N60478.AR.000466
NWS EARLE
5090.3a

# BIOSLURPER STATUS REPORT
# FOR FEBRUARY & MARCH 1998
# NAVAL WEAPONS STATION - EARLE
# COLTS NECK, NEW JERSEY

*Issued:*

April 21, 1998

*Prepared for:*

Naval Facilities Engineering Command
10 Industrial Highway
Lester, PA 19113

*Prepared by:*

Foster Wheeler Environmental Corporation
2300 Lincoln Highway
One Oxford Valley - Suite 200
Langhorne, PA 19047 - 1829

REMEDIAL ACTION CONTRACT N62472-94-D-0398
DELIVERY ORDER NO. 0017

BIOSLURPER STATUS REPORT
FOR FEBRUARY & MARCH 1998
NAVAL WEAPONS STATION - EARLE
COLTS NECK, NEW JERSEY

## TABLE OF CONTENTS


| SECTION | | PAGE |
|---|---|---|
| 1.0 | INTRODUCTION | 1 |
| 2.0 | SYSTEM OPERATIONS AND PROBLEMS ENCOUNTERED | 1 |
| 3.0 | EVALUATION OF SITE CONDITIONS | 4 |
| 4.0 | PRODUCT RECOVERY DATA | 5 |
| 5.0 | EFFLUENT AND AIR ANALYSIS | 5 |


## FIGURES


| FIGURE | PAGE |
|---|---|
| FIGURE 1: RECOVERY WELL/SYSTEM LAYOUT | 3 |


## TABLES


| | |
|---|---|
| TABLE 1: OIL AND GROUNDWATER EXTRACTED TO DATE | 6 |
| TABLE 2: TOTAL PETROLEUM HYDROCARBONS REMOVED VIA AIR AND GROUNDWATER TREATMENT | 6 |
| TABLE 3: ANALYTICAL RESULTS OF AIR DISCHARGE SAMPLES | 7 |
| TABLE 4:BIOSLURPER UNIT NO.1 TOTAL PETROLEUM HYDROCARBON (TPH) EFFLUENT CONCENTRATIONS | 8 |
| TABLE 5:BIOSLURPER UNIT NO.2 TOTAL PETROLEUM HYDROCARBON (TPH) EFFLUENT CONCENTRATIONS | 9 |

BIOSLURPER STATUS REPORT
FOR FEBRUARY & MARCH 1998
NAVAL WEAPONS STATION - EARLE
COLTS NECK, NEW JERSEY

## TABLE OF CONTENTS

## APPENDICES


APPENDIX A: GRAPHS OF OIL/WATER EXTRACTED TO DATE

APPENDIX B: GRAPHS OF WATER LEVELS AND PRODUCT THICKNESS DATA FROM EXTRACTION WELLS

APPENDIX C: GRAPHS OF AIR MEASUREMENTS OBTAINED FROM EXTRACTION WELLS

APPENDIX D: CALCULATIONS

APPENDIX E: ANALYTICAL DATA

## 1.0 INTRODUCTION

This report summarizes the first quarter results for the ongoing bioslurper operations at Site 16 at the Naval Weapons Station-Earle facility. The report summarizes the product recovered, groundwater treated, and the analytical results of the air and effluent discharges from the bioslurper systems.

Two bioslurper units were brought on line in January 1998. Due to Discharge Permit issues, the system was only operated for a short time in January. The systems were manned during their operational modes and the treated groundwater stored in an effluent tank. The systems were operated more frequently in February 1998, but not on a full-time basis. The bioslurper systems were operated intermittently due to process system shakedowns, minor system modifications, and consistently flooded conditions in the extraction well area due to heavy rains during the months of February and early March.

## 2.0 OPERATIONS AND DIFFICULTIES ENCOUNTERED

FEBRUARY

Bioslurper Unit #1 was operated for a total of 34 hours between January 15, 1998 and February 25, 1998, and Bioslurper Unit #2 was operated for a total of 15 hours. The total amount of groundwater extracted during this time period was 29,957 gallons, with approximately 425 gallons of free-phase oil removed. Appendix A provides a graphical representation of the amount of oil/groundwater extracted, and the operational hours for each Unit.

During normal operating conditions, the extraction wells remove between 0.5 to 1.5 gallons per minute (gpm) per well. During the month of February, the area around the extraction wells was flooded for the majority of the time. When the wells were operated, they were extracting between 2 to 6 gpm per well. Due to a minimal amount of oil being recovered during extended operation of the systems, the units were turned off the majority of the time. By operating the extraction units periodically, the maximum amount of oil was withdrawn while minimizing the amount of water that required treatment, thus decreasing some of the costs associated with change out of treatment media. During high precipitation periods, the surface water runoff lies in the drainage ditches in which the extraction wells are located. The extraction of excess water during flooded conditions is most likely due to the vacuum pulling in water infiltrating down through the vadose zone to the groundwater table. The elevated water table may also decrease the amount of available free-product available on the water table Non-aqueous phase liquid (NAPL) tends to smear-out as water table rises).

One of the operational difficulties encountered in February involved the build-up of excessive backpressure from the clay absorption units. The clay absorption units would build up excessive backpressure at an accelerated rate, activating the bagpressure

transducer (set at a maximum pressure of 100 pounds per square inch, psi). Backwashing the clay units into the oil/water separator resulted in only short-term improvements. In order to resolve the problem, the clay media vendor was replaced and the clay vessels were bedded with anthracite on the bottom. The media changeout alleviated the backpressure buildup. The backpressure will still build up as the media becomes spent, but at a more timely rate.

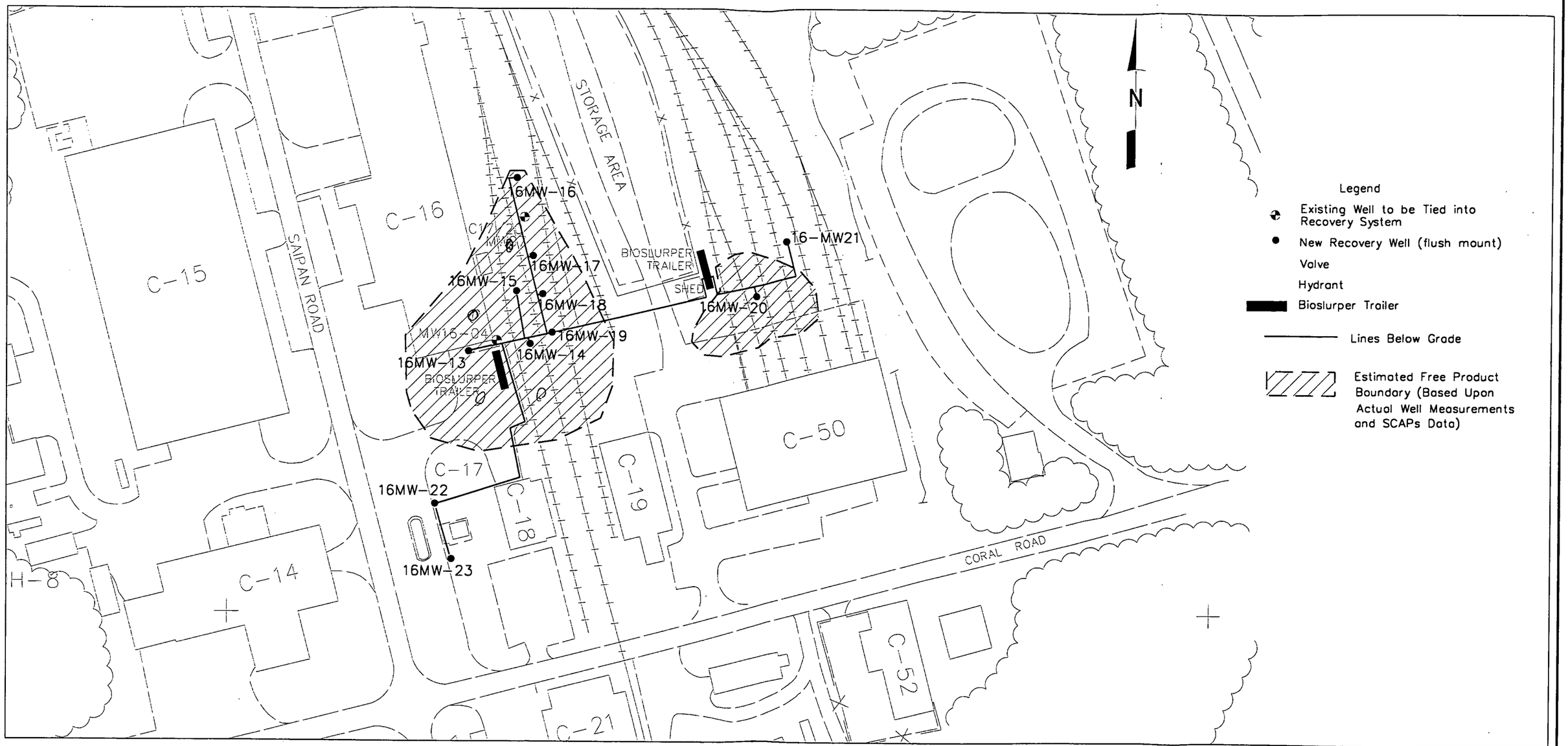
Additional modifications to the system during February included various combinations of extraction rates from different wells, and a re-determination of which Unit should extract from which wells. The optimal set-up determined was to use Bioslurper Unit #1 (located adjacent to Building C-16) to extract from the following product extraction wells: 16MW-13, 16MW-14, 16MW-15, MW16-04, and vapor extraction wells: 16MW-22 and 16MW-23. Bioslurper Unit #2 (located north of Building C-50), originally used only to extract from 16MW-20, was then reconfigured to also extract from 16MW-16, C17/20MW-07, 16MW-17 and 16MW-19. Figure 1 depicts the locations of the extraction wells and bioslurping systems.

MARCH

Bioslurper Unit #1 was operated for a total of 56.5 hours during March, and Bioslurper Unit #2 was operated for a total of 38.5 hours. The total amount of groundwater extracted during March was 46,755 gallons, with approximately 425 gallons of free-phase oil also removed. Appendix A provides a graphical representation of the amount of oil/groundwater extracted, and the operational hours for each Unit.

While more groundwater was extracted during the month of February than in March, the oil withdrawn remained essentially the same. The amount of water withdrawn averaged 1 gpm per well, which is standard for this type of recovery system. Cycling of the system was started the end of March, and will continue through April to determine if cycling the extraction systems several hours a day can recover all available oil, while minimizing the amount of groundwater withdrawn.

The operational problems encountered during March were typical fouling of level switches, which was rectified by cleaning as part of the routine O & M on the system.




U.S. Navy RAC
Naval Weapons Station - Earle

Recovery Well /System Layout

FOSTER WHEELER ENVIRONMENTAL CORPORATION

| SCALE | NO. | DATE | DESCRIPTION | PREP | CHECK | APPROVED | DRAWING NO. | DRAWN BY | APPROVED |
|---|---|---|---|---|---|---|---|---|---|
| 1"=100' | | | Issued for Construction | | | | Figure 1 | | C. Tippmann |

SITEPLN1

## 3.0 EVALUATION OF SITE CONDITIONS

Water level and product thickness measurements have been obtained periodically from the extraction wells since August 1997, to establish product thickness and groundwater elevation trends. Appendix B provides a graphical representation of the water levels and product thickness in the extraction wells. All of the product extraction wells contained measurable product, with the exception of 16MW-18 and 16MW-21. As expected, the vapor extraction wells (16MW-22 and 16MW-23) located near the former gas station, did not contain measurable free-product.

It is important to note that the oil thickness in the extraction wells do not directly correspond to the actual oil thickness in the aquifer formation. Capillary forces and liquid density differences result in a greater oil thickness within a well than is actually present in the formation. The "apparent oil thickness" in a well is a function of the grain size of the formation media, the water table elevation, and the type of oil. Published data suggest that the "apparent product thickness" exaggeration factor in the wells containing diesel fuel may be as high as a factor of 5.8. In other words, if the "apparent product thickness" in a well is measured to be 1 foot thick, the actual product thickness atop the water table is approximately 0.17 feet.

Another way of determining the actual product thickness versus the apparent product thickness in a well is to conduct a bail-down test. One type of bail-down test involves the removal of both product and water from the well until no further reduction in thickness can be achieved. Once the well is sufficiently bailed, the fluid recovery rate in the well is monitored. After the bail-down test is complete, the top of the water (product/water interface) initially rises then falls. The fall in the water level is due to the over-accumulation of product on the water surface, which displaces the water in the well. Published data refer to the point in which the groundwater water level in the well goes from rising to falling as *the inflection point*. The distance between the inflection point and the top of the product is considered to be the actual mobile product thickness in the formation. Six bail-down tests were completed on extraction wells prior to the start-up of the Bioslurper Units. Based on the actual product thickness (as determined by the product thickness at the inflection point during the bail-down test) and the "apparent product thickness" (determined by direct measurements in the well prior to the bail-down test), the average product thickness exaggeration in the wells at the site is a factor of four. In other words, if the "apparent product thickness" in a well is 1 foot, the actual product thickness in the aquifer is 0.25 feet.

Base line air measurements were also obtained prior to system start-up and during system operation. The air measurement readings from the wells are presented in Appendix C. As anticipated, the air levels in most extraction wells are showing an increase in oxygen concentration, while showing a decrease in carbon dioxide and methane.

## 4.0 PRODUCT RECOVERY DATA

Table 1 summarizes the amount of free-phase oil recovered from the Bioslurper Extraction Units. Appendix A provides a graphical representation of the amount of oil/groundwater extracted and the operational hours of the system. Table 2 summarizes the volume of petroleum hydrocarbons removed via the air extraction and groundwater treatment components of bioslurper systems. The calculations used to obtain this data are presented in Appendix D.

## 5.0 EFFLUENT AND AIR ANALYSIS

The effluent and the air discharges from the bioslurper units are routinely sampled to ensure the discharges are in compliance with the NJDEP air discharge permit and the requirements set forth by the Navy Weapons Station-Earle Sewer Treatment Plant. The air discharge is sampled for total volatile organics (including benzene) and total petroleum hydrocarbons (TPH). Table 3 summarizes the analytical results of the air discharge samples and the permit limits. Tables 4 and 5 summarize the analytical results for the groundwater effluent discharge samples collected from the bioslurper treatment units.

As indicated by the analytical results, both bioslurper units are operating within the permit requirements established for air and treated water discharge. The calculations for this data are provided in Appendix D, and the associated analytical data is provided in Appendix E.

**TABLE 1:**
**NAVAL WEAPONS STATION-EARLE BIOSLURPER UNITS**
**OIL AND GROUNDWATER EXTRACTED TO DATE**

| | Free-Phase Oil Extracted in February | Free-Phase Oil Extracted in March | Total Free-Phase Oil Extracted to Date | Groundwater Extracted/Treated in February | Groundwater Extracted/Treated in March | Total Groundwater Extracted/Treated to Date |
|---|---|---|---|---|---|---|
| Bioslurper System #1 | 400 gallons | 375 gallons | 775 gallons | 24,675 gallons | 26,169 gallons | 50,844 gallons |
| Bioslurper System #2 | 25 gallons | 50 gallons | 75 gallons | 5,282 gallons | 20,586 gallons | 25,868 gallons |
| Total | 425 gallons | 425 gallons | 850 gallons | 29,957 gallons | 46,775 gallons | 76,732 gallons |

**TABLE 2**
**NAVAL WEAPONS STATION-EARLE BIOSLURPER UNITS**
**TOTAL PETROLEUM HYDROCARBONS REMOVED VIA AIR AND GROUNDWATER TREATMENT**

| | Total Petroleum Hydrocarbons Extracted via Groundwater Treatment in February | Total Petroleum Hydrocarbons Extracted via Air in February | Total Petroleum Hydrocarbons Extracted via Groundwater Treatment in March | Total Petroleum Hydrocarbons Extracted via Air in March | Total TPH Extracted Via Air and Groundwater Treatment To Date |
|---|---|---|---|---|---|
| Bioslurper System #1 | 60.75 lbs. | 22.4 lbs. | 125.14 lbs. | 16.95 lbs. | 225.24 lbs. |
| Bioslurper System #2 | 4.25 lbs. | 4.5 lbs. | 14.17 lbs. | 7.7 lbs. | 30.62 lbs. |
| Total | 65 lbs. | 26.9 lbs. | 139.31 lbs. | 24.65 | 255.86 lbs. |

## TABLE 3:
## NAVAL WEAPONS STATION-EARLE BIOSLURPER UNITS
## ANALYTICAL RESULTS OF AIR DISCHARGE SAMPLES

| Bioslurper Unit | Total Volatile Organics in ppm(v)* | Total Volatile Organics (ppm(v)) Air Permit Limit | Total Volatile Organics in lbs./hr.. | Total Volatile Organics Air Permit Limits in lbs/hr. | Benzene Concentration in ppm(v) | Benzene Concentration Limit in ppm(v) for Air Permit | Benzene Concentration in lbs/hr | Benzene Concentration Limit in lbs/hr for Air Permit |
|---|---|---|---|---|---|---|---|---|
| Bioslurper Unit #1 16(A)VD-98-2 (1/29/98) | 10.3 ppm(v) | 27 ppm(v) | 0.014 lbs/hr | 0.035 lbs/hr | 4.2 ppm(v) | 7 ppm(v) | 0.005 lbs/hr | 0.008 lbs/hr |
| Bioslurper Unit #2 16(B)VD-98-2 (3/5/98) | 10.9 ppm(v) | 27 ppm(v) | 0.016 lbs/hr | 0.035 lbs/hr | 1.1 ppm(v) | 7 ppm (v) | 0.0012 lbs./hr | 0.008 lbs/hr |
| Bioslurper Unit #1 16(A)VD-98-3 (3/27/98) | 8.7 ppm(v) | 27 ppm(v) | 0.012 lbs/hr | 0.035 lbs/hr | 1.9 ppm(v) | 7 ppm(v) | 0.002 lbs/hr | 0.008 lbs/hr |
| Bioslurper Unit #2 16(B)VD-98-3 (3/28/98) | 7.1 ppm(v) | 27 ppm(v) | 0.011 lbs/hr | 0.035 lbs/hr | 0.5 ppm(v) | 7 ppm(v) | 0.0005 lbs/hr | 0.008 lbs/hr |

* Parts per million per volume of air

**TABLE 4:**
**BIOSLURPER UNIT NO.1**
**TOTAL PETROLEUM HYDROCARBON (TPH) EFFLUENT CONCENTRATIONS**

| EFFLUENT SAMPLES January 16, 1998 | TPH Concentration | EFFLUENT SAMPLES March 17, 1998 | TPH Concentration | EFFLUENT SAMPLES March 27, 1998 | TPH Concentration |
|---|---|---|---|---|---|
| Untreated Effluent **16(A)EW-98-S2** | 295 ppm | Untreated Effluent **16(A)EW-98-W3** | 395 ppm | Untreated Effluent **16(A)EW-98-W9** | 751 ppm |
| After 1st Clay Unit **16(A)EW-98-S3** | 12.1 ppm | After 1st Clay Unit **16(A)EW-98-W4** | 55.6 ppm | After 1st Clay Unit **16(A)EW-98-W10** | 148 ppm |
| After 2 Clay Units **16(A)EW-98-S4** | ND | After 2 Clay Units **16(A)EW-98-W5** | 31.4 ppm | After 2 Clay Units **16(A)EW-98-W11** | 196 ppm |
| | | After 3 Clay Units **16(A)EW-98-W6** | 18.7 ppm | After 3 Clay Units **16(A)EW-98-W12** | 10.8 ppm |
| After 2 Clay Units and 1 Carbon Unit **16(A)EW-98-S5** | ND | After 3 Clay Units and 1 Carbon Unit **16(A)EW-98-W7** | 10.6ppm | After 3 Clay Units and 1 Carbon Unit **16(A)EW-98-W13** | 1.14 ppm |
| After 2 Clay Units and 2 Carbon Units (2/9/98) **16(A)EW-98-S1** | ND | After 3 Clay Units and 2 Carbon Units **16(A)EW-98-W8** | 3.02 ppm | After 3 Clay Units and 2 Carbon Units **16(A)EW-98-W14** | ND |
| | | | | | |

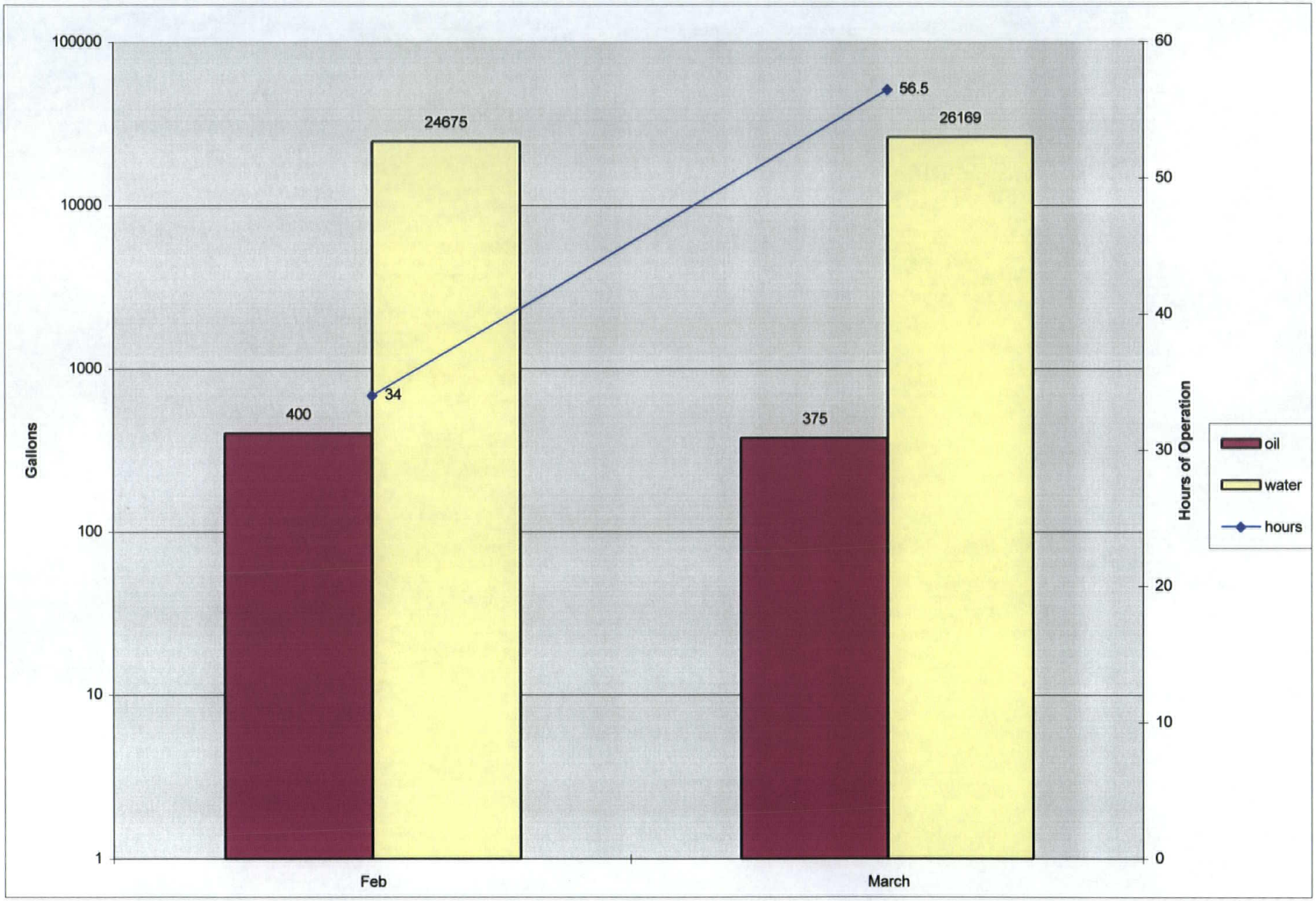
**The NWS-Earle Sewer Treatment Plant NJPDES Permit Discharge Limit for TPH is 10 ppm.**

## TABLE 5:
## BIOSLURPER UNIT NO.2
## TOTAL PETROLEUM HYDROCARBON (TPH) EFFLUENT CONCENTRATIONS

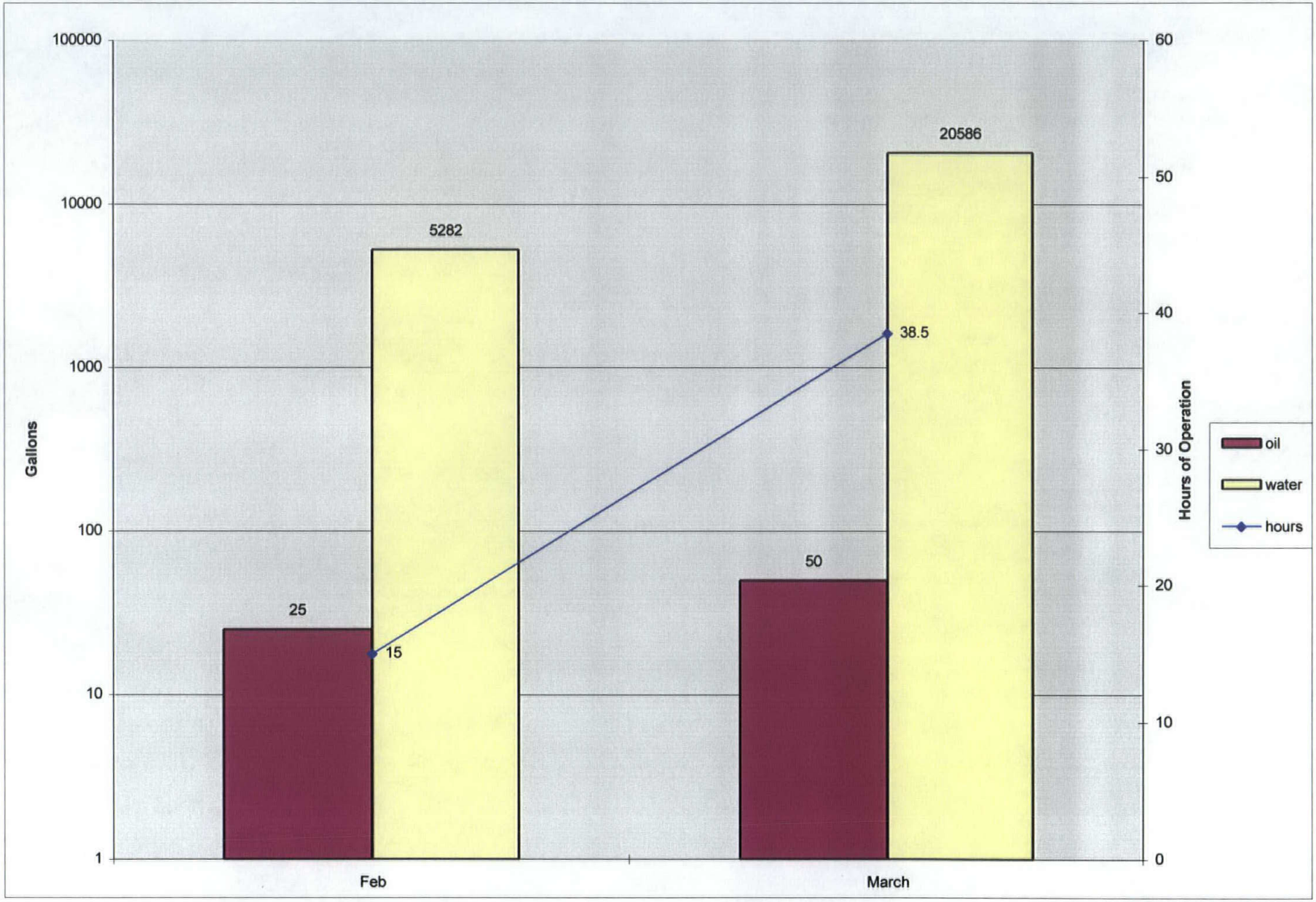
| EFFLUENT SAMPLES January 29, 1998 | TPH Concentration | EFFLUENT SAMPLES March 3, 1998 | TPH Concentration | EFFLUENT SAMPLES March 27, 1998 | TPH Concentration |
|---|---|---|---|---|---|
| Untreated Effluent **16(B)EW-98-S2** | 96.5 ppm | Untreated Effluent **16(B)EW-98-W1** | 112 ppm | Untreated Effluent **16(B)EW-98-W9** | 26.1 ppm |
| After 1st Clay Unit | --- | After 1st Clay Unit **16(B)EW-98-W2** | 137 ppm | After 1st Clay Unit **16(B)EW-98-W10** | 52.6 ppm |
| After 2 Clay Units | --- | After 2 Clay Units **16(B)EW-98-W3** | 38.5 ppm | After 2 Clay Units **16(B)EW-98-W11** | 11.2 ppm |
| | | | | After 3 Clay Units **16(B)EW-98-W12** | ND |
| After 2 Clay Units and 1 Carbon Unit | --- | After 2 Clay Units and 1 Carbon Unit **16(B)EW-98-W4** | 6.68 ppm | After 3 Clay Units and 1 Carbon Unit **16(B)EW-98-W13** | ND |
| After 2 Clay Units and 2 Carbon Units **16(A)EW-98-S6** | ND | After 2 Clay Units and 2 Carbon Units **16(B)EW-98-W5** | ND | After 3 Clay Units and 2 Carbon Units **16(B)EW-98-W14** | ND |
| | | | | | |

**The NWS-Earle Sewer Treatment Plant NJPDES Permit Discharge Limit for TPH is 10 ppm.**

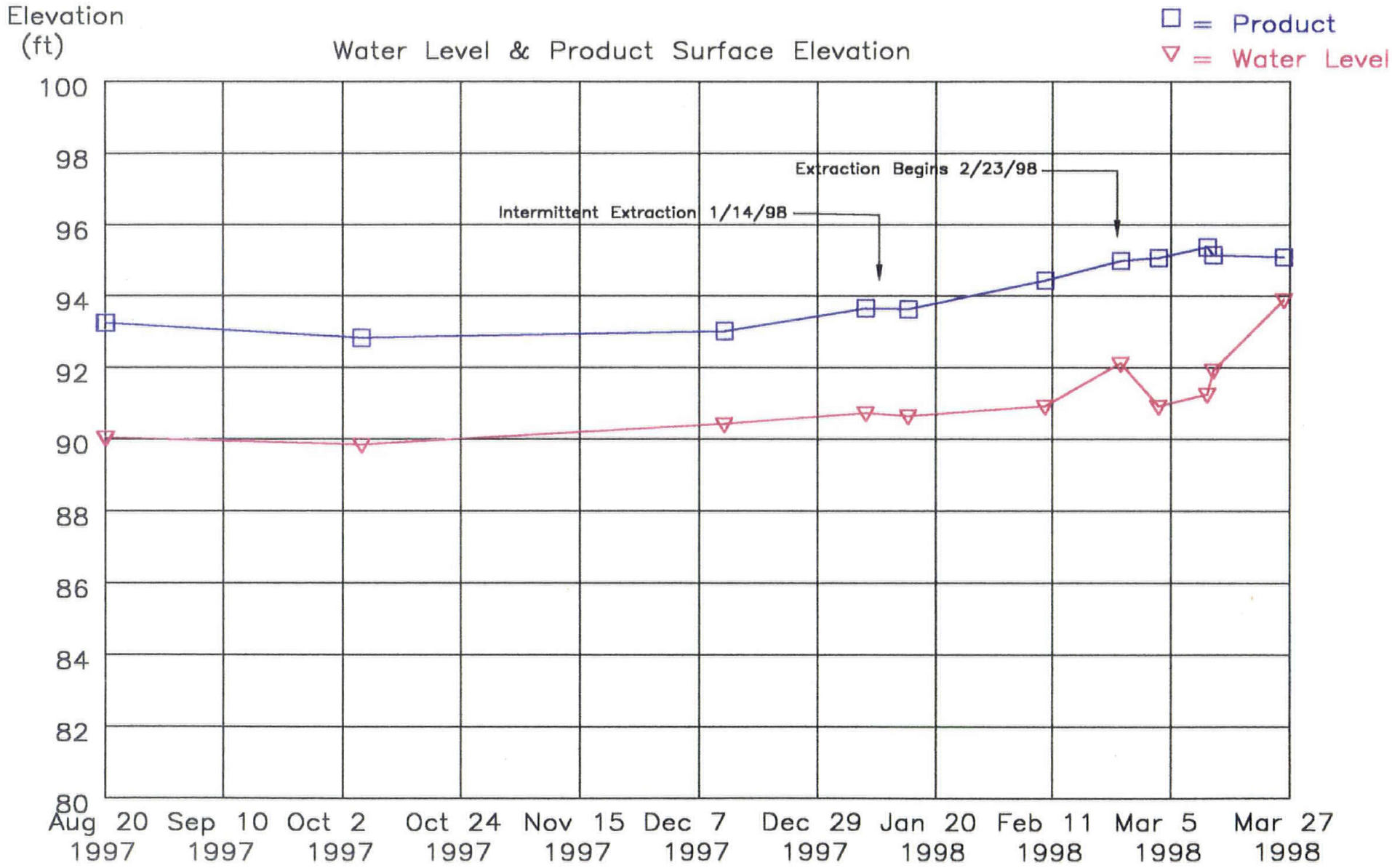
Bioslurper Unit #1: Groundwater/Oil Recovery Versus Operational Time



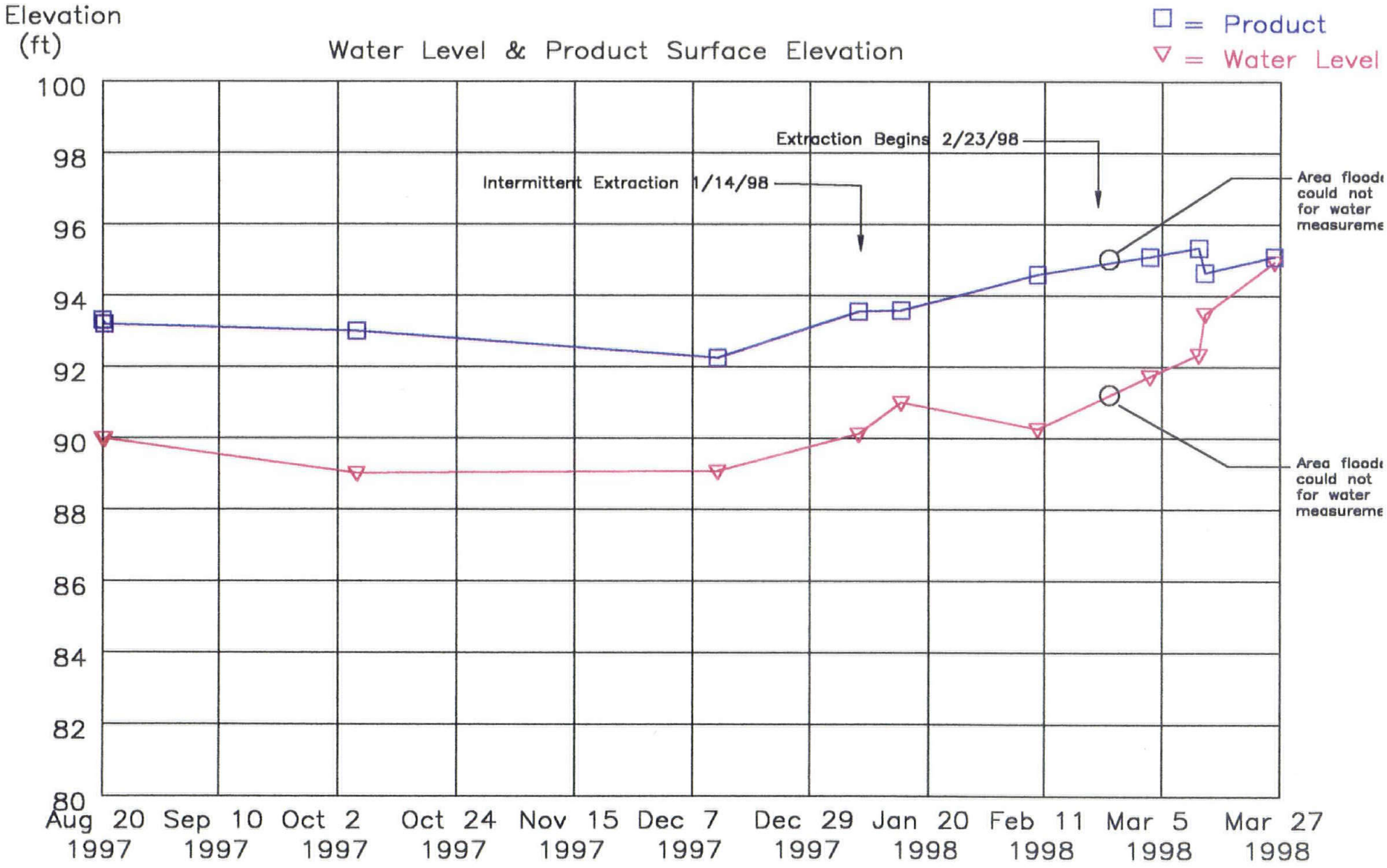
Bioslurper Unit #2: Groundwater/Oil Recovery Versus Operational Time



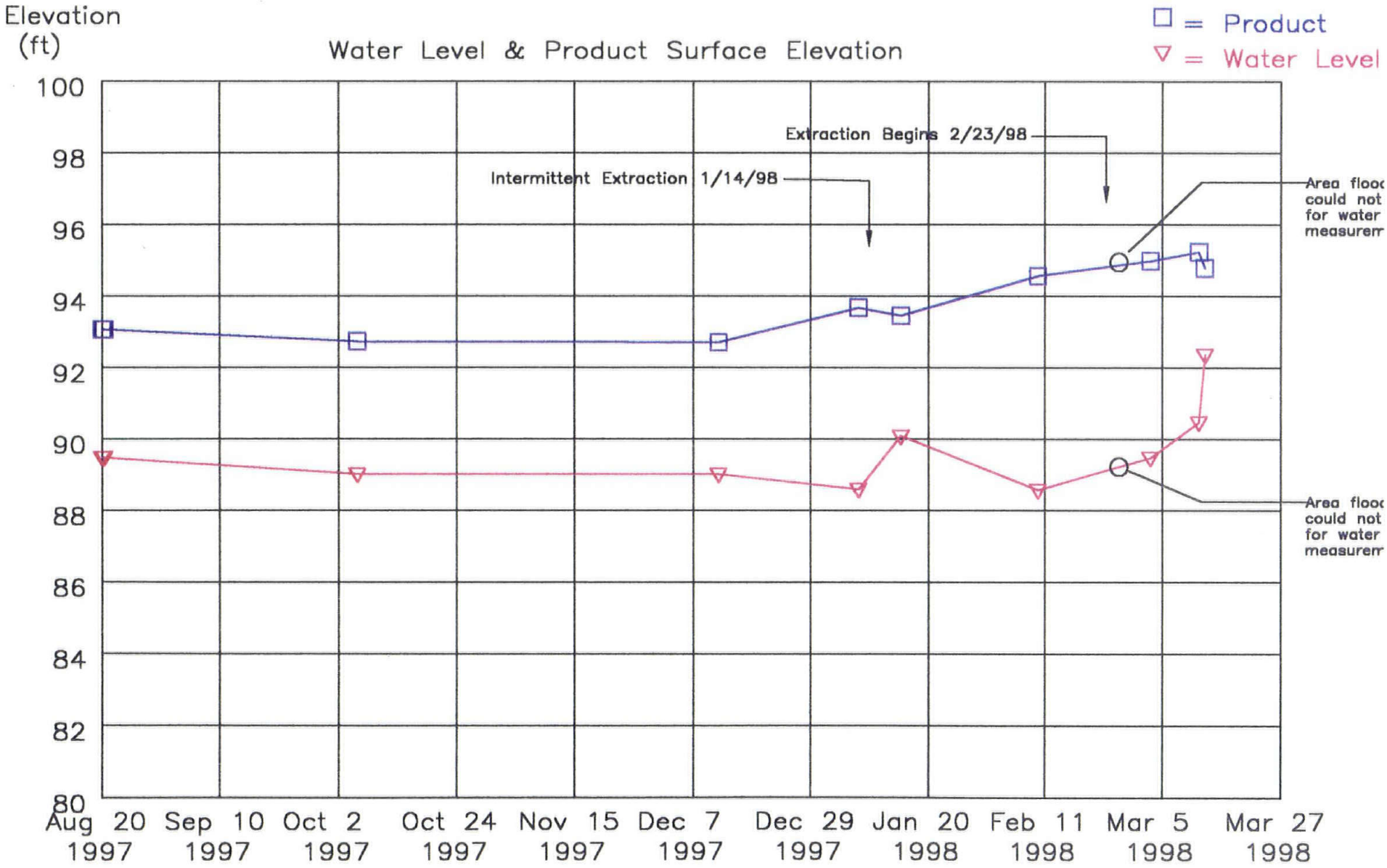
Site: 16MW-13


Elevation (ft)
Water Level & Product Surface Elevation
□ = Product
▽ = Water Level
Extraction Begins 2/23/98
Intermittent Extraction 1/14/98
100
98
96
94
92
90
88
86
84
82
80
Aug 20 1997
Sep 10 1997
Oct 2 1997
Oct 24 1997
Nov 15 1997
Dec 7 1997
Dec 29 1997
Jan 20 1998
Feb 11 1998
Mar 5 1998
Mar 27 1998

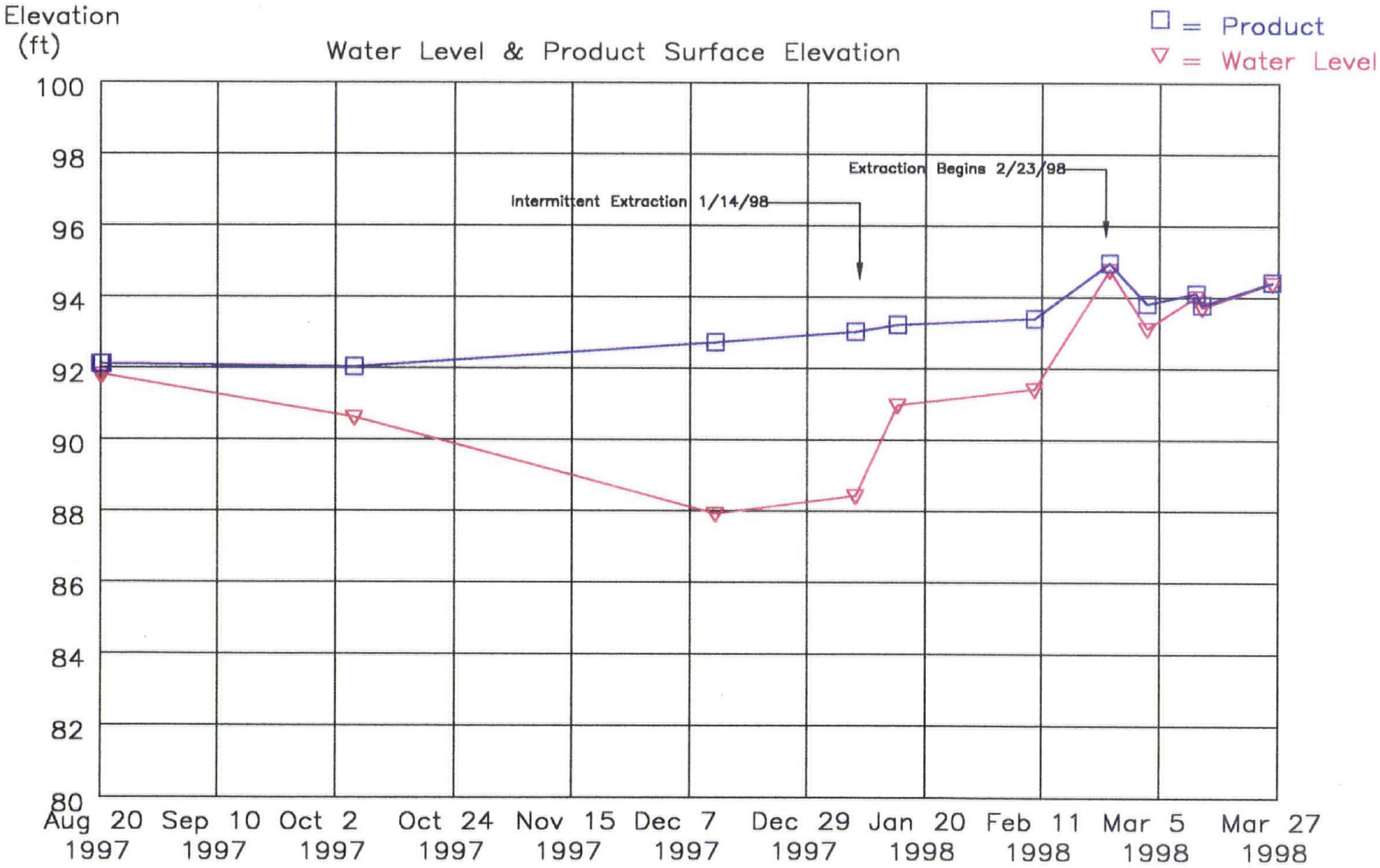
Site: 16MW-14


Elevation (ft)
Water Level & Product Surface Elevation
□ = Product
▽ = Water Level
100
98
96
94
92
90
88
86
84
82
80
Extraction Begins 2/23/98
Intermittent Extraction 1/14/98
Area flood
could not
for water
measureme
Area flood
could not
for water
measureme
Aug 20 1997
Sep 10 1997
Oct 2 1997
Oct 24 1997
Nov 15 1997
Dec 7 1997
Dec 29 1997
Jan 20 1998
Feb 11 1998
Mar 5 1998
Mar 27 1998

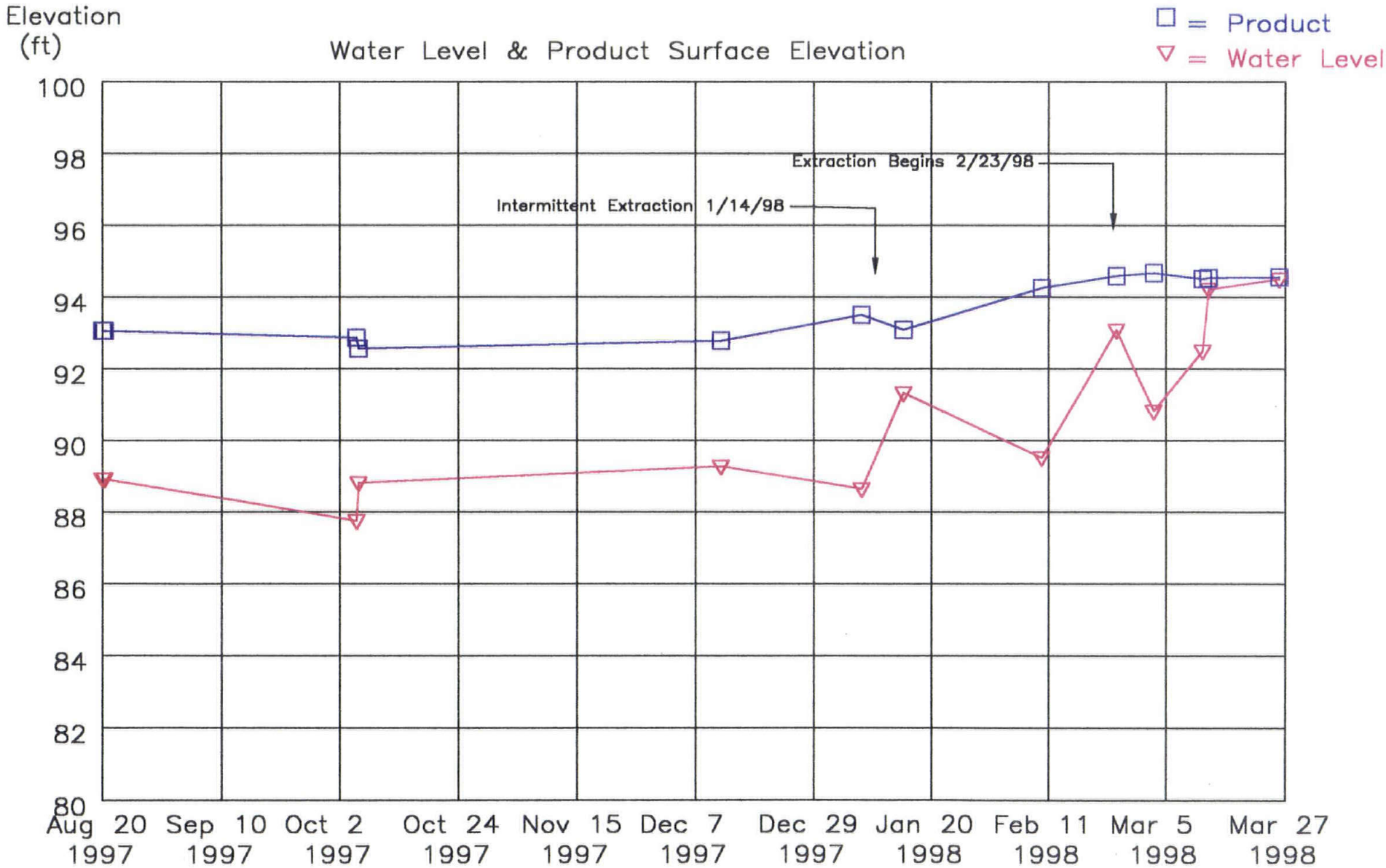
Site: 16MW-15


Elevation (ft)
Water Level & Product Surface Elevation
□ = Product
▽ = Water Level
100
98
96
94
92
90
88
86
84
82
80
Extraction Begins 2/23/98
Intermittent Extraction 1/14/98
Area flooc could not for water measurem
Area flooc could not for water measurem
Aug 20 1997
Sep 10 1997
Oct 2 1997
Oct 24 1997
Nov 15 1997
Dec 7 1997
Dec 29 1997
Jan 20 1998
Feb 11 1998
Mar 5 1998
Mar 27 1998

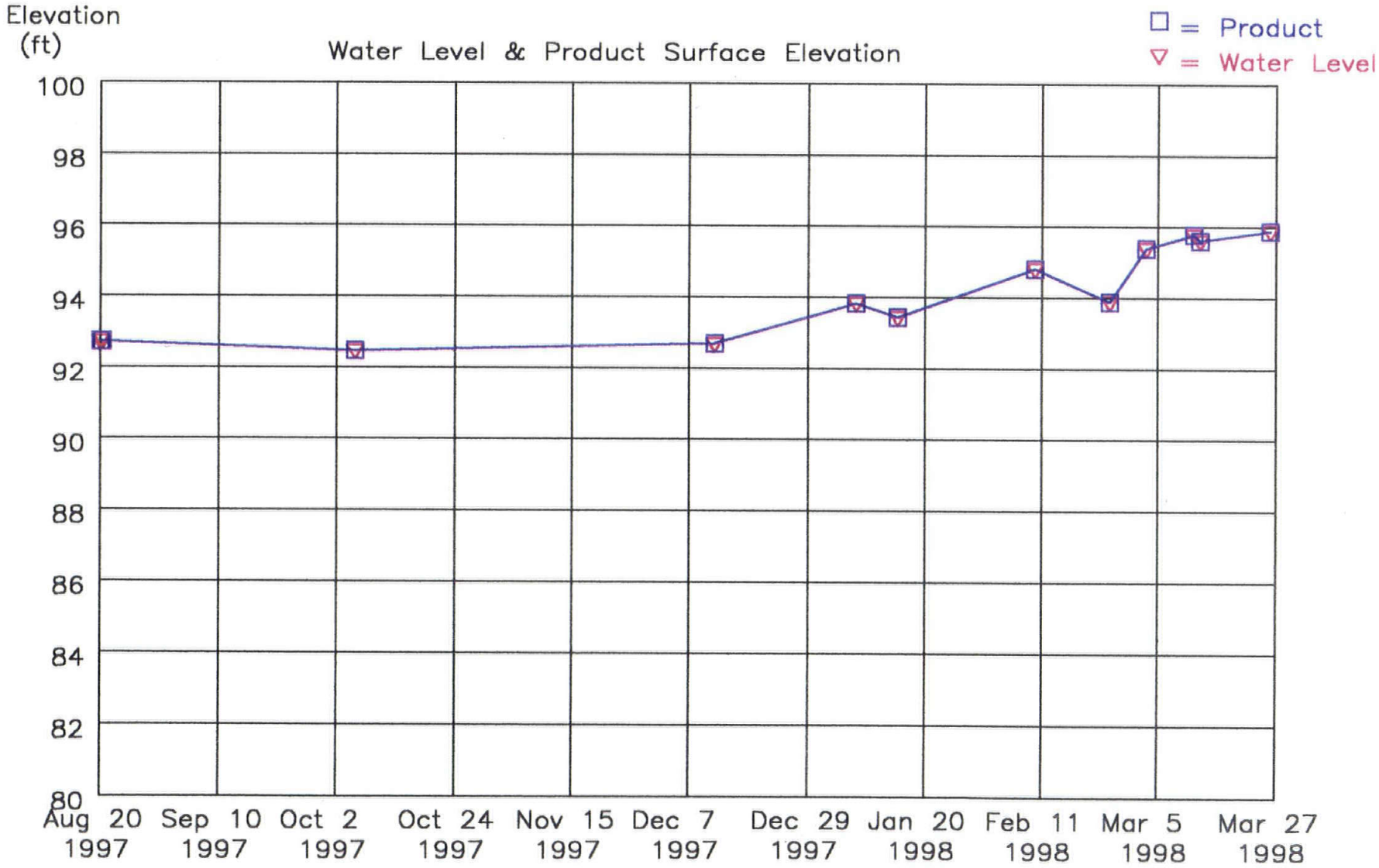
Site: 16MW-16


Elevation (ft)
Water Level & Product Surface Elevation
□ = Product
▽ = Water Level
Extraction Begins 2/23/98
Intermittent Extraction 1/14/98
100
98
96
94
92
90
88
86
84
82
80
Aug 20 1997
Sep 10 1997
Oct 2 1997
Oct 24 1997
Nov 15 1997
Dec 7 1997
Dec 29 1997
Jan 20 1998
Feb 11 1998
Mar 5 1998
Mar 27 1998

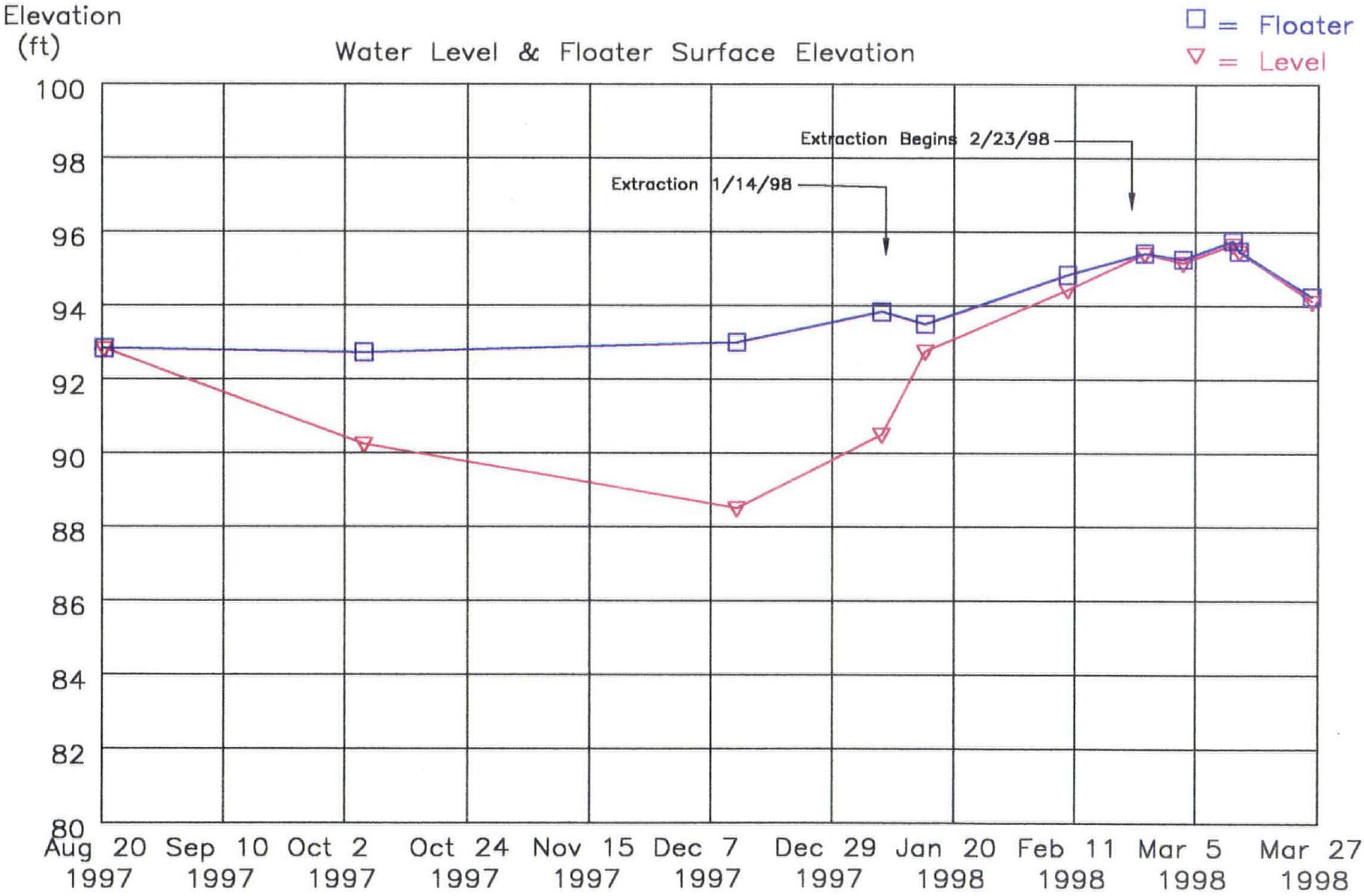
Site: 16MW-17


Elevation (ft)
Water Level & Product Surface Elevation
□ = Product
▽ = Water Level
Extraction Begins 2/23/98
Intermittent Extraction 1/14/98
100
98
96
94
92
90
88
86
84
82
80
Aug 20 1997
Sep 10 1997
Oct 2 1997
Oct 24 1997
Nov 15 1997
Dec 7 1997
Dec 29 1997
Jan 20 1998
Feb 11 1998
Mar 5 1998
Mar 27 1998

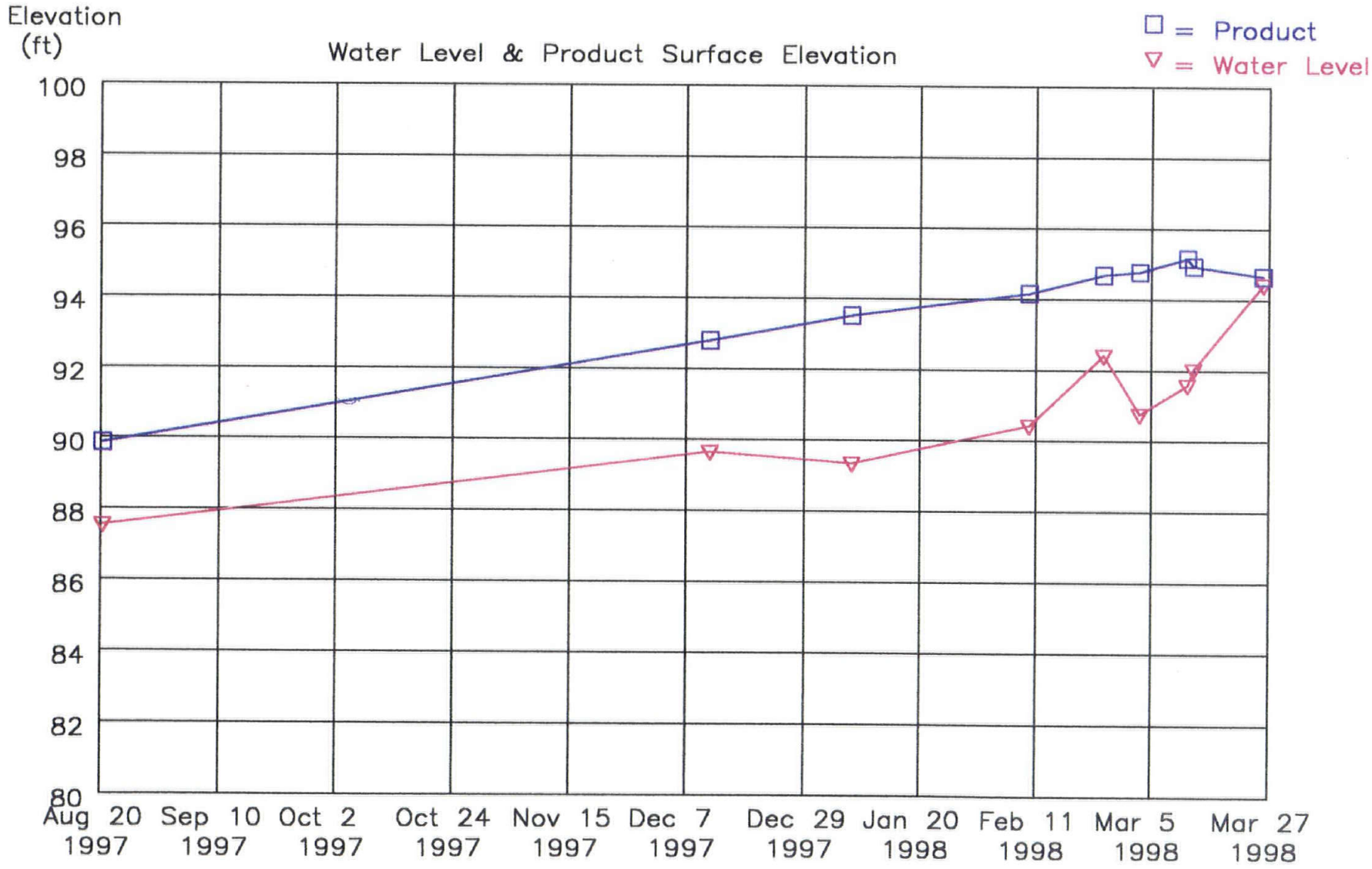
Site: 16MW-18


Elevation (ft)
Water Level & Product Surface Elevation
□ = Product
▽ = Water Level
100
98
96
94
92
90
88
86
84
82
80
Aug 20 1997
Sep 10 1997
Oct 2 1997
Oct 24 1997
Nov 15 1997
Dec 7 1997
Dec 29 1997
Jan 20 1998
Feb 11 1998
Mar 5 1998
Mar 27 1998

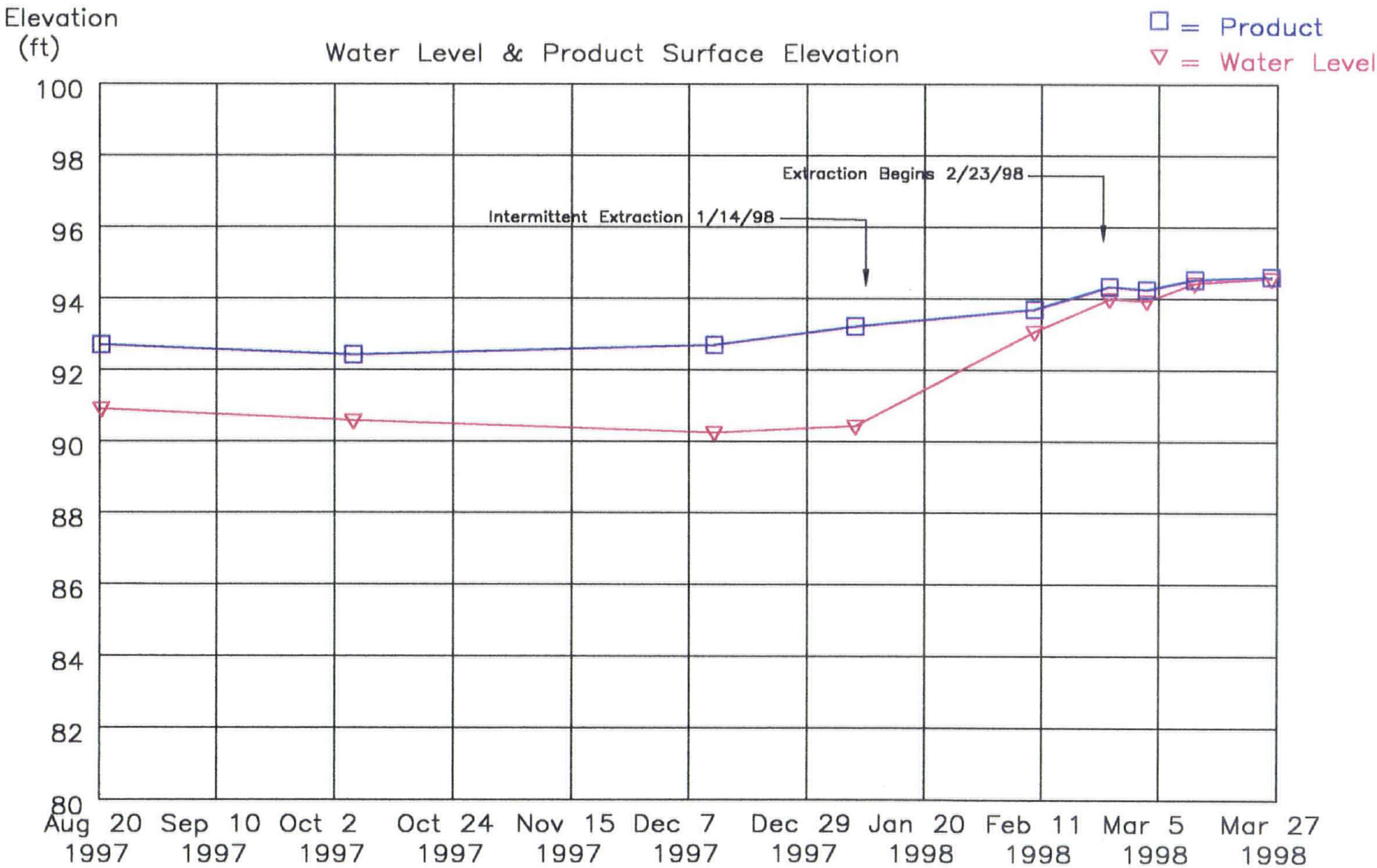
Site: 16MW-19


Elevation (ft)
Water Level & Floater Surface Elevation
□ = Floater
▽ = Level
Extraction Begins 2/23/98
Extraction 1/14/98
100
98
96
94
92
90
88
86
84
82
80
Aug 20 1997
Sep 10 1997
Oct 2 1997
Oct 24 1997
Nov 15 1997
Dec 7 1997
Dec 29 1997
Jan 20 1998
Feb 11 1998
Mar 5 1998
Mar 27 1998

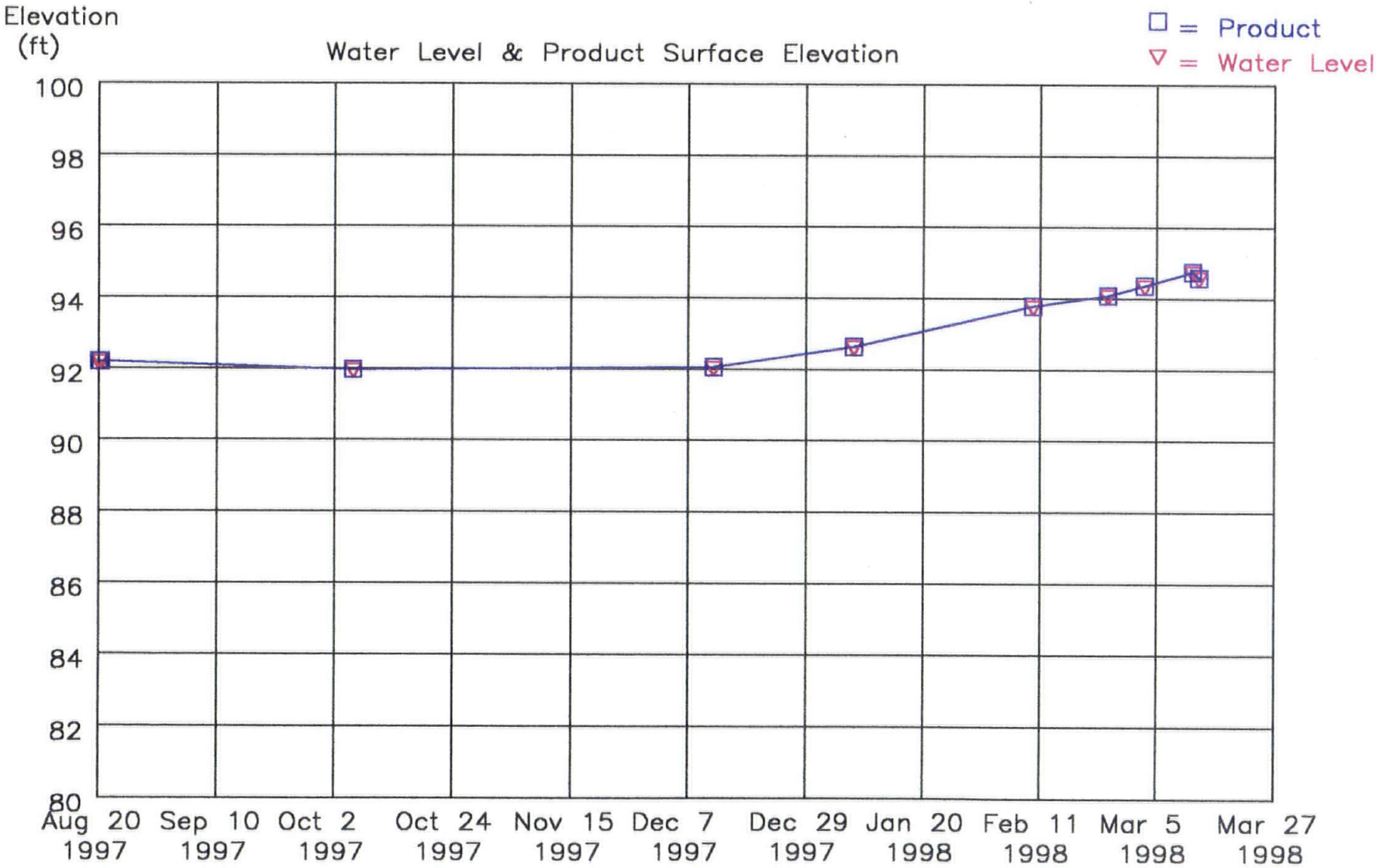
Site: 16MW-04


Elevation (ft)
Water Level & Product Surface Elevation
□ = Product
▽ = Water Level
100
98
96
94
92
90
88
86
84
82
80
Aug 20 1997
Sep 10 1997
Oct 2 1997
Oct 24 1997
Nov 15 1997
Dec 7 1997
Dec 29 1997
Jan 20 1998
Feb 11 1998
Mar 5 1998
Mar 27 1998

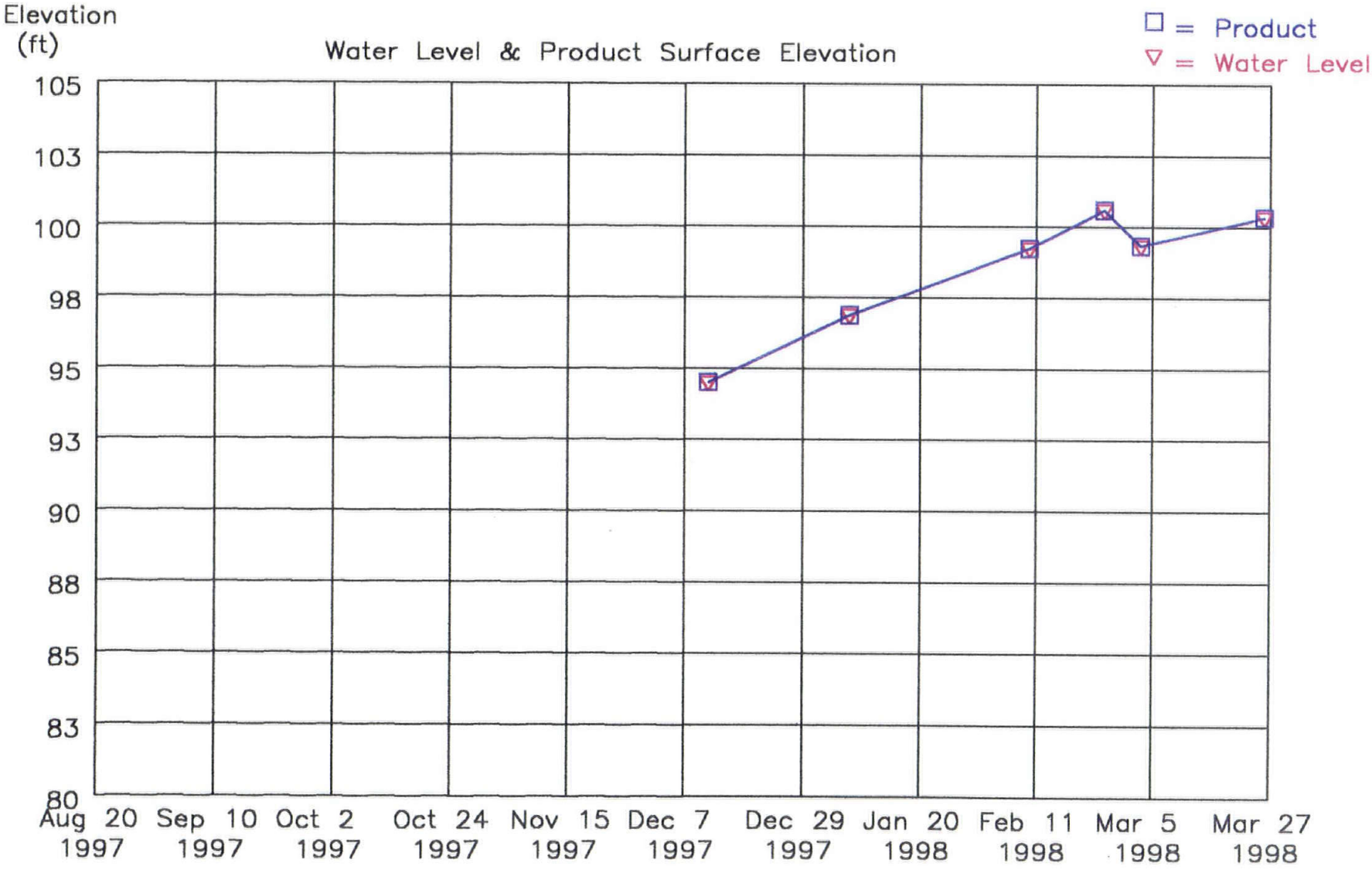
Site: 16MW-20


Elevation (ft)
Water Level & Product Surface Elevation
□ = Product
▽ = Water Level
Extraction Begins 2/23/98
Intermittent Extraction 1/14/98
100
98
96
94
92
90
88
86
84
82
80
Aug 20 1997
Sep 10 1997
Oct 2 1997
Oct 24 1997
Nov 15 1997
Dec 7 1997
Dec 29 1997
Jan 20 1998
Feb 11 1998
Mar 5 1998
Mar 27 1998

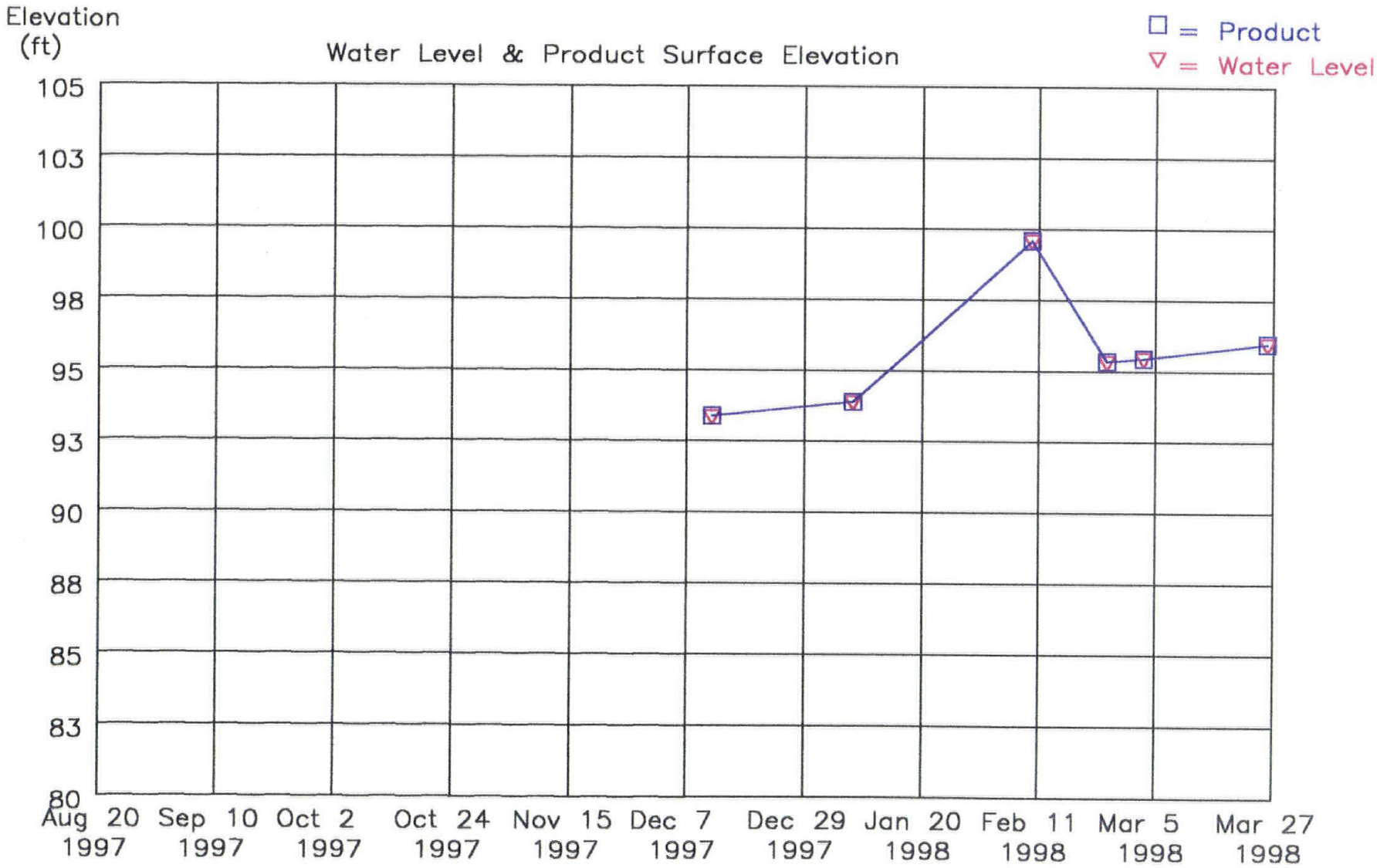
Site: 16MW-21


Elevation (ft)
Water Level & Product Surface Elevation
□ = Product
▽ = Water Level
100
98
96
94
92
90
88
86
84
82
80
Aug 20 1997
Sep 10 1997
Oct 2 1997
Oct 24 1997
Nov 15 1997
Dec 7 1997
Dec 29 1997
Jan 20 1998
Feb 11 1998
Mar 5 1998
Mar 27 1998

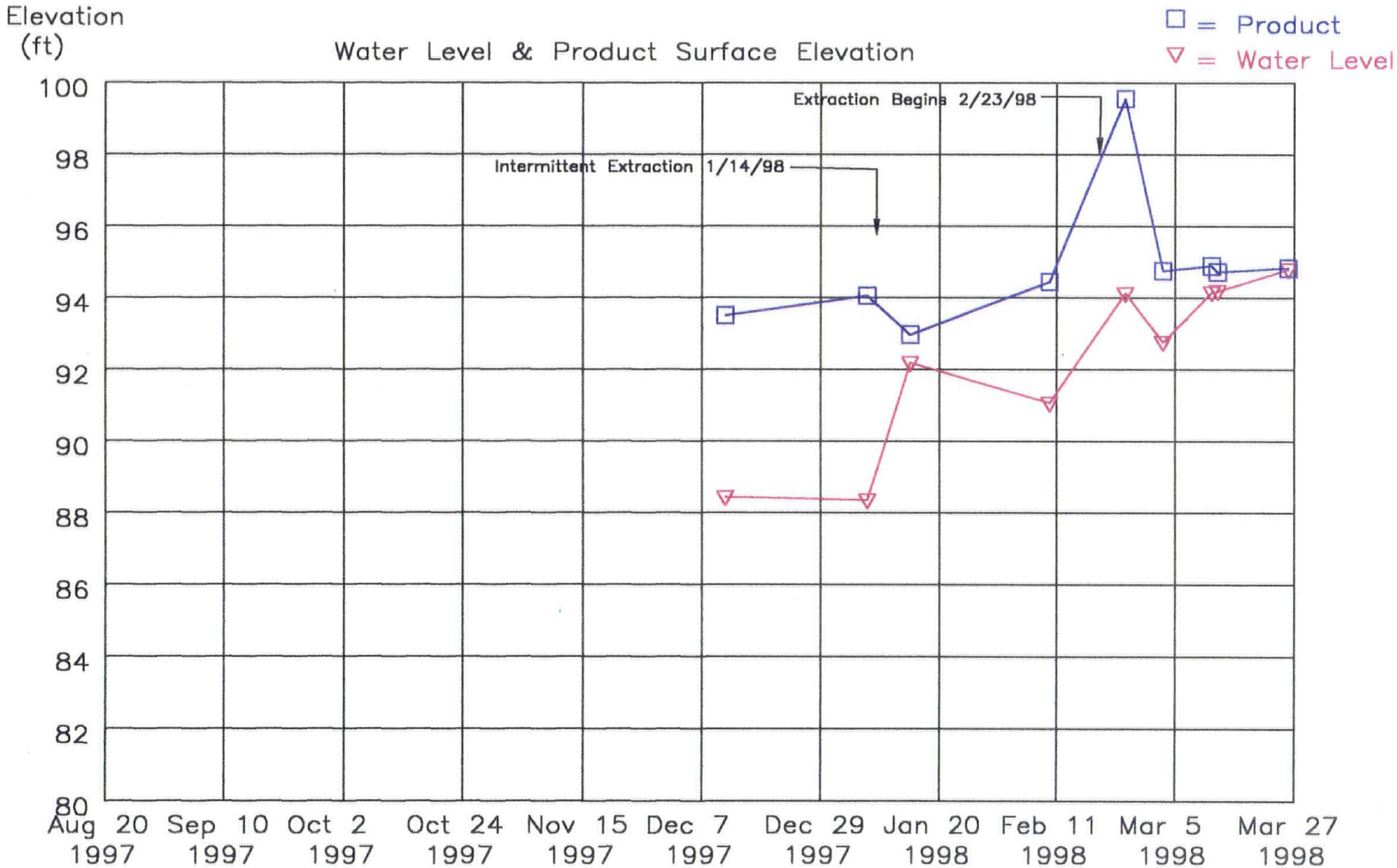
Site: 16MW-22


Elevation (ft)
Water Level & Product Surface Elevation
□ = Product
▽ = Water Level
105
103
100
98
95
93
90
88
85
83
80
Aug 20 1997
Sep 10 1997
Oct 2 1997
Oct 24 1997
Nov 15 1997
Dec 7 1997
Dec 29 1997
Jan 20 1998
Feb 11 1998
Mar 5 1998
Mar 27 1998

Site: 16MW-23


Elevation
(ft)
Water Level & Product Surface Elevation
□ = Product
▽ = Water Level
105
103
100
98
95
93
90
88
85
83
80
Aug 20 1997
Sep 10 1997
Oct 2 1997
Oct 24 1997
Nov 15 1997
Dec 7 1997
Dec 29 1997
Jan 20 1998
Feb 11 1998
Mar 5 1998
Mar 27 1998

Site: C17MW-07



Navy Weapons Station
Earle Bioslurper Extraction Wells
Water Level Product Thickness Data

| SITE | DATE | MP ELEVATION | TIME | DEPTH TO WATER | FLOATING PRODUCT THICKNESS | WATER ELEV. | CHANGE IN WATER ELEV. | EQUIV. FRESH WATER HEAD |
|---|---|---|---|---|---|---|---|---|
| 16MW-04 | 8/20/97 | 101.23 | 11:34 | 13.65 | 2.3 | 87.58 | NA | 89.53 |
| 16MW-04 | 12/12/97 | 101.23 | 0:00 | 11.55 | 3.15 | 89.68 | 2.1 | 92.36 |
| 16MW-04 | 1/7/98 | 101.23 | 11:02 | 11.85 | 4.15 | 89.38 | -0.3 | 92.91 |
| 16MW-04 | 2/10/98 | 101.23 | 0:00 | 10.78 | 3.74 | 90.45 | 1.07 | 93.63 |
| 16MW-04 | 2/24/98 | 101.23 | 0:00 | 8.78 | 2.26 | 92.45 | 2 | 94.37 |
| 16MW-04 | 3/3/98 | 101.23 | 0:00 | 10.45 | 4 | 90.78 | -1.67 | 94.18 |
| 16MW-04 | 3/12/98 | 101.23 | 0:00 | 9.6 | 3.54 | 91.63 | 0.85 | 94.64 |
| 16MW-04 | 3/13/98 | 101.23 | 0:00 | 9.15 | 2.87 | 92.08 | 0.45 | 94.52 |
| 16MW-04 | 3/26/98 | 101.23 | 0:00 | 6.76 | 0.21 | 94.47 | 2.39 | 94.64 |
| 16MW-13 | 8/20/97 | 100.97 | 0:00 | 10.9 | 3.2 | 90.07 | NA | 92.79 |
| 16MW-13 | 8/20/97 | 100.97 | 8:45 | 10.9 | 3.2 | 90.07 | 0 | 92.79 |
| 16MW-13 | 10/6/97 | 100.97 | 10:45 | 11.1 | 2.99 | 89.87 | -0.2 | 92.41 |
| 16MW-13 | 12/12/97 | 100.97 | 8:30 | 10.5 | 2.58 | 90.47 | 0.6 | 92.66 |
| 16MW-13 | 1/7/98 | 100.97 | 9:35 | 10.22 | 2.92 | 90.75 | 0.28 | 93.23 |
| 16MW-13 | 1/15/98 | 100.97 | 7:30 | 10.29 | 2.98 | 90.68 | -0.07 | 93.21 |
| 16MW-13 | 2/10/98 | 100.97 | 0:00 | 10.01 | 3.5 | 90.96 | 0.28 | 93.94 |
| 16MW-13 | 2/24/98 | 100.97 | 0:00 | 8.82 | 2.87 | 92.15 | 1.19 | 94.59 |
| 16MW-13 | 3/3/98 | 100.97 | 0:00 | 10.02 | 4.16 | 90.95 | -1.2 | 94.49 |
| 16MW-13 | 3/12/98 | 100.97 | 0:00 | 9.67 | 4.1 | 91.3 | 0.35 | 94.79 |
| 16MW-13 | 3/13/98 | 100.97 | 0:00 | 9.02 | 3.22 | 91.95 | 0.65 | 94.69 |
| 16MW-13 | 3/26/98 | 100.97 | 0:00 | 7.05 | 1.21 | 93.92 | 1.97 | 94.95 |
| 16MW-14 | 8/20/97 | 100.66 | 0:00 | 10.64 | 3.31 | 90.02 | NA | 92.84 |
| 16MW-14 | 8/20/97 | 100.66 | 8:48 | 10.64 | 3.2 | 90.02 | 0 | 92.74 |
| 16MW-14 | 10/6/97 | 100.66 | 10:45 | 11.61 | 3.97 | 89.05 | -0.97 | 92.43 |
| 16MW-14 | 12/12/97 | 100.66 | 8:30 | 11.55 | 3.16 | 89.11 | 0.06 | 91.8 |
| 16MW-14 | 1/7/98 | 100.66 | 9:49 | 10.52 | 3.44 | 90.14 | 1.03 | 93.07 |
| 16MW-14 | 1/7/98 | 100.66 | 9:56 | 10.52 | 3.44 | 90.14 | 0 | 93.07 |
| 16MW-14 | 1/15/98 | 100.66 | 7:30 | 9.61 | 2.54 | 91.05 | 0.91 | 93.21 |
| 16MW-14 | 2/10/98 | 100.66 | 0:00 | 10.36 | 4.31 | 90.3 | -0.75 | 93.97 |
| 16MW-14 | 3/3/98 | 100.66 | 0:00 | 8.9 | 3.34 | 91.76 | 1.46 | 94.6 |
| 16MW-14 | 3/12/98 | 100.66 | 0:00 | 8.29 | 2.99 | 92.37 | 0.61 | 94.91 |
| 16MW-14 | 3/13/98 | 100.66 | 0:00 | 7.15 | 1.15 | 93.51 | 1.14 | 94.48 |
| 16MW-14 | 3/26/98 | 100.66 | 0:00 | 5.7 | 0.13 | 94.96 | 1.45 | 95.07 |
| 16MW-15 | 8/20/97 | 100.98 | 0:00 | 11.49 | 3.59 | 89.49 | NA | 92.54 |
| 16MW-15 | 8/20/97 | 100.98 | 8:55 | 11.49 | 3.59 | 89.49 | 0 | 92.54 |
| 16MW-15 | 8/20/97 | 100.98 | 9:12 | 11.49 | 3.59 | 89.49 | 0 | 92.54 |
| 16MW-15 | 10/6/97 | 100.98 | 10:45 | 11.98 | 3.73 | 89 | -0.49 | 92.17 |
| 16MW-15 | 12/12/97 | 100.98 | 8:30 | 11.96 | 3.7 | 89.02 | 0.02 | 92.17 |
| 16MW-15 | 1/7/98 | 100.98 | 10:05 | 12.38 | 5.08 | 88.6 | -0.42 | 92.92 |
| 16MW-15 | 1/15/98 | 100.98 | 7:30 | 10.88 | 3.36 | 90.1 | 1.5 | 92.96 |
| 16MW-15 | 2/10/98 | 100.98 | 0:00 | 12.4 | 5.98 | 88.58 | -1.52 | 93.67 |
| 16MW-15 | 3/3/98 | 100.98 | 0:00 | 11.5 | 5.5 | 89.48 | 0.9 | 94.16 |
| 16MW-15 | 3/12/98 | 100.98 | 0:00 | 10.5 | 4.76 | 90.48 | 1 | 94.53 |

Navy Weapons Station
Earle Bioslurper Extraction Wells
Water Level Product Thickness Data

| SITE | DATE | MP ELEVATION | TIME | DEPTH TO WATER | FLOATING PRODUCT THICKNESS | WATER ELEV. | CHANGE IN WATER ELEV. | EQUIV. FRESH WATER HEAD |
|---|---|---|---|---|---|---|---|---|
| 16MW-15 | 3/13/98 | 100.98 | 0:00 | 8.6 | 2.42 | 92.38 | 1.9 | 94.44 |
| 16MW-16 | 8/20/97 | 98.82 | 0:00 | 7.01 | 0.32 | 91.81 | NA | 92.08 |
| 16MW-16 | 8/20/97 | 98.82 | 9:12 | 7.01 | 0.32 | 91.81 | 0 | 92.08 |
| 16MW-16 | 10/6/97 | 98.82 | 10:45 | 8.19 | 1.42 | 90.63 | -1.18 | 91.83 |
| 16MW-16 | 12/12/97 | 98.82 | 8:30 | 10.9 | 4.81 | 87.92 | -2.71 | 92.01 |
| 16MW-16 | 1/7/98 | 98.82 | 10:10 | 10.4 | 4.61 | 88.42 | 0.5 | 92.34 |
| 16MW-16 | 1/15/98 | 98.82 | 7:30 | 7.83 | 2.24 | 90.99 | 2.57 | 92.89 |
| 16MW-16 | 2/10/98 | 98.82 | 0:00 | 7.38 | 1.97 | 91.44 | 0.45 | 93.11 |
| 16MW-16 | 2/24/98 | 98.82 | 0:00 | 4.05 | 0.2 | 94.77 | 3.33 | 94.94 |
| 16MW-16 | 3/3/98 | 98.82 | 0:00 | 5.7 | 0.69 | 93.12 | -1.65 | 93.7 |
| 16MW-16 | 3/12/98 | 98.82 | 0:00 | 4.81 | 0.11 | 94.01 | 0.89 | 94.1 |
| 16MW-16 | 3/13/98 | 98.82 | 0:00 | 5.12 | 0.09 | 93.7 | -0.31 | 93.77 |
| 16MW-16 | 3/26/98 | 98.82 | 0:00 | 4.42 | 0.04 | 94.4 | 0.7 | 94.43 |
| 16MW-17 | 8/20/97 | 99.79 | 0:00 | 10.87 | 4.14 | 88.92 | NA | 92.44 |
| 16MW-17 | 8/20/97 | 99.79 | 9:07 | 10.87 | 4.14 | 88.92 | 0 | 92.44 |
| 16MW-17 | 10/6/97 | 99.79 | 0:00 | 12.03 | 5.12 | 87.76 | -1.16 | 92.12 |
| 16MW-17 | 10/6/97 | 99.79 | 10:45 | 10.98 | 3.77 | 88.81 | 1.05 | 92.02 |
| 16MW-17 | 12/12/97 | 99.79 | 8:30 | 10.5 | 3.5 | 89.29 | 0.48 | 92.27 |
| 16MW-17 | 1/7/98 | 99.79 | 10:23 | 11.15 | 4.86 | 88.64 | -0.65 | 92.78 |
| 16MW-17 | 1/15/98 | 99.79 | 7:30 | 8.45 | 1.75 | 91.34 | 2.7 | 92.83 |
| 16MW-17 | 2/10/98 | 99.79 | 0:00 | 10.24 | 4.71 | 89.55 | -1.79 | 93.56 |
| 16MW-17 | 2/24/98 | 99.79 | 0:00 | 6.7 | 1.5 | 93.09 | 3.54 | 94.36 |
| 16MW-17 | 3/3/98 | 99.79 | 0:00 | 8.95 | 3.83 | 90.84 | -2.25 | 94.1 |
| 16MW-17 | 3/12/98 | 99.79 | 0:00 | 7.27 | 1.99 | 92.52 | 1.68 | 94.21 |
| 16MW-17 | 3/13/98 | 99.79 | 0:00 | 5.55 | 0.3 | 94.24 | 1.72 | 94.49 |
| 16MW-17 | 3/26/98 | 99.79 | 0:00 | 5.29 | 0.06 | 94.5 | 0.26 | 94.55 |
| 16MW-18 | 8/20/97 | 100.69 | 0:00 | 7.96 | 0 | 92.73 | NA | 92.73 |
| 16MW-18 | 8/20/97 | 100.69 | 9:03 | 7.96 | 0 | 92.73 | 0 | 92.73 |
| 16MW-18 | 10/6/97 | 100.69 | 10:45 | 8.21 | 0 | 92.48 | -0.25 | 92.48 |
| 16MW-18 | 12/12/97 | 100.69 | 8:30 | 7.98 | 0 | 92.71 | 0.23 | 92.71 |
| 16MW-18 | 1/7/98 | 100.69 | 10:30 | 6.85 | 0 | 93.84 | 1.13 | 93.84 |
| 16MW-18 | 1/15/98 | 100.69 | 7:30 | 7.24 | 0 | 93.45 | -0.39 | 93.45 |
| 16MW-18 | 2/10/98 | 100.69 | 0:00 | 5.86 | 0 | 94.83 | 1.38 | 94.83 |
| 16MW-18 | 2/24/98 | 100.69 | 0:00 | 6.8 | 0 | 93.89 | -0.94 | 93.89 |
| 16MW-18 | 3/3/98 | 100.69 | 0:00 | 5.3 | 0 | 95.39 | 1.5 | 95.39 |
| 16MW-18 | 3/12/98 | 100.69 | 0:00 | 4.89 | 0 | 95.8 | 0.41 | 95.8 |
| 16MW-18 | 3/13/98 | 100.69 | 0:00 | 5.06 | 0 | 95.63 | -0.17 | 95.63 |
| 16MW-18 | 3/26/98 | 100.69 | 0:00 | 4.78 | 0 | 95.91 | 0.28 | 95.91 |
| 16MW-19 | 8/20/97 | 100.54 | 0:00 | 7.7 | 0 | 92.84 | NA | 92.84 |
| 16MW-19 | 8/20/97 | 100.54 | 8:57 | 7.7 | 0 | 92.84 | 0 | 92.84 |
| 16MW-19 | 10/6/97 | 100.54 | 10:45 | 10.29 | 2.48 | 90.25 | -2.59 | 92.36 |
| 16MW-19 | 12/12/97 | 100.54 | 8:30 | 12.02 | 4.5 | 88.52 | -1.73 | 92.35 |
| 16MW-19 | 1/7/98 | 100.54 | 10:37 | 10 | 3.3 | 90.54 | 2.02 | 93.35 |

Navy Weapons Station
Earle Bioslurper Extraction Wells
Water Level Product Thickness Data

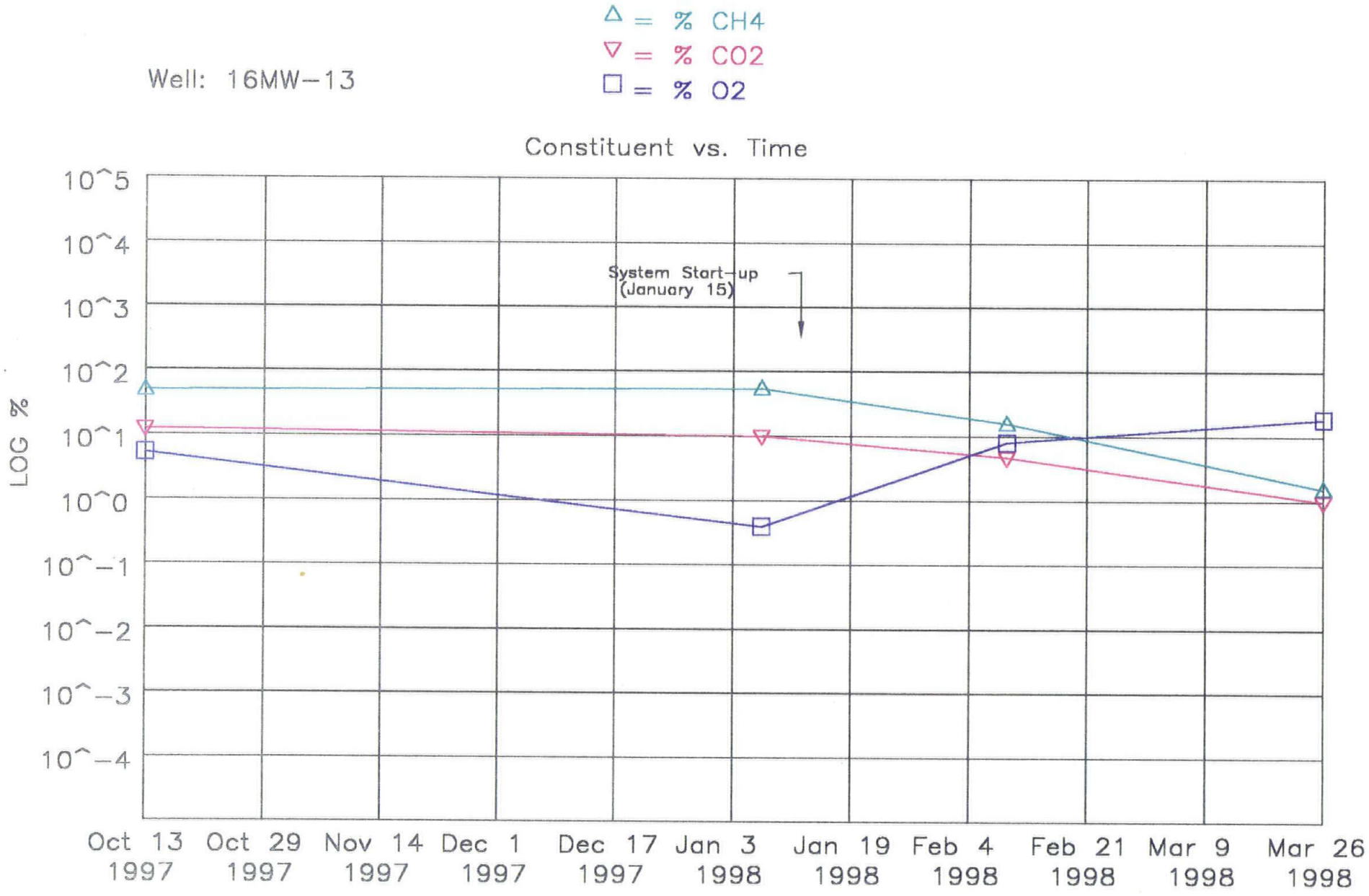
| SITE | DATE | MP ELEVATION | TIME | DEPTH TO WATER | FLOATING PRODUCT THICKNESS | WATER ELEV. | CHANGE IN WATER ELEV. | EQUIV. FRESH WATER HEAD |
|---|---|---|---|---|---|---|---|---|
| 16MW-19 | 1/15/98 | 100.54 | 7:30 | 7.76 | 0.73 | 92.78 | 2.24 | 93.4 |
| 16MW-19 | 2/10/98 | 100.54 | 0:00 | 6.07 | 0.38 | 94.47 | 1.69 | 94.79 |
| 16MW-19 | 2/24/98 | 100.54 | 0:00 | 5.1 | 0 | 95.44 | 0.97 | 95.44 |
| 16MW-19 | 3/3/98 | 100.54 | 0:00 | 5.35 | 0.06 | 95.19 | -0.25 | 95.24 |
| 16MW-19 | 3/12/98 | 100.54 | 0:00 | 4.85 | 0.06 | 95.69 | 0.5 | 95.74 |
| 16MW-19 | 3/13/98 | 100.54 | 0:00 | 5.05 | 0 | 95.49 | -0.2 | 95.49 |
| 16MW-19 | 3/26/98 | 100.54 | 0:00 | 6.4 | 0.12 | 94.14 | -1.35 | 94.24 |
| 16MW-20 | 8/20/97 | 100.82 | 9:26 | 9.88 | 1.78 | 90.94 | NA | 92.45 |
| 16MW-20 | 10/6/97 | 100.82 | 10:45 | 10.22 | 1.84 | 90.6 | -0.34 | 92.16 |
| 16MW-20 | 12/12/97 | 100.82 | 8:30 | 10.55 | 2.45 | 90.27 | -0.33 | 92.35 |
| 16MW-20 | 1/7/98 | 100.82 | 10:49 | 10.36 | 2.78 | 90.46 | 0.19 | 92.82 |
| 16MW-20 | 2/10/98 | 100.82 | 0:00 | 7.71 | 0.61 | 93.11 | 2.65 | 93.62 |
| 16MW-20 | 2/24/98 | 100.82 | 0:00 | 6.8 | 0.32 | 94.02 | 0.91 | 94.29 |
| 16MW-20 | 3/3/98 | 100.82 | 0:00 | 6.85 | 0.29 | 93.97 | -0.05 | 94.21 |
| 16MW-20 | 3/12/98 | 100.82 | 0:00 | 6.37 | 0.09 | 94.45 | 0.48 | 94.52 |
| 16MW-20 | 3/26/98 | 100.82 | 0:00 | 6.21 | 0.01 | 94.61 | 0.16 | 94.61 |
| 16MW-21 | 8/20/97 | 99.78 | 0:00 | 7.57 | 0.01 | 92.21 | NA | 92.21 |
| 16MW-21 | 8/20/97 | 99.78 | 9:35 | 7.57 | 0.01 | 92.21 | 0 | 92.21 |
| 16MW-21 | 10/6/97 | 99.78 | 10:45 | 7.8 | 0 | 91.98 | -0.23 | 91.98 |
| 16MW-21 | 12/12/97 | 99.78 | 8:30 | 7.7 | 0 | 92.08 | 0.1 | 92.08 |
| 16MW-21 | 1/7/98 | 99.78 | 10:58 | 7.12 | 0 | 92.66 | 0.58 | 92.66 |
| 16MW-21 | 2/10/98 | 99.78 | 0:00 | 6 | 0 | 93.78 | 1.12 | 93.78 |
| 16MW-21 | 2/24/98 | 99.78 | 0:00 | 5.67 | 0 | 94.11 | 0.33 | 94.11 |
| 16MW-21 | 3/3/98 | 99.78 | 0:00 | 5.4 | 0 | 94.38 | 0.27 | 94.38 |
| 16MW-21 | 3/12/98 | 99.78 | 0:00 | 5.03 | 0 | 94.75 | 0.37 | 94.75 |
| 16MW-21 | 3/13/98 | 99.78 | 0:00 | 5.17 | 0 | 94.61 | -0.14 | 94.61 |
| 16MW-22 | 12/12/97 | 102.22 | 0:00 | 7.7 | 0 | 94.52 | NA | 94.52 |
| 16MW-22 | 1/7/98 | 102.22 | 0:00 | 5.34 | 0 | 96.88 | 2.36 | 96.88 |
| 16MW-22 | 2/10/98 | 102.22 | 0:00 | 2.98 | 0 | 99.24 | 2.36 | 99.24 |
| 16MW-22 | 2/24/98 | 102.22 | 0:00 | 1.6 | 0 | 100.62 | 1.38 | 100.62 |
| 16MW-22 | 3/3/98 | 102.22 | 0:00 | 2.87 | 0 | 99.35 | -1.27 | 99.35 |
| 16MW-22 | 3/26/98 | 102.22 | 0:00 | 1.85 | 0 | 100.37 | 1.02 | 100.37 |
| 16MW-23 | 12/12/97 | 102.58 | 8:30 | 9.19 | 0 | 93.39 | NA | 93.39 |
| 16MW-23 | 1/7/98 | 102.58 | 9:35 | 8.67 | 0 | 93.91 | 0.52 | 93.91 |
| 16MW-23 | 1/7/98 | 102.58 | 9:49 | 8.67 | 0 | 93.91 | 0 | 93.91 |
| 16MW-23 | 2/10/98 | 102.58 | 0:00 | 2.98 | 0 | 99.6 | 5.69 | 99.6 |
| 16MW-23 | 2/24/98 | 102.58 | 0:00 | 7.2 | 0 | 95.38 | -4.22 | 95.38 |
| 16MW-23 | 3/3/98 | 102.58 | 0:00 | 7.1 | 0 | 95.48 | 0.1 | 95.48 |
| 16MW-23 | 3/26/98 | 102.58 | 0:00 | 6.6 | 0 | 95.98 | 0.5 | 95.98 |
| C17MW-0 | 12/12/97 | 100.16 | 0:00 | 11.69 | 5.04 | 88.47 | NA | 92.76 |
| C17MW-0 | 1/7/98 | 100.16 | 0:00 | 11.78 | 5.68 | 88.38 | -0.09 | 93.21 |
| C17MW-0 | 1/15/98 | 100.16 | 0:00 | 7.95 | 0.78 | 92.21 | 3.83 | 92.87 |
| C17MW-0 | 2/10/98 | 100.16 | 0:00 | 9.05 | 3.34 | 91.11 | -1.1 | 93.95 |

Navy Weapons Station
Earle Bioslurper Extraction Wells
Water Level Product Thickness Data

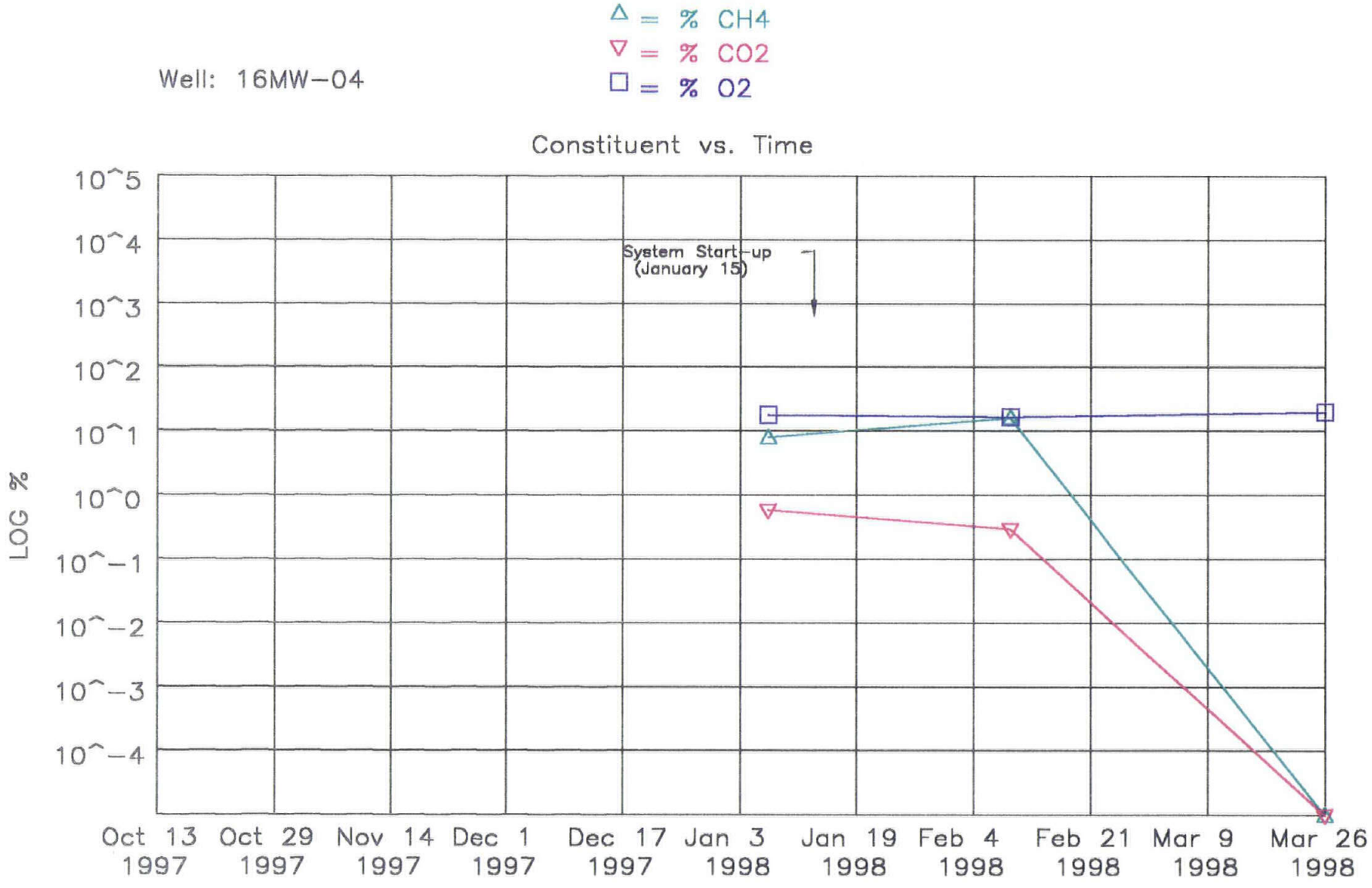
| SITE | DATE | MP ELEVATION | TIME | DEPTH TO WATER | FLOATING PRODUCT THICKNESS | WATER ELEV. | CHANGE IN WATER ELEV. | EQUIV. FRESH WATER HEAD |
|---|---|---|---|---|---|---|---|---|
| C17MW-0 | 2/24/98 | 100.16 | 0:00 | 6 | 5.4 | 94.16 | 3.05 | 98.76 |
| C17MW-0 | 3/3/98 | 100.16 | 0:00 | 7.36 | 1.96 | 92.8 | -1.36 | 94.46 |
| C17MW-0 | 3/12/98 | 100.16 | 0:00 | 5.99 | 0.72 | 94.17 | 1.37 | 94.78 |
| C17MW-0 | 3/13/98 | 100.16 | 0:00 | 5.96 | 0.54 | 94.2 | 0.03 | 94.66 |
| C17MW-0 | 3/26/98 | 100.16 | 0:00 | 5.35 | 0.05 | 94.81 | 0.61 | 94.85 |

(2) Measurements Based on Mean Sea Level

**Naval Weapons Station - Earle**
**Air Data from Bioslurper Extraction Wells**



Naval Weapons Station – Earle
Air Data from Bioslurper Extraction Wells

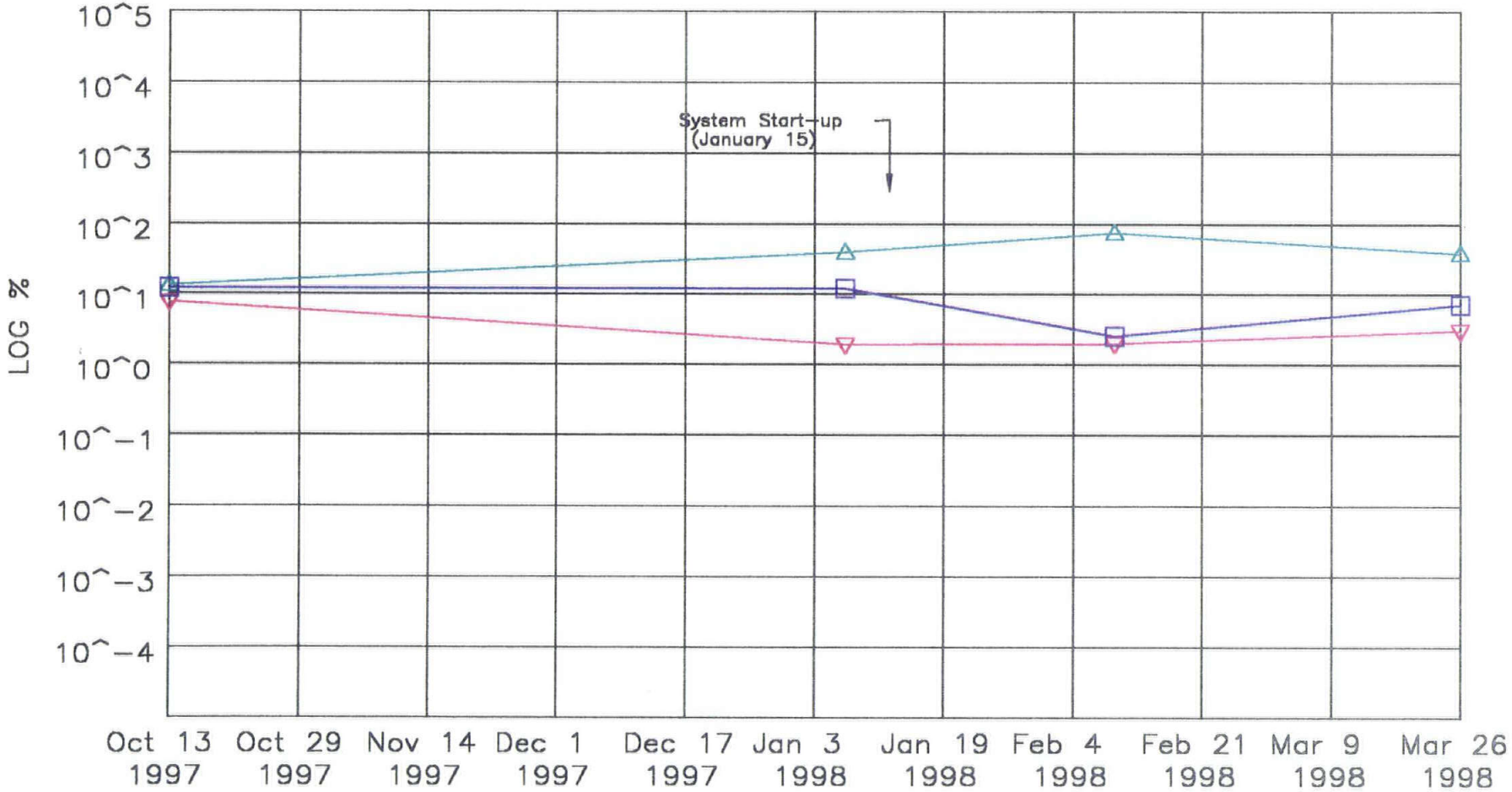


**Naval Weapons Station - Earle**
**Air Data from Bioslurper Extraction Wells**

△ = % CH4
▽ = % CO2
□ = % O2

Well: 16MW-14

Constituent vs. Time

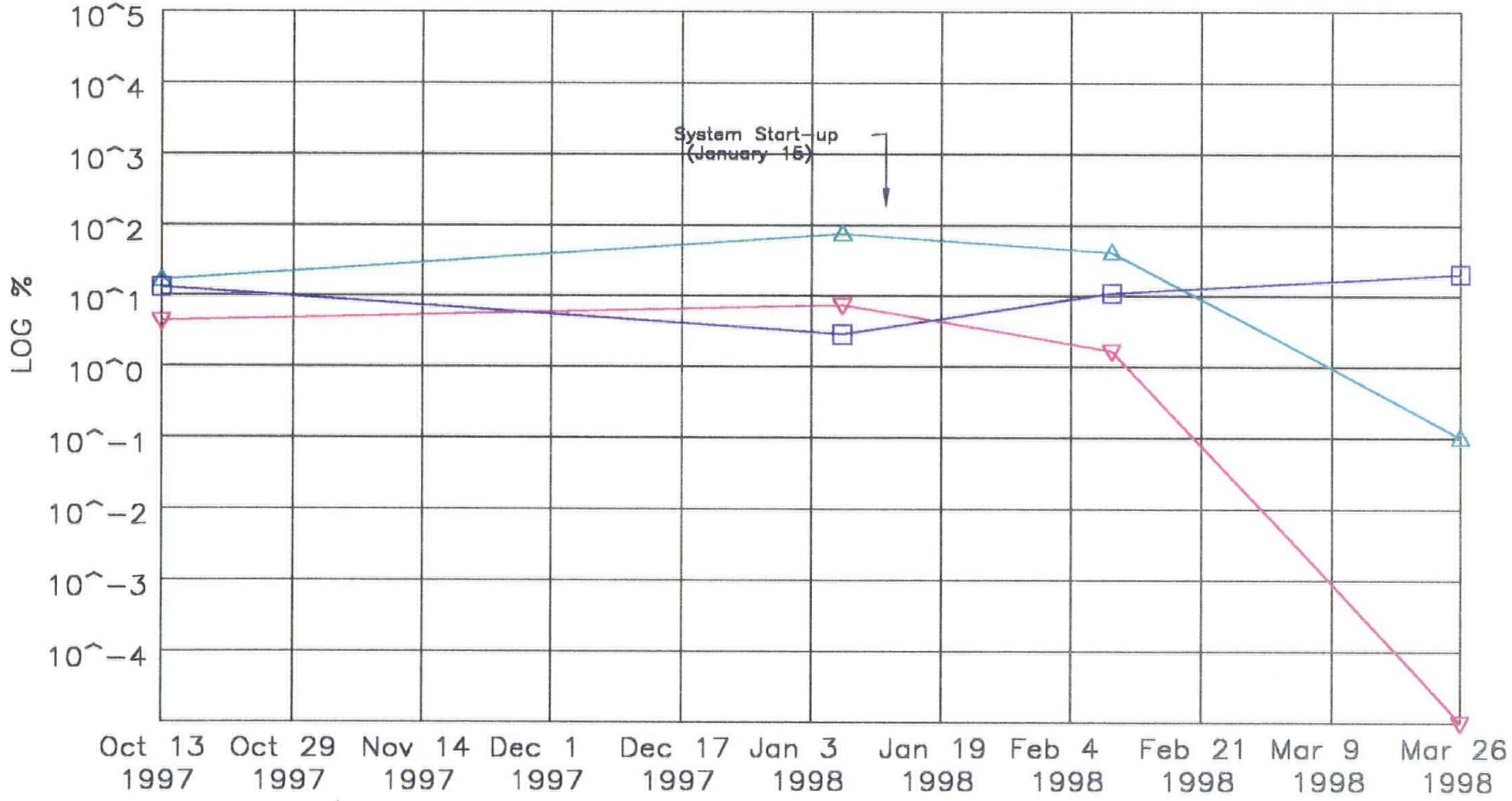


**Naval Weapons Station - Earle**
**Air Data from Bioslurper Extraction Wells**

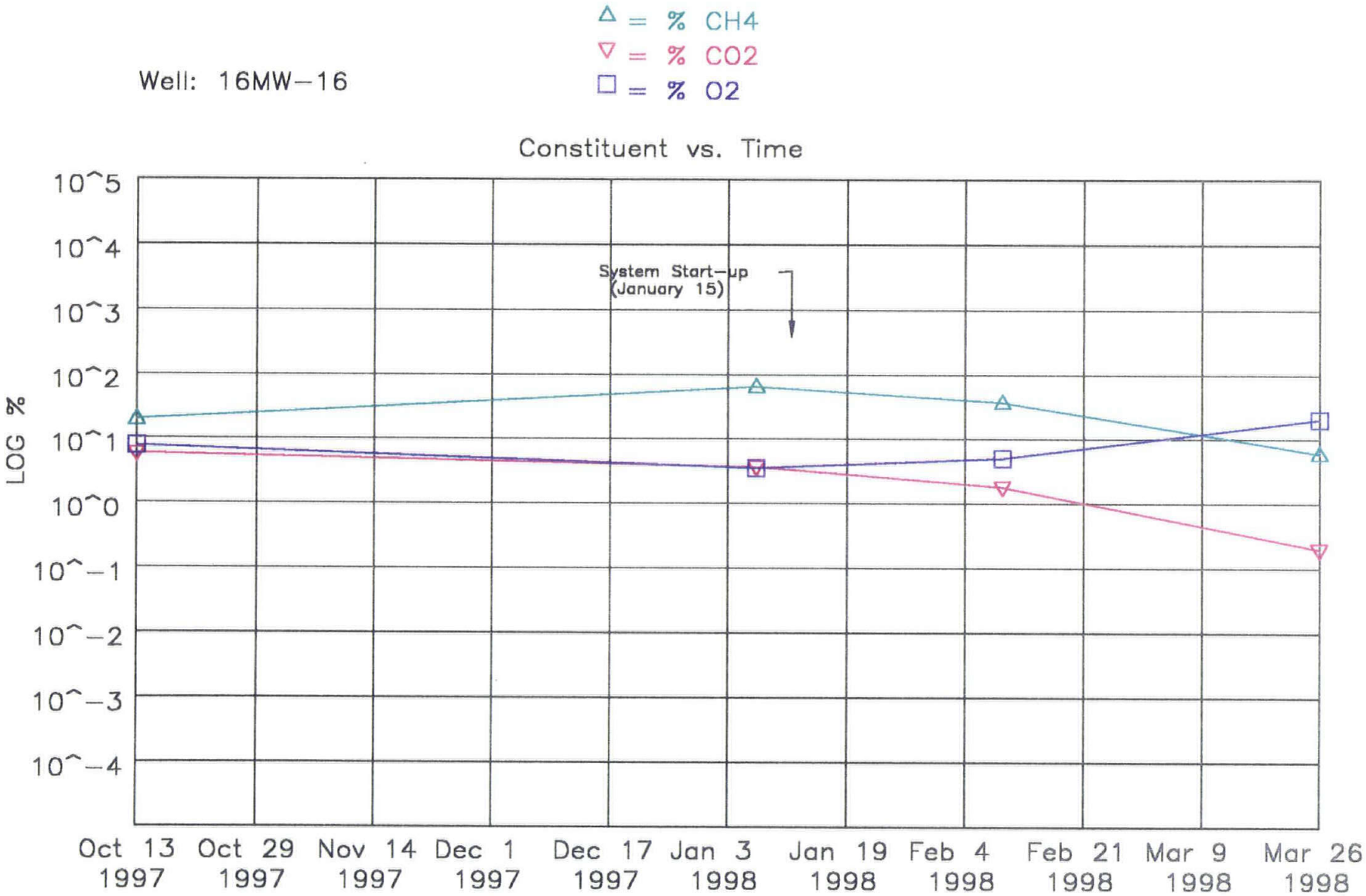
Well: 16MW-15

△ = % CH4
▽ = % CO2
□ = % O2

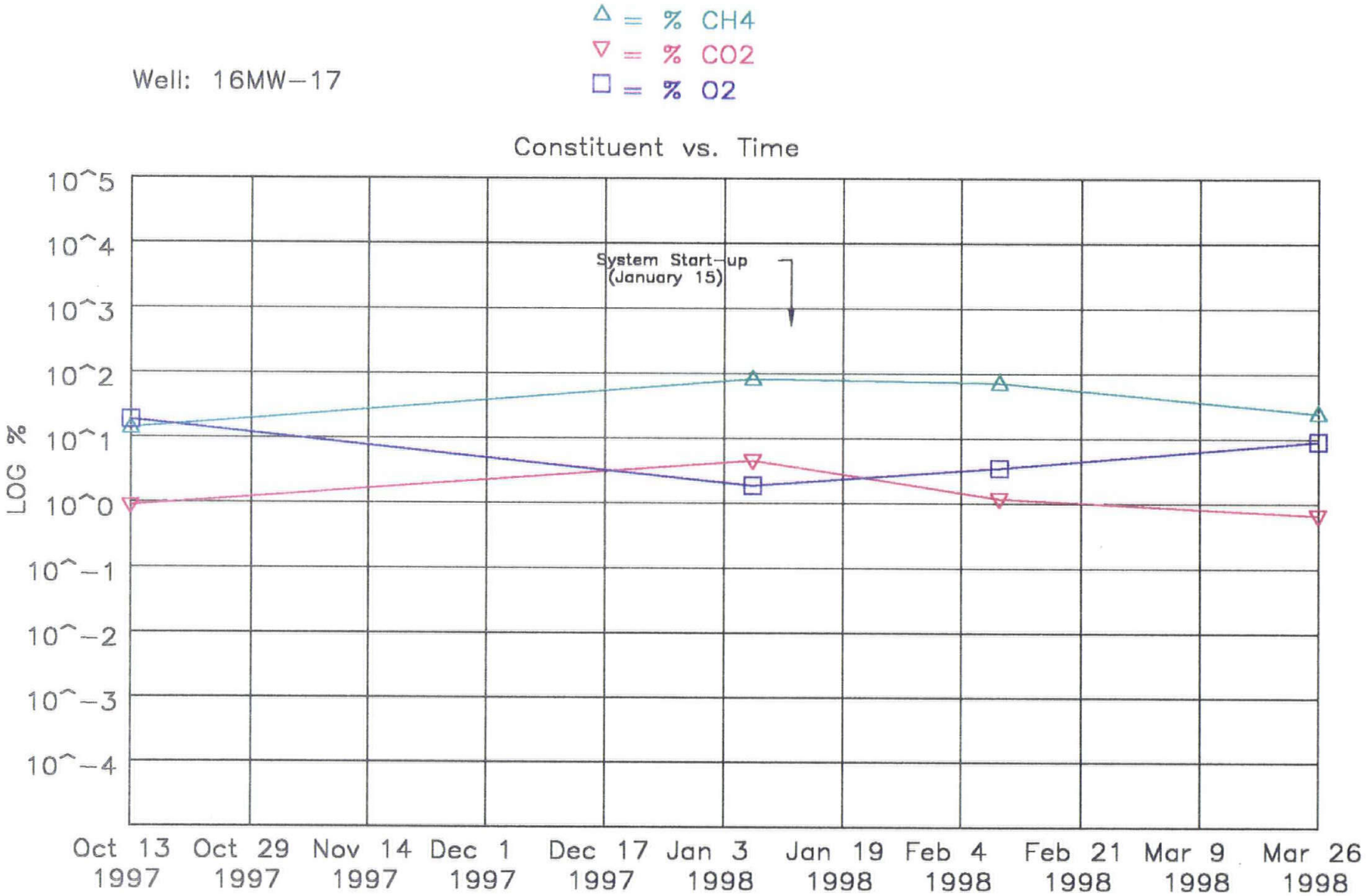
Constituent vs. Time



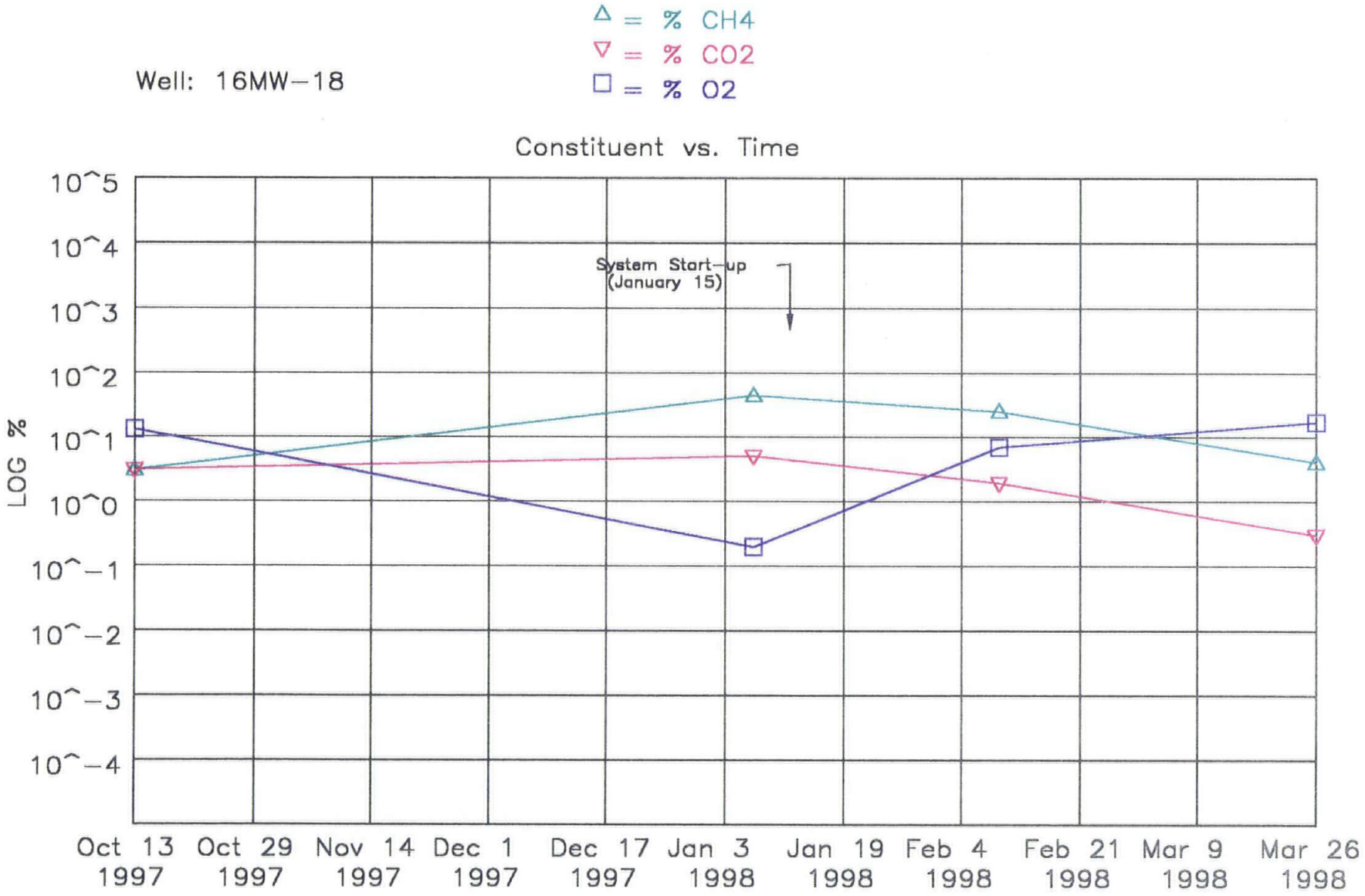
**Naval Weapons Station - Earle**
**Air Data from Bioslurper Extraction Wells**



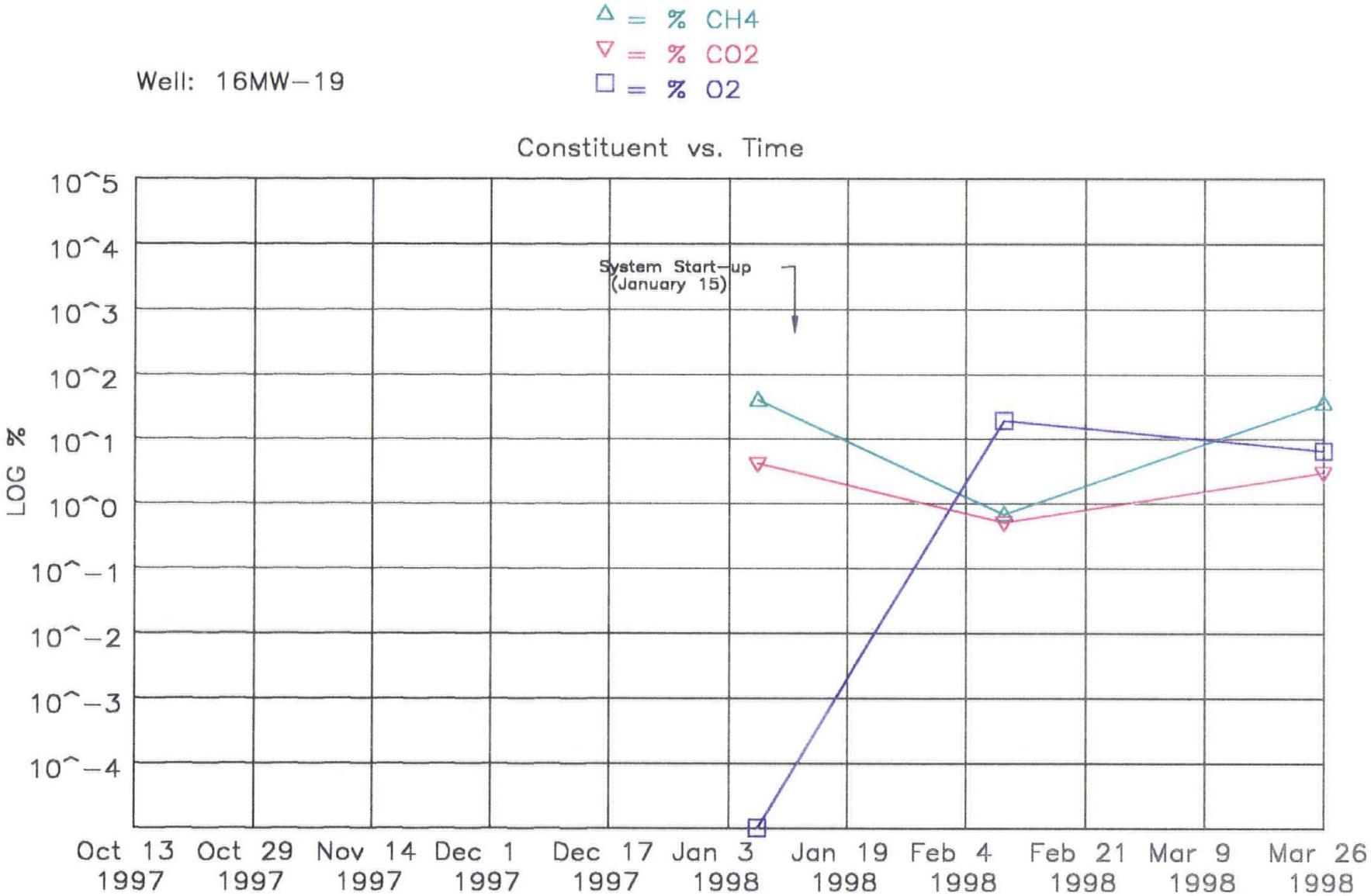
**Naval Weapons Station - Earle**
**Air Data from Bioslurper Extraction Wells**



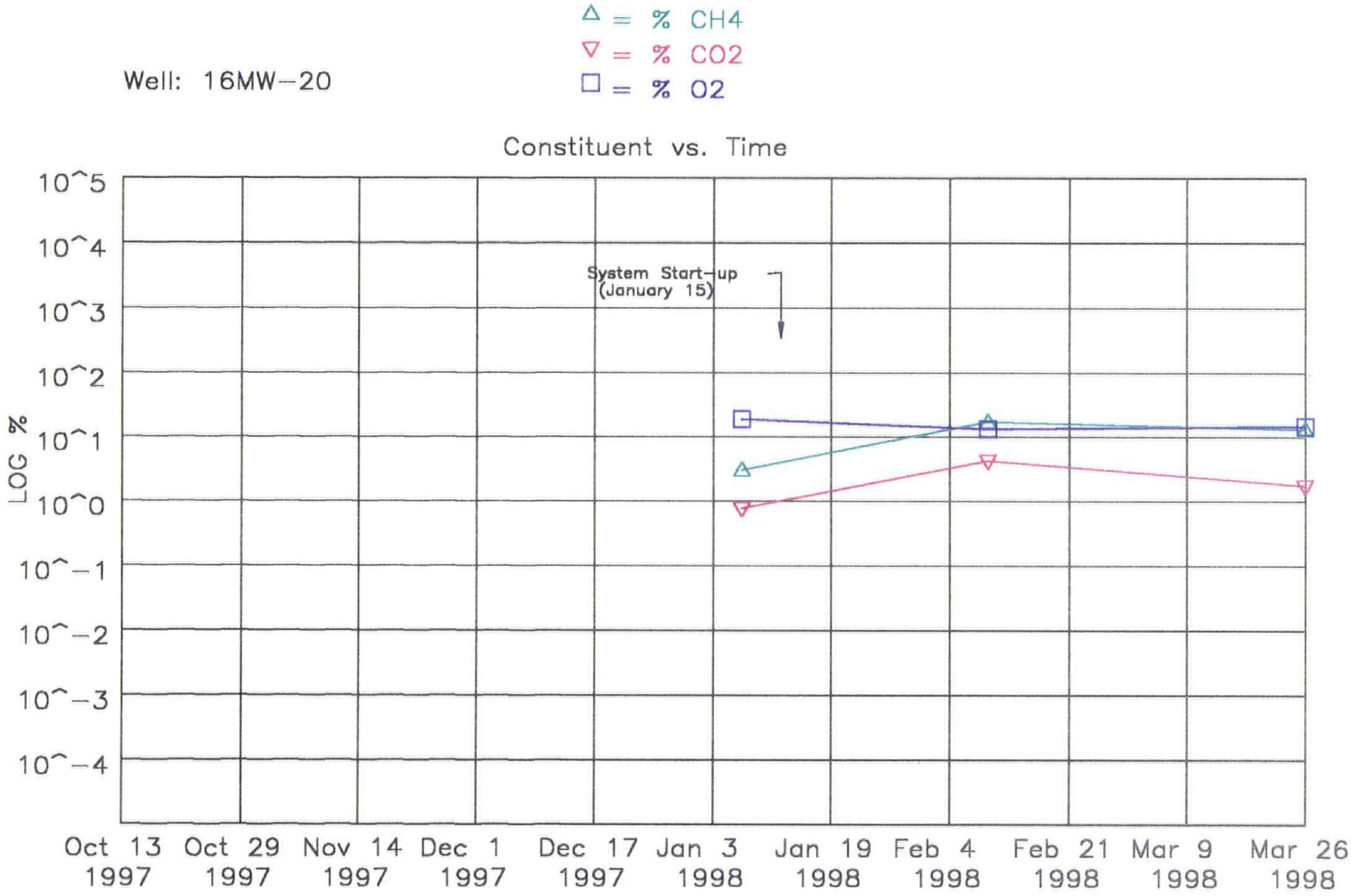
**Naval Weapons Station - Earle**
**Air Data from Bioslurper Extraction Wells**



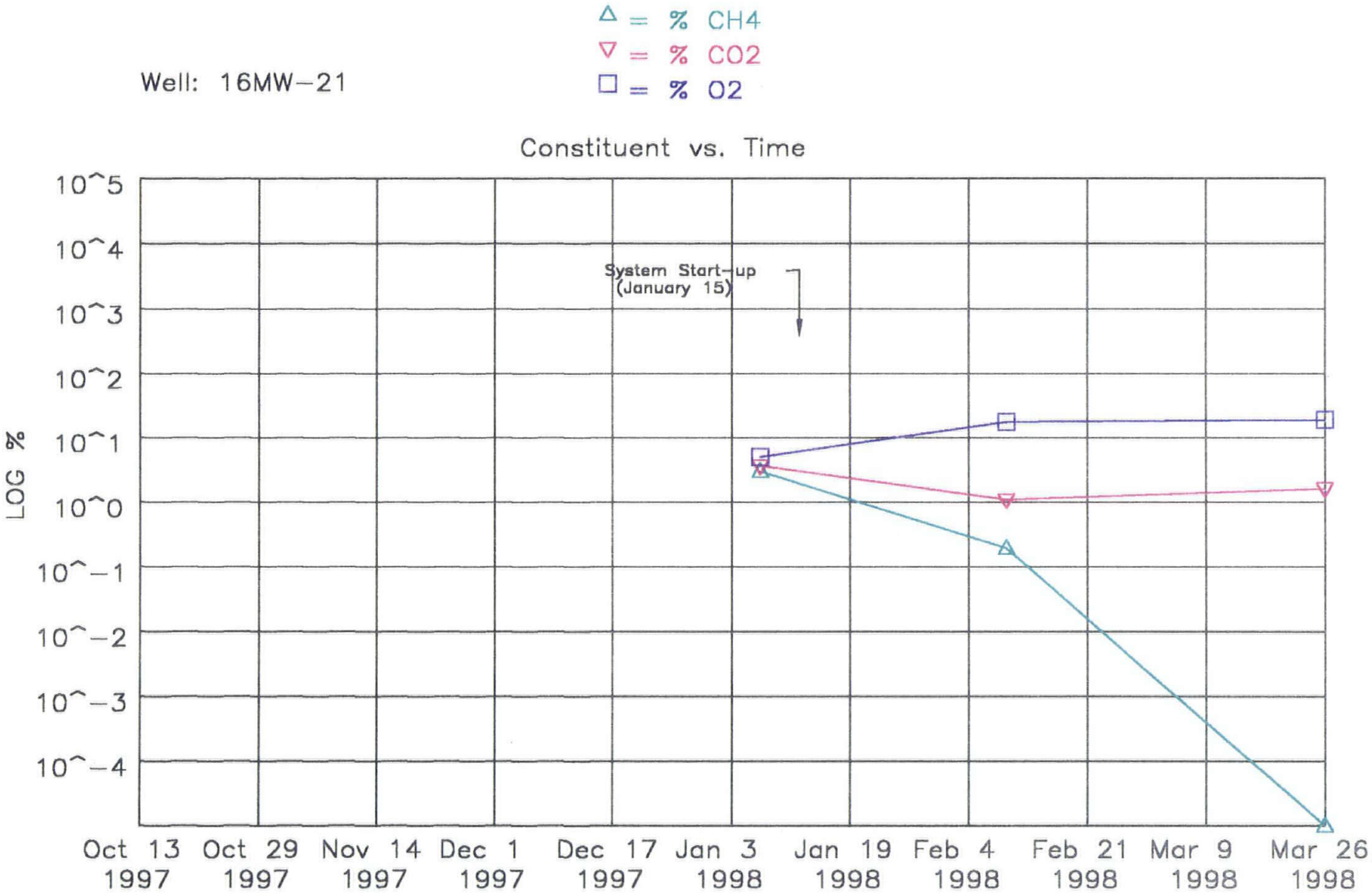
**Naval Weapons Station - Earle**
**Air Data from Bioslurper Extraction Wells**



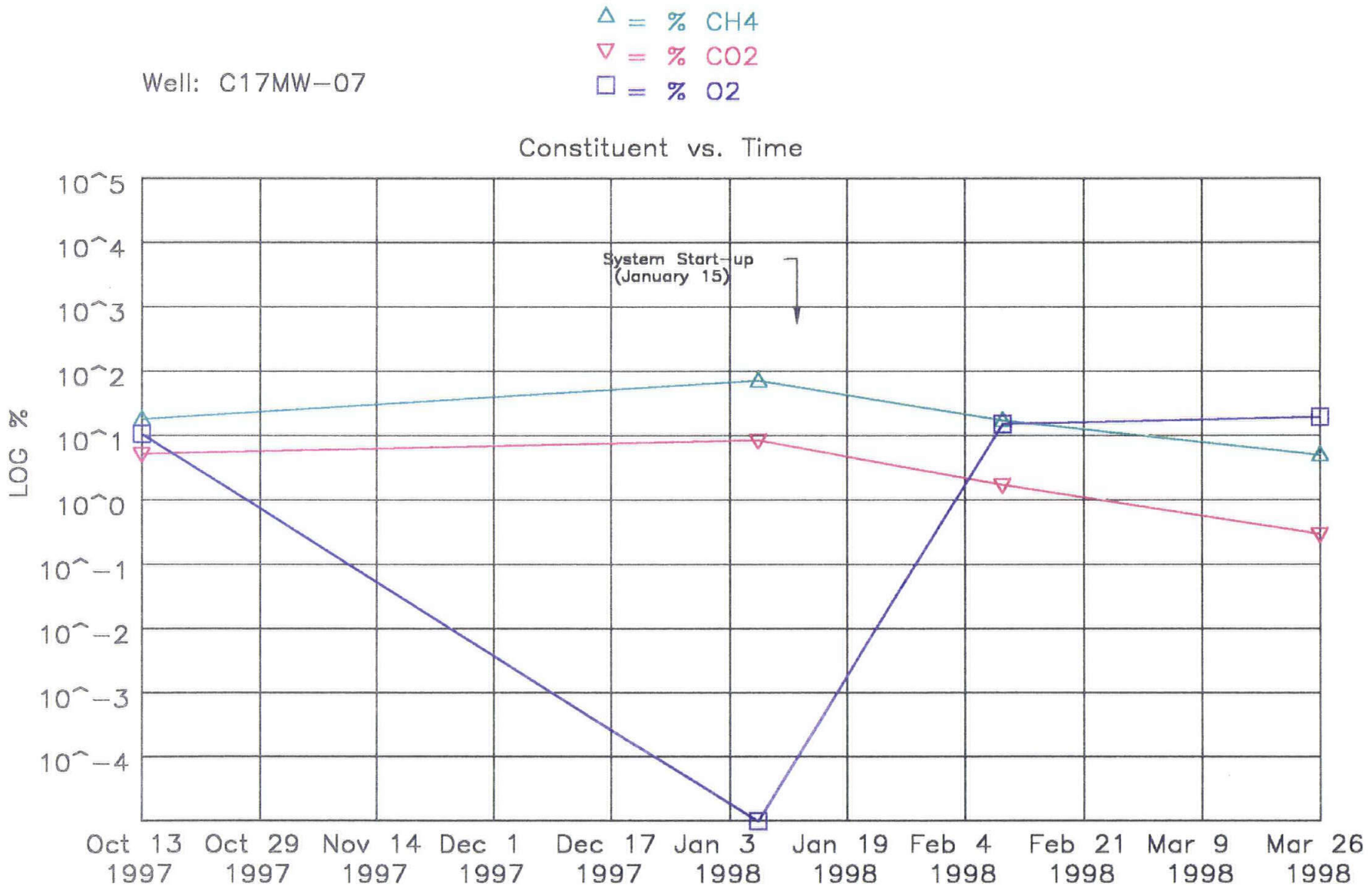
**Naval Weapons Station - Earle**
**Air Data from Bioslurper Extraction Wells**



**Naval Weapons Station - Earle**
**Air Data from Bioslurper Extraction Wells**



**Naval Weapons Station - Earle**
**Air Data from Bioslurper Extraction Wells**



## Naval Weapons Stati n-Earl :

## Air R sults From Extracti n Wells

**Results for 10/13/97**

| CONSTITUENT: | SAMPLE ID: | 16MW-13 | 16MW-14 | 16MW-15 | 16MW-16 | 16MW-17 | 16MW-18 | C17MW-07 |
|---|---|---|---|---|---|---|---|---|
| | DEPTH (ft): | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| % CH4 | | 49.8 | 13.7 | 16.7 | 20 | 14.4 | 3 | 18.4 |
| % CO2 | | 12.4 | 7.7 | 4.4 | 5.8 | 0.9 | 3 | 5.3 |
| % O2 | | 5.3 | 12.2 | 13 | 7.8 | 19.6 | 13 | 10.8 |

**Results for 01/17/98**

| CONSTITUENT: | SAMPLE ID: | 16MW-04 | 16MW-13 | 16MW-14 | 16MW-15 | 16MW-16 | 16MW-17 | 16MW-18 | 16MW-19 | 16MW-20 | 16MW-21 | 16MW-22 | 16MW-23 | C17MW-07 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | DEPTH (ft): | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| % CH4 | | 8.2 | 55.8 | 40 | 76.2 | 66.7 | 84.6 | 44.8 | 40.8 | 3 | 3.1 | 0 | 0 | 74.2 |
| % CO2 | | 0.6 | 10.1 | 1.9 | 7.5 | 3.6 | 4.6 | 5 | 4.1 | 0.8 | 3.6 | 3 | 6.3 | 8.7 |
| % O2 | | 18.5 | 0.4 | 12.1 | 2.8 | 3.5 | 1.9 | 0.2 | 0 | 19.2 | 5.1 | 4.5 | 0.9 | 0 |

**Results for 02/10/98**

| CONSTITUENT: | SAMPLE ID: | 16MW-04 | 16MW-13 | 16MW-14 | 16MW-15 | 16MW-16 | 16MW-17 | 16MW-18 | 16MW-19 | 16MW-20 | 16MW-21 | 16MW-22 | 16MW-23 | C17MW-07 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | DEPTH (ft): | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| % CH4 | | 17 | 16 | 77 | 41.4 | 38 | 73 | 25.2 | 0.7 | 17.3 | 0.2 | 0 | 2.8 | 18.2 |
| % CO2 | | 0.3 | 4.8 | 2 | 1.7 | 1.8 | 1.2 | 1.9 | 0.5 | 4.4 | 1.1 | 0 | 0.3 | 1.8 |
| % O2 | | 17.2 | 8.1 | 2.6 | 10.9 | 5 | 3.7 | 6.9 | 19.5 | 13.6 | 17.8 | 18.2 | 19.2 | 15.6 |

**Results for 3/26/98**

| CONSTITUENT: | SAMPLE ID: | 16MW-04 | 16MW-13 | 16MW-14 | 16MW-15 | 16MW-16 | 16MW-17 | 16MW-18 | 16MW-19 | 16MW-20 | 16MW-21 | 16MW-22 | 16MW-23 | C17MW-07 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | DEPTH (ft): | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| % CH4 | | 0 | 1.6 | 39.5 | 0.1 | 5.9 | 25.4 | 4 | 35.8 | 13.1 | 0 | 0 | 0 | 5.2 |
| % CO2 | | 0 | 1 | 3.1 | 0 | 0.2 | 0.7 | 0.3 | 2.9 | 1.8 | 1.6 | 0 | 0 | 0.3 |
| % O2 | | 20.9 | 19.1 | 7.1 | 20.9 | 20.6 | 9.5 | 17.6 | 6.4 | 15.1 | 19.4 | 0 | 0 | 20.2 |

# FOSTER WHEELER ENVIRONMENTAL CORPORATION

BY _____ DATE _____ SHEET _____ OF _____

CHKD. BY _____ DATE _____ OFS NO. _____ DEPT. NO. _____

CLIENT U.S. Navy

PROJECT Naval Weapons Station - Earle

SUBJECT Biosluper Unit : TPH removal via air

February 1998

Biosluper Unit #1

- Operated 34 hrs.
- Average flow rate 95 cubic feet per minute (CFM)
- TPH = 1,920 mg/m³ (as per analytical)

- $95 \frac{ft^3}{min} \times 0.02832 \frac{m^3}{ft^3} = 2.69 \, m^3/min$
- $2.69 \frac{m^3}{min} \times 1920 \frac{mg}{m^3} = 5165.6 \frac{mg}{min}$ of TPH
- $5165.6 \frac{mg}{min} \times 0.001 \frac{grams}{mg} = 5.17$ grams
- $5.17$ grams $\times 0.002205 \frac{lbs}{gram} = 0.011$ lbs./min of TPH

$0.011 \frac{lbs.}{min} \times \frac{60 min}{hr.} = 0.66 \frac{lbs. of TPH}{hr.}$

$0.66 \frac{lbs}{hr.} \times 34$ hrs. = 22.4 lbs of TPH

Biosluper Unit #2

- Operated 15 hrs.
- Average flow rate 88 CFM
- TPH = 880 mg/m³ (as per analytical)

- $88 \frac{ft^3}{min} \times 0.02832 \frac{m^3}{ft^3} = 2.49 \frac{m^3}{min}$
- $2.49 \frac{m^3}{min} \times 880 \frac{mg}{m^3} = 2191 \frac{mg}{min}$ of TPH
- $2191 \frac{mg}{min} \times 0.001 \frac{grams}{mg} = 2.19$ grams
- $2.19$ grams $\times 0.002205 \frac{lbs}{grams} = 0.005 \frac{lbs}{min}$ of TPH $\times \frac{60 min}{hr.} = 0.3 \frac{lbs}{hr.}$

$0.3$ lbs/hr. $\times 15$ hrs $= 4.5$ lbs of TPH

# FOSTER WHEELER ENVIRONMENTAL CORPORATION

BY _____ DATE _____ SHEET _____ OF _____

CHKD. BY _____ DATE _____ OFS NO. _____ DEPT. NO. _____

CLIENT U.S. Navy

PROJECT Naval Weapons Station - Earle

SUBJECT Biosluper Units : TPH Removal via air

March 1998

Biosluper Unit #1

- Operated 56.5 hrs.
- Average flow rate 90 cubic feet per minute (CFM)
- TPH = 840 mg/m³ (as per analytical)

- $90 \frac{ft^3}{min} \times 0.02832 \frac{m^3}{ft^3} = 2.55 \, m^3/min$
- $2.55 \frac{m^3}{min} \times 840 \frac{mg}{m^3} = 2142 \frac{mg}{min}$ of TPH
- $2142 \frac{mg}{min} \times 0.001 \frac{grams}{mg} = 2.14$ grams
- $2.14$ grams $\times 0.002205 \frac{lbs}{gram} = 0.005$ lbs./min of TPH

$0.005 \frac{lbs.}{min} \times \frac{60 min}{hr.} = 0.30 \frac{lbs. \text{ of TPH}}{hr.}$

$0.30 \frac{lbs}{hr.} \times 56.5$ hrs. = 16.95 lbs of TPH

Biosluper Unit #2

- Operated 38.5 hrs.
- Average flow rate 89 CFM
- TPH = 600 mg/m³ (as per analytical)

- $89 \frac{ft^3}{min} \times 0.02832 \frac{m^3}{ft^3} = 2.52 \frac{m^3}{min}$
- $2.52 \frac{m^3}{min} \times 600 \frac{mg}{m^3} = 1512 \frac{mg}{min}$ of TPH
- $1512 \frac{mg}{min} \times 0.001 \frac{grams}{mg} = 1.51$ grams
- $1.51$ grams $\times 0.002205 \frac{lbs}{grams} = 0.003 \frac{lbs}{min}$ of TPH $\times \frac{60 min}{hr.} = 0.2 \frac{lbs}{hr.}$

$0.2$ lbs/hr. $\times 38.5$ hrs $= 7.7$ lbs of TPH

# FOSTER WHEELER ENVIRONMENTAL CORPORATION

BY _____ DATE _____ SHEET _____ OF _____

CHKD. BY _____ DATE _____ OFS NO. _____ DEPT. NO. _____

CLIENT U.S. Navy

PROJECT Naval Weapons Station - Earle

SUBJECT Bioslurper Units: TPH Removed via Groundwater Treatment

February 1998

Bioslurper Unit #1

- TPH influent to treatment units: 295 mg/l
- TPH effluent from treatment units 0 mg/l
- Total effluent treated: 24,675 gallons

- 24,675 gallons x 3.785 $\frac{\text{liters}}{\text{gallon}}$ = 93,395 liters

- 295 $\frac{\text{mg}}{\text{l}}$ x 93,395 l = 27,551,525 mg or 27,551 grams of TPH

- 27,551 grams x 0.002205 $\frac{\text{pound}}{\text{gram}}$ = 60.75 pounds of TPH

Bioslurper Unit #2

- TPH influent to treatment units: 96.5 mg/l
- TPH effluent from treatment units: 0 mg/l
- Total effluent treated: 5282 gallons

- 5282 gallons x 3.785 $\frac{\text{liters}}{\text{gallon}}$ = 19,992 liters

- 96.5 $\frac{\text{mg}}{\text{l}}$ x 19,992 l = 1,929,263 mg or 1,929 grams of TPH

- 1,929 grams x 0.002205 $\frac{\text{pound}}{\text{gram}}$ = 4.25 pounds of TPH

# FOSTER WHEELER ENVIRONMENTAL CORPORATION

BY _____ DATE _____ SHEET _____ OF _____

CHKD. BY _____ DATE _____ OFS NO. _____ DEPT. NO. _____

CLIENT U.S. Navy

PROJECT Naval Weapons Station - Earle

SUBJECT Biosluper Units: TPH Removed via Groundwater Treatment

March 1998

Biosluper Unit #1

- TPH influent to treatment units: 573 mg/l
- TPH effluent from treatment units 0 mg/l
- Total effluent treated: 26,169 gallons

- 26,169 gallons x 3.785 $\frac{\text{liters}}{\text{gallon}}$ = 99049 liters

- 573 $\frac{\text{mg}}{\text{l}}$ x 99049 l = 56,755,458 mg or 56,755 grams of TPH

- 56,755 grams x 0.002205 $\frac{\text{pound}}{\text{gram}}$ = 125.14 pounds of TPH

Biosluper Unit #2

- TPH influent to treatment units: 82.3 mg/l
- TPH effluent from treatment units: 0 mg/l
- Total effluent treated: 20,586 gallons

- 20,586 gallons x 3.785 $\frac{\text{liters}}{\text{gallon}}$ = 77918 liters

- 82.3 $\frac{\text{mg}}{\text{l}}$ x 77918 l = 6,428,235 mg or 6,428 grams of TPH

- 6,428 grams x 0.002205 $\frac{\text{pound}}{\text{gram}}$ = 14.17 pounds of TPH

# FOSTER WHEELER ENVIRONMENTAL CORPORATION

BY _____ DATE _____ SHEET _____ OF _____

CHKD. BY _____ DATE _____ OFS NO. _____ DEPT. NO. _____

CLIENT _____

PROJECT Navy Weapons Station - Earle

SUBJECT Analytical Data for Air Discharge of Boiler Upper Unit #1

1/29/98 - 16(A) VD-98-2

total volatile organics = 10.3 ppm(v) (* Air Permit Limit; 27 ppm(v))
= 38.7 mg/m³

38.7 mg/m³ x 2.69 m³/min (Airflow)* = 104.1 mg/min

104.1 mg/min x 0.001 grams/mg = 0.104 grams/min

0.104 grams/min x 0.002205 lbs/gram = 0.00023 lbs/min

0.00023 lbs/min x 60 min/hr = 0.014 lbs/hr of total volatile organics

(* Permit Limit = 0.035 lbs/hr)

16(A) VD-98-2

Benzene : 13 mg/m³
: 4.2 ppm(v) (Permit Limit : 7 ppm(v))

13 mg/m³ x 2.69 m³/min (Airflow)* = 34.97 mg/min

34.97 mg/min x 0.001 grams/mg = 0.0350 grams/min

0.0350 grams/min x 0.0022205 lbs/gram = 0.0000776 lbs/min

0.0000776 lbs/min x 60 min/hr = 0.005 lbs/hr of benzene

(* Permit Limit 0.008 lbs/hr)

* Average Airflow for February

# FOSTER WHEELER ENVIRONMENTAL CORPORATION

BY _____ DATE _____ SHEET _____ OF _____

CHKD. BY _____ DATE _____ OFS NO. _____ DEPT. NO. _____

CLIENT _____

PROJECT Navy Weapons Station - Earle

SUBJECT Analytical Data for Air Discharge of Bioslurper #1

3/27/98 - 16(A) VD-98-3

total volatiles = 8.7 ppm (v) (* Permit limit = 27 ppm(v))

= 35.9 mg/m³

35.9 mg/m³ x 2.55 m³/min (airflow)* = 91.5 mg/min

91.5 mg/min x 0.001 grams/mg = 0.0915 grams/min

0.0915 grams/min x 0.002205 lbs/gram = 0.0002 lbs/min

0.0002 lbs/min x 60 min/1 hr. = 0.012 lbs/hr. of total volatiles

(* Permit limit = 0.035 lbs/hr.)

16(A) VD-98-3

Benzene = 6 mg/m³ 1.9 ppm(v) (* Permit limit = 7 ppm(v))

6 mg/m³ x 2.55 m³/min (airflow)* = 15.3 mg/min

15.3 mg/min x 0.001 grams/mg = 0.0153 grams/min

0.0153 grams/min x 0.002205 lbs/gram = 0.0000337 lbs/min

0.0000337 lbs/min x 60 min/1 hr = 0.002 lbs/hr. of benzene

(* Permit Limit = 0.008 lbs/hr.)

* Average airflow for March

# FOSTER WHEELER ENVIRONMENTAL CORPORATION

BY _____ DATE _____ SHEET _____ OF _____

CHKD. BY _____ DATE _____ OFS NO. _____ DEPT. NO. _____

CLIENT _____

PROJECT Navy Weapons Station - Earle

SUBJECT Analytical Data for Air Discharge of Bioslurper Unit #2

3/5/98 : 16(B) VD-98-2

Total Volatile Organics = 10.9 ppm(v) (Permit Limit 27 ppm(v))
= 47.1 mg/m³

47.1 mg/m³ x 2.49 m³/min (airflow)* = 117.28 mg/min

117.28 mg/min x 0.001 grams/mg = 0.117 grams/min

0.117 grams/min x 0.002205 lbs/gram = 0.00026 lbs/min

0.00026 lbs/min x 60 min/hr. = 0.016 lbs/hr. of total volatile organics

(Permit Limit = 0.035 lbs/hr.)

16(B) VD-98-2

Benzene = 3.6 mg/m³
= 1.1 ppm(v) (Permit Limit = 7 ppm(v))

3.6 mg/m³ x 2.49 m³/min (airflow) = 8.96 mg/min

8.96 mg/min x 0.001 grams/mg = 0.009 grams/min

0.009 grams/min x 0.002205 lbs/gram = 0.00002 lbs/min

0.00002 lbs/min x 60 min/hr. = 0.0012 lbs/hr of benzene

(Permit Limit 0.008 lbs/hr)

* Average airflow for February

# FOSTER WHEELER ENVIRONMENTAL CORPORATION

BY _____ DATE _____ SHEET _____ OF _____

CHKD. BY _____ DATE _____ OFS NO. _____ DEPT. NO. _____

CLIENT _____

PROJECT Navy Weapons Station - Earle

SUBJECT Analytical Data for Air Discharge of Brasilgrper Unit #2

3/27/98: 16(B)VD-98-3

Total Volatile organics = 7.1 ppm(v) Permit Limit (27 ppm(v))

= 32.9 mg/m³

32.9 mg/m³ x 2.52 m³/min (airflow)* = 82.91 mg/min

82.91 mg/min x 0.001 grams/mg = 0.083 grams/min

0.083 grams/min x 0.002205 lbs/gram = 0.00018 lbs/min

0.00018 lbs/min x 60 min/hr. = 0.011 lbs/hr. of total volatile organics

(Permit Limit: 0.035 lbs/hr.

16(B)VD-98-3

Benzene = 1.6 mg/m³

0.5 ppm(v) (Permit Limit = 7 ppm(v))

1.6 mg/m³ x 2.52 m³/min (airflow) = 4.03 mg/min

4.03 mg/min x 0.001 grams/mg = 0.004 grams/min

0.004 grams/min x 0.002205 lbs/gram = 0.000009 lbs/min

0.000009 lbs/min x 60 min/hr. = 0.0005 lbs/hr. of benzene

(Permit Limit 0.008 lbs/hr.

* Average Airflow for March

TOXIKON
15 Wiggins Ave., Bedford, MA 01730
Telephone: (617) 275-3330
Fax: (617) 275-7478

# CHAIN OF CUSTODY RECORD

WORK ORDER #: 98-02-199

DUE DATE : 2-13-98

COMPANY: Foster Wheeler
ADDRESS: One Oxford Valley, Suite 200
Langhorne, PA 19047
PHONE #: (215) 702-4015 FAX #: (215) 702-4045
P.O. #:
PROJECT MANAGER: Mike Heffron
PROJECT ID/LOCATION: Navy Weapons - Earle

SAMPLE TYPE
1. WASTEWATER
2. SOIL
3. SLUDGE
4. OIL
5. DRINKING WATER
6. WATER (GW/MW/SW)
7. OTHER (SPECIFY

CONTAINER TYPE
P - PLASTIC
G - GLASS
V - VOA

ANALYSES

| XIKON # | SAMPLE IDENTIFICATION | SAMPLE TYPE | CONTAINER SIZE | CONTAINER TYPE | CONTAINER # | SAMPLING DATE | SAMPLING TIME | PRESERVATIVE | Oil & Grease | | | | | | | | | | | | SPECIAL INSTRUCTIONS/ COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 16(B)EW98W1 | 6 | 1 | G | 1 | 2/9/98 | 16:30 | $H_2SO_4$ | X | | | | | | | | | | | | Rush |

| | | | |
|---|---|---|---|
| MPLED BY: | DATE: 2-9-98 | QUOTATION #: | |
| | TIME: 16:30 | | |
| LINQUISHED BY: | DATE: 2-9-98 | RECEIVED BY: | DATE: 2-10-98 |
| | TIME: - - | | TIME: 11-20 - |
| UNQUISHED BY: | DATE: - | RECEIVED FOR LAB BY: | DATE: - - |
| | TIME: - - | | TIME: - - |
| THOD OF SHIPMENT | | COOLER TEMPERATURE | |

☐ RUSH ..... BUSINESS DAY TURN AROUND
☐ ROUTINE

*Sample disposal information*
Are there any other known or suspected contaminants in these samples other than those listed above?
Yes [redacted] No [redacted] If Yes [redacted] Know [redacted]

FROM : TOXIKON PHONE NO. : 6172711135 Feb. 13 1998 11:15AM P

Page 1 TOXIKON CORP. REPORT Work Order # 98-02-199

Received: 02/10/98 02/13/98 10:57:46

REPORT FOSTER & WHEELER
TO 1 OXFORD VALLEY, SUITE 200
LANGHORNE, PA. 19047
215-702-4007 FAX: 4047
ATTEN MICHAEL HEFFRON

PREPARED TOXIKON CORPORATION
BY 15 WIGGINS AVE
BEDFORD, MA 01730
ATTEN PAUL LEZBERG
PHONE (617)275-3330

CERTIFIED BY

CONTACT CHUCKC

CLIENT FOSTER SAMPLES 1
COMPANY FOSTER & WHEELER
FACILITY 1 OXFORD VALLEY, SUITE 200
LANGHORNE, PA. 19047

MA CERT # M-MA064: TRACE METALS, SULFATE,CYANIDE,RES. FREE CHLORINE, Ca, TOTAL ALK., TDS, pH, THMs, VOC, PEST.,NUTRIENTS. DEMAND. O&G, PHENOLICS, PCBs . CT DHS #PH-0563, NY #10778 FL HRS E87143, NJ DER 59538, NC DNR286, SC 88002, NH 204091-C.

WORK ID NAVY WEAPONS EARLE
TAKEN 2/9/98 16:30
TRANS
TYPE WATER
P.O. #
INVOICE under separate cover

VERIFIED BY: Rhonda Fanella

**SAMPLE IDENTIFICATION**

01 16(B) EW98W1

**TEST CODES and NAMES used on this workorder**

O G GR O. & G. by Gravimetric

 TOXIKON CORP. REPORT Work Order # 98-02-199

Received: 02/10/98 Results by Sample

SAMPLE ID 16(B) EW98W1 SAMPLE # 01 FRACTIONS: A

Date & Time Collected 02/09/98 16:30:00 Category WATER

O_G_GR ND

mg/L DL=5.0

 TOXIKON CORP. REPORT Work Order # 98-03-116

Received: 03/06/98 Results by Sample

SAMPLE ID 16 B EW-98W1 SAMPLE # 01 FRACTIONS: A
Date & Time Collected 03/05/98 12:22:00 Category WATER

TPH_IR 112
mg/L DL=1.0

SAMPLE ID 16 B EW-98W2 SAMPLE # 02 FRACTIONS: A
Date & Time Collected 03/05/98 12:24:00 Category WATER

TPH_IR 137
mg/L DL=1.0

SAMPLE ID 16 B EW-98W3 SAMPLE # 03 FRACTIONS: A
Date & Time Collected 03/05/98 12:26:00 Category WATER

TPH_IR 38.5
mg/L DL=1.0

SAMPLE ID 16 B EW-98W4 SAMPLE # 04 FRACTIONS: A
Date & Time Collected 03/05/98 12:28:00 Category WATER

TPH_IR 6.86
mg/L DL=1.0

SAMPLE ID 16 B EW-98W5 SAMPLE # 05 FRACTIONS: A
Date & Time Collected 03/05/98 12:30:00 Category WATER

TPH_IR ND
mg/L DL=1.0

**TOXIKON**
Wiggins Ave., Bedford, MA 01730
Telephone: (781) 275-3330
Fax: (781) 275-7478

# CHAIN OF CUSTODY RECORD

WORK ORDER #: 98-03-977

DUE DATE : 3-31-98

COMPANY: Foster Wheeler Environmental
ADDRESS: One Oxford Valley, Suite 200
Langhorne, PA
PHONE #: (215) 702-4015 FAX #: (215) 702-4075
P.O. #:
PROJECT MANAGER: Mike Heffron
PROJECT ID/LOCATION: NWS-Earle

| SAMPLE TYPE | CONTAINER TYPE |
|---|---|
| 1. WASTEWATER | P - PLASTIC |
| 2. SOIL | G - GLASS |
| 3. SLUDGE | V - VOA |
| 4. OIL | |
| 5. DRINKING WATER | |
| 6. WATER (GW/MW/SW) | |
| 7. OTHER (SPECIFY | |

ANALYSES

| TOXIKON # | SAMPLE IDENTIFICATION | SAMPLE TYPE | CONTAINER SIZE | CONTAINER TYPE | CONTAINER # | SAMPLING DATE | SAMPLING TIME | PRESERVATIVE | TPH | SPECIAL INSTRUCTIONS/ COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 16(A) EW-98-W9 | W | 1l | GB | 1 | 3/27/98 | 13:10 | $H_2SO_4$ | X | |
| 2 | 16(A) EW-98-W10 | | | | | 3/27/98 | 13:12 | | X | |
| 3 | 16(A) EW-98-W11 | | | | | 3/27/98 | 13:15 | | X | |
| 4 | 16(A) EW-98-W12 | | | | | 3/27/98 | 13:17 | | X | |
| 5 | 16(A) EW-98-W13 | | | | | 3/27/98 | 13:19 | | X | |
| 6 | 16(A) EW-98-W14 | | | | | | 13:21 | | X | |
| 7 | 16(B) EW-98-W9 | | | | | | 14:00 | | | |
| 8 | 16(B) EW-98-W10 | | | | | | 14:02 | | | |
| 9 | 16(B) EW-98-W11 | | | | | | 14:03 | | | |
| 10 | 16(B) EW-98-W12 | | | | | | 14:05 | | | |
| 11 | 16(B) EW-98-W13 | | | | | | 14:08 | | | |
| 12 | 16(B) EW-98-W14 | | | | | | 14:10 | | | |

| | | | |
|---|---|---|---|
| SAMPLED BY: | DATE: 3-27-98 | QUOTATION #: | |
| | TIME: | | |
| RELINQUISHED BY: | DATE: 3-27-98 | RECEIVED BY: M. Gentile | DATE: 3-27-98 |
| | TIME: | | TIME: 1520 |
| RELINQUISHED BY: | DATE: | RECEIVED FOR LAB BY: | DATE: |
| | TIME: | | TIME: |
| METHOD OF SHIPMENT | | COOLER TEMPERATURE | |

72 hr. turnaround
☒ RUSH ..... BUSINESS DAY TURN AROUND
☐ ROUTINE

*Sample disposal information*
Are there any other known or suspected contaminants in these samples other than those listed above?
Yes [redacted] No [redacted] If Yes [redacted] Know [redacted]

FROM : TOXIKON PHONE NO. : 6172711135 Mar. 31 1998 04:43PM P6

Page 1 TOXIKON CORP. REPORT Work Order # 98-03-544
Received: 03/27/98 03/31/98 16:11:53

REPORT FOSTER & WHEELER
TO 1 OXFORD VALLEY, SUITE 200
LANGHORNE, PA. 19047
215-702-4007 FAX: 4047
ATTEN MICHAEL HEFFRON

PREPARED TOXIKON CORPORATION
BY 15 WIGGINS AVE
BEDFORD, MA 01730
ATTEN PAUL LEZBERG
PHONE (617)275-3330

CERTIFIED BY
CONTACT CHUCKC

CLIENT FOSTER SAMPLES 12
COMPANY FOSTER & WHEELER
FACILITY 1 OXFORD VALLEY, SUITE 200
LANGHORNE, PA. 19047

MA CERT # M-MA064: TRACE METALS, SULFATE,CYANIDE,RES. FREE CHLORINE, Ca, TOTAL ALK., TDS, pH, THMs, VOC, PEST.,NUTRIENTS. DEMAND, O&G, PHENOLICS, PCBs , CT DHS #PH-0563, NY #10778 FL HRS E87143, NJ DEP 59538, NC DNR286, SC 88002, NH 204091-C.

WORK ID NWS EARLE
TAKEN 3/27/98
TRANS
TYPE WATER
P.O. #
INVOICE under separate cover

VERIFIED BY:

SAMPLE IDENTIFICATION

01 16 (A) EW-98-W9
02 16(A) EW-98-W10
03 16(A) EW-98-W11
04 16(A) EW-98-W12
05 16(A) EW-98-W13
06 16(A) EW-98-W14
07 16(B) EW-98-W9
08 16(B) EW-98-W10
09 16(B) EW-98-W11
10 16(B) EW-98-W12
11 16(B) EW-98-W13
12 16(B) EW-98-W14

TEST CODES and NAMES used on this workorder

TPH IR TPH BY IR

TOXIKON CORP. REPORT Work Order # 98-03-544

Received: 03/27/98

Results by Sample

SAMPLE ID 16 (A) EW-98-W9 SAMPLE # 01 FRACTIONS: A
Date & Time Collected 03/27/98 13:10:00 Category WATER

TPH_IR 751
mg/L DL=1.0

SAMPLE ID 16(A) EW-98-W10 SAMPLE # 02 FRACTIONS: A
Date & Time Collected 03/27/98 13:12:00 Category WATER

TPH_IR 148
mg/L DL=1.0

SAMPLE ID 16(A) EW-98-W11 SAMPLE # 03 FRACTIONS: A
Date & Time Collected 03/27/98 13:15:00 Category WATER

TPH_IR 196
mg/L DL=1.0

SAMPLE ID 16(A) EW-98-W12 SAMPLE # 04 FRACTIONS: A
Date & Time Collected 03/27/98 13:17:00 Category WATER

TPH_IR 10.8
mg/L DL=1.0

SAMPLE ID 16(A) EW-98-W13 SAMPLE # 05 FRACTIONS: A
Date & Time Collected 03/27/98 13:19:00 Category WATER

TPH_IR 1.14
mg/L DL=1.0

SAMPLE ID 16(A) EW-98-W14 SAMPLE # 06 FRACTIONS: A
Date & Time Collected 03/27/98 13:21:00 Category WATER

TPH_IR ND
mg/L DL=1.0

SAMPLE ID 16(B) EW-98-W9 SAMPLE # 07 FRACTIONS: A
Date & Time Collected 03/27/98 14:00:00 Category WATER

TPH_IR 26.1
mg/L DL=1.0

SAMPLE ID 16(B) EW-98-W10 SAMPLE # 08 FRACTIONS: A
Date & Time Collected 03/27/98 14:02:00 Category WATER

TPH_IR 52.6
mg/L DL=1.0

Received: 03/27/98

Results by Sample

SAMPLE ID 16(B) EW-98-W11 SAMPLE # 09 FRACTIONS: A
Date & Time Collected 03/27/98 14:03:00 Category WATER

TPH_IR 11.2
mg/L DL=1.0

SAMPLE ID 16(B) EW-98-W12 SAMPLE # 10 FRACTIONS: A
Date & Time Collected 03/27/98 14:05:00 Category WATER

TPH_IR ND
mg/L DL=1.0

SAMPLE ID 16(B) EW-98-W13 SAMPLE # 11 FRACTIONS: A
Date & Time Collected 03/27/98 14:08:00 Category WATER

TPH_IR ND
mg/L DL=1.0

SAMPLE ID 16(B) EW-98-W14 SAMPLE # 12 FRACTIONS: A
Date & Time Collected 03/27/98 14:10:00 Category WATER

TPH_IR ND
mg/L DL=1.0

Received: 03/27/98 Test Methodology

TEST CODE TPH IR NAME TPH BY IR

EPA METHOD: 418.1 for water sample.

Reference: Methods for Chemical Analysis of Water and Wastes.
EPA 600/4-79-020 (Revised, March 1983). EPA/EMSL, Cincinnati, OH.

EPA METHOD: 9071/9073

Reference: Test Methods for Evaluating Solid Waste: Physical/Chemical Methods.
EPA SW-846 (Third Edition) 1986. Office of Solid Waste, USEPA.

**Apollo Analytics, Inc.**
2960 Airway Ave., Suite B-101 • Costa Mesa, CA 92626
Phone (714) 751-3210 • FAX (714) 751-6414

# Chain of Custody

DATE 7/4/98 PAGE 1 OF 1

**PROJECT MANAGER:** Mike Heffron
**COMPANY:** Foster Wheeler Enviro
**ADDRESS:** One Oxford Valley Suite 300 Langhorne, PA 19047
**PHONE #** (215) 702-4015 **FAX #** (215) 702-4045
**BILL TO:** Langhorne, PA
**COMPANY:** Same as above
**ADDRESS:**

SAMPLERS: (Signature) ( ) - PHONE NUMBER

Recommended Quantity and Preservative (Provide triple volume on QC Samples)

| SAMPLE ID | DATE | TIME | MATRIX | LAB ID | Air Toxics | Volatile Cmpds (EPA TO14) | Hydrocarbon Speciations | Fixed Gases ($CH_4$, $O_2$, $CO_2$, CO) | TPH/BTXE | TNMOC (SCAQMD 25.2) | Metals (CARB 436) | Soil & Water Toxics | Petroleum Hyrdocarbons (418.1) | Oil and Grease (413.2) | Gasoline (MOD 8015/DOHS) | Diesel (MOD 8015/DOHS) | Gasoline /BTXE (MOD 8015/8020) | (MOD 8015) | BTXE (8020) | Chlorinated Hydrocarbons (8010) | Aromatic Hydrocarbons (8020) | Organic Lead (Pb) | Volatile Cmpds GC/MS (8240/8260) | Semi-Volatile Cmpds GC/MS (8270) | Pesticides/PCB (8080) | Polynuclear Aromatic (8310) | CCR Metals | Priority Pollutant Metals | Number of Containers |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 4L | 1L | 1L | 1L | 1L | | | | 1L ($H_2SO_4$)/100g | 4 oz (HCL)/50g | 4 oz (HCL)/50g | 4 oz (HCL)/50g | 4 oz (HCL)/50g | 2X40ml (HCL)/50g | 2X40ml (HCL)/50g | 2X40ml (HCL)/50g | 500ml/50g | 2X40ml (HCL)/100g | 1L/100g | 1L/50g | 1L/100g | 500ml/100g | 500ml/100g | |
| 16(A) VD-04 | 4/3/98 | 13:20 | Air | -001 | | X | | | ~~X~~ | | | | X | X | | | | | | | | | | | | | | | |
| 16(B) VD-04 | 4/3/98 | 13:00 | ↓ | -002 | | X | | | ~~X~~ | | | | X | | | | | | | | | | | | | | | | |

**PROJECT INFORMATION**

PROJECT NUMBER: 1284-3017
PROJECT NAME: NWS-Earle
PURCHASE ORDER NUMBER:
SHIPPED VIA: Fed Ex.
TAT: ☐ 24HR ☐ 48HR ☐ 1WK ☒ 2WKS
Comments:

**SAMPLE RECEIPT**

| | |
|---|---|
| TOTAL NUMBER OF CONTAINERS | 2 |
| CHAIN OF CUSTODY SEALS Y/N/NA | NA |
| INTACT? Y/N/NA | Y |
| RECEIVED GOOD COND/COLD | Y |
| AAI RFS #: | 9809601 |

| RELINQUISHED BY: 1. | RELINQUISHED BY: 2. | RELINQUISHED BY: 3. |
|---|---|---|
| Signature: Time: | Signature: Time: | Signature: Time: |
| Printed Name: Michael Heffron Date: 4/3 | Printed Name: Date: | Printed Name: Date: |
| Company: Foster Wheeler | Company: | Company: |
| **RECEIVED BY: 1.** | **RECEIVED BY: 2.** | **RECEIVED BY: 3.** |
| Signature: Time: | Signature: Time: | Signature: Time: 9:45 A.M. |
| Printed Name: Date: | Printed Name: Date: | Printed Name: LETICIA ZELAYA Date: 4/6/98 |
| Company: | Company: | Apollo Analytics, Inc. |

**SAMPLE DISPOSAL INSTRUCTIONS**

☐ AAI [redacted]al (B[redacted]e) ☐ R[redacted] ☐ [redacted]ickup ([redacted]ll)

DISTRIBUTION: White, Canary – APOLLO ANALYTICS, INC. • PINK – ORIGINATOR

# VOLATILE ORGANIC ANALYSIS

| | | | |
|---|---|---|---|
| **CLIENT NAME:** | Foster Wheeler Environmental | **CLIENT SAMPLE ID:** | Method Blank |
| **PROJECT #:** | 1284-B017 | **AAI RFS#** | 9809601 |
| **PROJECT NAME:** | NWS EARLE | **AAI ID#:** | Method Blank |
| **MATRIX:** | Air/Canister | | |
| **SAMPLE VOLUME:** | 0.02 Liter | **DATE SAMPLED:** | 4/3/98 |
| **INITIAL PRESSURE:** | 1.00 psia | **DATE RECEIVED:** | 4/6/98 |
| **FINAL PRESSURE:** | 1.00 psia | **DATE ANALYZED:** | 4/8/98 |
| **PRES. DILUTION :** | 1.00 | | |
| **DILUTION FACTOR:** | 1 | **ANALYTICAL METHOD:** | EPA TO14 (GC/MS) |

| CAS NUMBER | COMPOUND | CONCENTRATION mg/m3 | PQL | ppm(v) | PQL |
|---|---|---|---|---|---|
| 74-87-3 | Chloromethane | ND< | 0.250 | ND< | 0.121 |
| 74-83-9 | Bromomethane | ND< | 0.250 | ND< | 0.064 |
| 75-01-04 | Vinyl Chloride | ND< | 0.250 | ND< | 0.098 |
| 75-00-3 | Chloroethane | ND< | 0.250 | ND< | 0.095 |
| 75-69-4 | Freon 11 | ND< | 0.250 | ND< | 0.045 |
| 75-35-4 | 1,1-Dichloroethene | ND< | 0.250 | ND< | 0.063 |
| 76-13-1 | Freon 113 | ND< | 0.250 | ND< | 0.033 |
| 75-09-2 | Methylene Chloride | ND< | 0.250 | ND< | 0.072 |
| 75-35-3 | 1,1-Dichloroethane | ND< | 0.250 | ND< | 0.062 |
| 156-60-5 | trans-1,2-Dichloroethene | ND< | 0.250 | ND< | 0.063 |
| 156-59-2 | cis-1,2-Dichloroethene | ND< | 0.250 | ND< | 0.063 |
| 67-66-3 | Chloroform | ND< | 0.250 | ND< | 0.051 |
| 71-55-6 | 1,1,1-Trichloroethane | ND< | 0.250 | ND< | 0.046 |
| 56-23-5 | Carbon Tetrachloride | ND< | 0.250 | ND< | 0.040 |
| 71-43-2 | Benzene | ND< | 0.250 | ND< | 0.078 |
| 107-06-2 | 1,2-Dichloroethane | ND< | 0.250 | ND< | 0.062 |
| 79-01-6 | Trichloroethene | ND< | 0.250 | ND< | 0.047 |
| 78-87-5 | 1,2-Dichloropropane | ND< | 0.250 | ND< | 0.054 |
| 10061-02-6 | trans-1,3-Dichloropropene | ND< | 0.250 | ND< | 0.055 |
| 108-88-3 | Toluene | ND< | 0.250 | ND< | 0.066 |
| 10061-01-5 | cis-1,3-Dichloropropene | ND< | 0.250 | ND< | 0.055 |
| 79-00-5 | 1,1-2-Trichloroethane | ND< | 0.250 | ND< | 0.046 |
| 127-18-4 | Tetrachloroethene | ND< | 0.250 | ND< | 0.037 |
| 106-93-4 | Ethylene Dibromide | ND< | 0.250 | ND< | 0.033 |
| 108-90-7 | Chlorobenzene | ND< | 0.250 | ND< | 0.054 |
| 100-41-4 | Ethylbenzene | ND< | 0.250 | ND< | 0.058 |
| 1330-20-7 | m,p-Xylene | ND< | 0.250 | ND< | 0.058 |
| 95-47-6 | o-Xylene | ND< | 0.250 | ND< | 0.058 |
| 100-42-5 | Styrene | ND< | 0.250 | ND< | 0.059 |
| 79-34-5 | 1,1,2,2-Tetrachlorethane | ND< | 0.250 | ND< | 0.036 |
| 108-67-8 | 1,3,5-Trimethyl Benzene | ND< | 0.250 | ND< | 0.051 |
| 95-63-6 | 1,2,4-Trimethyl Benzene | ND< | 0.250 | ND< | 0.051 |
| 541-73-1 | 1,3-Dichlorobenzene | ND< | 0.250 | ND< | 0.042 |
| 106-46-7 | 1,4-Dichlorobenzene | ND< | 0.250 | ND< | 0.042 |
| 100-44-7 | Chlorotoluene | ND< | 0.250 | ND< | 0.048 |
| 95-50-1 | 1,2-Dichlorobenzene | ND< | 0.250 | ND< | 0.042 |
| 67-64-1 | Acetone | ND< | 0.250 | ND< | 0.105 |
| 78-93-3 | 2-Butanone | ND< | 0.250 | ND< | 0.085 |
| 108-10-1 | 4-methyl-2-pentanone | ND< | 0.250 | ND< | 0.061 |
| 591-78-6 | 2-Hexanone | ND< | 0.250 | ND< | 0.061 |

| Surrogate Recovery | % Recovery | |
|---|---|---|
| 1,2-Dichloroethane-D4 (SS1) | 97 | 70-130 |
| Toluene-d8 (SS2) | 91 | 70-130 |
| 4- Bromofluorobenzene (SS3) | 145* | 70-130 |

ND- Not detected

TR - Trace

*Value outside QC limits due to matrix interfence.

# VOLATILE ORGANIC ANALYSIS

| | | | |
|---|---|---|---|
| **CLIENT NAME:** | Foster Wheeler Environmental | **CLIENT SAMPLE ID:** | 16 (A) VD-04 |
| **PROJECT #:** | 1284-B017 | **AAI RFS#** | 9809601 |
| **PROJECT NAME:** | NWS EARLE | **AAI ID#:** | 9809601-001 |
| **MATRIX:** | Air/Canister | | |
| **SAMPLE VOLUME:** | 0.02 Liter | **DATE SAMPLED:** | 4/3/98 |
| **INITIAL PRESSURE:** | 14.10 psia | **DATE RECEIVED:** | 4/6/98 |
| **FINAL PRESSURE:** | 24.70 psia | **DATE ANALYZED:** | 4/8/98 |
| **PRES. DILUTION :** | 1.75 | | |
| **DILUTION FACTOR:** | 1 | **ANALYTICAL METHOD:** | EPA TO14 (GC/MS) |

| CAS NUMBER | COMPOUND | CONCENTRATION mg/m3 | PQL | ppm(v) | PQL |
|---|---|---|---|---|---|
| 74-87-3 | Chloromethane | ND< | 0.438 | ND< | 0.212 |
| 74-83-9 | Bromomethane | ND< | 0.438 | ND< | 0.113 |
| 75-01-04 | Vinyl Chloride | ND< | 0.438 | ND< | 0.171 |
| 75-00-3 | Chloroethane | ND< | 0.438 | ND< | 0.166 |
| 75-69-4 | Freon 11 | ND< | 0.438 | ND< | 0.078 |
| 75-35-4 | 1,1-Dichloroethene | ND< | 0.438 | ND< | 0.111 |
| 76-13-1 | Freon 113 | ND< | 0.438 | ND< | 0.057 |
| 75-09-2 | Methylene Chloride | ND< | 0.438 | ND< | 0.126 |
| 75-35-3 | 1,1-Dichloroethane | ND< | 0.438 | ND< | 0.108 |
| 156-60-5 | trans-1,2-Dichloroethene | ND< | 0.438 | ND< | 0.111 |
| 156-59-2 | cis-1,2-Dichloroethene | ND< | 0.438 | ND< | 0.111 |
| 67-66-3 | Chloroform | ND< | 0.438 | ND< | 0.090 |
| 71-55-6 | 1,1,1-Trichloroethane | ND< | 0.438 | ND< | 0.080 |
| 56-23-5 | Carbon Tetrachloride | ND< | 0.438 | ND< | 0.070 |
| 71-43-2 | Benzene | 11 | 0.438 | 3.4 | 0.137 |
| 107-06-2 | 1,2-Dichloroethane | ND< | 0.438 | ND< | 0.108 |
| 79-01-6 | Trichloroethene | ND< | 0.438 | ND< | 0.082 |
| 78-87-5 | 1,2-Dichloropropane | ND< | 0.438 | ND< | 0.095 |
| 10061-02-6 | trans-1,3-Dichloropropene | ND< | 0.438 | ND< | 0.097 |
| 108-88-3 | Toluene | 6.6 | 0.438 | 1.7 | 0.116 |
| 10061-01-5 | cis-1,3-Dichloropropene | ND< | 0.438 | ND< | 0.097 |
| 79-00-5 | 1,1-2-Trichloroethane | ND< | 0.438 | ND< | 0.080 |
| 127-18-4 | Tetrachloroethene | ND< | 0.438 | ND< | 0.065 |
| 106-93-4 | Ethylene Dibromide | ND< | 0.438 | ND< | 0.057 |
| 108-90-7 | Chlorobenzene | ND< | 0.438 | ND< | 0.095 |
| 100-41-4 | Ethylbenzene | 16 | 0.438 | 3.6 | 0.101 |
| 1330-20-7 | m,p-Xylene | 46 | 0.438 | 11 | 0.101 |
| 95-47-6 | o-Xylene | 14 | 0.438 | 3.3 | 0.101 |
| 100-42-5 | Styrene | ND< | 0.438 | ND< | 0.103 |
| 79-34-5 | 1,1,2,2-Tetrachlorethane | ND< | 0.438 | ND< | 0.064 |
| 108-67-8 | 1,3,5-Trimethyl Benzene | 6.1 | 0.438 | 1.2 | 0.089 |
| 95-63-6 | 1,2,4-Trimethyl Benzene | 15 | 0.438 | 3.1 | 0.089 |
| 541-73-1 | 1,3-Dichlorobenzene | ND< | 0.438 | ND< | 0.073 |
| 106-46-7 | 1,4-Dichlorobenzene | ND< | 0.438 | ND< | 0.073 |
| 100-44-7 | Chlorotoluene | ND< | 0.438 | ND< | 0.085 |
| 95-50-1 | 1,2-Dichlorobenzene | ND< | 0.438 | ND< | 0.073 |
| 67-64-1 | Acetone | ND< | 0.438 | ND< | 0.185 |
| 78-93-3 | 2-Butanone | ND< | 0.438 | ND< | 0.149 |
| 108-10-1 | 4-methyl-2-pentanone | ND< | 0.438 | ND< | 0.107 |
| 591-78-6 | 2-Hexanone | ND< | 0.438 | ND< | 0.107 |

| Surrogate Recovery | % Recovery | |
|---|---|---|
| 1,2-Dichloroethane-D4 (SS1) | 93 | 70-130 |
| Toluene-d8 (SS2) | 106 | 70-130 |
| 4- Bromofluorobenzene (SS3) | 113 | 70-130 |

ND- Not detected

TR - Trace

*Value outside QC limits due to matrix interfence.

# VOLATILE ORGANIC ANALYSIS

| | | | |
|---|---|---|---|
| **CLIENT NAME:** | Foster Wheeler Environmental | **CLIENT SAMPLE ID:** | 16 (B) VD-04 |
| **PROJECT #:** | 1284-B017 | **AAI RFS#** | 9809601 |
| **PROJECT NAME:** | NWS EARLE | **AAI ID#:** | 9809601-002 |
| **MATRIX:** | Air/Canister | | |
| **SAMPLE VOLUME:** | 0.02 Liter | **DATE SAMPLED:** | 4/3/98 |
| **INITIAL PRESSURE:** | 13.90 psia | **DATE RECEIVED:** | 4/6/98 |
| **FINAL PRESSURE:** | 24.90 psia | **DATE ANALYZED:** | 4/8/98 |
| **PRES. DILUTION :** | 1.79 | | |
| **DILUTION FACTOR:** | 1 | **ANALYTICAL METHOD:** | EPA TO14 (GC/MS) |

| CAS NUMBER | COMPOUND | CONCENTRATION mg/m3 | PQL | ppm(v) | PQL |
|---|---|---|---|---|---|
| 74-87-3 | Chloromethane | ND< | 0.448 | ND< | 0.217 |
| 74-83-9 | Bromomethane | ND< | 0.448 | ND< | 0.115 |
| 75-01-04 | Vinyl Chloride | ND< | 0.448 | ND< | 0.175 |
| 75-00-3 | Chloroethane | ND< | 0.448 | ND< | 0.170 |
| 75-69-4 | Freon 11 | ND< | 0.448 | ND< | 0.080 |
| 75-35-4 | 1,1-Dichloroethene | ND< | 0.448 | ND< | 0.113 |
| 76-13-1 | Freon 113 | ND< | 0.448 | ND< | 0.058 |
| 75-09-2 | Methylene Chloride | ND< | 0.448 | ND< | 0.129 |
| 75-35-3 | 1,1-Dichloroethane | ND< | 0.448 | ND< | 0.111 |
| 156-60-5 | trans-1,2-Dichloroethene | ND< | 0.448 | ND< | 0.113 |
| 156-59-2 | cis-1,2-Dichloroethene | ND< | 0.448 | ND< | 0.113 |
| 67-66-3 | Chloroform | ND< | 0.448 | ND< | 0.092 |
| 71-55-6 | 1,1,1-Trichloroethane | ND< | 0.448 | ND< | 0.082 |
| 56-23-5 | Carbon Tetrachloride | ND< | 0.448 | ND< | 0.071 |
| 71-43-2 | Benzene | 0.9 | 0.448 | 0.3 | 0.140 |
| 107-06-2 | 1,2-Dichloroethane | ND< | 0.448 | ND< | 0.111 |
| 79-01-6 | Trichloroethene | ND< | 0.448 | ND< | 0.083 |
| 78-87-5 | 1,2-Dichloropropane | ND< | 0.448 | ND< | 0.097 |
| 10061-02-6 | trans-1,3-Dichloropropene | ND< | 0.448 | ND< | 0.099 |
| 108-88-3 | Toluene | ND< | 0.448 | ND< | 0.119 |
| 10061-01-5 | cis-1,3-Dichloropropene | ND< | 0.448 | ND< | 0.099 |
| 79-00-5 | 1,1-2-Trichloroethane | ND< | 0.448 | ND< | 0.082 |
| 127-18-4 | Tetrachloroethene | ND< | 0.448 | ND< | 0.066 |
| 106-93-4 | Ethylene Dibromide | ND< | 0.448 | ND< | 0.058 |
| 108-90-7 | Chlorobenzene | ND< | 0.448 | ND< | 0.097 |
| 100-41-4 | Ethylbenzene | 3.1 | 0.448 | 0.7 | 0.103 |
| 1330-20-7 | m,p-Xylene | 9.0 | 0.448 | 2.1 | 0.103 |
| 95-47-6 | o-Xylene | 2.9 | 0.448 | 0.7 | 0.103 |
| 100-42-5 | Styrene | ND< | 0.448 | ND< | 0.105 |
| 79-34-5 | 1,1,2,2-Tetrachlorethane | ND< | 0.448 | ND< | 0.065 |
| 108-67-8 | 1,3,5-Trimethyl Benzene | 2.1 | 0.448 | 0.4 | 0.091 |
| 95-63-6 | 1,2,4-Trimethyl Benzene | 4.5 | 0.448 | 0.9 | 0.091 |
| 541-73-1 | 1,3-Dichlorobenzene | ND< | 0.448 | ND< | 0.075 |
| 106-46-7 | 1,4-Dichlorobenzene | ND< | 0.448 | ND< | 0.075 |
| 100-44-7 | Chlorotoluene | ND< | 0.448 | ND< | 0.087 |
| 95-50-1 | 1,2-Dichlorobenzene | ND< | 0.448 | ND< | 0.075 |
| 67-64-1 | Acetone | ND< | 0.448 | ND< | 0.189 |
| 78-93-3 | 2-Butanone | ND< | 0.448 | ND< | 0.152 |
| 108-10-1 | 4-methyl-2-pentanone | ND< | 0.448 | ND< | 0.110 |
| 591-78-6 | 2-Hexanone | ND< | 0.448 | ND< | 0.109 |

| Surrogate Recovery | % Recovery | |
|---|---|---|
| 1,2-Dichloroethane-D4 (SS1) | 99 | 70-130 |
| Toluene-d8 (SS2) | 91 | 70-130 |
| 4- Bromofluorobenzene (SS3) | 98 | 70-130 |

ND- Not detected

TR - Trace

*Value outside QC limits due to matrix interfence.

ANALYTICAL RESULTS

**AAI RFS #: 9809601**

Client Name: Foster Wheeler Environmental
Project Name: NWS EARLE
Project #: 1284-B017
Matrix: Air/Canister

Date(s) Sampled: 4/3/98
Date(s) Analyzed: 4/6/98
Analytical Method: CARB/EPA
Chemist: HA

| | Units | 16 (A) VD-04 9809601 -001 | 16 (B) VD-04 9809601 -002 | Method Blank |
|---|---|---|---|---|
| **EPA 8015mod** | | | | |
| TPH as gasoline | (mg/m3) | 1,610 | 340 | ND<1.0 |

QUALITY CONTROL

**AAI RFS #: 9809601**

Client Name: Foster Wheeler Environmental
Project Name: NWS EARLE
Project #: 1284-B017
Matrix: Air/Canister

Date(s) Sampled: 4/3/98
Date(s) Analyzed: 4/6/98
Analytical Method: CARB/EPA
Chemist: HA

| | Sample Result 9809601-001 (mg/m3) | Duplicate Result 9809601-001 (mg/m3) | RPD (%) | Quality Control Limits (%) |
|---|---|---|---|---|
| **EPA 8015mod** | | | | |
| TPH as gasoline | 1,610 | 1,750 | 8 | 30 |