphthalene), may pose a concern in subsurface soils and groundwater due to the greater solubility and lower adsorptivity of these compounds relative to other constituents detected at the facility. However, even these compounds are present at relatively low levels. Based on the above discussion, Section 5.0 focuses primarily on the potential persistence and/or transport of these VOCs and semivolatile organics in subsurface soils and groundwater.

5.0 CHEMICAL CONSTITUENT FATE AND TRANSPORT

5.1 Introduction

As concluded in Section 4.0, alkylbenzene type VOCs (particularly benzene) and soluble semivolatile organics in subsurface soils and groundwater appear to be the only potential environmental impacts of concern at the site due to their mobility and low adsorptivity. This section addresses the potential sources, fate and transport mechanisms, potential migration pathways, and receptors of these constituents in the soil and groundwater beneath the site, and presents a preliminary conceptual model of the site developed based on the available chemical and hydrogeological data.

This section discusses the following constituent fate and transport factors:

- Persistence
- Mobility
- Sources
- Migration Pathways

5.2 Persistence

Numerous studies have demonstrated that petroleum hydrocarbons can be considered relatively nonpersistent chemicals that undergo significant natural degradation or "weathering" in the environment. Weathering is a complex process that involves the gradual loss of organic compounds due chiefly to their biodegradability (petroleum hydrocarbons are easily degraded by microorganisms), and for some compounds, their volatility and water solubility. Field and laboratory indicator parameter data generated during the RI strongly indicate that a significant level of weathering has occurred at the site. However, the undetermined age and origin of constituents within soil samples recovered for analysis, as is the case of similar past disposal sites, makes it impractical to ascertain how quickly weathering has acted on the impacted soils.

Benzene is the simplest of the aromatic class of organic compounds found in petroleum. In pure form, benzene exists as a clear, colorless liquid at ambient conditions. Chemically, it is fairly stable, but can undergo substitution to form halogen, nitrate, sulfonate, and alkyl derivatives. Photochemical formation of nitrobenzene and nitrophenols from benzene has been observed in the presence of nitrogen oxides.

Important active benzene removal processes that potentially can occur at the Texaco facility include phase transfer (water to air, soil to water, soil to air), chemical transformation (hydrolysis, photolysis), and biological transformation. Phase transfer of benzene in particular appears to be limited. Benzene mass transfer from water to air does not appear to be a factor based on the absence of any benzene detected in the surface water samples. Based upon the extensively available TCLP data from subsurface soil samples, mass transfer from soil to groundwater also appears to be limited. Mass transfer of benzene from soil to air appears to be minor based on the low levels of benzene detected in ambient air samples.

Table 5-1 lists overall half-lives which estimate losses of compounds via abiotic and biotic processes for identified alkylbenzenes. Various microorganisms, such as the Pseudomonas strains, can use benzene as their sole carbon source. Benzene can also undergo ring opening by oxidation with the aid of Pseudomonas and Morazella species. In addition, benzene can be photochemically degraded by reactions with ozone. However, compared to other aromatic hydrocarbons, benzene is the least susceptible to microbial oxidation. Hence, it expresses an elevated environmental half-life. Other alkylbenzene compounds found at the site are more susceptible to microbial activity due to the increased level of alkyl-substitution and as such should be less persistent. In addition, should microbial oxidation succeed in removing only aliphatic side-chains, benzene will potentially form as a product of biodegradation.

5.3 Migration

Several soil properties can combine effectively to provide a natural capacity to buffer and ameliorate the impact and mobility of VOCs and semivolatile organics. The physical and chemical properties of all VOCs and semivolatile organics are also a factor in their migrating potential. Benzene has a higher vapor pressure (95.2 mm Hg at 25°C) than all other organic compounds detected in soils and groundwater at the site. This suggests that benzene has a much higher potential for volatilization from degraded surface soils. Benzene is also the most soluble and has the lowest organic adsorption partition coefficient (Koc), making it less prone to adsorb to soil surfaces and organic matter, and susceptible to leaching from degraded soils. Thus, benzene migration in groundwater flow is relatively uninhibited (low retardation factor). This combination of high water solubility and low Koc makes benzene the greatest potential candidate for offsite migration via leaching from subsurface soils to aquifer systems underlying the Texaco facility. Benzene is highly mobile in groundwater and travels the farthest of all constituents of concern. Based on these observations, benzene is used as the primary indicator chemical to evaluate the transport and fate of organic constituents at the site.

TABLE 5-1

Half-Lifes of Benzene and Other Selected Alkyl Benzene Compounds in Various Media

Compounds	Half-Life Range (days)					
	Soil		Air		Water	
	Low	High	Low	High	Low	High
Ethylbenzene	NA	NA	1.46	---	1.5	7.5
Benzene	NA	NA	6.0	---	1.0	10.5
Toluene	NA	NA	1.3	---	0.17	---
Total Xylenes	NA	NA	0.5	---	1.5	9.0

NA = not available in reviewed sources. Half-lifes in soil of volatile compounds with high vapor pressures are difficult to calculate without interferences because of volatilization.

Sources:

a. Superfund Public Health Evaluation Manual EPA/540/1-86/060, Exhibit A-2.

b. Processes, Coefficients, and Models for Simulation of Toxic Organics and Heavy Metals in Surface Waters. J.L. Schnoor et al., EPA/600/3-87/015, 1987.

Constituent migration in groundwater is dependent on aquifer properties including permeability, transmissivity and hydraulic conductivity, hydraulic gradients and flow direction.

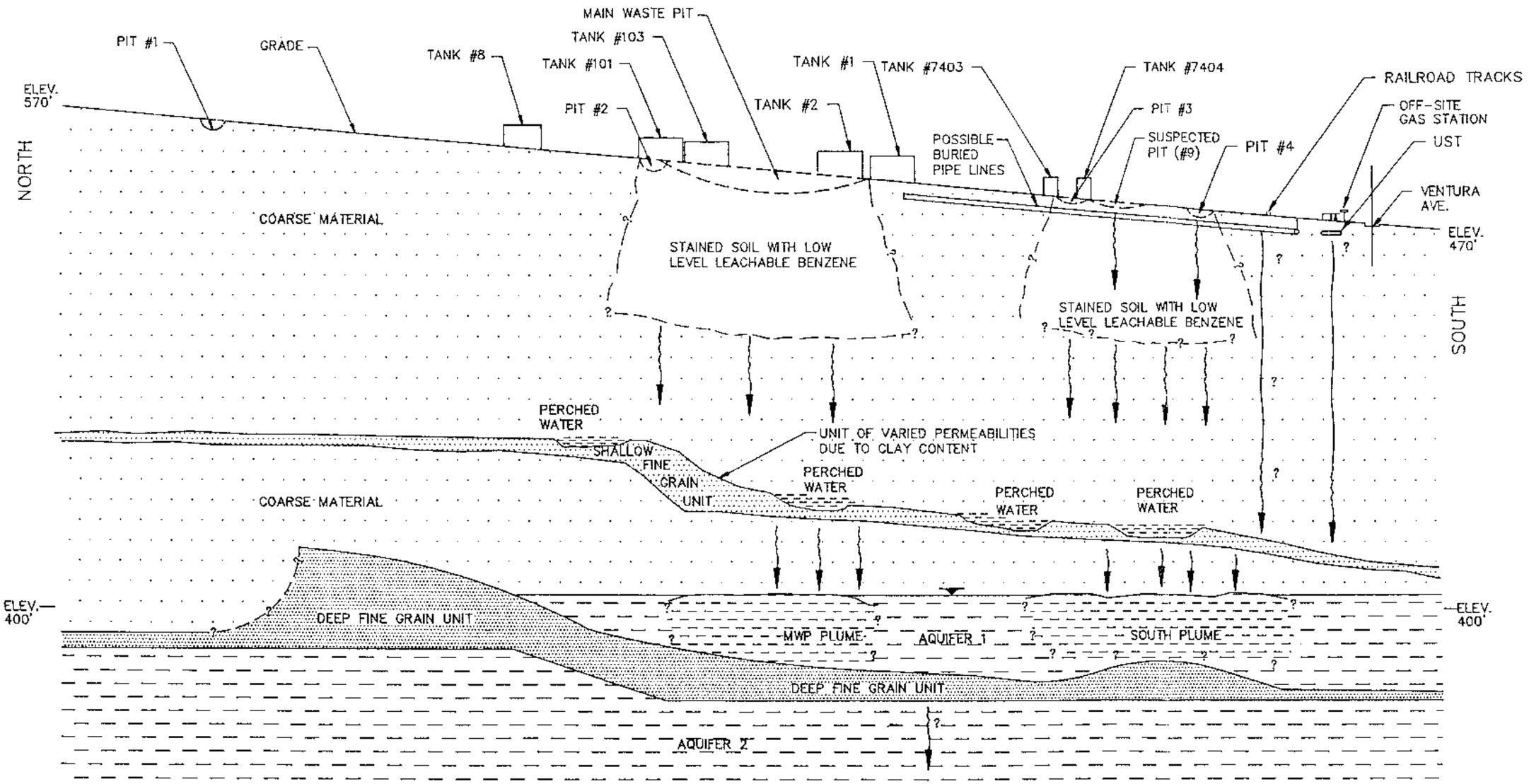
5.4 Potential Sources

Figure 5-1 presents a preliminary conceptual model of the potential sources and migration pathways present at the site. The model is based on the best available knowledge of the chemical characteristics and hydrogeological conditions beneath the site. Likely scenarios derived from this model are discussed in the sections below.

Five types of potential sources of VOCs and semivolatile organic constituent releases to soil and groundwater have been identified at the site:

- Former main waste and small waste disposal pits.
- Former pipelines, aboveground tanks, or other refinery equipment or process operation units.
- Existing pipelines, aboveground tanks, or other product transfer equipment.
- Offsite sources of the Texaco Fillmore facility, include the commercial activity area on the south side of Highway 126 to the southeast of the facility, the auto salvage/service activities to the southeast of the facility, and the Ultramar service station to the south/southwest.
- Naturally-occurring constituents which are augmenting the presence of hydrocarbons.

The RI concentrated on investigating the waste pits, assuming that they are the main sources of constituents of concern to soil and groundwater beneath the site. The resulting data appears to indicate that, while at low levels, subsurface soil and groundwater have been impacted in the MWP and southern regions. The constituents present in the subsurface soil and the groundwater beneath the MWP and the southern regions are compounds typically associated with petroleum industry operations. Soil in these areas appear to remain a potential source even after all the waste has been excavated from the pits. However, only trace levels of leachable components have been measured. Furthermore, with the removal of the waste from the pits, the driving force of additional constituents into the soil has been removed. Finally, it is notable that, in general, benzene levels in groundwater have been decreasing over the course of the four groundwater sampling events.



NOT TO SCALE

LEGEND			
		CLIENT NAME:	TEXACO INC.
		REPORT TITLE:	TEXACO FILLMORE DRAFT REMEDIAL INVESTIGATION REPORT
		FIGURE: 5-1	SCHEMATIC CONCEPTUAL MODEL
		DATE:	PROJECT NO. 6600-047 / DWG: CUTEAST
		DRAFTED BY: M.S.	REVISED BY: / APP. BY:

The potential presence of chronic sources such as minor leaks or releases from underground piping and aboveground oil storage tanks over a number of years (including both former refinery and current crude oil transferring operations) was not investigated. A geophysical investigation designed to map all former and existing underground piping and verify their integrity and points of origin and destination, is recommended to study these potential sources and better explain constituent migration patterns.

5.5 Potential Migration Pathways

The potential migration pathways identified at the Texaco Fillmore facility include leachate leaving impacted soils below the waste disposal areas into the perched zone and water table aquifer (Aquifer 1), offsite migration of the Aquifer 1 benzene plumes beneath the MWP and southern portion of the site, and migration into the lower aquifer, Aquifer 2. The perched zone at the site is not a continuous aquifer and does not present a potential pathway of concern.

A rising groundwater table could potentially serve as a means of contaminant transport via leaching of contaminants from subsurface soils. However, the extensive analytical data presented in Chapter 4 shows for TCLP analysis for organic compounds that very low levels of leachable constituents were found at depths that would preclude leaching of the constituents into groundwater. In the Main Waste Pit area, leachable constituents were found at a minimum elevation of 455 feet above mean sea level (msl), which is over 30 feet higher than the historical regional high groundwater elevation of 424 feet above msl (in 1969) and well above recent groundwater elevations at the Texaco Fillmore facility. All subsurface soil samples taken below 455 feet above msl had no leachable organic constituents detected.

In the southern area, leachable constituents (toluene and xylene) were detected at a minimum elevation of approximately 420 to 425 feet above msl, which is near the historical regional high groundwater elevation of 424 feet above msl (in 1969), yet above recent groundwater elevations at the Texaco facility. However, these compounds were detected at levels below laboratory reporting limits, and the analytical results are estimated. All subsurface soil samples taken below approximately 420 feet above msl had no leachable organic constituents detected.

Figure 5-1 presents a depiction of the conceptual model of the site. The figure is not to scale and should only be considered a very crude depiction of the understanding of the facility.

Because the variability of sediment type and size (and therefore permeability and transmissivity) even within the site is very high, it would be highly speculative to extrapolate this information to offsite areas. Similarly, detailed groundwater gradient information is available on the site for only the past few years, and offsite very little is known at less than a regional scale. Historical groundwater gradient values and variations offsite are even less well known. Combined with the scenario that benzene does not last long in groundwater without a continuing source and the fact that the waste pits were excavated of wastes in 1986, the calculation of groundwater transport of benzene based on unknown or highly estimated gradients, permeabilities, and other required variables would result in speculative and/or unreliable conclusions.

The facts remain that the constituent of principal concern in the groundwater has been determined to be benzene, and that the present extent of the benzene plume in the groundwater below the site has been fairly well defined in both the horizontal and vertical dimensions. With this in mind, the following sections discuss the findings concerning potential local migration pathways for the two defined plumes, the Main Waste Pit plume, and the southern plume.

5.5.1 Main Waste Pit Plume

The MWP plume located in Aquifer 1 appears to have the highest benzene concentrations in Aquifer I directly beneath the MWP. The plume's source is likely to be caused by low-level residual VOCs in soils beneath the extent of past MWP excavations. With the removal of wastes from the pits, additional constituents are not being added to the soil. It is most likely that chemical constituents migration from the soil to the groundwater will only diminish from its current level. The low levels of benzene in groundwater are consistent with levels in soils in the area.

The discontinuity of the perched zone (shallow fine-grained unit) throughout the site provides a pathway for migration of constituents from the soil to groundwater in zones of high permeability.

The localized groundwater flows in a west to northwesterly direction precluding any migration of the MWP plume to the south. Migration to the north and east is also mitigated by the limited extent of Aquifer 1 in the northern portion of the facility. Migration downward is retarded by the thickness of the deep fine-grained unit (estimated at 10 to 20 feet in this region).

Unsaturated soils of various permeabilities and grain size are present at the facility and need to be assessed further. Gravity has minimal influence in downward migration of VOCs from the soil because constituents were not detected at saturated levels. However, infiltration of rainwater through the soil matrix could cause leachate from the soil into the groundwater. The rate of leachate generation and movement is not known.

Other onsite sources of chemical constituents, such as abandoned or former pipelines, remain a possibility. The impact of offsite sources to groundwater in the Aquifer 1 MWP plume is less credible due to the distance groundwater must travel (more than 1,200 feet to the southwest and over 800 feet across gradient from potential sources). This assessment is supported by the absence of benzene in wells MW-11, MW-25S and MW-21S, which define a "belt" of nonaffected groundwater between the MWP plume and all potential offsite sources to the south.

While it is entirely reasonable that some contribution to petroleum hydrocarbons detected in subsurface soil and groundwater is being made by natural hydrocarbons, it is not likely that the benzene plumes detected below the MWP and southern area have any substantial origin from the naturally-occurring oil-bearing rocks. This conclusion is supported by the presence of clean wells (e.g., MW-22S and MW-22D) in areas of the site with no artificial sources. Furthermore, the fraction of benzene in the hydrocarbons detected in the groundwater is too large for normal, naturally-occurring hydrocarbons of crude petroleum. For example, the levels of benzene found in MW-6S, MW-19S, MW-20S, and MW-26S represent from 4 to 17 percent of the total hydrocarbons present in those wells. This suggests a refined product source (strongly suggests gasoline) and not crude petroleum.

5.5.2 Southern Plume

The southern plume, also in Aquifer I, may have several onsite sources that contribute to benzene levels including Pits 3, 4, and 9, former pipelines, and a former bulk loading area. It is also possible that the gas station and salvage yard facilities on nearby properties act as offsite sources of benzene in groundwater.

An evaluation of the available monitoring well data in the southern portion indicates that the offsite sources present a potential for impacting the southern groundwater plume at the site. Distances from these sources to the plume are relatively small — 400 feet to the upgradient possible source area and 200 feet over a confused gradient area to the Ultramar service station and the auto salvage/service area. Analytical results of groundwater samples from all monitoring wells located between these potential sources and the southern plume show detectable levels of benzene. In addition, chemical analyses of groundwater samples from

the Ultramar plume and the southern plume have similarities which suggest common sources or mixing of slightly dissimilar hydrocarbon plumes. Therefore, it appears that the Ultramar plume and the southern plume may be connected.

A similar assessment of the factors affecting potential constituent migration in the MWP Plume can be made of the Southern Plume with the following differences:

- Unlike the MWP Plume, the Southern Plume does not appear to be confined by the northern and eastern limitations of Aquifer 1.

- The deep fine-grained unit appears to thin dramatically to the south to about two feet thick, presenting a potential for vertical driving pressures transporting constituents from Aquifer 1 to Aquifer 2 in areas where leaky conditions may prevail. This is evidenced by benzene detected in the deep aquifer in MW-25D.

6.0 SUMMARY AND RECOMMENDATIONS

6.1 Nature and Extent of Chemical Constituents

Chemical constituents identified in media investigations completed at the Texaco Fillmore facility are compounds typically associated with petroleum industry operations. Refer to Section 4.0 for a detailed representation of the distribution and magnitude of identified constituents within the Texaco facility. The findings of the media investigations can be summarized as follows:

- VOCs are the most common constituents identified in the groundwater adjacent to the Texaco Fillmore facility. Eight VOCs have been detected in groundwater underlying the facility: benzene, toluene, ethylbenzene, xylenes, acetone, 4-methyl-2-pentanone (MIBK), 2-butanone (MEK), and 1,2-dichloroethane.

- VOC concentrations are, in general, the highest in the shallow perched zone well on the east side of the facility (MW-10P) and in Aquifer 1 in two plumes: one plume in the area of the MWP (MW-6S, MW-27S, MW-28S, and MW-32S), and the other plume in the southern part of the facility (MW-8S, MW-18S, MW-19S, MW-20S, MW-26S, and MW-29S). High VOC concentrations also present in a third plume originating from the Ultramar gas station located offsite to the southwest of the Fillmore site (ULTM-MW-9 and ULTM-MW-10) appear to have mingled with the southern plume. A general declining trend in VOCs was evident in the Texaco Fillmore wells through the RI sampling period.

- Three semivolatile organic constituents were detected in groundwater samples from the Texaco Fillmore facility. These compounds are naphthalene, 2-methyl-naphthalene, and bis(2-ethylexyl)phthalate. The semivolatile organic compounds were encountered in the perched zone (MW-10P), Aquifer I in the MWP Plume (MW-6S and MW-27S), the Southern Plume (MW-8S and MW-18S, and ULTM-MW-9 and ULTM-MW-10). A general declining trend in SVOCs was also evident in the Texaco Fillmore wells through the RI sampling period.

- In isolated incidents, target metal concentrations in groundwater exceeded msl. The target metals encountered above msl were arsenic (MW-8), barium (MW-19S) and cadmium (MW-16D). Barium and cadmium levels appear consistent with background levels. The high arsenic level in MW-8 was subsequently flagged as

estimated during data validation and arsenic levels were all below MCLs in the May 1991 sampling.

- Surface soil samples were collected at 32 locations within the Texaco facility. Identified volatile and semivolatile organic constituents were at or near the reported analytical limits of detection. Target metal concentrations were at levels representative of background conditions for these constituents.

- For the surface water samples, two organic compounds were detected, styrene and diethylphthalate. Styrene was also detected in stream sediment samples downstream of the Texaco Fillmore facility, but is not believed to be associated with refinery operations. Organic and metal concentrations detected were consistent in both the upstream and downstream locations.

- Paired stream sediment samples were collected from Pole Creek both up- and downstream of the Texaco facility. Identified semivolatile organic constituents are at or near reported analytical limits of detection. Elevated downstream levels of styrene and lead may have come from the facility or other sources nearby.

- Up- and downwind ambient air samples were collected over three consecutive days. Target metal, volatile, and semivolatile concentrations in ambient air samples were either below detection limits or there was no significant difference in concentrations between up and downwind concentrations. Integrated surface sampling (ISS) above the MWP detected toluene and phenol at concentrations slightly above the reported limits of detection.

- There were 785 subsurface soil samples were collected from 68 boreholes distributed throughout the Texaco Fillmore facility. Target metal concentrations in these soil samples were representative of background conditions for these constituents. Benzene was detected in only four samples (38 ppb, 25 ppb, 22 ppb, and 12 ppb) above the FSP characterization threshold level (11 ppb). Xylene was detected in only three samples (860 ppb, 810 ppb, and 640 ppb) above the FSP threshold (620 ppb). Other target volatile constituents in soils analyzed by TCLP did not exceed threshold values established for these constituents in the field sampling plan. In the semivolatile fraction, naphthalene was reported at levels up to six times its detection limit, while 2-methylnaphthalene was reported at levels up to seven times its detection limit. The risk assessment to be conducted for the facility will determine whether the presence of these compounds constitutes a potential threat.

In addition, other volatile and semivolatile organic constituents identified in soils analyzed by TCLP were at or near reported limits of analytical detection.

6.2 Summary of Fate and Transport of Chemical Constituents

The fate and transport of chemical constituents at the facility focuses specifically on benzene migration for the following reasons:

- Benzene in the groundwater is the only constituent that exceeded msl established for drinking water. Moreover, most other constituents were at or near the reported limits of detection and site characterization data reveals no identifiable spatial pattern of detection.

- Physical and chemical properties of benzene indicate that inter- and intra-phase movement of this compound is relatively uninhibited compared to other volatile aromatics identified in media investigations. In addition, attenuation of benzene via sorption processes or degradation is relatively low. Therefore, benzene possesses the potential for offsite migration.

A preliminary conceptual model has been developed to define and address potential routes of benzene migration in media underlying the Texaco Fillmore facility and subsequent fate and transport mechanisms that act on this constituent. Currently, this model consists of the following elements:

- Naturally-occurring hydrocarbons are not likely to be a source of the degree of benzene dissolved in the groundwater of Aquifer 1. However, naturally-occurring petroleum hydrocarbons may be contributing to the extent and magnitude of identified constituents.

- The MWP Plume appears to have the highest benzene concentrations in Aquifer 1 beneath the MWP. The plume's source is likely to be low-level residual volatiles in soils beneath the extent of past MWP excavations. However, other sources of chemical constituent, such as abandoned or former pipelines, remain a possibility.

- The Southern Plume, also in Aquifer 1, may have several sources within the Texaco facility that contribute to benzene levels. For example, the Southern Plume underlies Pits 3, 4, and 9, former pipelines, and a former bulk loading area. It is also possible that the gas station and salvage yard facilities on nearby properties act as offsite

sources of benzene in groundwater, thus expanding the extent of the plume to the west-southwest.

- Migration of the MWP Plume is probably minimized by the limited extent of Aquifer 1 in the northern portion of the facility.

6.3 Summary of Risk Assessment

A site specific risk assessment of the Texaco Fillmore facility has not been performed by ENSR or Texaco. CH2MHill will be completing the risk assessment on behalf of EPA, Region IX and it will be available as a separate document. However, a few cursory observations concerning the site are provided below.

Ultimate decisions regarding any further cleanup requirements, if any, for subsurface soil contamination at the Fillmore facility, will be based on the presence of potential risk to human health and the environment. Characterization of such risk by the EPA will be a function of the toxicity and mobility of the contaminants, and the likelihood of human exposure.

A risk assessment and evaluation of potential exposure is beyond the scope of this report and will be conducted by the EPA. An issue of concern is whether the levels in soil at the Fillmore facility could pose a threat to groundwater as long as the water-soluble components remained. Texaco encourages and supports a scientific and regulatory agreement on the risks, if any, posed by the TPH-impacted soil at Fillmore, that allows for the cost-effective elimination of these risks with minimum disruption to the environment, if CERCLA covers these substances.

Soil cleanup requirements for the Texaco Fillmore facility, if any, should recognize that there is a point of diminishing return regarding expenditures that provide increased environmental protection, at which each additional dollar spent for removal of chemical constituents from soil provides only a marginal reduction of the risk posed by those constituents. It is important to recognize the inherent and significant differences in the risks posed by differing levels of chemical constituents in the soils in comparison to similar constituents in soil and water. Subsurface soil by its very nature is not a commodity that is normally breathed, ingested, or brought in contact with the skin. That is, it is not a mobile media like air and water. Future facility use may cause direct contact with subsurface soils and should also be taken into consideration.

6.4 Summary of Recommendations

Identified below are recommendations for future work at the Texaco Fillmore facility:

- Investigate the southern portion of the facility for the presence of underground pipelines.

- Evaluate site hydrogeological conditions, such as hydraulic head, material constants of the saturated and unsaturated zones such as porosity and transmissivity, identification of attenuation mechanisms, such as adsorption/desorption or degradation. Site-specific information on these parameters will be critical for any subsequent analytical or numerical modeling efforts designed to assess the transport of benzene in groundwater, and for assessing the feasibility of remedial actions, if any, required to be conducted at the site.

LEGEND

⊗	GROUNDWATER PRODUCTION WELL		ULTRAMAR GASOLINE STATION
⊐	PIPE	●	ORCHARD
←	DIRECTION OF SURFACE RUNOFF	-·-·-	FENCE (TEXACO FACILITY PROPERTY LINE)
⋮⋮	CRUDE OIL STORAGE TANKS		

ENSR

0 100 200
SCALE IN FEET

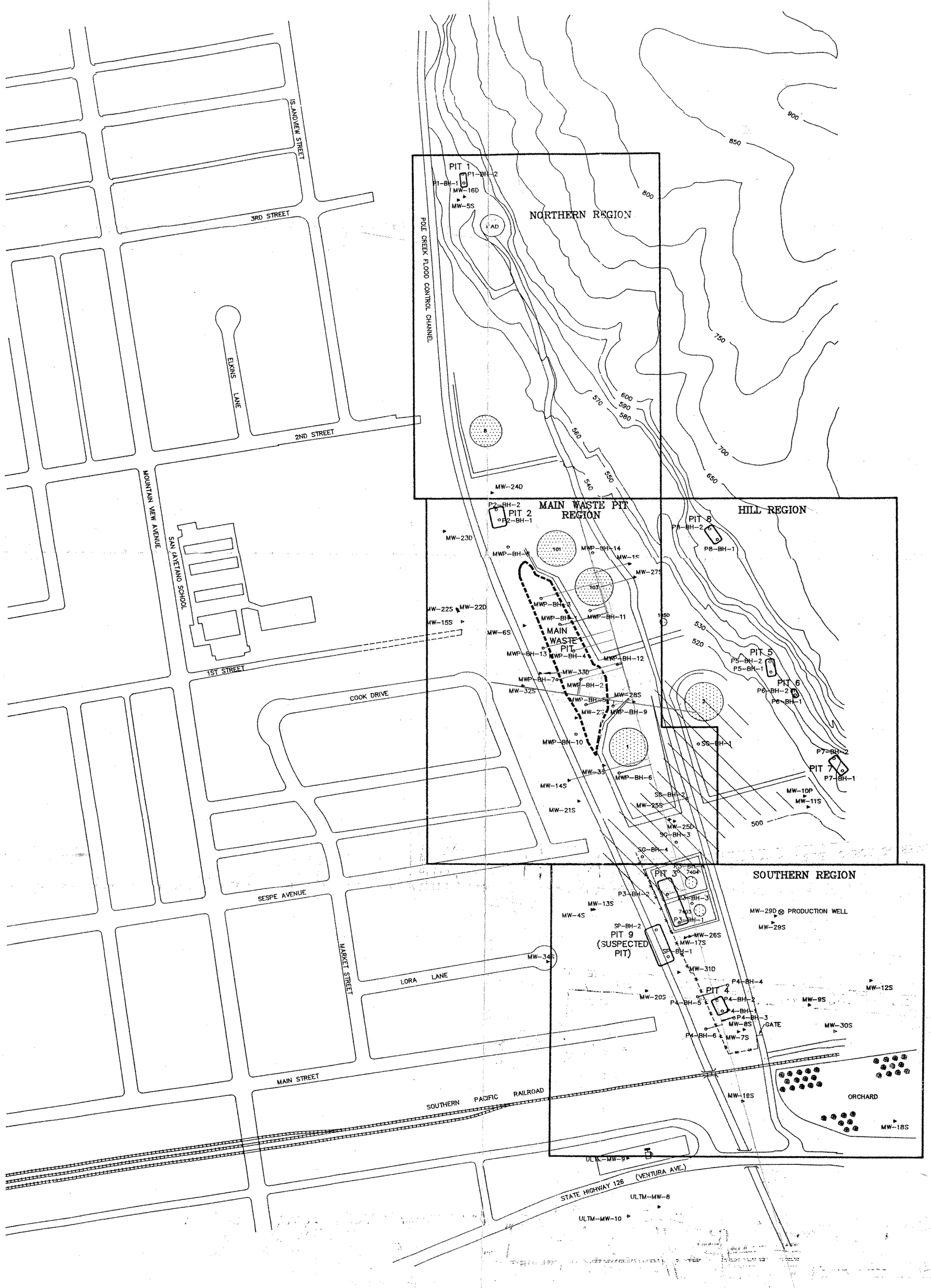
PLATE: 2-1 SITE TOPOGRAPHY AND SURFACE RUN-OFF MAP

REPORT: TEXACO FILLMORE REMEDIAL INVESTIGATION REPORT

CLIENT: TEXACO INC. ENSR PROJECT NO. 6600-047

DATE: 6/17/91 DRAWING FILE NAME: 6600-047.DWG LAYERS USED: 1,2,2A,4,4A,5,5A,13,15,16,32

DRAFTED BY: M. SCOP REVIEWED BY: APPROVED BY:



LEGEND

⊗	GROUNDWATER PRODUCTION WELL		ULTRAMAR GASOLINE STATION
▸	GROUNDWATER MONITORING WELL	●	ORCHARD
▹	GROUNDWATER MONITORING WELL (DECOMMISSIONED)		
○	SOIL BOREHOLE		
///	SOIL GAS SURVEY	-x-x-	FENCE (TEXACO FACILITY PROPERTY LINE)
⋰⋱	CRUDE OIL STORAGE TANKS		

ENSR

0 100 200
SCALE IN FEET

PLATE: 2-2 WATER MONITORING WELLS AND SOIL BOREHOLES LOCATIONS

REPORT: TEXACO FILLMORE REMEDIAL INVESTIGATION REPORT

CLIENT: TEXACO INC. ENSR PROJECT NO. 6600-047

DATE: 6/17/91 DRAWING FILE NAME: 6600-047.DWG LAYERS USED: 0,1,2,2A,3,3A,5,5A,6,6A1,6A2,9U,10,10A,13,15,16,23

DRAFTED BY: M. SCOP REVIEWED BY: APPROVED BY:

LEGEND

⊗	GROUNDWATER PRODUCTION WELL		ULTRAMAR GASOLINE STATION
▪	GROUNDWATER MONITORING WELL		ORCHARD
⑦	GRID DESIGNATOR NUNBER		
			FENCE (TEXACO FACILITY PROPERTY LINE)
	CRUDE OIL STORAGE TANKS		

ENSR

0 100 200
SCALE IN FEET

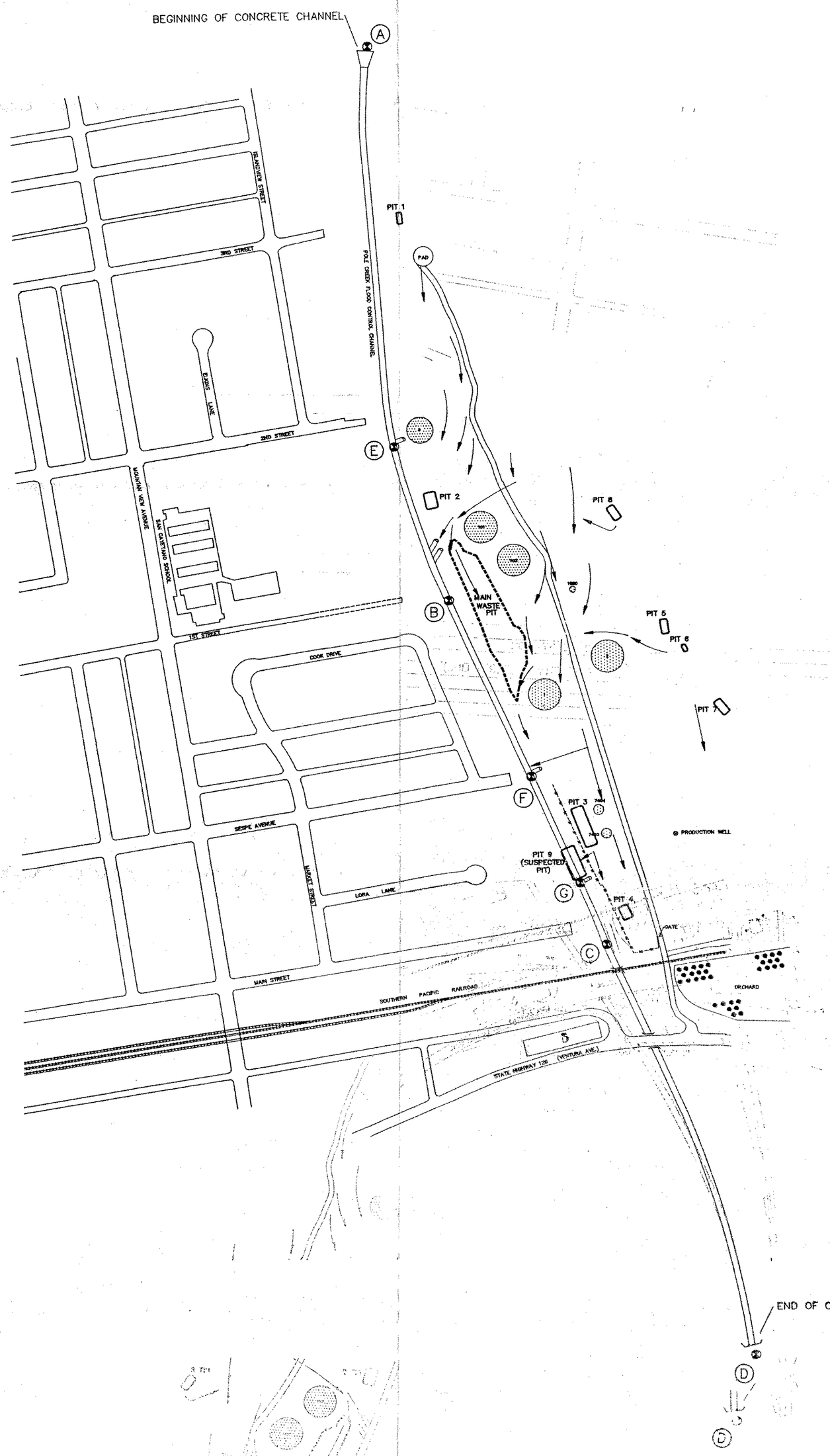
PLATE: 2-3 SURFACE SOIL SAMPLING LOCATION MAP

REPORT: TEXACO FILLMORE REMEDIAL INVESTIGATION REPORT

CLIENT: TEXACO INC. ENSR PROJECT NO. 6600-047

DATE: 6/20/91 DRAWING FILE NAME: 6600-047.DWG LAYERS USED: 0,1,2,2A,3,4A,5,5A,9,12A,13,15,16

DRAFTED BY: M. SCOP REVIEWED BY: APPROVED BY:



LEGEND			
⊗	PRODUCTION WELL	⛽	ULTRAMAR GASOLINE STATION
⊗	SAMPLE LOCATION	•	ORCHARD
——→	DIRECTION OF SURFACE RUNOFF	———	FENCE (TEXACO FACILITY PROPERTY LINE)
═══	PIPE		
	CRUDE OIL STORAGE TANKS (IN USE)		

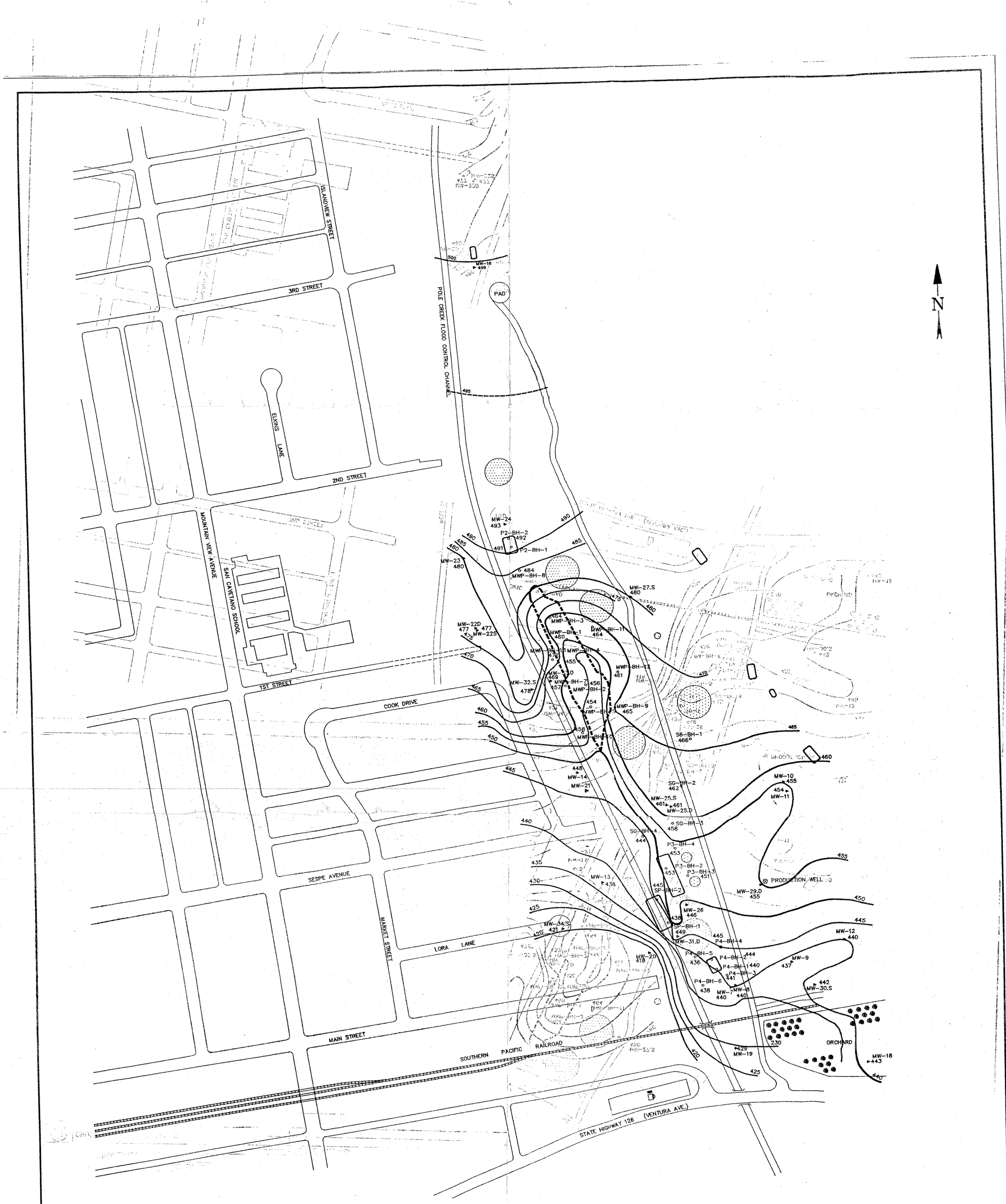
0 150 300
SCALE IN FEET

PLATE 2-4 SURFACE WATER SAMPLE LOCATION MAP

REPORT TITLE: TEXACO FILLMORE DRAFT REMEDIAL INVESTIGATION REPORT

CLIENT NAME: TEXACO INC. 6600-047

DATE: 5/10/91	DRAWING FILE NAME: 6600-047.DWG	LAYERS USED: 0,2,5,6A,13,15,16,32,35
DRAFTED BY: M. SCOP	REVIEWED BY:	APPROVED BY:



LEGEND			
⊗	GROUNDWATER PRODUCTION WELL		ULTRAMAR GASOLINE STATION
∘	SOIL BOREHOLE		ORCHARD
▸446	DATA POINT WITH ELEVATION OF STRUCTURE TOP		
445	CONTOURS, FEET RELATIVE TO MSL	----	FENCE (TEXACO FACILITY PROPERTY LINE)
	CRUDE OIL STORAGE TANKS		

ENSR

0 100 200
SCALE IN FEET

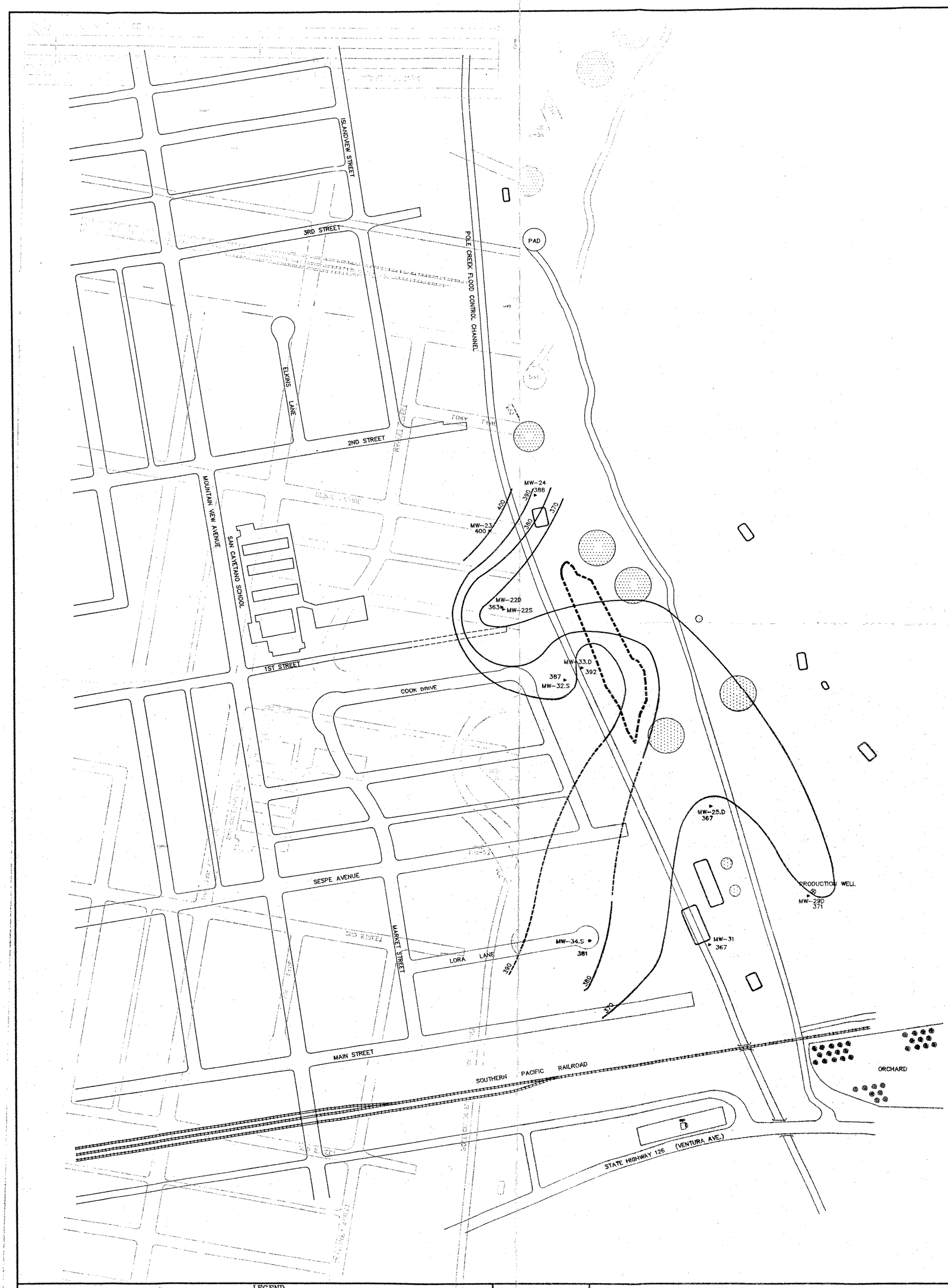
PLATE: 3-1 STRUCTURE CONTOURS OF TOP OF THE UPPER FINE GRAINED UNIT

REPORT: TEXACO FILLMORE REMEDIAL INVESTIGATION REPORT

CLIENT: TEXACO INC. ENSR PROJECT NO. 6600-047

DATE: 6/17/91 DRAWING FILE NAME: 6600-047.DWG LAYERS USED: 0,1,2,PA,5,5A,13,15,16,18

DRAFTED BY: M. SCOP REVIEWED BY: APPROVED BY:



LEGEND

⊗	GROUNDWATER PRODUCTION WELL		ULTRAMAR GASOLINE STATION
▸381	DATA POINT WITH ELEVATION OF STRUCTURE TOP		ORCHARD
—380—	CONTOURS, FEET RELATIVE TO MSL		
	CRUDE OIL STORAGE TANKS		

0 100 200
SCALE IN FEET

PLATE: 3-3 STRUCTURE CONTOURS OF BOTTOM OF THE LOWER FINE GRAINED UNIT

REPORT: TEXACO FILLMORE REMEDIAL INVESTIGATION REPORT

CLIENT: TEXACO INC. ENSR PROJECT NO. 6600-047

DATE: 6/17/91 DRAWING FILE NAME: 6600-047.DWG LAYERS USED: 0,1,2,5,5A,13,15,16,20

DRAFTED BY: M. SCOP REVIEWED BY: APPROVED BY:

LEGEND

⊗	GROUNDWATER PRODUCTION WELL		ULTRAMAR GASOLINE STATION
∘	SOIL BOREHOLE		ORCHARD
∘446	DATA POINT WITH ELEVATION OF STRUCTURE TOP		
445	CONTOURS, FEET RELATIVE TO MSL		
	PERCHED WATER ZONE AREA		
	CRUDE OIL STORAGE TANKS		

ENSR

0 100 200
SCALE IN FEET

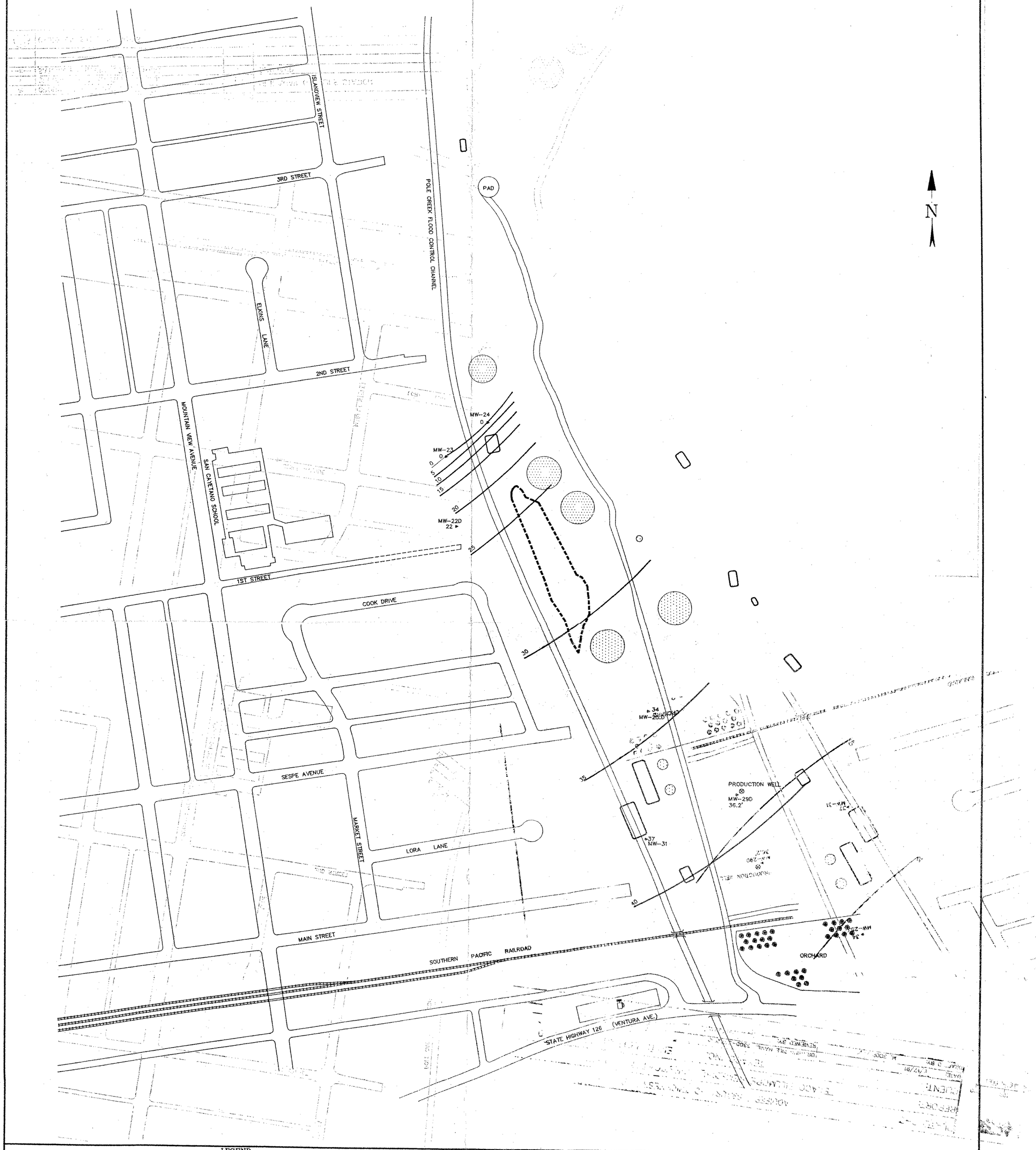
PLATE: 3-6 APPROXIMATE AREAS OF PERCHED ZONE WATER

REPORT: TEXACO FILLMORE REMEDIAL INVESTIGATION REPORT

CLIENT: TEXACO INC. ENSR PROJECT NO. 6600-047

DATE: 6/17/91 DRAWING FILE NAME: 6600-047.DWG LAYERS USED: 0,1,2,5,54,13,16,18,31

DRAFTED BY: M. SCOP REVIEWED BY: APPROVED BY:



LEGEND

⊗	GROUNDWATER PRODUCTION WELL		ULTRAMAR GASOLINE STATION
•	GROUNDWATER MONITORING WELL		ORCHARD
—30—	SATURATED THICKNESS CONTOUR		
	CRUDE OIL STORAGE TANKS		

ENSR

0 100 200
SCALE IN FEET

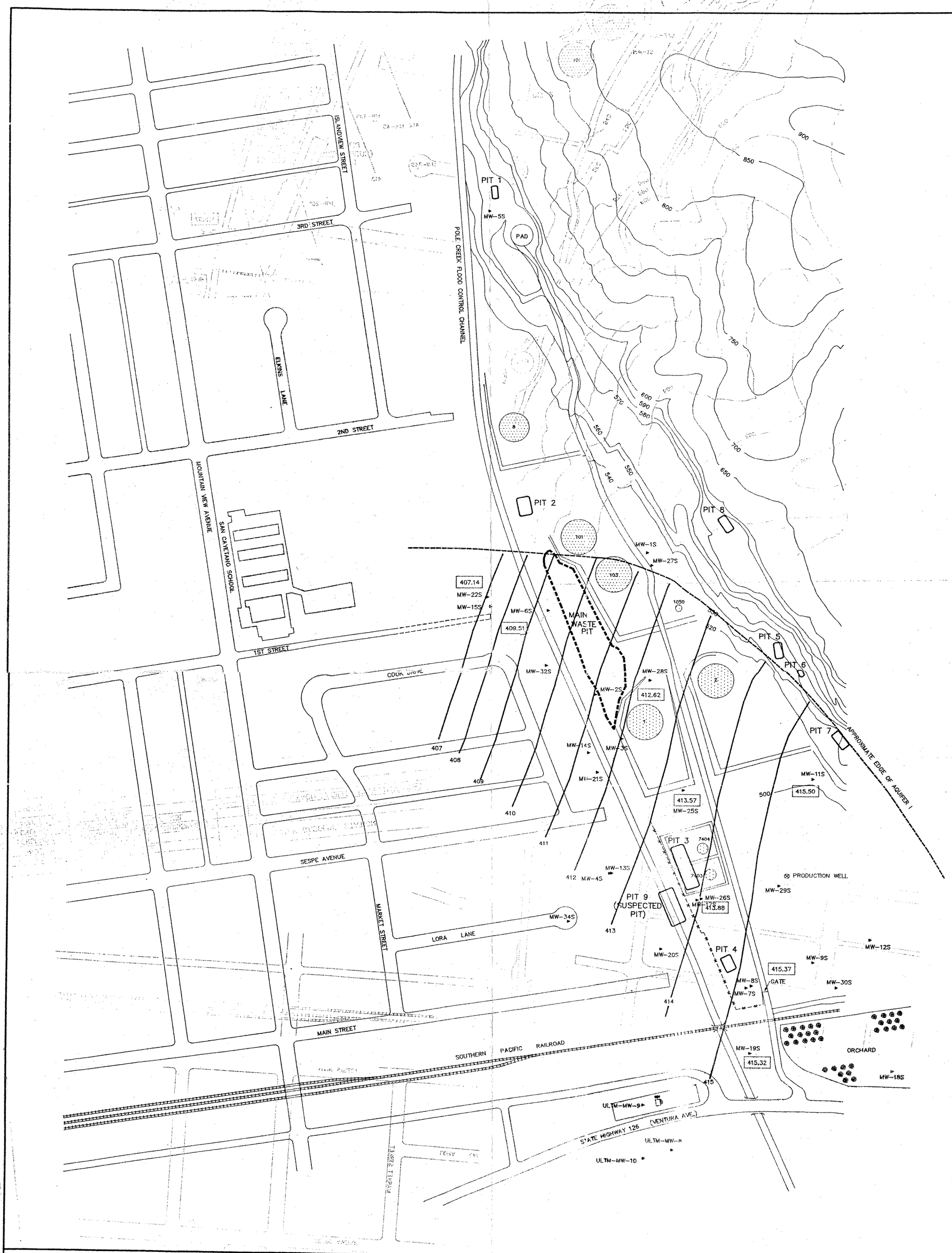
PLATE: 3-7 AQUIFER I SATURATED THICKNESS MAP

REPORT: TEXACO FILLMORE REMEDIAL INVESTIGATION REPORT

CLIENT: TEXACO INC. ENSR PROJECT NO. 6600-047

DATE: 6/17/91 | DRAWING FILE NAME: 6600-047.DWG | LAYERS USED: 0,1,2,5,6a,13,15,16,19

DRAFTED BY: M. SCOP | REVIEWED BY: | APPROVED BY:



LEGEND

⊗ GROUNDWATER PRODUCTION WELL	ULTRAMAR GASOLINE STATION
▸ GROUNDWATER MONITORING WELL	ORCHARD
▸ GROUNDWATER MONITORING WELL (DECOMMISSIONED)	
407.14 GROUNDWATER ELEVATION (FEET) ABOVE MSL	
407 AQUIFER I GRADIENT CONTOURS	FENCE (TEXACO FACILITY PROPERTY LINE)
CRUDE OIL STORAGE TANKS	

0 100 200
SCALE IN FEET

ENSR

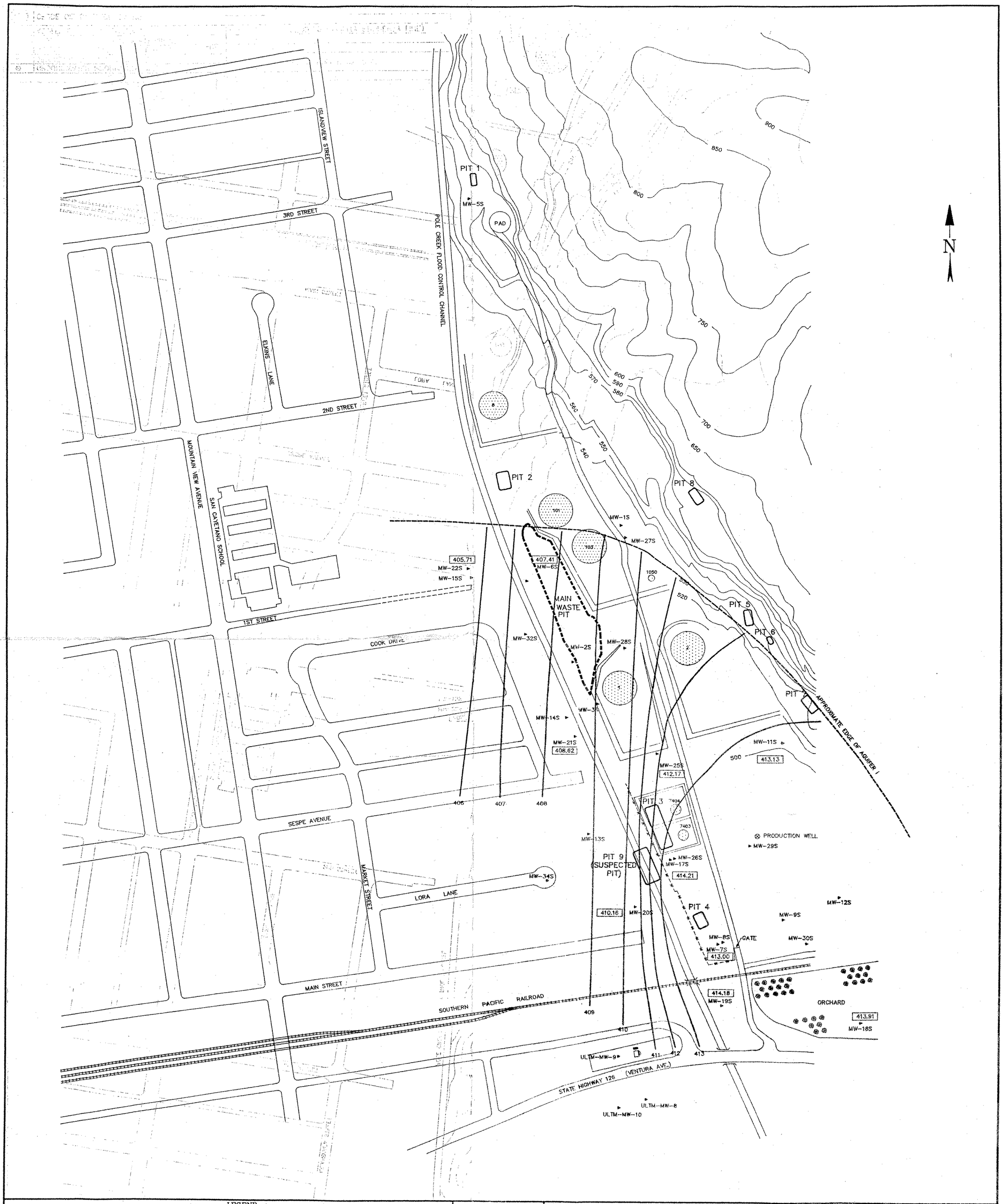
PLATE: 3-8 (AUG. 1990) AQUIFER I GROUNDWATER SURFACE ELEVATION MAP

REPORT: TEXACO FILLMORE REMEDIAL INVESTIGATION REPORT

CLIENT: TEXACO INC. ENSR PROJECT NO. 6600-047

DATE: 6/17/91 | DRAWING FILE NAME: 6600-047.DWG | LAYERS USED: 01,22A,4,4A,5,5A,6,6A1,8U,13,15,16,36

DRAFTED BY: M. SCOP | REVIEWED BY: | APPROVED BY:



LEGEND

⊗	GROUNDWATER PRODUCTION WELL		ULTRAMAR GASOLINE STATION
▸	GROUNDWATER MONITORING WELL	⊛	ORCHARD
▹	GROUNDWATER MONITORING WELL (DECOMMISSIONED)		
413.00	GROUNDWATER ELEVATION (FEET) ABOVE MSL		
413	AQUIFER II GRADIENT CONTOUR		FENCE (TEXACO FACILITY PROPERTY LINE)
	CRUDE OIL STORAGE TANKS		

ENSR

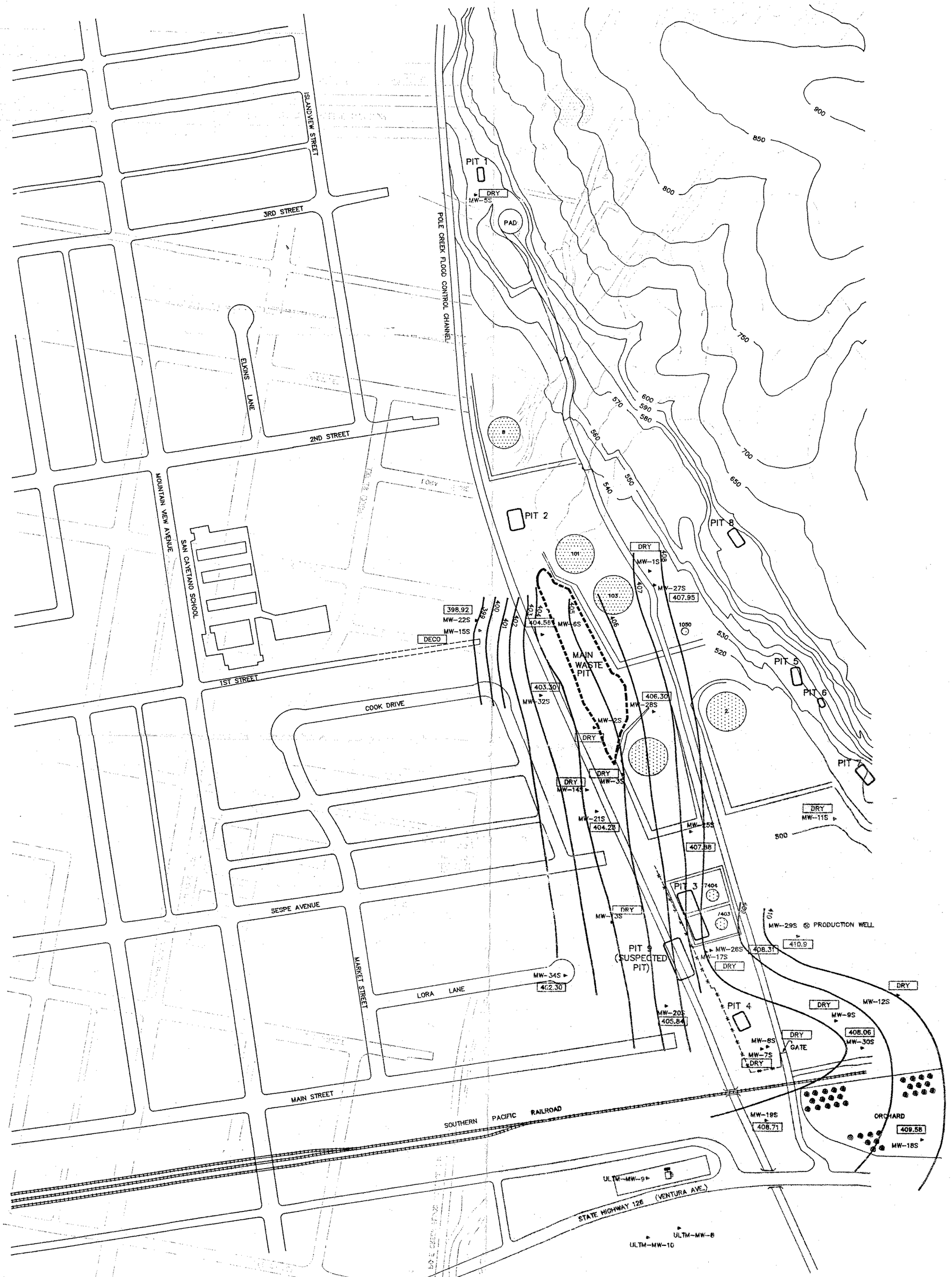
0 100 200
SCALE IN FEET

PLATE: 3-9 (SEP. 1990) AQUIFER I GROUNDWATER SURFACE ELEVATION MAP

REPORT: TEXACO FILLMORE REMEDIAL INVESTIGATION REPORT

CLIENT: TEXACO INC. ENSR PROJECT NO. 6600-047

DATE: 6/6/91	DRAWING FILE NAME: 6600-047.DWG	LAYERS USED: 0,1,2,2A,4,4A,5,5A,6,6A1,6T,6U,13,15,16,27
DRAFTED BY: M. SCOP	REVIEWED BY:	APPROVED BY:



N

LEGEND

⊗	GROUNDWATER PRODUCTION WELL		ULTRAMAR GASOLINE STATION
▸	GROUNDWATER MONITORING WELL		ORCHARD
▸	GROUNDWATER MONITORING WELL (DECOMMISSIONED)		
398.92	GROUNDWATER ELEVATION (FEET) ABOVE MSL		
405	AQUIFER I GRADIENT CONTOUR		FENCE (TEXACO FACILITY PROPERTY LINE)
	CRUDE OIL STORAGE TANKS		

ENSR

0 100 200
SCALE IN FEET

PLATE: 3-10 FIRST QUARTER (JAN. 1991) AQUIFER I GROUNDWATER SURFACE ELEVATION MAP

REPORT: TEXACO FILLMORE REMEDIAL INVESTIGATION REPORT

CLIENT: TEXACO INC. ENSR PROJECT NO. 6600-047

DATE: 6/5/91 DRAWING FILE NAME: 6600-047.DWG LAYERS USED: 0,1,2,2A,4,4A,5,5A,6,6A1,6T,6U,13,15,16,37

DRAFTED BY: M. SCOP REVIEWED BY: APPROVED BY:

LEGEND			
⊗	GROUNDWATER PRODUCTION WELL		ULTRAMAR GASOLINE STATION
▸	GROUNDWATER MONITORING WELL	⊛	ORCHARD
▹	GROUNDWATER MONITORING WELL (DECOMMISSIONED)		
408.00	GROUNDWATER ELEVATION (FEET) ABOVE MSL		
408	AQUIFER I GRADIENT CONTOURS		FENCE (TEXACO FACILITY PROPERTY LINE)
	CRUDE OIL STORAGE TANKS		

ENSR

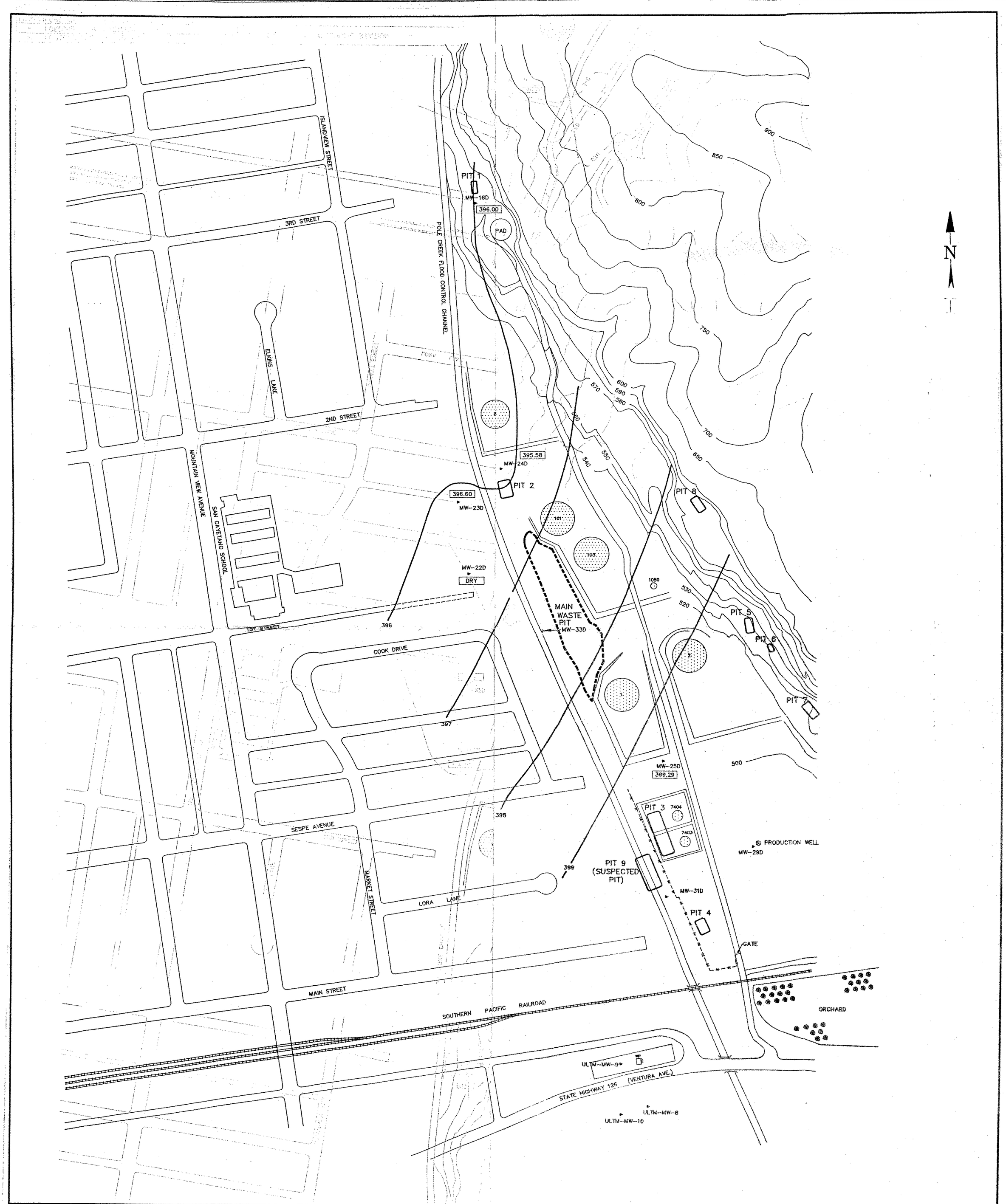
0 100 200
SCALE IN FEET

PLATE: **3-11** SECOND QUARTER (MAY, 1991) AQUIFER I GROUNDWATER SURFACE ELEVATION MAP

REPORT: TEXACO FILLMORE REMEDIAL INVESTIGATION REPORT

CLIENT: TEXACO INC. ENSR PROJECT NO. 6600-047

DATE: 6/17/91	DRAWING FILE NAME: 6600-047.DWG	LAYERS USED: 0,1,2,2A,4,4A,5,5A,6,6A1,6T,6U,13,15,16,45
DRAFTED BY: M. SCOP	REVIEWED BY:	APPROVED BY:



LEGEND			
⊗	GROUNDWATER PRODUCTION WELL		ULTRAMAR GASOLINE STATION
▸	GROUNDWATER MONITORING WELL	●	ORCHARD
396.00	GROUNDWATER ELEVATION (FEET) ABOVE MSL		
396	AQUIFER II GRADIENT CONTOUR	-•-•-	FENCE (TEXACO FACILITY PROPERTY LINE)
	CRUDE OIL STORAGE TANKS		

ENSR

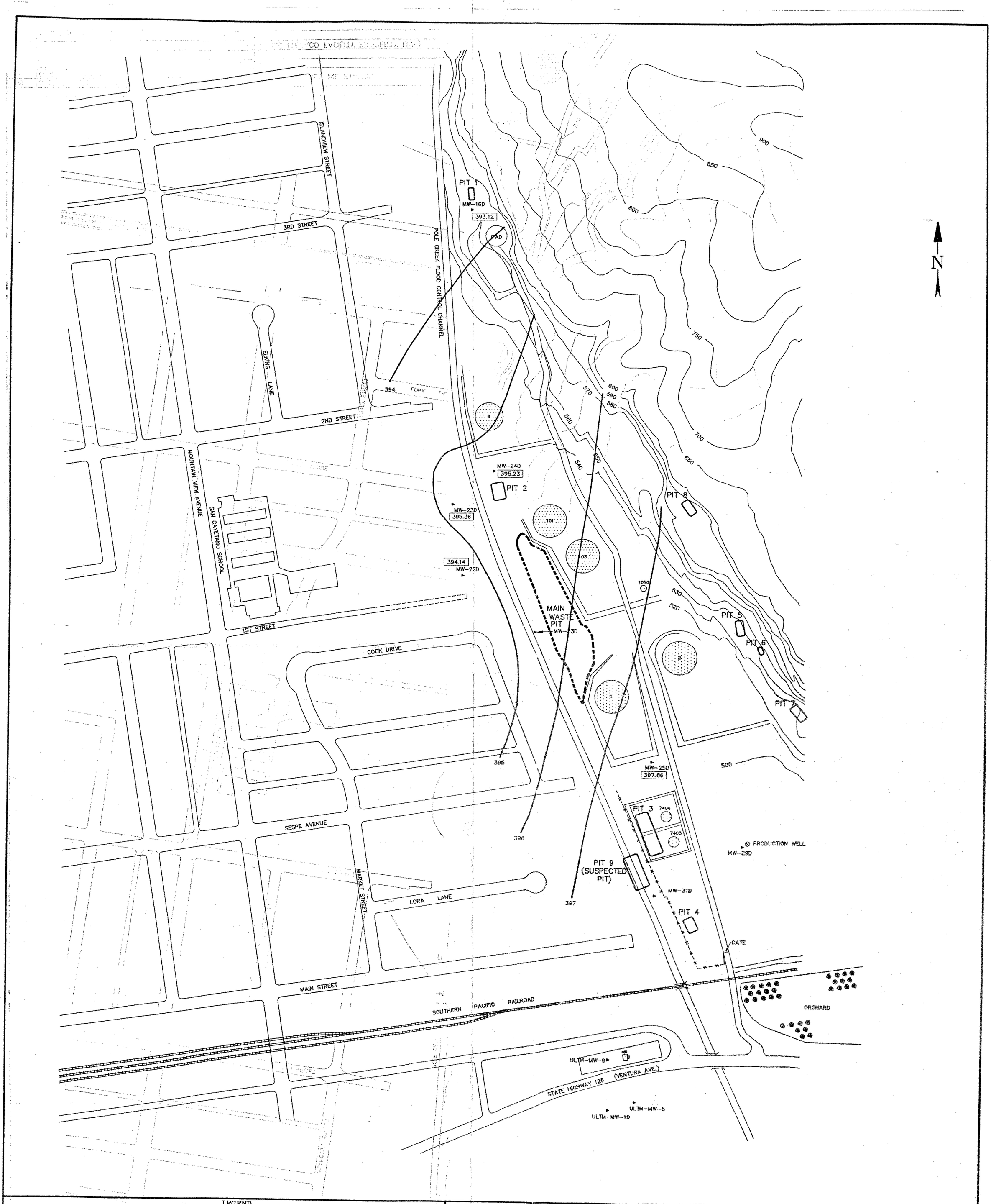
0 100 200
SCALE IN FEET

PLATE: **3-12** (AUG. 1990) AQUIFER II GROUNDWATER SURFACE ELEVATION MAP

REPORT: TEXACO FILLMORE REMEDIAL INVESTIGATION REPORT

CLIENT: TEXACO INC. ENSR PROJECT NO. 6600-047

DATE: 6/6/91	DRAWING FILE NAME: 6600-047.DWG	LAYERS USED: 0,1,2,2A,4,4A,5,5A,6,6A2,6T,6U,13,15,16,28
DRAFTED BY: M. SCOP	REVIEWED BY:	APPROVED BY:



LEGEND

⊗	GROUNDWATER PRODUCTION WELL		ULTRAMAR GASOLINE STATION
▸	GROUNDWATER MONITORING WELL		ORCHARD
396.00	GROUNDWATER ELEVATION (FEET) ABOVE MSL		
396	AQUIFER II GRADIENT CONTOUR		FENCE (TEXACO FACILITY PROPERTY LINE)
	CRUDE OIL STORAGE TANKS		

ENSR

0 100 200
SCALE IN FEET

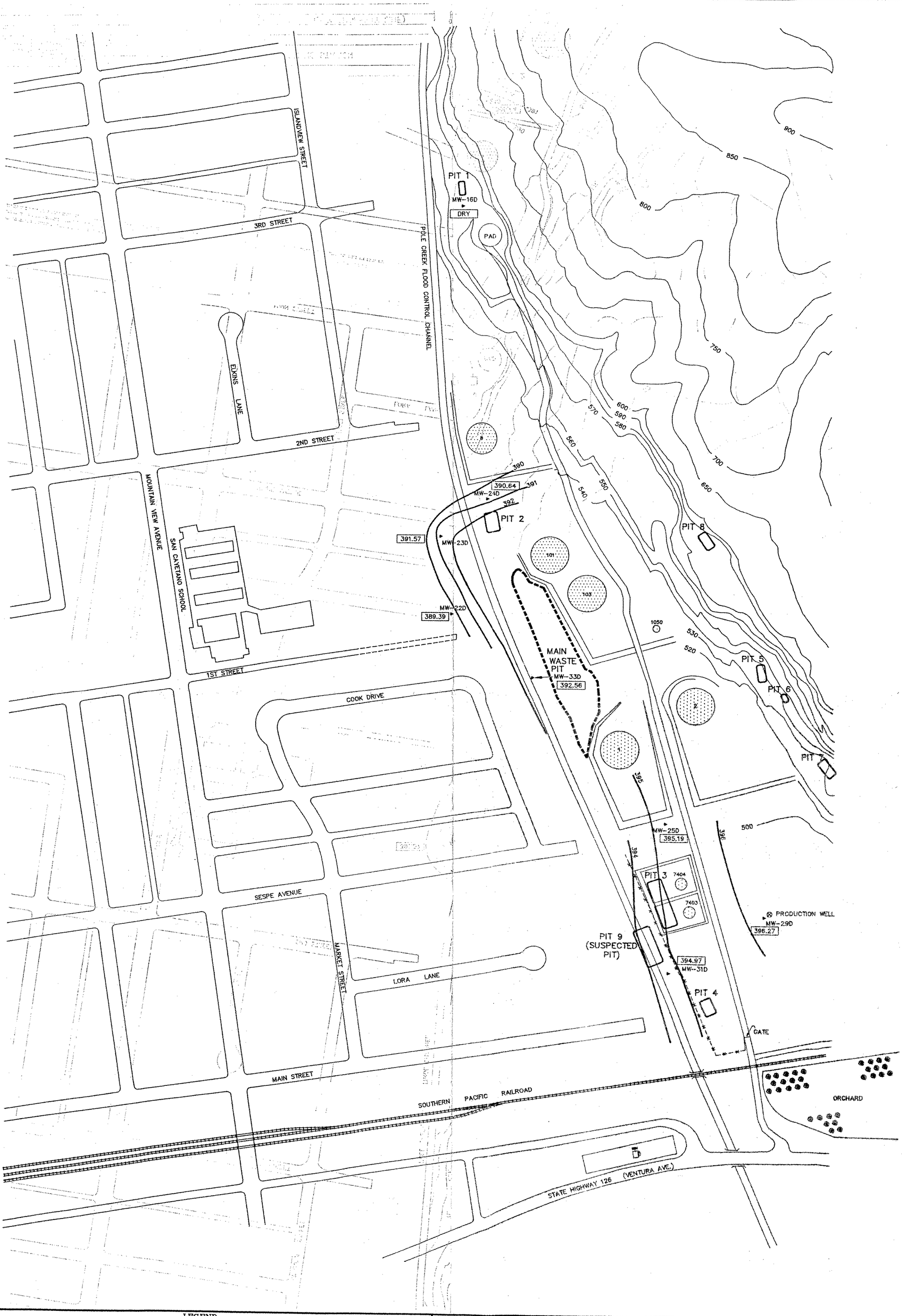
PLATE: 3-13 (SEP. 1990) AQUIFER II GROUNDWATER SURFACE ELEVATION MAP

REPORT: TEXACO FILLMORE REMEDIAL INVESTIGATION REPORT

CLIENT: TEXACO INC. ENSR PROJECT NO. 6600-047

DATE: 6/6/91 DRAWING FILE NAME: 6600-047.DWG LAYERS USED: 0,1,2,2(,3,4A,5,5A,6,6A2,6T,6U,13,15,16,29

DRAFTED BY: M. SCOP REVIEWED BY: APPROVED BY:



LEGEND

⊗	GROUNDWATER PRODUCTION WELL		ULTRAMAR GASOLINE STATION
▸	GROUNDWATER MONITORING WELL		ORCHARD
391.57	GROUNDWATER ELEVATION (FEET) ABOVE MSL		
396	AQUIFER II GRADIENT CONTOUR		FENCE (TEXACO FACILITY PROPERTY LINE)
	CRUDE OIL STORAGE TANKS		

ENSR

0 100 200

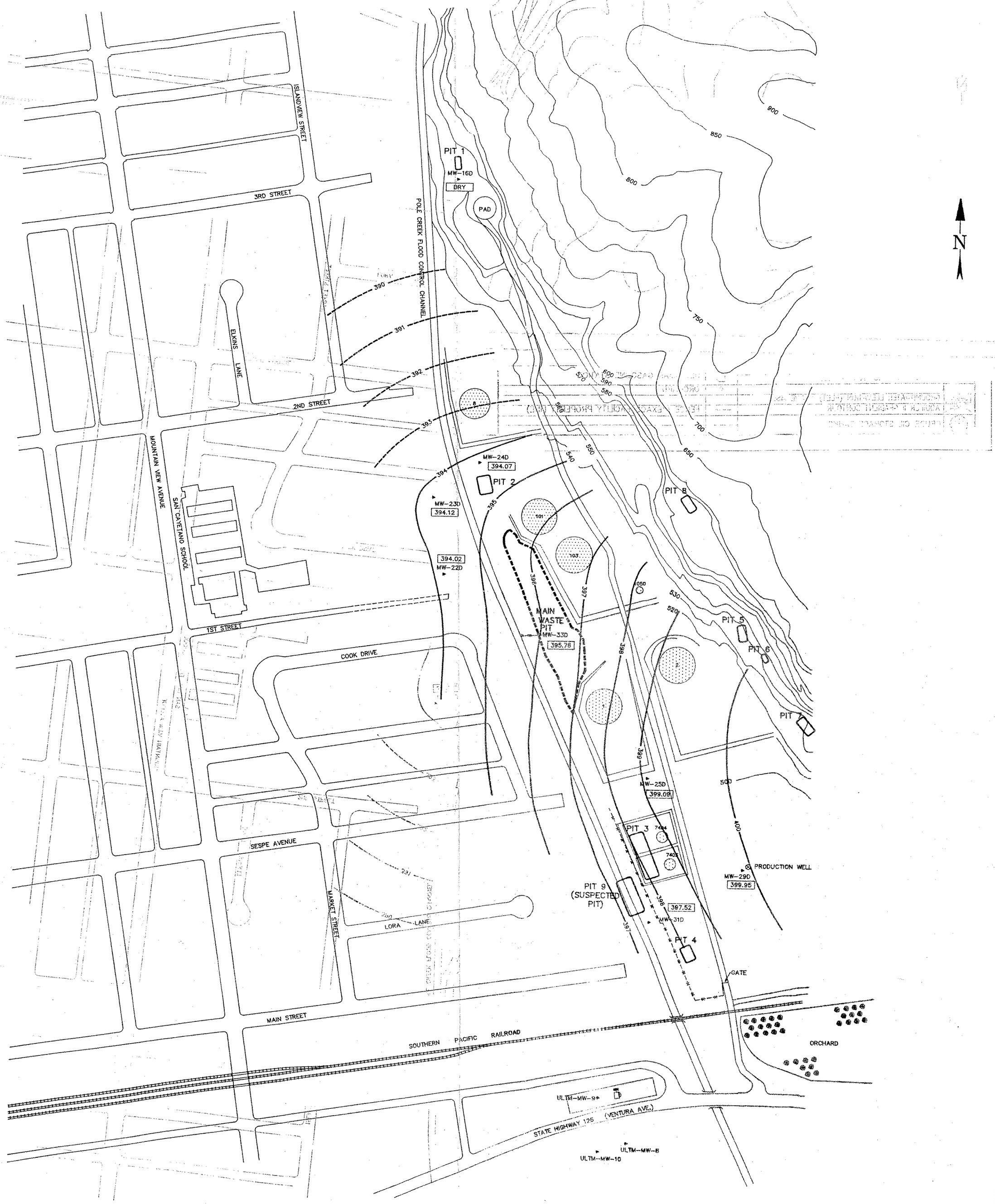
SCALE IN FEET

PLATE: 3-14 FIRST QUARTER (JAN. 1991) AQUIFER II GROUNDWATER SURFACE ELEVATION MAP

REPORT: TEXACO FILLMORE REMEDIAL INVESTIGATION REPORT

CLIENT: TEXACO INC. ENSR PROJECT NO. 6600-047

DATE: 6/5/91	DRAWING FILE NAME: 6600-047.DWG	LAYERS USED: 0,1,2,2A,4,4A,5,5A,6,6A2,6T,6U,13,15,16,38
DRAFTED BY: M. SCOP	REVIEWED BY:	APPROVED BY:



LEGEND			
⊗	GROUNDWATER PRODUCTION WELL		ULTRAMAR GASOLINE STATION
▸	GROUNDWATER MONITORING WELL	⊛	ORCHARD
396.00	GROUNDWATER ELEVATION (FEET) ABOVE MSL		FENCE (TEXACO FACILITY PROPERTY LINE)
396	AQUIFER II GRADIENT CONTOUR		
	CRUDE OIL STORAGE TANKS		

ENSR

0 100 200
SCALE IN FEET

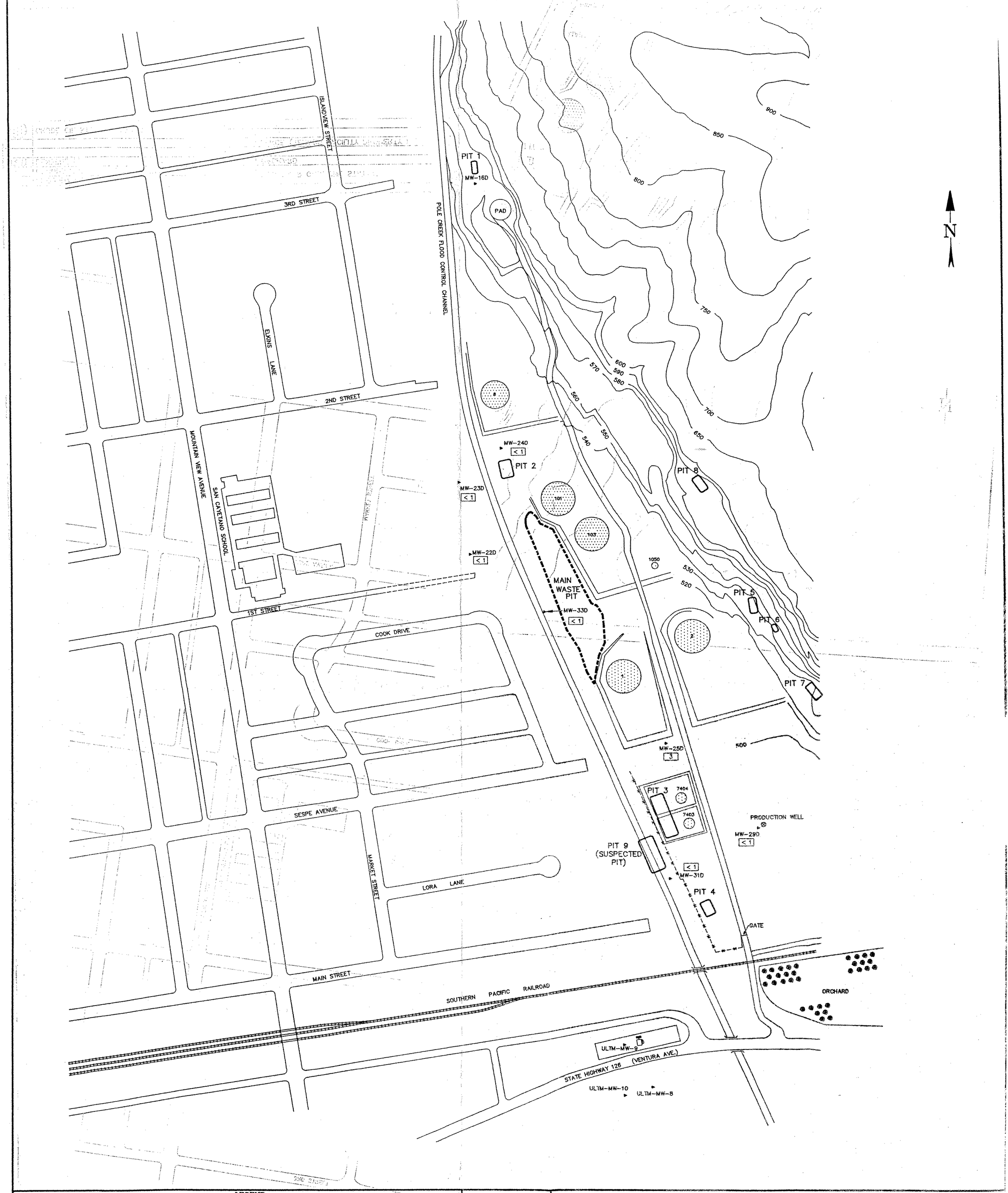
PLATE: 3-15 SECOND QUARTER (MAY, 1991) AQUIFER II GROUNDWATER SURFACE ELEVATION MAP

REPORT: TEXACO FILLMORE REMEDIAL INVESTIGATION REPORT

CLIENT: TEXACO INC. ENSR PROJECT NO. 6600-047

DATE: 6/13/91 DRAWING FILE NAME: 6600-047.DWG LAYERS USED: 0,1,2,3,4,4A,5,5A,6,6A2,6T,6U,13,15,16,46

DRAFTED BY: M. SCOP REVIEWED BY: APPROVED BY:



LEGEND			
⊗	GROUNDWATER PRODUCTION WELL		ULTRAMAR GASOLINE STATION
▸	GROUNDWATER MONITORING WELL		ORCHARD
< 1	BENZENE ppb		
			FENCE (TEXACO FACILITY PROPERTY LINE)
	CRUDE OIL STORAGE TANKS		

ENSR

0 100 200
SCALE IN FEET

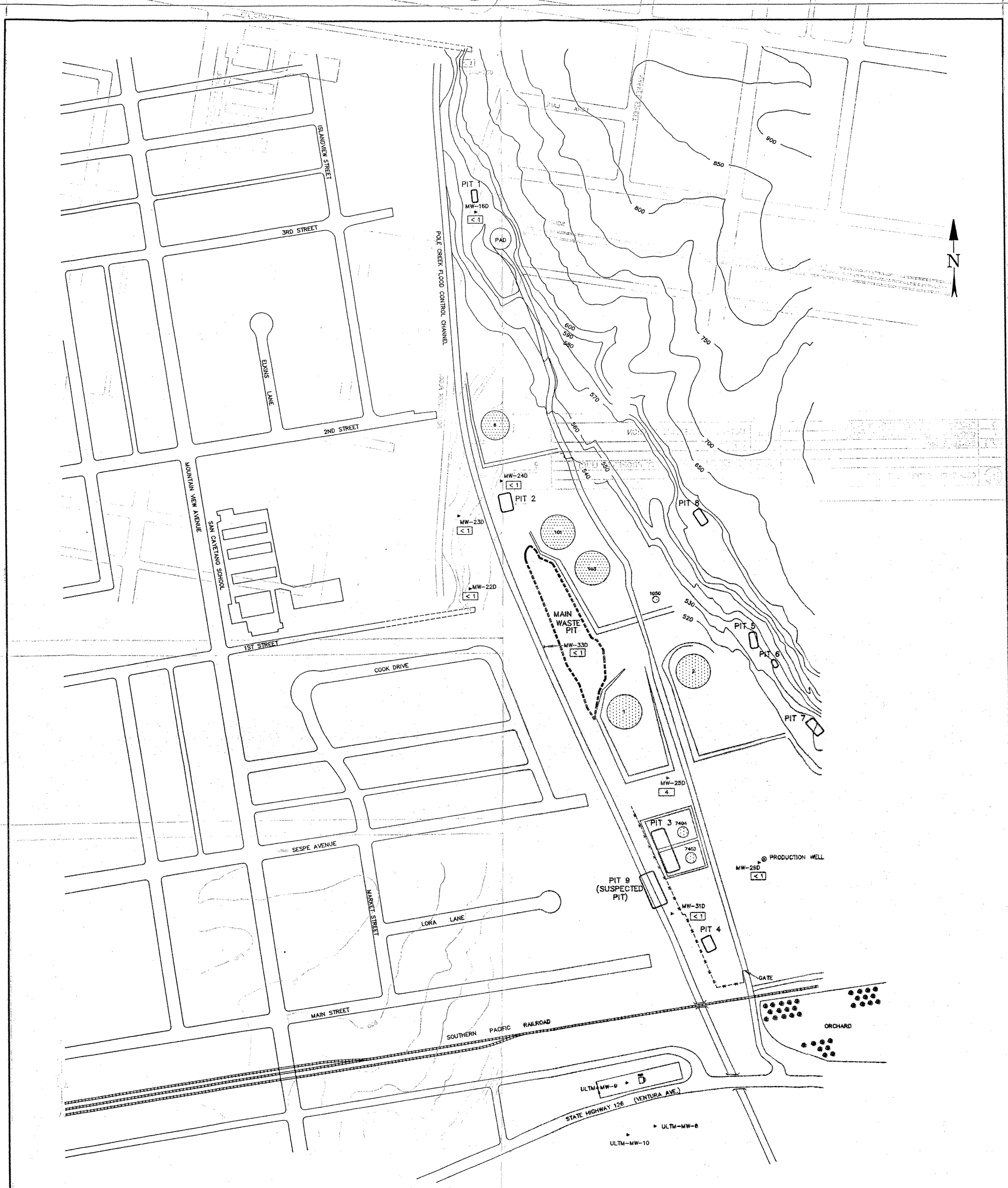
PLATE: 4-1 (SEPT. – OCT. 1990) AQUIFER II BENZENE PLUME

REPORT: TEXACO FILLMORE REMEDIAL INVESTIGATION REPORT

CLIENT: TEXACO INC. ENSR PROJECT NO. 6600-047

DATE: 6/18/91 DRAWING FILE NAME: 6600-047.DWG LAYERS USED: 0,1,2,3,4,44,5,54,6,642,67,69,13,15,16,49

DRAFTED BY: M. SCOP REVIEWED BY: Allen L. Hatfield APPROVED BY:



LEGEND

⊗	GROUNDWATER PRODUCTION WELL		ULTRAMAR GASOLINE STATION
▸	GROUNDWATER MONITORING WELL		ORCHARD
4	BENZENE ppb		
			FENCE (TEXACO FACILITY PROPERTY LINE)
	CRUDE OIL STORAGE TANKS		

ENSR

0 100 200
SCALE IN FEET

PLATE: 4-2 FIRST QUARTER (JAN. 1991) AQUIFER II BENZENE PLUME

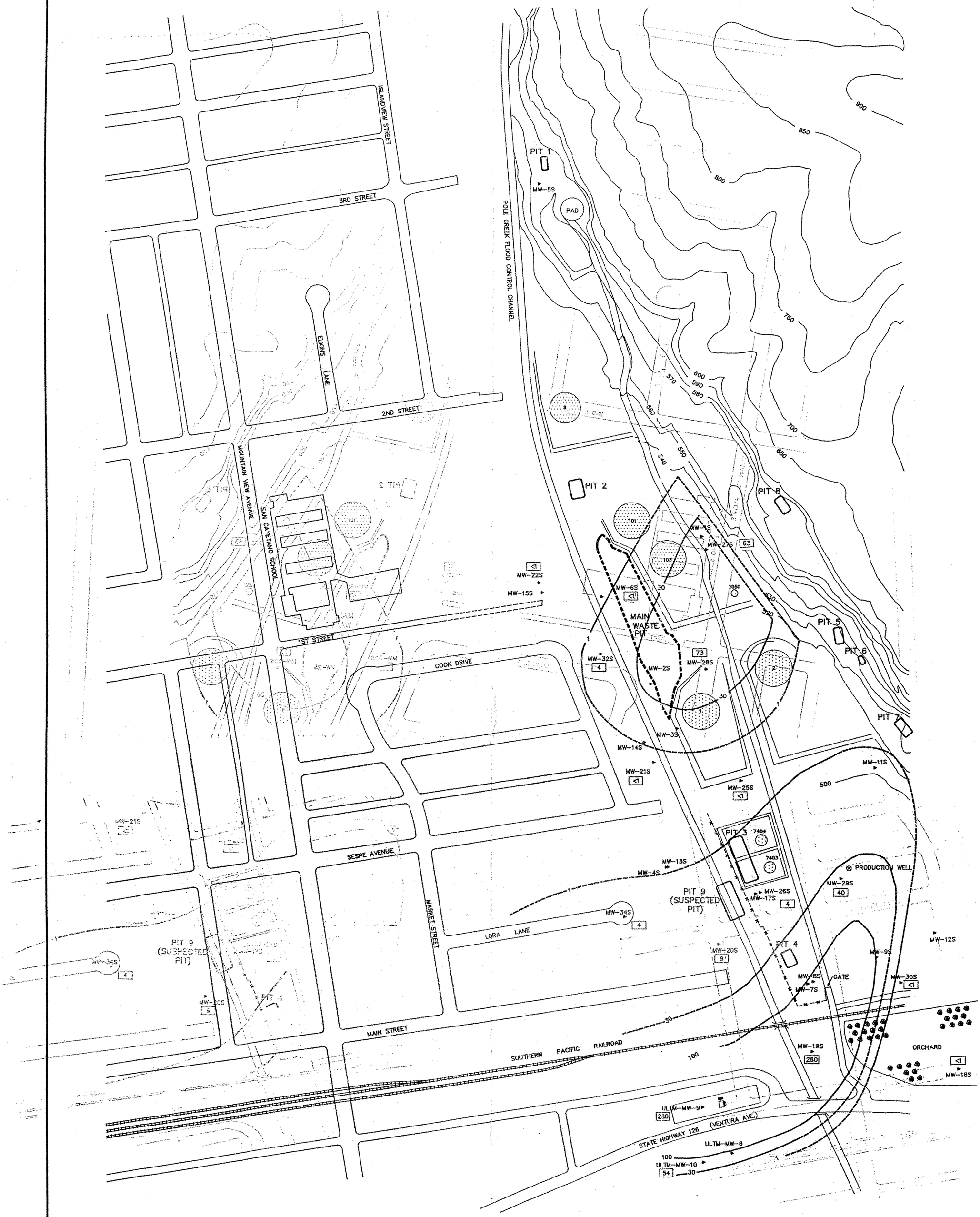
REPORT: TEXACO FILLMORE REMEDIAL INVESTIGATION REPORT

CLIENT: TEXACO INC. ENSR PROJECT NO. 6600-047

DATE: 6/20/91 DRAWING FILE NAME: 6600-047.DWG LAYERS USED: 0,1,2,3A,4,4A,5,5A,6,6A2,6T,8U,13,15,16,41

DRAFTED BY: M. SCOP REVIEWED BY: APPROVED BY:

ISLANDVIEW STREET
3RD STREET
ELKINS LANE
2ND STREET
MOUNTAIN VIEW AVENUE
SAN CAYETANO SCHOOL
1ST STREET
COOK DRIVE
SESPE AVENUE
MARKET STREET
LORA LANE
MAIN STREET
SOUTHERN PACIFIC RAILROAD
STATE HIGHWAY 126 (VENTURA AVE.)
POLE CREEK FLOOD CONTROL CHANNEL
PIT 1
MW-16D
< 1
PAD
MW-24D
PIT 2
MW-23D
MW-22D
MAIN WASTE PIT
MW-33D
MW-25D
11
PIT 3
7404
7403
PIT 9 (SUSPECTED PIT)
MW-31D
PIT 4
PIT 8
PIT 5
PIT 6
PIT 7
MW-29D
ULTM-MW-9
ULTM-MW-10
ULTM-MW-8
ORCHARD
PRODUCTION WELL
900
850
800
750
700
650
600
590
570
560
550
540
530
520
500
1050
101
103
8
2
3
N
LEGEND
GROUNDWATER PRODUCTION WELL
GROUNDWATER MONITORING WELL
BENZENE ppb
CRUDE OIL STORAGE TANKS
ULTRAMAR GASOLINE STATION
ORCHARD
FENCE (TEXACO FACILITY PROPERTY LINE)
0 100 200
SCALE IN FEET
ENSR
PLATE: 4-3
SECOND QUARTER (MAY 1991) AQUIFER II BENZENE PLUME
REPORT: TEXACO FILLMORE REMEDIAL INVESTIGATION REPORT
CLIENT: TEXACO INC. ENSR PROJECT NO. 6600-047
DATE: 6/6/91
DRAFTED BY: M. SCOP
DRAWING FILE NAME: 6600-047.DWG
REVIEWED BY:
LAYERS USED: 0,1,2,3,4,4A,5,5A,6,6A2,6T,6U,13,15,16,44
APPROVED BY:



LEGEND

⊗	GROUNDWATER PRODUCTION WELL		ULTRAMAR GASOLINE STATION
▸	GROUNDWATER MONITORING WELL		ORCHARD
▸	GROUNDWATER MONITORING WELL (DECOMMISSIONED)	54	BENZENE ppb
30	BENZENE CONCENTRATION CONTOUR		FENCE (TEXACO FACILITY PROPERTY LINE)
	CRUDE OIL STORAGE TANKS		

ENSR

0 100 200
SCALE IN FEET

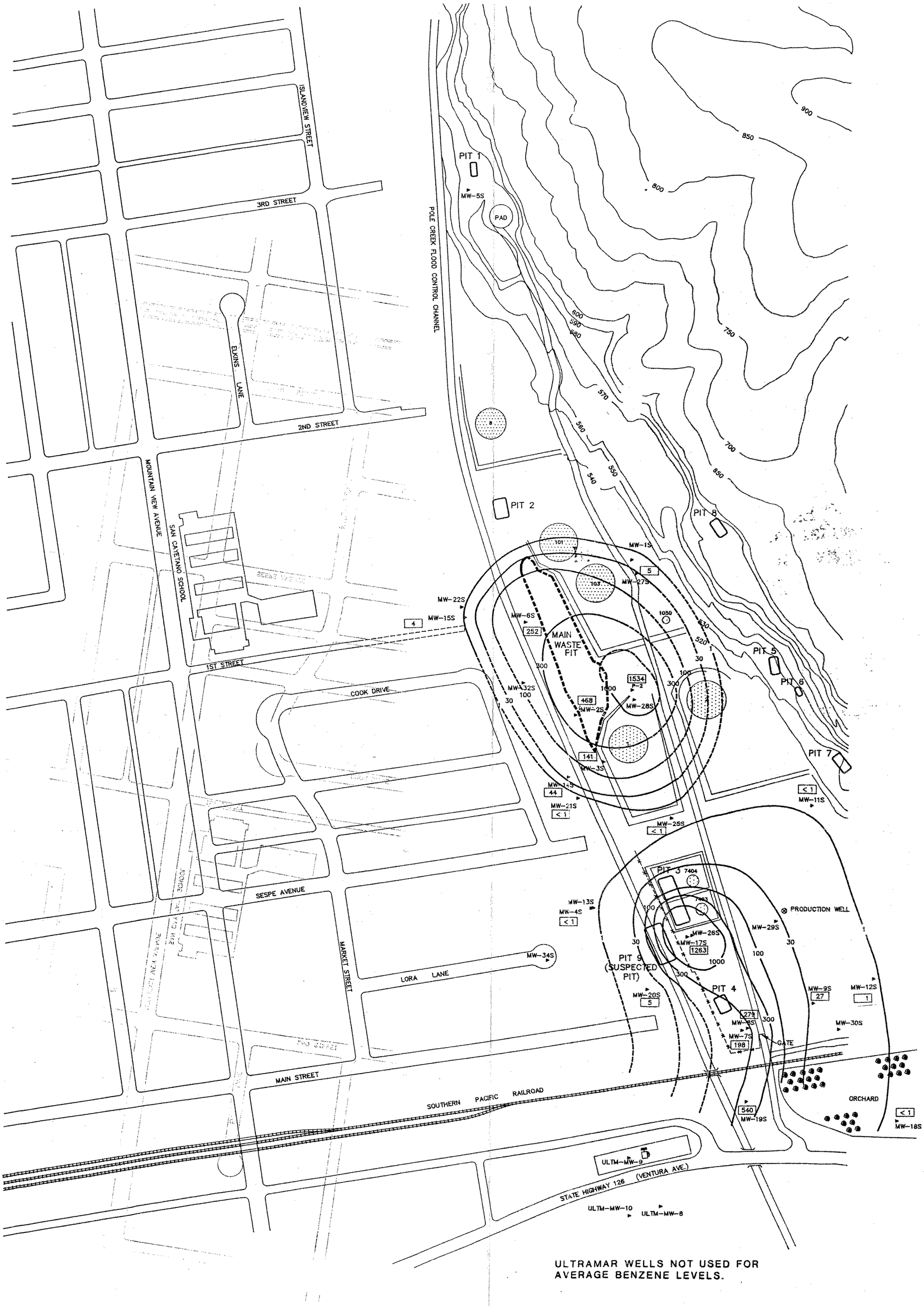
PLATE: 4-6 SECOND QUARTER (MAY, 1991) AQUIFER I BENZENE PLUME

REPORT: TEXACO FILLMORE REMEDIAL INVESTIGATION REPORT

CLIENT: TEXACO INC. ENSR PROJECT NO. 6600-047

DATE: 6/13/91 DRAWING FILE NAME: 6600-047.DWG LAYERS USED: 0,1,2,2A,4,4A,5,5A,6,6A1,6T,6U,13,15,16,47

DRAFTED BY: M. SCOTT REVIEWED BY: APPROVED BY:



ULTRAMAR WELLS NOT USED FOR AVERAGE BENZENE LEVELS.

LEGEND

⊗	GROUNDWATER PRODUCTION WELL		ULTRAMAR GASOLINE STATION
▸	GROUNDWATER MONITORING WELL		ORCHARD
▹	GROUNDWATER MONITORING WELL (DECOMMISSIONED)		
4	BENZENE ppb		
—30—	BENZENE CONCENTRATION CONTOUR		FENCE (TEXACO FACILITY PROPERTY LINE)
	CRUDE OIL STORAGE TANKS		

ENSR

0 100 200
SCALE IN FEET

PLATE: 4-7 AVERAGE BENZENE CONCENTRATION (1986–1990), AQUIFER I MONITORING WELLS

REPORT: TEXACO FILLMORE REMEDIAL INVESTIGATION REPORT

CLIENT: TEXACO INC. ENSR PROJECT NO. 6600-047

DATE: 6/24/91 DRAWING FILE NAME: 6600-047.DWG LAYERS USED: 1,2,2A,4,4A,5,5A,6,6A1,6T,6U,13,15,24

DRAFTED BY: M. SCOP REVIEWED BY: Ellen J. Hadfield APPROVED BY:

SOURCE:
TRIHYDRO CORPORATION
"SOIL GAS RI/FS INVESTIGATION
TEXACO FACILITY
FILLMORE, CALIFORNIA"

LEGEND

⊗	GROUNDWATER PRODUCTION WELL		ULTRAMAR GASOLINE STATION
·	TESTHOLE LOCATION		ORCHARD
■	AIR WELL LOCATION		
—12—	TOTAL ORGANIC VAPOR CONCENTRATION CONTOUR, (ppmv)		FENCE (TEXACO FACILITY PROPERTY LINE)
◯	CRUDE OIL STORAGE TANKS		

ENSR

0 100 200
SCALE IN FEET

PLATE: 4-8 SOIL GAS SURVEY LOCATIONS AND ORGANIC VAPOR CONTOUR MAP

REPORT: TEXACO FILLMORE REMEDIAL INVESTIGATION REPORT

CLIENT: TEXACO INC. ENSR PROJECT NO. 6600-047

DATE: 6/20/91	DRAWING FILE NAME: 6600-047.DWG	LAYERS USED: 0,1,2,2A,4,4A,5,5A,13,15,16,51
DRAFTED BY: M. SCOP	REVIEWED BY:	APPROVED BY: