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OPERATIONS AND MAINTENANCE SUMMARY REPORT FUEL FARM 216 MULTI-PHASE RECOVERY SYSTEM 28 APRIL 1997 THROUGH 18 SEPTEMBER 1998 NAS CORPUS CHRISTI TX

10/1/1998

MORRISON KNUDSEN CORPORATION

Operations and Maintenance Summary Report
Fuel Farm 216 Multi-Phase Recovery System
28 April 1997 through 18 September 1998

NAS Corpus Christi
Corpus Christi, TX

Unit Identification Code: N 91734
Contract No. N62467-94-D-1106

October 1998

Revision 0

Southern Division
Naval Facilities Engineering Command
North Charleston, South Carolina
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28 APRIL 1997 THROUGH 18 SEPTEMBER 1998

NAVAL AIR STATION, CORPUS CHRISTI
CORPUS CHRISTI, TEXAS

October 26, 1998

Revision 0

CONTRACT N62467-93-D-1106
DELIVERY ORDER #0016
STATEMENT OF WORK #024

Prepared for

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EXECUTIVE SUMMARY

Fuel Farm 216 at Naval Air Station (NAS) Corpus Christi, Corpus Christi, Texas, consisted of thirty-six (36) 25,000 gallon tanks that were constructed in the early 1940s to store aviation fuel and two 10,000 gallon tanks to store diesel fuel for NAS Corpus Christi. Closure of Fuel Farm 216 was completed in November 1987 under a separate contract. During closure, the two diesel storage tanks were removed from service in 1986 and the 25,000-gallon tanks were abandoned in place and filled with a mixture of sand and cement. The two diesel tanks were subsequently removed from the site October 1991. Recovery of free-product and groundwater began in 1985 via pumping or bailing using two 24 inch diameter wells. This methodology was used until the installation and startup of the multi-phase recovery system in January 1997.

Morrison Knudsen Corporation (MK) was tasked to design and install a multi-phase recovery system at Fuel Farm 216 at NAS Corpus Christi. The work was performed for Southern Division Naval Facilities Engineering Command (SOUTHNAVFACENGCOM) as defined in Delivery Order 16, Statement of Work 24, under Contract N62467-93-D-1106. The work was performed in accordance with the approved Work Plan [MK, 1996].

Design of the full-scale system was completed in October 1996. Construction and installation were completed on 17 December 1996. During start-up, hydrocarbon vapor, phase separated hydrocarbon liquid, and groundwater were recovered from the site. System recovery of vapor phase hydrocarbon was greater than expected. Limited system operation occurred from January through April 1997. A thermal oxidizer was installed to replace the activated carbon for treating the recovered vapors. Installation of the thermal oxidizer was completed 21 April 1997. Full time operation began 28 April 1997.

The multi-phase product recovery system installed at NAS Corpus Christi consists of recovery wells equipped with a drop pipe, a skid-mounted liquid ring vacuum pump (LRVP) with a moisture separator, a seal water tank, an oil/water separator, a product tank, a transfer tank, a storage tank, a vapor stream condensate separator, and a thermal oxidation unit for off gas treatment. Groundwater, separate phase hydrocarbon, and subsurface vapor are drawn from each vacuum well by the LRVP. After filtration, the groundwater and liquid hydrocarbon are pumped from the moisture separator to an oil/water separator. From the oil/water separator, the liquid phase hydrocarbon passes to a product tank where it is stored for recycling or disposal. The residual water flows from the oil/water separator by gravity to a water transfer tank where it is pumped to a water storage tank. The residual water is stored until it is automatically transferred to the base wastewater treatment plant. A flow meter records the total quantity of fluid pumped to the base wastewater treatment plant.

Operation and Maintenance (O&M) of the system began 28 April 1997. MK's contract to operate and maintain the system concluded on 18 September 1998. During operation, system improvements, modifications and additions occurred. A bag filter was installed prior to the LRVP to prevent sediment from entering the initial process feed tank and to prevent associated problems with the discharge pump. Two chemical metering pumps were added to the system to inject scale inhibitor and dispersant chemicals into the system. Potable water usage was essentially eliminated by the installation of piping so that recovered groundwater could be recycled for use as seal water for the LRVP. A moisture separator was added prior to the thermal oxidizer to collect condensate and an automatic discharge system was added to eliminate the need to manually pump out the discharge tank. The programmable logic controller (PLC) program was modified so that the system did not automatically cycle from well to well. Wells MW-14, MW-22, and RW-03 were added to the system.

As of 18 September 1998 the system was operating properly and had removed and destroyed 36,409 pounds (5,135 gallons) of hydrocarbons in vapor form from the ground at Fuel Farm 216, NAS Corpus Christi. The product layer remaining in the ground has been reduced. The separate phase product

thickness found in all of the extraction wells has been reduced to less than six inches from as much as 4.5 feet. Most of the wells had between one and three feet of product before starting the vacuum extraction system. Three of the eight product recovery wells had no measurable layer of product when measured on 18 August. Well 22 had the most significant reduction in product thickness. The product layer was reduced from more than 4.5 feet of product on 1 August 1998 to less than 3 inches for five consecutive measurements in August and September 1998.

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ACRONYMS AND ABBREVIATIONS

AES	Applied Earth Sciences, Inc.
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, xylene
CPU	central processing unit
FID	flame ionization detector
FI/FC - #	flow indicator/flow controller, number
GP - #	gas probe, number
HDPE	high density polyethylene
in. Hg	Inches of mercury
LRVP	liquid ring vacuum pump
MK	Morrison Knudsen Corporation
MRS	multi-phase recovery system
MW	monitoring well
MV	motor valve
NAS	Naval Air Station
NPT	National Pipe Taper
O&M	operations and maintenance
PLC	programmable logic controller
ppmv	parts per million by volume
PVC	polyvinyl chloride
ROICC	Resident Officer in Charge of Construction
RPM	Remedial Project Manager
RW	recovery well
SB	soil boring
SCFM	standard cubic feet per minute
SOUTHNAVFACENGCOM	Southern Division, Naval Facilities Engineering Command
TNRCC	Texas Natural Resource Conservation Commission
TPH	total petroleum hydrocarbon
UL	Underwriters Laboratory
UPS	uninterruptible power supply

1.0
INTRODUCTION

1.1 BACKGROUND

This report summarizes the operations and maintenance actions performed from 28 April 1997 through 18 September 1998 on the multi-phase recovery system at Fuel Farm 216, Naval Air Station (NAS) Corpus Christi, Corpus Christi, Texas. This summary report was prepared by Morrison Knudsen Corporation (MK) for Southern Division Naval Facilities Engineering Command (SOUTHNAVFACENGCOM), pursuant to the scope of work defined in Delivery Order 16, Statement of Work 24, under Contract N62467-93-D-1106.

The NAS Corpus Christi facility is under a consent decree by the State of Texas to remediate the subsurface at Fuel Farm 216 by removing residual petroleum left in the subsurface from previous fueling operations at Fuel Farm 216.

Fuel Farm 216 is located on Ocean Drive near the south gate of NAS Corpus Christi. The fuel farm consists of thirty-six (36) 25,000 gallon tanks constructed in the early 1940s to store aviation fuel for NAS Corpus Christi. Two 10,000 gallon tanks at the fuel farm were also installed at that time to store diesel fuel. The fuel farm is located immediately adjacent to Corpus Christi Bay. There is no evidence of hydrocarbon migration from the site to the adjacent bay.

Twelve of the thirty-six tanks were taken out of service prior to 1979. By November 1987, the closure of Fuel Farm 216 was completed, with all 36 aviation fuel tanks filled with a sand-cement mixture and abandoned in place. The two diesel storage tanks were removed from service in 1986, but were not excavated and removed from the site until October 1991. Recovery of free-product and groundwater began in 1985 via pumping or bailing using two 24 inch diameter wells, RW-2 and RW-3. This methodology was used until installation and startup of the multi-phase recovery system in January 1997. Pumping and bailing resulted in minimal product recovery.

In September 1996, MK performed soil borings, groundwater monitoring, subsurface gas monitoring, and a liquid ring vacuum pump (LRVP) pilot test. The LRVP recovery system was then designed and installed. Operation of the system began in January 1997 using activated carbon to treat the recovered subsurface vapors. Limited system operation occurred from January through April 1997. A thermal oxidizer was installed in April 1997, to replace the activated carbon for treating the recovered vapors. Installation of the thermal oxidizer was completed 21 April 1997. System operations and maintenance began on 28 April 1997. Additional information related to the system installation can be found in the Construction Completion Report [MK, 1998a]. Details for the operations of the system can be found in the Operations and Maintenance Manual [MK, 1998b]. Operations data can be found in the Operations and Maintenance Data [MK, 1998c].

The purpose of this report is to provide a summary of the O&M activities completed between 28 April 1997 and 18 September 1998, to present the results and conclusions, and to provide recommendations for future work. Further details of O&M activities were presented to Southern Division in the respective monthly reports.

The primary objectives of the O&M functions were to:

- Recover vapor-phase product
- Recover liquid-phase product
- Monitor free product elevation and thickness
- Perform adjustments to the treatment system to maximize product recovery
- Provide corrective action during a system malfunction

1.2 TREATMENT SYSTEM DESCRIPTION

The multi-phase product recovery system installed at NAS Corpus Christi consists of a skid-mounted LRVP (VP-1) with a moisture separator (T-1) and a seal water tank (T-2), an oil/water separator (T-3), a product tank (T-4), a transfer tank (T-5), a storage tank (T-6), a vapor stream condensate separator (T-7), and a thermal oxidation unit for off gas treatment. Details of equipment are included in the O&M Manual [MK, 1998].

Groundwater, separate phase hydrocarbon, and subsurface vapor are drawn from each vacuum well by the LRVP (VP-1) through a bag filter (F-1) into a moisture separator (T-1). The groundwater and separate phase hydrocarbon are pumped from the moisture separator (T-1) to an oil/water separator (T-3) by a submersible transfer pump (P-1) in T-1. From the oil/water separator, the liquid phase hydrocarbon passes to a product tank (T-4), where it is stored until removal for recycling or disposal. The residual water flows from the oil/water separator (T-3) by gravity to a water transfer tank (T-5). From T-5, the water is pumped by a transfer pump (P-2) to a water storage tank (T-6), where it is stored until it is automatically transferred to the base wastewater treatment plant. Flow meter FQ-1 records the total quantity of fluid pumped to the base wastewater treatment plant. Flow meter FQ-2 measures the amount of LRVP seal makeup water (base water) supplied to the system.

Seal water tank (T-2) serves as a reservoir for water used as the seal for the LRVP (VP-1). When a low level switch in the T-2 tank is actuated, solenoid valve SV-3 opens and solenoid valve SV-4 closes redirecting the system to obtain seal water from the groundwater storage tank (T-6). Optionally, low level in T-2 is also wired to open solenoid valve (SV-2) if adding potable water to T-2 is desired. Manual valves in the potable water line are normally closed. Seal water in T-2 continually flows through the adjustable flow meter (FI/FC-2) into a moisture separator (T-1) to draw away heat generated by the LRVP.

Scale prevention and dispersant chemicals are metered into the system between the transfer pump (P-2) and the groundwater storage tank (T-6) to minimize scale in the vacuum pump (VP-1). These chemicals are also intended to disperse and reduce algae accumulation in the system sight glasses and polyethylene storage tanks.

The vapor phase recovered from the well passes through the moisture separator (T-1), the LRVP (VP-1), and into the seal water tank (T-2). The vapor phase then passes through two orifice meters (GOM-2 and GOM-3) and out through a condensate collector (T-7) to the thermal oxidation unit.

The thermal oxidation unit uses natural gas as auxiliary fuel. The unit is provided with a combustion air blower, a dilution air blower, an automatic dilution air control valve, and a flame arrestor. A chart recorder continuously monitors the thermal oxidation temperature.

Eight wells (MW-13, MW-14, MW-20, MW-21, MW-22, MW-26, MW-29, and RW-03) are connected to the remediation system and enter the compound through five lines. The piping from the recovery wells enters the equipment compound through a vault located in the northeast corner of the compound which also serves as a sump for the compound. The wells are connected to valves leading to a manifold, valve positions determine which wells are in operation.

The recovery wells are equipped with a drop pipe which can extend to a depth of two feet below the historic groundwater low level for the well. The drop pipe may be adjusted up or down as required to maintain groundwater at a desired level.

2.0
OPERATIONS AND MAINTENANCE

2.1 WORK ACCOMPLISHED

MK provided project management and engineering oversite for the operations and maintenance of the system. MK's primary operations and maintenance subcontractor was Applied Earth Sciences, Inc. (AES). Analytical services were provided by Gulf States Analytical Core Laboratories. MK provided O&M services from 28 April 1997 through 18 September 1998 for the multi-phase extraction and treatment system. The details of the O&M activities were presented to Southern Division in the monthly reports. A summary of these O&M activities is provided below:

- Routine system inspections and maintenance were conducted from 28 April 1997 through 18 September 1998. This activity included visual inspection of the treatment system, recording readings from all indicators, gauges, and meters and making system adjustments.

- Scheduled maintenance of the treatment system equipment was performed per manufacturer's recommendations.

- Corrective actions were conducted in a timely fashion when the treatment system malfunctioned. The activities for corrective action included repair and replacement of parts if necessary.

- System modifications were made to improve the efficiency of the recovery system.

- Monthly reports were prepared and distributed to Southern Division. Each monthly report described the activities performed during that month.

2.2 CHRONOLOGY

The following chronology summarizes the events that occurred during the operations and maintenance of this system. For detailed log notes, refer to Operations and Maintenance Data, Multi-phase Extraction and Treatment System, [MK, 1998b]. Site activities that occurred prior to 28 April 1997, including system startup, are included in the construction completion report [MK 1998a].

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28 April	Operations and maintenance (O&M) began. The temperature switch in T-2 was disconnected due to problems controlling the water level in the T-2 tank. T-2 level control was from the level float switch only. Weekly maintenance was performed.
29 April	The filter and strainer for the water flow into the LRVP were cleaned.
30 April	A replacement level switch was installed in the T-2 tank. The temperature switch was wired in series to allow temperature and level control in the tank. The thermal oxidizer shut down on high temperature alarm, BF-2 was adjusted. The system shut down on high level in the T-2 tank. The system shut down on high level in the T-5 tank. System adjustments were made and the system was restarted.
03 May	The system was checked for proper operation. The vacuum pump had shut down due to an amperage overload on the pump. The system was restarted.
04 May	The system was checked for proper operation. The vacuum pump had shut down due to an amperage overload on the pump. The system was restarted. The system shut down due to high level in the T-6 tank.
07 May	Weekly maintenance was performed.

12 May	PLC modifications were made to enhance system performance. Well cycle timers were changed, the thermal oxidizer set points were changed, a time delay was added for low temperature alarms, and an alarm call out was added if the LRVP overload breaker tripped.
13 May	The P-1 pump was not operating properly. Upon inspection, sediment was found in the T-1 tank. Approximately 25 gallons of sediment was removed from the T-1 tank and disposed of by the Navy, Public Works Department. Weekly maintenance was performed.
20 May	Weekly maintenance was performed.
29 May	Weekly maintenance was performed.
02 June	The sludge from the oil/water separator was removed. The product tank was full. The water was pumped out and processed back through system. The Navy Public Works Office handled all waste disposal.
03 June	Water samples were collected. The oil/water separator was cleaned. Weekly maintenance was performed.
04 June	The temperature controller on the thermal oxidizer was adjusted. The alarm set point was raised to 1,550°F (stack temperature). The dilution valve controller was adjusted; the burn temperature to begin opening the dilution valve was lowered from 1,450°F to 1,440°F. The rate of opening was also increased so that the dilution valve was fully open at a burn temperature of 1,475°F instead of 1,500°F. These modifications were performed to reduce the alarms caused by high temperature in the thermal oxidizer.
07 June	The groundwater recycle piping from Tank T-6 to the LRVP for seal water supply was installed to reduce potable water usage.
10 June	The level switch in the T-2 tank was replaced. The removed switch was defective and resulted in intermittent problems. Weekly maintenance was performed.
12 June	A valve was added to throttle the flow into the ambient bleed valve. When the T-1 tank fills up, the system is designed to switch to ambient flow to prevent overfilling the tank. However, when the system switched to ambient air, the LRVP often tripped the circuit breaker due to the changing load condition. A valve was also added to the sump vacuum line to control the flow rate to T-1 from the sump.
17 June	Weekly maintenance was performed.
24 June	Samples of the sludge that resulted from cleaning of the oil/water separator and the T-1 tank were collected for analysis. Weekly maintenance was performed.
27 June	The LRVP was acid-washed to remove scale.
30 June	The system shut down due to a thermal oxidizer shutdown resulting from water entering the oxidizer. Water was drained from the piping leading to the oxidizer. The system was restarted. Vapor samples were collected. Weekly maintenance was performed.
01 July	The gas meter was installed.
03 July	Rust on the skid was removed and painted. The system shut down due to thermal oxidizer shutdown resulting from water entering the thermal oxidizer.
04 July	The system was restarted. The LRVP was scaled again and required acid cleaning to restart.
07 July	The gas line was primed and painted. The system shut down due to T-6 high level alarm. NAS Corpus drained the tank, and the system was restarted.
08 July	The thermal oxidizer interior was inspected for possible damage. No problems were detected; everything was in proper order in the burner chamber. Weekly inspections and weekly and monthly maintenance were performed.
09 July	The system was restarted after shutting down due to over-amperage on the LRVP pump. The flow rate into the LRVP was further adjusted to lower the operating amps to the pump. The system was restarted.
10 July	The system was restarted after shutting down due to over-amperage on the LRVP pump. The flow rate into the LRVP was adjusted further to lower the operating amps to the

	pump. The system was restarted.
13 July	The system shut down due to T-6 tank high alarm. The tank was full, and the system could not be restarted until the tank was emptied.
16 July	The system was restarted after shutting down on 12 July, as a result of high level in the T-6 Tank. NAS Corpus emptied the tank on 14 July, however, notification did not occur until 16 July. Weekly inspections and maintenance were performed.
17 July	Vapor concentrations were measured.
23 July	Weekly inspections and maintenance were performed.
29 July	The system was operating, however, a minimal vacuum was being generated. AES determined that the sediment filter cartridge leading to the LRVP was plugged and required cleaning. The filter cartridge was cleaned and the vacuum was restored. The weekly maintenance procedures were modified to include monthly change-outs of the filter cartridge and weekly cleaning between the change-outs.
30 July	Weekly maintenance was started. A broken valve stem at MV-5 was also replaced.
31 July	Weekly maintenance was completed. All motor valves were cleaned and serviced.
03 August	AES responded to an alarm call. The system had shut down due to high temperature alarm. The flow from MW-20 was reduced. The system was restarted.
06 August	Weekly and semiannual maintenance were performed.
11 August	The filter to the LRVP was cleaned. The vacuum was increased at MW-20 to allow multi-phasing. The vacuum pressure was increased to 20 inches of mercury (in. Hg) vacuum before it began to multi-phase. After starting to multi-phase, the vacuum returned to 6-10 in. Hg vacuum. During adjustment, the temperature spiked at 1,500°F before settling down to 1,450°F.
13 August	Weekly maintenance was performed.
14 August	The system alarmed twice for a tripped circuit breaker on the LRVP. The system was restarted each time; the water flow into the seal of the LRVP was adjusted to reduce the amperage. Higher than normal temperatures were noted.
15 August	The system was down due to a high temperature alarm on MW-20. The flow was reduced and the system was restarted.
18 August	The filter to the LRVP was cleaned. The moisture separator and associated piping were drained.
20 August	The system was down for a tripped circuit breaker on the LRVP. The LRVP was badly scaled. The pump was completely disassembled and cleaned. The shaft seal was replaced.
21 August	LRVP pump reassembly was completed. A rotometer was installed to replace a flow control valve FI/FC-1. FI/FC-1 was a non indicating flow control valve. The system was restarted. The flow into the LRVP was set at 2.2 gpm.
22 August	Weekly maintenance was performed. Air samples were collected. Chemical feed system pumps were shipped to AES.
27 August	Weekly maintenance was performed.
28 August	Quarterly maintenance was performed.
02 September	Preliminary results for samples collected on 22 August indicate the effluent concentrations after the thermal oxidizer are non-detect indicating greater than 99% destruction.
03 September	Weekly maintenance was performed.
07 September	Water samples were collected.
10 September	The installation of the particulate filter and chemical feed systems was started. Cleaning of tanks, T-5 and T-6, was started. The system was shut off to perform these tasks.
12 September	The installation of the particulate filter and chemical feed systems was completed and tested. Cleaning of tanks, T-5 and T-6, was completed. NAS Corpus, Public Works Department removed the residual water from the tanks using a vacuum truck. The system was restarted. Weekly maintenance was performed.

13 September	MK performed an engineering evaluation of the system and provided recommendations to improve performance and reliability.
15 September	The inlet water filter for the seal water to the LRVP was replaced with a "Y" Strainer.
18 September	Weekly and monthly maintenance were performed. A GEMS conductivity level switch was ordered to replace the problematic float switch in the T-2 tank.
24 September	Installation of the replacement switch for the T-2 tank began. The LRVP was cleaned to remove scale that may have accumulated prior to installation of the chemical feed system.
25 September	Weekly maintenance was performed.
26 September	A new level switch was installed in the T-2 tank.
02 October	Weekly maintenance was performed.
06 October	Installation of the T-7 moisture separator tank began.
09 October	Installation of the T-7 tank was completed.
13 October	Weekly maintenance was performed; no vapor samples were collected. A problem with the relay board that controlled several level switches was discovered.
16 October	The system shut down due to high level in T-6 tank.
17 October	The relay board was replaced.
20 October	T-6 was pumped out, the system was restarted.
22 October	Weekly maintenance was started.
23 October	Weekly maintenance was completed, air samples were collected. Monthly maintenance was performed.
29 October	Weekly maintenance was performed.
05 November	Weekly maintenance was performed.
12 November	Weekly maintenance was performed.
13 November	Monthly maintenance was performed.
19 November	Weekly maintenance was performed.
19 November	Air samples were collected.
19 November	The system was shut off for quarterly maintenance.
20 November	The system was restarted after measuring water levels as part of quarterly maintenance.
24 November	The installation of the automatic discharge system for T-6 was started.
26 November	The installation of the automatic discharge system for T-6 was completed and operational.
26 November	Weekly maintenance was performed. Final site restoration for the automatic discharge piping installation was completed.
03 December	Weekly maintenance was performed.
13 December	Weekly and monthly maintenance was performed.
17 December	Weekly maintenance was performed. Air samples were collected.
24 December	Weekly maintenance was performed.
29 December	The construction completion report was sent to the Navy for review and comment.
31 December	Weekly maintenance was performed.

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07 January	Weekly maintenance was performed.
15 January	Comments were received from the Navy on the construction completion report.
17 January	Weekly and monthly maintenance was performed.
21 January	Weekly maintenance was performed. The LRVP was removed for repairs.
27 January	The LRVP was re-installed and the system was restarted
28 January	Weekly maintenance was performed.
28 January	Air samples were collected.
30 January	The construction completion report [MK, 1998a] Revision 0, was sent to the Navy, and distribution.
04 February	Weekly maintenance was performed.

11 February	MK performed a quality control inspection and monthly maintenance was started.
12 February	Monthly maintenance was completed.
13 February	Air monitoring of weekly service was completed, the system had shut down due to high amperage on the LRVP. Weekly maintenance was performed.
22 February	Weekly maintenance was performed and air samples were collected.
25 February	Quarterly maintenance was performed, the system was shut off to allow wells to recharge.
26 February	Weekly maintenance was performed, quarterly maintenance was completed, product levels in wells were measured. A water sample was collected.
04 March	Weekly maintenance was performed and the oil/water separator was cleaned.
10 March	Weekly maintenance was performed. The system shut down due to amperage overload on the LRVP after leaving the site.
11 March	The system was restarted. After leaving, it shut down again, AES returned to the site and installed additional shims and spring to the LRVP to correct the problem. The amperage was still higher than normal.
12 March	The system shut down again due to the LRVP amperage overload.
13 March	AES responded to the site and shut off power and ordered a replacement LRVP.
14 March	Weekly and Monthly maintenance was performed except for vapor monitoring. The LRVP was removed.
18 March	The new LRVP was installed and the system was restarted. In addition to the replacement LRVP, a transformer to convert from 240 Volt to 208 Volt power was installed to accommodate the replacement pump motor. No 240 volt motors were available on short notice. Flexible connectors were installed at the inlet and outlet of the LRVP to reduce line vibration.
21 March	Weekly maintenance was performed and air samples were collected.
25 March	Weekly maintenance was performed.
01 April	Weekly maintenance was performed
08 April	Weekly maintenance was performed. Monthly maintenance was started.
09 April	Monthly maintenance was completed.
13 April	The PLC was reprogrammed. Cycling between wells was eliminated.
15 April	Weekly maintenance was performed, the flame ionization detector (FID) was not working for air monitoring.
18 April	Air monitoring for the 15 April weekly maintenance was performed. The bag filter was cleaned.
20 April	The system shut down on 19 April. Numerous alarm lights were on including power interruption. The system was restarted on 20 April. The shut down was believed to have been caused by a power interruption.
22 April	Weekly maintenance was performed.
29 April	Weekly maintenance was performed.
02 May	The system shut down due to a loss of natural gas pressure. The system was restarted.
06 May	The system shut down due to an amperage overload on the LRVP. The problem was found to be the P-1 pump had deteriorated and caused the system to switch to ambient air flow. The P-1 pump was replaced. The system was restarted. Well MW-29 when operating with other wells was found to be causing short circuiting. As a result, the air flow to the LRVP increased and caused the system to shut down due to a tripped overload breaker. The system was restarted, however, due to subsurface conditions, only one well could be operated at a time.
07 May	Weekly maintenance was performed. Air samples were collected.
15 May	The system shut down due to a power outage. The system was restarted.
16 May	Weekly maintenance was performed. Monthly maintenance was performed.
20 May	Weekly maintenance was performed.
27 May	Weekly maintenance was performed. The system was shut down for quarterly

	maintenance and well measurements.
28 May	Quarterly maintenance was performed. The system was restarted. The Rotron blower for the thermal oxidizer required cleaning during system restart. The blower was cleaned and the system was restarted.
01 June	The system shut down due to a loss of natural gas pressure. The system was restarted. Weekly maintenance was performed.
02 June	The system shut down due to a loss of natural gas pressure. The system was left off at the Navy's request due to repairs being made to the gas supply line.
04 June	Weekly maintenance was performed. Measurements for connection of additional wells were taken.
10 June	The Navy's natural gas contractor damaged the tee on MW-20. Weekly maintenance was performed.
11 June	AES repaired the damaged well at the Navy's request. The well head assembly for well MW-21 was moved to RW-3. The product level measured in RW-3 was 9.19 feet below the top of the casing and the water level was 9.79 feet below the top of the casing.
17 June	Monthly maintenance was performed. Corrosion was removed and the surfaces were primed and painted. Weekly maintenance was performed.
24 June	The Navy provided notification that the gas pressure had been restored and the system could be restarted. Weekly maintenance was performed. The lines leading to the oil/water separator were cleaned. The product tank was full (mostly water) after cleaning the lines. The tank needed to be cleaned before starting the system. Several switches also required cleaning for the restart.
25 June	Cleaning of the switches and product tank was completed. The contents of the product tank were processed back through the oil/water separator. The system was restarted.
26 June	The system shut down due to low gas pressure. AES responded to the site and left the system off because work was continuing on the base's natural gas line.
09 July	Monthly maintenance was performed. The bearings for the thermal oxidizer blower were detected as deteriorating and a replacement blower for the thermal oxidizer was ordered.
15 July	Installation of the well head modifications began.
17 July	The well head modifications were completed. During QC testing of the lines, gate valves at MW-20 and MW-21 were found to be leaking.
20 July	The gate valves were replaced. The replacement blower for the thermal oxidizer was installed. Several fuses in the panel were blown and required replacement.
22 July	The fuses were replaced and the system was restarted.
23 July	AES responded to a high level alarm in the T-5 tank. The level switch was sticking due to algae growth in the sight glass. The accumulation of algae was probably due to inactivity of the system. The switch and sight glass were cleaned and the system was restarted. The level switch was tested by filling the tank with water and allowing it to pump down. The system was operating properly during testing.
24 July	AES responded to a high level alarm in T-5 again. The sight glass was removed again. Some additional algae were found to be interfering with the float operation. The floats were cleaned again and the system was restarted.
27 July	AES responded to the system which had shut down but not alarmed. No alarm light was flashing and no automatic call out was made. The problem was detected by Navy personnel. The problem appeared to be power related, however, no alarm indicators were found on the panels. The power supply was checked, all circuit breakers and fuses were checked. The cause of the problem was not identified.
28 July	Technicians from Thermtech and Allen-Bradley were contacted. Wire connections between the thermal oxidizer and the vacuum system were checked. The central processing unit (CPU) to the programmable logic controller (PLC) was reset and wire connections were reinstalled. The cause of the problem was identified as a PLC shut down. The CPU was reset, all wires between the units were reconnected, and the

	system restarted.
29 July	Weekly maintenance was performed. Water level and hydrocarbon thickness was measured in the extraction wells.
30 July	Air samples were collected.
3 August	AES responded to the site due to the system being down on a CPU fault. No alarm call occurred. The system was reset and restarted.
5 August	Weekly maintenance was performed. The water level and hydrocarbon thickness were measured in the extraction wells. Trouble shooting of the system indicated it was likely a power fluctuation or flutter. The system was restarted after resetting the PLC. The flow controller between T-1 and T-2 was cleaned to remove scale build up.
6 August	The system had shut down again on CPU fault with no alarm call out. AES reset the system and the system was restarted.
14 August	AES and a PLC technician from Data Control Systems arrived on site to reload the PLC program and trouble shoot the cause of the CPU fault errors. The error was cleared and the system was restarted. Weekly maintenance was performed.
17 August	MK met with the Navy to discuss the training agenda for O&M of the system.
18 August	MK and AES began O&M training for the future O&M contractor, Artrex. Information covered on 18 August included weekly maintenance and part of monthly maintenance. Air sampling and trouble shooting were also discussed and/or demonstrated.
19 August	Training was continued. Topics covered included: monthly maintenance, tank cleaning, and quarterly maintenance. The system was restarted and shut down due to a CPU fault. The system was left off for annual maintenance and an electrical check.
20 August	Electricians from NAS Corpus Christi and Scott Electric (AES' subcontractor) were on site to trouble shoot the electrical supply to determine if it is the cause of the CPU fault error with the PLC. The electricians concluded the power supply was stable. A decision was made to replace the CPU unit and to install an uninterruptible power supply (UPS) unit. O&M training was completed.
21 August	A replacement CPU unit was installed, the system was restarted for testing. At the direction of the Navy, the system was turned off for the weekend due to pending severe weather.
24 August	The system was restarted and problems continued with the PLC and the system shut down due to CPU fault.
31 August	The UPS system was installed.
02 September	A replacement output board for the PLC was installed. A damaged surge protector was also replaced. The replacement of the output board resolved the PLC and CPU faults that were causing system shut downs during August. The system was restarted.
4 September	Weekly maintenance was performed. The system had shut down due a combustion blower failure. The auto dialer did not call out the alarm.
8 September	AES went to the site to reprogram the auto dialer. The system was down due to a power failure. The combustion blower had to be manually restarted. The auto dialer did not dial out for the alarm.
9 September	The auto dialer was replaced. The combustion blower motor was removed for replacement. The replacement blower motor was not the correct size. The system was left off due to the combustion blower.
10 September	The replacement combustion blower was installed. During replacement of the combustion blower, rainwater entered the combustion line. The system could not be started until the line was dried out.
11 September	The flame arrester was checked for moisture. The ultra-violet (UV) scanner was cleaned. The T-2 level probe was not responding to the water level in the tank. AES cleaned the probes. The water level in the T-6 tank was lower than expected. The level float for T-6 was cleaned and tested. Algae growth was noted in the T-2 tank. The auto dialer was tested. The system was restarted. The LVRP was left operating using potable water for the seal. Weekly maintenance was performed.

14 September	AES checked the system. The system was operating properly. The seal water supply was switched from potable water back to the T-6 tank.
17 September	A letter of transfer and equipment acceptance was issued to the Navy signifying the completion of MK's O&M contract.
18 September	Artrex and AES performed weekly maintenance. The extraction wells were measured for water level and hydrocarbon thickness. Valve labels were installed by AES.

2.3 PROBLEMS/SOLUTIONS

The following major system modifications were made to the system during the O&M period.

2.3.1 T-2 Tank Level Control

The T-2 seal water tank was originally equipped with a temperature switch that would cause the solenoid valve SV-2 to open to add makeup water to the T-2 tank when the temperature of the seal water in tank T-2 exceeded 125°F. However, it was discovered that the T-2 tank would sometimes run dry due to evaporation and/or flow into tank T-1, causing the LRVP to lose its seal before the temperature of the water would exceed 125°F.

After the initial start-up, a pressure transducer was added to the bottom of tank T-2 to activate the makeup water solenoid valve SV-2 when the pressure in the tank dropped too low. This worked well to keep a more constant level of seal water in tank T-2 when the LRVP system was running continuously. However, if the LRVP was set to recover from fewer than all five recovery wells, the LRVP would shut off for a time. When the LRVP shut off, the reduced pressure would cause tank T-2 to fill, sometimes higher than the high level alarm in the tank, shutting down the entire system.

The pressure transducer was removed from the seal water tank and a differential float switch was installed in tank T-2, however, the ball float was degraded by the hydrocarbons present in the tank. On 26 September 1997, a new level controller equipped with conductivity probes was installed into tank T-2 to properly control the level of seal water in the tank.

2.3.2 Tank T-6

The system was using a large quantity of potable water for make-up seal water. The seal water is removed from the T-2 tank to the T-1 tank through an adjustable flow meter. From tank T-1, it flows with the recovered groundwater through the oil/water separator into the T-5 tank and eventually into the T-6 tank. NAS Corpus Christi was using a vacuum truck to transport water accumulating in the T-6 tank to the base wastewater treatment plant on base several times per week.

On 6 June 1997, a recirculation line from tank T-6 to the LRVP was installed. When the seal water level in tank T-2 is low, the LRVP draws make-up water from the T-6 tank instead of adding more base potable water. This eliminated the use of base water and maintained an adequate supply of seal water for the LRVP.

Even though the quantity of water generated was greatly reduced due to the elimination of potable water use, frequent vacuum truck trips were still required to maintain the T-6 tank below the high level shut off alarm. On 24 November 1997, installation of an automatic discharge system consisting of a transfer pump and level control switch began. Installation was completed 26 November 1997. This eliminated the need to manually drain the T-6 tank.

2.3.3 Scale Prevention System

After the installation of the piping from the T-6 tank to the LRVP to allow reuse of recovered groundwater as seal water, increased accumulation of scale in the LRVP became a problem. The scale periodically prevented the pump from rotating, and caused excessive current to be drawn by the LRVP motor. On 12 September 1997, two chemical metering pumps were installed to inject scale inhibiting and dispersant chemicals into the water being transferred from tank T-5 to tank T-6. The scaling problem has been eliminated.

2.3.4 Sediment Accumulation in the T-1 Tank

More sediment than expected was entering the system from the wells. As a result the T-1 tank was filling with sediment and was causing problems with the P-1 submersible pump. A bag filter was installed between the manifold and the T-1 tank. The filter removes most of the sediment. However, tank cleaning was also added to the monthly preventive maintenance. Weekly filter cleaning was also added to the preventive maintenance schedule. The bag filter reduced the majority of the sediments entering the T-1 tank. The reduction of sediment and modifications to the maintenance schedule have eliminated problems with the P-1 pump.

2.3.5 Vapor Condensate Removal

The multi-phase recovery system was originally installed without a moisture separator immediately prior to vapor treatment. A significant quantity of condensate was generated in the vapor piping as the vapor stream cooled after leaving the LRVP. When too much liquid accumulated into the vapor pipe leading into the thermal oxidizer, the oxidizer would shut down due to a flame failure at the burner.

The T-7 moisture separator tank was installed immediately before the thermal oxidizer system. The moisture separator was equipped with an automatic discharge pump with level control switches. The pump discharges to the oil/water separator. This modification has eliminated the flame failure problem that was caused by moisture entering the thermal oxidizer.

2.3.6 PLC Program Changes

Modifications were made to the system control logic. The changes are summarized below:

- A 60-second delay was programmed into the PLC. If the temperature in the thermal oxidizer drops below the set point temperature then the delay timer begins before the LRVP shuts down.
- The low temperature set point was reduced from 1,395°F to 1,360° F. The operating temperature is still 1,410° F. The autodialer does not call out when a low temperature alarm occurs if the system returns to normal temperature within 60 seconds.
- An alarm call out will be made if the circuit breaker to the LRVP pump is tripped. The alarm is on LSHH-2. The alarm light flashes quickly to indicate the LRVP alarm.
- The motor valve timers were changed so that the system no longer cycles between wells. Because the motor valves were no longer being used to cycle between wells, the motor valves were all electrically disabled in the open position. Manual valves are used to select which wells are active. The PLC, however, still requires that at least one motor valve switch is placed in the "AUTO" position to operate the LRVP in the "AUTO" mode.

2.3.7 Oil/water Separator

The product tank was filling with water indicating that the oil/water separator was not working properly. Sludge build up in the oil/water separator was found to be the cause of the operating problems.

The preventive maintenance schedule was modified. A "rapid" clean was added to the weekly maintenance. The "rapid" clean consists of using a water spray to dislodge the accumulated sludge from the surface of the oil/water separator and physically skimming the surface to remove the majority of the sludge from the oil/water separator. A complete cleaning was also added as a monthly maintenance item. The complete cleaning includes removal, and cleaning of the coalescing tubes, draining and cleaning the oil/water separator, and reassembling the oil/water separator. With the added preventive maintenance, water carry over to the product tank has been minimized.

2.3.8 Thermal Oxidizer

High temperature alarms were a problem with the thermal oxidizer when the system switched between wells. Modifications were made to the temperature controller in the oxidizer to generate a more rapid control response. The modifications to the temperature controller eliminated most high temperature alarms. The PLC was modified on 13 April 1998 to extend the recovery time on individual wells and automatic cycling between wells was eliminated. As a result, rapid changes in flow and concentration only occur when the extraction well is changed in the presence of an operator.

3.0
RESULTS

The performance of the treatment system was monitored weekly using a FID to measure the influent and effluent vapor concentrations to the thermal oxidizer. Mass balance calculations were performed based on the FID readings to determine the quantity of hydrocarbons removed and destroyed. Air samples were collected monthly to confirm the destruction efficiency of the thermal oxidizer. The Navy Public Works Office measured water and product levels in surrounding monitoring wells monthly. Wells used for extraction were measured quarterly until April 1998, at which point the extraction wells were monitored weekly. The results of this monitoring effort are presented in the attached tables and figures and described below.

3.1 PRODUCT REMOVAL

A cumulative total of 36,409 pounds (5,135 gallons) of vapor phase product has been removed and destroyed since 28 April 1997 based on calculations made using the FID readings. A natural gas meter was installed on 1 July 1997, which allowed an alternative calculation to be performed to confirm the FID concentration-based calculation. The alternative calculation uses the quantity of natural gas used, British Thermal Unit (BTU) value of natural gas, and the burner rating. Based on the FID concentration-based calculation, 5,457 pounds of hydrocarbon had been removed by 1 July 1997 when the gas meter was installed. Utilizing this quantity as a starting point, the BTU-based calculation indicates 39,178 pounds of vapor phase product has been removed and destroyed from 28 April 1997 through 18 September 1998. The two calculation methods differ by less than 10%. Table 1 provides a summary of the calculated quantity of vapor phase petroleum hydrocarbons removed using the FID-based calculation. Table 2 provides a summary of the calculated quantity of vapor phase petroleum hydrocarbons removed using the BTU-based calculation. Figure 1 shows the cumulative pounds of petroleum hydrocarbon removed to date in the vapor phase using both the FID concentration-based calculation and the BTU-based calculation.

A total of 182,079 gallons of water have been discharged to the base wastewater treatment plant as of 18 September 1998. Table 3 shows the quantity of water transferred to the base wastewater treatment plant.

3.2 BURNER EFFICIENCY

Table 4 shows the results of FID monitoring, analytical results, and calculated burner efficiency. The system has consistently performed at greater than 98% destruction.

3.3 SYSTEM OPERATION

Table 5 summarizes the system operating time and percentages. The system operating percentages ranged from 6.7% in July 1998 when gas line work was being performed to 97.6% in April 1998. The system operated an average of 63.2% of the time and was down for scheduled shutdowns for 19.5% of the time including system modifications and base gas line replacement. Figure 2 shows the operating percentage on a monthly basis for the system since installation of the thermal oxidizer on 28 April 1997. Figure 3 shows the number of unscheduled shutdowns per month. The number of unscheduled shut downs per month ranged from 15 during the first month of operation to one during five out of the first six months in 1998. The system shut down an average of 4.3 times per month. Tables 6 and 7 show the cumulative data from the weekly inspection visits. Table 8 shows a summary of alarm calls and response action that was taken.

3.4 MEASUREMENTS OF MONITORING AND RECOVERY WELLS

The product thicknesses for wells MW-13, MW-14, MW-20, MW-21, MW-22, MW-26, and MW-29 and RW-03 are shown in Figures 4 through 11. The product layer has been reduced in seven of eight wells. The product level in the eighth well, MW-29, fluctuates within the range of the pre-extraction levels. No measurable product layer remained in wells MW-13, MW-22 and MW-26 as of 18 September 1998. At one time, wells MW-13, MW-22, and MW-26 had product layers ranging from 1.2 feet to 4.5 feet. All of the wells contained less than six inches of floating product when measured on 18 September 1998. Most of the wells had between one and three feet of product before starting the vacuum extraction system. MW-22 had the thickest layer of product (4.56 feet) measured during operation and maintenance of this system on 1 August 1997. The product thickness in MW-22 measured in the last five consecutive measurements has been less than 3 inches, two of the five measurements were zero.

4.0
CONCLUSIONS AND RECOMMENDATIONS

4.1 CONCLUSIONS

The following conclusions were made with regard to the operation of the multi-phase recovery system at Fuel Farm 216 at NAS Corpus:

- Based on observation of the system, FID readings, and calculations, the multi-phase extraction system has been effective at recovering hydrocarbons from the subsurface
- As evidenced by the water and product thickness measurements in the monitoring and recovery wells, the multi-phase extraction system has significantly reduced thickness and areal extent of the separate phase hydrocarbon remaining at the site
- System operating data indicate that preventive maintenance is critical for sustained operation of the system
- Operating data indicate that the system is less susceptible to problems when it is operated continuously and that extended shut downs resulted in more problems

4.2 RECOMMENDATIONS

The following recommendations were made with regard to the future operation of the multi-phase recovery system at Fuel Farm 216 at NAS Corpus:

- The measurement of product and water in the wells should be continued to track product removal, to show if product migration is being prevented, and to provide the basis for determining when the system can be shut off
- Preventive maintenance should be continued to maximize system operating time

5.0
REFERENCES

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MK, 1998c. *Operations and Maintenance Data, Multi-Phase Extraction and Treatment System*, NAS Corpus Christi, Corpus Christi, Texas, Prepared by Morrison Knudsen, August 1998.

APPENDIX A
TABLES

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TABLE 1 VAPOR PHASE PRODUCT RECOVERED AND DESTROYED FID-BASED CALCULATION NAS CORPUS CHRISTI				
	Vapor Phase Product Destroyed			
Date	Total Per Period		Cumulative Total	
	(lb.)	gallons	(lb.)	(gallons)
4/28/97	0	0	0	0
4/30/97	205	29	205	29
5/30/97	2807	396	3012	425
6/30/97	2445	345	5457	770
7/23/97	1938	273	7395	1043
8/22/97	2695	380	10090	1423
9/18/97	902	127	10993	1550
10/23/97	1920	271	12913	1821
10/29/97	689	97	13601	1918
11/7/97	830	117	14431	2035
11/13/97	387	55	14818	2090
11/19/97	62	9	14880	2098
11/28/97	175	25	15055	2123
12/3/97	237	33	15291	2156
12/13/97	451	64	15743	2220
12/17/97	285	40	16028	2260
12/24/97	467	66	16495	2326
12/31/97	377	53	16872	2379
1/7/98	858	121	17730	2500
1/17/98	1360	192	19089	2692
1/28/98	631	89	19720	2781
2/4/98	660	93	20381	2874
2/13/98	1065	150	21446	3024
2/22/98	903	127	22349	3152
2/26/98	303	43	22652	3194
3/4/98	657	93	23309	3287
3/21/98	1962	277	25271	3564
4/1/98	1605	226	26876	3790
4/8/98	1108	156	27984	3946
4/13/98	687	97	28671	4043
4/15/98	573	81	29244	4124
4/22/98	1921	271	31165	4395
4/29/98	2198	310	33363	4705
5/7/98	1418	200	34781	4905
5/16/98	236	33	35017	4938
5/20/98	95	13	35111	4952
5/27/98	646	91	35758	5043
6/1/98	397	56	36155	5099
6/4/98	0	0	36155	5099
6/10/98	0	0	36155	5099
6/17/98	0	0	36155	5099
6/25/98	0	0	36155	5099
7/8/98	0	0	36155	5099
7/15/98	0	0	36155	5099

TABLE 1 (Continued)
VAPOR PHASE PRODUCT RECOVERED AND DESTROYED
FID-BASED CALCULATION
NAS CORPUS CHRISTI

Date	Vapor Phase Product Destroyed			
	Total Per Period		Cumulative Total	
	(lb.)	gallons	(lb.)	(gallons)
7/22/98	12	2	36167	5100
7/29/98	44	6	36210	5107
8/5/98	16	2	36226	5109
8/14/98	6	1	36233	5110
8/18/98	34	5	36267	5115
9/4/98	26	4	36293	5118
9/18/98	113	16	36406	5134

TABLE 2
VAPOR PHASE PRODUCT RECOVERED AND DESTROYED
BTU-BASED CALCULATION
NAS CORPUS CHRISTI

Date	Vapor Phase Product Destroyed			
	Total Per Period		Cumulative Total	
	(lb.)	gallons	(lb.)	(gallons)
4/28/98	0	0	0	0
7/1/97	5457	770	5457	770
7/8/97	703	99	6160	869
7/16/97	490	69	6651	938
7/23/97	717	101	7368	1039
7/31/97	973	137	8341	1176
8/6/97	594	84	8934	1260
8/13/97	781	110	9716	1370
8/22/97	983	139	10699	1509
8/27/97	245	34	10943	1543
9/3/97	335	47	11278	1590
9/12/97	680	96	11958	1686
9/18/97	629	89	12587	1775
9/25/97	760	107	13347	1882
10/2/97	951	134	14298	2016
10/13/97	334	47	14631	2063
10/23/97	1167	165	15798	2228
10/29/97	687	97	16485	2325
11/7/97	912	129	17398	2454
11/13/97	259	37	17657	2490
11/19/97	263	37	17920	2527
11/28/97	671	95	18591	2622
12/3/97	628	89	19219	2710
12/13/97	877	124	20096	2834
12/17/97	370	52	20466	2886
12/24/97	813	115	21279	3001
12/31/97	745	105	22023	3106
1/7/98	751	106	22775	3212
1/17/98	1131	160	23906	3371
1/28/98	584	82	24490	3454
2/4/98	826	117	25316	3570
2/13/98	881	124	26198	3695
2/22/98	1003	142	27201	3836
2/26/98	325	46	27526	3882
3/4/98	708	100	28234	3982
3/21/98	1325	187	29559	4169
4/1/98	1302	184	30861	4352
4/8/98	756	107	31617	4459
4/15/98	629	89	32246	4547
4/22/98	1216	171	33462	4719
4/29/98	882	124	34344	4843
5/7/98	695	98	35039	4941
5/16/98	1132	160	36172	5101
5/20/98	407	57	36579	5159

TABLE 2 (Continued) VAPOR PHASE PRODUCT RECOVERED AND DESTROYED BTU-BASED CALCULATION NAS CORPUS CHRISTI				
	Vapor Phase Product Destroyed			
Date	Total Per Period		Cumulative Total	
	(lb.)	gallons	(lb.)	(gallons)
5/27/98	923	130	37502	5289
6/1/98	710	100	38212	5389
6/4/98	0	0	38212	5389
6/10/98	0	0	38212	5389
6/17/98	0	0	38212	5389
6/25/98	1	0	38213	5389
7/29/98	99	14	38312	5403
8/5/98	286	40	38598	5443
8/14/98	141	20	38740	5463
8/18/98	219	31	38959	5494
9/4/98	124	17	39083	5512
9/18/98	95	13	39178	5525

TABLE 3 WATER TRANSFERRED TO POTW BTU-BASED CALCULATION NAS CORPUS CHRISTI		
Date	**Quantity Transferred**	**Cumulative Total**
	(Gallons)	(Gallons)
1/6/97	0	0
4/30/97	6000	6000
5/1/97	2700	8700
5/5/97	3600	12300
5/15/97	1800	14100
5/16/97	1800	15900
5/20/97	900	16800
5/21/97	2700	19500
5/23/97	2700	22200
5/27/97	1800	24000
5/30/97	3600	27600
6/5/97	3600	31200
6/9/97	1800	33000
6/13/97	3600	36600
6/16/97	2700	39300
6/20/97	1800	41100
6/23/97	2700	43800
6/26/97	900	44700
7/3/97	900	45600
7/9/97	2700	48300
7/14/97	1700	50000
7/28/97	1800	51800
8/1/97	2700	54500
8/5/97	1800	56300
8/22/97	3600	59900
9/2/97	2700	62600
9/5/97	1800	64400
9/11/97	2700	67100
9/12/97	1800	68900
9/19/97	1800	70700
9/26/97	1800	72500
9/29/97	900	73400
10/3/97	1800	75200
10/6/97	1800	77000
10/10/97	1800	78800
10/14/97	900	79700
10/20/97	3600	83300
10/24/97	3600	86900
10/30/97	1800	88700
11/4/97	3600	92300
11/13/97	1800	94100
11/28/97	3600	97700
	Automatic discharge began	
12/3/97	7443	105143
12/13/97	6390	111533

TABLE 3 (Continued) WATER TRANSFERRED TO POTW BTU-BASED CALCULATION NAS CORPUS CHRISTI		
Date	**Quantity Transferred**	**Cumulative Total**
	(Gallons)	(Gallons)
12/17/97	24	111557
12/24/97	1015	112572
12/31/97	10	112582
1/7/98	2034	114616
1/17/98	2028	116644
1/28/98	1302	117946
2/4/98	1288	119234
2/13/98	989	120223
2/22/98	125	120348
2/26/98	1165	121513
3/4/98	996	122509
3/21/98	2324	124833
4/1/98	2106	126939
4/8/98	601	127540
4/15/98	1102	128642
4/22/98	3427	132069
4/29/98	4552	136621
5/7/98	9520	146141
5/16/98	12771	158912
5/20/98	5308	164220
5/27/98	4305	168525
6/1/98	7998	176523
6/4/98	0	176523
6/10/98	0	176523
6/17/98	0	176523
6/25/98	2	176525
7/8/98	0	176525
7/15/98	0	176525
7/22/98	0	176525
7/29/98	0	176525
8/5/98	10	176535
8/14/98	1001	177536
8/18/98	1	177537
9/4/98	2329	179866
9/18/98	2213	182079

TABLE 4 THERMAL OXIDIZER BURNER EFFICIENCY NAS CORPUS CHRISTI				
Date	Well	Average FID Concentration of Diluted Process Air BV-20 (thermal oxidizer inlet) (ppmv)	FID Concentration of Stack Effluent S-1007 (ppmv)	Burner efficiency based on FID readings
4/29/97	MW-26	90	0	100.0%
5/13/97	MW-26	5700	0	100.0%
5/21/97	MW-26	12500	0	100.0%
5/29/97	MW-26	3065	230	92.5%
6/3/97	MW-26	10250	0	100.0%
6/11/97	MW-26	1255	Not measured	Not measured
6/17/97	MW-26	405	Not measured	Not measured
6/24/97	MW-26	390	1	99.7%
6/30/97	MW-26	3150	0	100.0%
7/8/97	MW-26	2650	0	100.0%
7/17/97	MW-26	5400	20	99.6%
7/23/97	MW-26	4500	50	98.9%
7/31/97	MW-26	3375	0	100.0%
8/6/97	MW-26	3450	20	99.4%
8/13/97	MW-20	3720	0	100.0%
8/22/97	MW-20	1130	15	98.7%
8/27/97	MW-20	2925	0	100.0%
9/6/97	MW-29	550	0	100.0%
9/12/97	MW-29	420	0	100.0%
9/18/97	MW-20	1185	0	100.0%
9/25/97	MW-29	2750	50	98.2%
10/2/97	MW-29	1780	10	99.4%
10/23/97	MW-29	960	0	100.0%
10/29/97	MW-20	535	0	100.0%
11/13/97	MW-29	3660	0	100.0%
11/19/97	MW-29	325	0	100.0%
12/3/97	MW-29	1285	0	100.0%
12/13/97	MW-13	4850	0	100.0%
12/17/97	MW-29	1085	20	98.2%
12/31/97	MW-20	1700	0	100.0%
1/7/98	MW-29	2125	0	100.0%
1/17/98	MW-29	1305	0	100.0%
1/28/98	MW-29	1490	0	100.0%
2/4/98	MW-26	5580	0	100.0%
2/13/98	MW-29	1300	0	100.0%
2/22/98	MW-21	455	0	100.0%
2/26/98	MW-26	6785	0	100.0%
2/26/98	MW-29	1450	0	100.0%
2/26/98	MW-21	1615	0	100.0%
2/26/98	MW-13	1250	0	100.0%
2/26/98	MW-20	3775	0	100.0%
3/4/98	MW-26	6540	0	100.0%

TABLE 4 (Continued) THERMAL OXIDIZER BURNER EFFICIENCY NAS CORPUS CHRISTI				
Date	Well	Average FID Concentration of Diluted Process Air BV-20 (thermal oxidizer inlet) (ppmv)	FID Concentration of Stack Effluent S-1007 (ppmv)	Burner efficiency based on FID readings
3/4/98	MW-29	1260	0	100.0%
3/4/98	MW-21	1525	0	100.0%
3/4/98	MW-13	1125	0	100.0%
3/4/98	MW-20	2925	0	100.0%
3/21/98	MW-20	5620	0	100.0%
4/1/98	MW-20	6640	0	100.0%
4/1/98	MW-26	5690	0	100.0%
4/1/98	MW-29	2002	0	100.0%
4/1/98	MW-21	950	0	100.0%
4/1/98	MW-13	1150	0	100.0%
4/8/98	MW-29	7650	0	100.0%
4/8/98	MW-20	1900	0	100.0%
4/8/98	MW-26	2350	0	100.0%
4/8/98	MW-13	17700	0	100.0%
4/8/98	MW-21	15900	0	100.0%
4/18/98	MW-29	2695	0	100.0%
4/29/98	MW-29	165	0	100.0%
5/7/98	MW-29	750	0	100.0%
5/16/98	MW-29	370	0	100.0%
5/20/98	MW-29	724	0	100.0%
5/20/98	MW-20	3420	0	100.0%
5/20/98	MW-26	952	0	100.0%
5/20/98	MW-13	866	0	100.0%
5/20/98	MW-21	861	0	100.0%
5/27/98	MW-29	360	0	100.0%
6/25/98	RW-3	169	0	100.0%
6/25/98	MW-29	240	0	100.0%
7/29/98	MW-22	690	0	100.0%
7/29/98	MW-14	7990	0	100.0%
8/5/98	MW-22	139	0	100.0%
8/5/98	MW-29	820	0	100.0%
8/18/98	RW-03	580	0	100.0%
9/4/98	RW-03	620	0	100.0%
9/18/98	RW-03	371	0	100.0%

TABLE 4 (Continued)
THERMAL OXIDIZER BURNER EFFICIENCY
NAS CORPUS CHRISTI

		TPH	Benzene	Ethylbenzene	m, p-xylene	o-xylene	Xylenes total	Toluene
Sample ID	**Description**	**ppmv**	**ppbv**	**ppbv**	**ppbv**	**ppbv**	**ppbv**	**ppbv**
NAS Corpus Christi Samples collected 1/28/98								
CCT\ VP2 130128	MW-13 diluted, before oxidizer	284.00	5700	2900	8300	4400	13000	3300
CCT\ VP3 130128	MW-13 after oxidizer	U	U	U	11	U	11	28
Destruction Efficiency		100.0%	100.0%	100.0%	99.9%	100.0%	99.9%	99.2%
CCT\ VP2 200128	MW-20 diluted, before oxidizer	446.00	3400	3300	10000	3200	14000	3000
CCT\ VP3 200128	MW-20 after oxidizer	U	U	U	7	U	14	51
Destruction Efficiency		100.0%	100.0%	100.0%	99.9%	100.0%	99.9%	98.3%
NAS Corpus Christi Samples collected 2/22/98								
CCT\ VP2 200222	MW-20 diluted, before oxidizer	715.00	5700	4000	8600	1900	10000	16000
CCT\ VP3 200222	MW-20 after oxidizer	0.02	U	U	U	U	U	U
Destruction Efficiency		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
CCT\ VP2 260222	MW-26 diluted, before oxidizer	466.00	1800	1700	5300	1400	6700	1300
CCT\ VP3 260222	MW-26 after oxidizer	0.02	U	U	U	U	U	U
Destruction Efficiency		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
NAS Corpus Christi Samples collected 3/21/98								
CCT\ VP2 200321	MW-20 diluted, before oxidizer	U	3300	3500	8000	1700	9700	370
CCT\ VP3 200321	MW-20 after oxidizer	1.2 J	U	U	U	U	U	U
Destruction Efficiency		NA	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
CCT\ VP2 260321	MW-26 diluted, before oxidizer	U	540	1000	3300	950	4250	250
CCT\ VP3 260321	MW-26 after oxidizer	1.30	U	6	16	7	23	14
Destruction Efficiency		NA	100.0%	99.4%	99.5%	99.3%	99.5%	94.4%

TABLE 4 (Continued)
THERMAL OXIDIZER BURNER EFFICIENCY
NAS CORPUS CHRISTI

Sample ID	Description	TPH ppmv	Benzene ppbv	Ethylbenzene ppbv	m, p-xylene ppbv	o-xylene ppbv	Xylenes total ppbv	Toluene ppbv
NAS Corpus Christi Samples collected 5/7/98								
CCT\ VP2 200507	MW-20 diluted, before oxidizer	U	8000	4600	10000	2600	13000	1400
CCT\ VP3 200507	MW-20 after oxidizer	U	U	U	U	U	U	U
Destruction Efficiency		NA	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
CCT\ VP2 260507	MW-26 diluted, before oxidizer	U	1300	950	2900	910	3800	1200
CCT\ VP3 260507	MW-26 after oxidizer	U	U	U	U	U	U	U
Destruction Efficiency		NA	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
NAS Corpus Christi Samples collected 6/25/98								
CCT\ VP2 030625	RW-03 diluted, before oxidizer	U	9800	5100	16000	340	16000	620
CCT\ VP3 030625	RW-03 after oxidizer	U	U	U	U	U	U	5
Destruction Efficiency		NA	100.0%	100.0%	100.0%	100.0%	100.0%	99.2%
CCT\ VP2 290625	MW-29 diluted, before oxidizer	U	22000	32000	110000	37000	150000	35000
CCT\ VP3 290625	MW-29 after oxidizer	U	U	U	U	U	U	7
Destruction Efficiency		NA	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
NAS Corpus Christi Samples collected 7/30/98								
CCT\ VP2 140730	MW-14 diluted, before oxidizer	U	1500	1900	4900	160	5100	110
CCT\ VP3 140730	MW-14 after oxidizer	U	U	U	U	U	U	6
Destruction Efficiency		NA	100.0%	100.0%	100.0%	100.0%	100.0%	94.5%
CCT\ VP2 220730	MW-22 diluted, before oxidizer	U	960	920	2000	110	2100	120
CCT\ VP3 220730	MW-22 after oxidizer	U	U	U	U	U	U	U
Destruction Efficiency		NA	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
NAS Corpus Christi Samples collected 8/18/98								
CCT\ VP2 030818	MW-03 diluted, before oxidizer	U	1200	990	2900	290	3200	73
CCT\ VP3 030818	MW-03 after oxidizer	U	U	U	U	U	U	U
Destruction Efficiency		NA	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

TABLE 5
THERMAL OXIDIZER OPERATING PERCENTAGE
NAS CORPUS CHRISTI

Date Period ending	Time	Total Hours Available from previous date	Thermal Oxidizer operating hours cumulative (hr)	Scheduled maintenance	Thermal Oxidizer Operating Hours	Unscheduled shut downs hours	Percent Operating	Percent Scheduled Maintenance	Unscheduled Shut Downs	Notes
4/29/97	11:30		34.3							
5/29/97	18:42	727	374.8	81.0	340.5	305.5	46.8%	11.1%	15	T-6 Full twice
6/30/97	13:10	763	915.7	45.0	540.9	177.1	70.9%	5.9%	9	Install T-6 Piping
7/23/97	15:40	554	1303.1	120.0	387.4	46.6	69.9%	21.7%	3	Install Gas meter, T-6 full
8/22/97	14:58	719	1941.49	20.0	638.4	60.6	88.8%	2.8%	6	
9/18/97	11:10	645	2257.0	95.3	315.5	234.2	48.9%	14.8%	10	Installed filter and chemical feed, cleaned tanks
10/23/97	11:10	840	2853.0	224.0	596.0	20.0	70.9%	26.7%	4	Two power outages, T-6 full twice, install moisture separator
11/19/97	14:00	651	3289.94	145.0	437.0	69.0	67.1%	22.3%	2	Other shut downs due to T-6 full once and Natural gas shut off once
12/17/97	12:05	670	3802.25	124.7	512.3	33.0	76.5%	18.6%	2	Other shut downs due to T-6 full twice, power interruption, and installation of discharge piping
1/28/98	13:41	1009	4639.88	20.2	837.6	151.2	83.0%	2.0%	1	Shut down occurred as the result of a problem with the LRVP that was detected during routine maintenance. and corrected before it could worsen.
2/22/98	14:00	601	5216.31	11.6	576.4	13.0	95.9%	1.9%	1	Shut down occurred as the result of an amp overload alarm with the LRVP, adjustments were made to the flow to the LRVP.
3/21/98	12:00	646	5700.34	33.8	484.0	128.2	74.9%	5.2%	3	Shut down occurred as the result of a amp overload alarm with the LRVP, adjustments were made to the flow to the LRVP. The LRVP was replaced

TABLE 5 (Continued)
THERMAL OXIDIZER OPERATING PERCENTAGE
NAS CORPUS CHRISTI

Date Period ending	Time	Total Hours Available from previous date	Thermal Oxidizer operating hours cumulative (hr)	Scheduled maintenance	Thermal Oxidizer Operating Hours	Unscheduled shut downs hours	Percent Operating	Percent Scheduled Maintenance	Unscheduled Shut Downs	Notes
4/22/98	14:30	770	6451.83	0.0	751.5	18.5	97.6%	0.0%	1	Shut down occurred as the result of a power outage 19 April. the system was restarted.
5/20/98	13:30	671	268.65	19.2	586.1	65.8	87.3%	2.9%	1	Shut down occurred as the result of a power outage 19 April. The system was restarted. The hour counter was replaced.
6/25/98	15:30	866	543.43	590.2	274.8	1.0	31.7%	68.2%	1	Shut down occurred as the result of an amperage overload on 22 May the system was restarted. Other shut downs occurred as a result of low gas pressure due to work on the gas line at the site. These were not included as unscheduled shut downs.
7/29/98	16:00	817	598.2	655.5	54.8	106.8	6.7%	80.2%	4	Blown fuses prevent system restart on 7/20/98. T-5 high level on 7/22 and 7/23, CPU shut down on 7/26.
8/18/98	10:00	474	736.1	88	137.9	248.2	29.1%	18.6%	6	CPU faults continued to shut the system down.
9/18/98	9:30	743	950.0	96	214.0	433.1	28.8%	12.9%	5	CPU faults continued to shut the system down. The CPU was replaced. An UPS system was installed. The output boards were replaced. The autodialer was replaced. The combustion blower motor was replaced.

TABLE 6
WEEKLY INSPECTION LOG
SYSTEM OPERATING CONDITIONS
NAS CORPUS CHRISTI

Date	Ambient Temp. (deg. F)	550 gallon water tank volume (gal)	5000 gallon water tank T-6 volume (gal)	Pump P-1 Discharge Pressure at PI-8 (psi)	Pump P-2 Discharge Pressure at PI-9 (psi)	Pump P-3 Discharge Pressure at PI-10 (psi)	Pump P-6 Discharge Pressure at PI-11 (psi)	Water Flow Meter from T-2 FI/FC-2 (gpm)	Water Flow Meter to LRVP FI/FC-3 (gpm)	Thermal Oxidizer Operating Hours (hr)	Product Tank, T-4, Top of Product to Tank Bottom (in)	Product Tank, T-4, Top of Water to Tank Bottom (in)	Discharge Water Flow Totalizer FQ-1 (gal)	Potable Water Flow Totalizer FQ-2 (gal)	Gas Meter (CF)
2/3/97	65			60				0.2		NA			366	609	
4/29/97		120	2900	60	25			0.2	2.0	34.3			9502	6928	
5/7/97	78	250	2400	50	27			0.8	2.0	146.7	10.0	7.3	15716	9280	
5/13/97		315	1650	55	26			0.7	2.0	174.3	10.0	7.3	17810	10325	
5/20/97	85	125	3250	55	25			0.9	3.0	276.9	11.5	9.0	24290	14267	
5/29/97	92	200	2500	50	26			0.9	3.0	374.8	16.0	14.0	34385	18886	
6/3/97	85	150	2750	50	25			1.0	2.0	417.6	9.0	6.5	39000	20940	
6/10/97	90	320	2700	40	26			2.1	2.0	497.6	11.6	10.3	47488	23357	
6/17/97	90	290	1500	33	24			1.2	2.0	657.5	12.3	10.5	58661	23478	
6/24/97	85	125	2000	30	24			1.1	2.0	807.5			71556	23478	
6/30/97	90	325	1250	40	24			0.9	2.0	915.7	12.3	10.5	72905	23532	
7/1/97										935.0	Gas meter installed				0
7/8/97	85	90	3200	56	24			0.6	3.0	1049.6	12.3	10.5	80628	24234	14000
7/16/97	90	160	2475	60	26			1.3	3.0	1138.7	12.3	10.5	87095	24235	25900
7/23/97	90	210	2400	53	26			1.5	3.0	1303.1	13.3	11.0	99676	24245	51200
7/31/97	88	225	2750	55	26			2.0	3.0	1489.8	13.3	12.0	114253	24291	77100
8/6/97	90	200	2600	50	26			2.2	3.0	1601.1	13.3	11.5	126148	24291	92300
8/13/97	92	385	2750	52	25			2.1	3.0	1771.3	13.4	11.8	147077	24291	117800
8/22/97	95	110	2050	52	25			2.0	2.7	1941.5	13.8	12.3	165279	24308	139700
8/27/97	95	210	2750	55	25			2.2	2.3	1973.7	14.5	13.0	170851	24309	142800
9/3/97	90	320	1750	55	25			2.2	2.2	2020.2			180690	24349	147600
9/12/97	90	110	800	55	25			1.8	1.8	2136.5	13.8	12.0	197831	24616	162400
9/18/97	90	290	2850	53	25			1.3	1.5	2257.0	14.0	12.8	208577	24692	179100
9/25/97	85	155	3450	50	25			1.7	3.1	2389.7	14.0	11.0	225396		196300
10/2/97	92	160	3400	52	25			1.8	2.9	2550.6	14.0	11.8	248287	24751	216600
10/13/97				Estimated						2685.8					242000
10/23/97	85	160	2550	50	26			1.9	3.8	2853.0	15.5	12.8	292800	24757	259900
10/29/97	70	295	2750	50	27			1.8	3.9	2996.5	15.8	14.0	314564	24757	280900
11/7/97	65	320	2700	58	28			1.5	4.0	3184.5	5.5	4.0	341648	24767	308200
11/13/97	65	200	700	65	26			1.5	4.0	3236.0	6.0	4.5	350786	24767	315500
11/19/97	60	260	2700	65	26			1.5	4.0	3289.9	6.0	4.5	360665	24767	323300
11/28/97	70	190	2650	62	27	25		1.5	4.0	3419.7	6.8	3.8	374844	24758	341400
12/3/97	68	220	2500	62	27	30	14	1.5	4.0	3539.7	9.5	6.5	382287	24759	358000
12/13/97	55	260	1000	80	27	30	20	1.5	4.0	3716.0	16.8	15.0	388677	24941	383200
12/17/97	70	110	2900	80	25	30	15	1.5	4.0	3802.3	16.8	15.5	388701	24941	396600
12/24/97	50	250	3000	80	25			1.3	4.0	3969.3	13.0	12.0	389716	24941	420800
12/31/97	50	100	3200	80	25	30	20	1.2	4.0	4137	14.2	13.0	389726	24957	446400

TABLE 6 (Continued)
WEEKLY INSPECTION LOG
SYSTEM OPERATING CONDITIONS
NAS CORPUS CHRISTI

Date	Ambient Temp. (deg. F)	550 gallon water tank volume (gal)	5000 gallon water tank T-6 volume (gal)	Pump P-1 Discharge Pressure at PI-8 (psi)	Pump P-2 Discharge Pressure at PI-9 (psi)	Pump P-3 Discharge Pressure at PI-10 (psi)	Pump P-6 Discharge Pressure at PI-11 (psi)	Water Flow Meter from T-2 FI/FC-2 (gpm)	Water Flow Meter to LRVP FI/FC-3 (gpm)	Thermal Oxidizer Operating Hours (hr)	Product Tank, T-4, Top of Product to Tank Bottom (in)	Product Tank, T-4, Top of Water to Tank Bottom (in)	Discharge Water Flow Totalizer FQ-1 (gal)	Potable Water Flow Totalizer FQ-2 (gal)	Gas Meter (CF)
1/7/98	60	240	3050	80	27	30	16	1.5	4.0	4293.3	16.5	15.3	391760	24947	469200
1/17/98	68	310	3000	80	27	30	15	1.5	4.0	4523.3	16.8	15.0	393788	25021	502300
1/28/98	75	240	3200	80	25	30	15	1.5	4.0	4639.9	16.8	15.0	395090	25023	518900
2/4/98	70	125	3000	80	26	30	15	1.5	4.0	4811.0	17.0	15.5	396378	25029	543800
2/13/98	70	110	3000	80	25	30	15	1.5	4.0	4994.5	17.3	15.5	397367	25029	570600
2/22/98	70	230	3300	80	26	30	15	1.4	4.0	5216.3	18.5	15.5	397492	25029	604100
2/26/98	74	250	3000	84	25	30	15	1.5	4.0	5276.7	19.0	16.0	398657	25030	612300
3/4/98	68	125	2500	84	25	30	15	1.5	4.0	5424.4	19.2	16.2	399653	25030	633900
3/21/98	70	280	2800	80	26	30	15	1.5	2.8	5700.3	16.0	12.5	401977	25073	674200
4/1/98	75	250	2800	85	25	35	20	1.5	3.0	5964.1	17.0	7.5	404083	25073	712100
4/8/98	82	250	3300	85	25	35	20	1.5	3.5	6128.5	17.0	10.0	404684	25073	736700
4/13/98	Estimated									6230.5					
4/15/98	80	200	2500	85	25	35	20	1.3	3.5	6277.5	16.0	12.0	405786	25073	760000
4/22/98	75	310	2550	80	26	30	14	1.5	2.9	6383.8	16.0	12.0	409213	25073	778000
4/29/98	74	240	3250	80	26	30	14	1.5	2.8	6383.9	16.5	13.3	413765	25073	801200
5/7/98	86	280	3400	75	25	30	14	1.5	2.5	0.4	16.3	12.8	423285	25074	823500
5/16/98	84	175	3300	70	25	30	14	1.4	2.2	187.7	17.0	14.0	436056	25074	846700
5/20/98	90	260	2800	70	25	35	20	1.5	3.0	268.7			441364	25074	858200
5/27/98	88	150	3000	70	25	30	13	1.3	2.2	438.6	18.0	15.0	445669	25074	881100
6/1/98	90	320	3200	NA	NA	NA	NA	NA	NA	542.9	NA	NA	453667	25074	892600
6/4/98	90	320	3200	NA	NA	NA	NA	NA	NA	542.9	NA	NA	453667	25074	892600
6/10/98	90	320	3200	NA	NA	NA	NA	NA	NA	542.9	NA	NA	453667	25074	892600
6/17/98	90	320	3200	NA	NA	NA	NA	NA	NA	542.9	NA	NA	453667	25074	892600
6/25/98	90	325	3000	80	25	35	20	1	3	543.4			453669	25074	892700
7/8/98	NA	NA	NA	NA	NA	NA	NA	NA	NA	543.4	NA	NA	453669	NA	NA
7/15/98	NA	NA	NA	NA	NA	NA	NA	NA	NA	543.4	NA	NA	453669	NA	NA
7/22/98	90	250	1800	75	25	35	25	1.3	3.0	555.2	12.0	9.0	453669	25074	
7/29/98	96	150	2500	70	25	35	25	1.3	3.0	598.2	16.0	12.0	453669	25074	900900
8/5/98	93	280	3300	80	23	30	15	1.5	2.4	670.7	13	10	453679	25074	912600
8/14/98	90	350	3000	70	25	35	25	1.3	3.0	698.0			454680	25130	916400
8/18/98	95	100	2400	55	19	40	10	1	2	736	11	7	454681	25198	921300
9/4/98	80	160	1700	60	25	1	2			761.6	11.4	7.2	457010	26591	925000
9/18/98	85	275	1000	60	25	1	2			950.0	12.0	6.0	459223	27925	967000

TABLE 7
WEEKLY INSPECTION LOG
MULTIPLE WELLS
NAS CORPUS CHRISTI

Date	Motor valve / Well								Water Temp. in T-2 Tank TI-1 (°F)	Vacuum Pressure at Well	Vacuum Pressure at Manifold	Vacuum Pressure at PI-6	Vacuum Pressure at PI-7	Differential Pressure of Vapor Stream	Pressure of Vapor Stream	Vapor Stream Temp. at TI-2 (°F)	Vapor Concentration Measured with FID	Burner temperature (°F)
	1	1	2	3	3	4	5	5		(in Hg)	(in Hg)	(in Hg)	(in Hg)	GOM-3	GOM-3		Average (ppmv)	
	29	14	20	26	22	13	21	RW-3										
4/15/98	X		X	X						NA	11	18	15.5	103.6	136.9	89	25,000	1,409
4/22/98	X		X	X					95	NA	9	16.5	14	114.9	134.9	94	28,995	1,413
4/29/98						X	X			NA	19	24	23	19.5	24.3	90	62,525	1,411
5/7/98			X	X					100	NA	11.5	19	17	75.9	71.9	98	25,725	1,409
5/16/98						X	X		100	NA	21	26	24.5	11.8	40.1	92	10,200	1,410
5/20/98	X								104	13	15	21	19.5	54.9	74.2	102	4,860	1,405
5/27/98			X						110	14.5	18	23	21.5	69.1	70.4	99	12,350	1,408
6/1/98			X						110	14.5	18	23	21.5	69.1	70.4	99	12,350	1,408
6/3/98	System shut down for gas line repairs									NA	NA	NA	NA	NA	NA	NA	NA	NA
6/10/98	System shut down for gas line repairs									NA	NA	NA	NA	NA	NA	NA	NA	NA
6/17/98	System shut down for gas line repairs									NA	NA	NA	NA	NA	NA	NA	NA	NA
6/25/98								X	100	22	22.5	23.5	23	17.3	35.2	105	6,840	1,413
7/8/98	System shut down for gas line repairs									NA	NA	NA	NA	NA	NA	NA	NA	NA
7/15/98	System shut down for gas line repairs									NA	NA	NA	NA	NA	NA	NA	NA	NA
7/22/98					X					NA	NA	NA	NA	NA	NA	NA	NA	NA
7/29/98					X				120	7	7	11.5	10	10	10	112		1,407
8/5/98	X								106	8.5	8.5	11.5	11.5	159.3	131.9	106		1,410
8/14/98	X								122	12	13	16	15	10	10	120		1,410
8/18/98								X	120	14	15	20	28	1.9	28	109		1,410
9/4/98								X	95	21	24	28	26.5	NA	NA	100	13,590	1,406
9/18/98								X	98	NA	18	27.5	27	NA	NA	98	7,754	1,408

TABLE 7 (Continued)
WEEKLY INSPECTION LOG
MULTIPLE WELLS
NAS CORPUS CHRISTI

Date	Lower Stack Temperature (°F)	Differential Pressure Diluted Process Air FI-309 (in. H_2O)	Natural Gas Pressure PSH-106 (in. H_20)	Vacuum on Process Air PI-302 (in. H_2O)	Pressure on Process Air PI-301 (in. H_2O)	Differential Pressure on Natural Gas PI-107 (in. H_2O)	Differential Pressure on Burner PDI-501 (in. H_2O)	Diluted Process Air Temperature TI-307 (°F)	Average FID Concentration of Diluted Process Air BV-20 (ppm)
4/15/98	1,391	0.06	18.5	7	35	0.45	0.4	105	7395
4/22/98	1,397	0.065	18.5	7	32	0.4	0.35	105	6805
4/29/98	1,392	0.06	18.5	9.8	9	0.4	0.4	105	7940
5/7/98	1,404	0.06	19	8	11	0.2	0.3	110	5800
5/16/98	1,385	0.05	17.5	9.8	36	0.9	0.5	110	770
5/20/98	1,383		18	8.5	30	0.4	0.5	116	724
5/27/98	1,389	0.06	18.5	9.8	9	0.45	0.35	115	2350
6/1/98	1,389	0.06	18.5	9.8	9	0.45	0.35	115	2350
6/3/98	NA	NA	NA	NA	NA	NA	NA	NA	NA
6/10/98	NA	NA	NA	NA	NA	NA	NA	NA	NA
6/17/98	NA	NA	NA	NA	NA	NA	NA	NA	NA
6/25/98	1,387	0.05	18	7.2	1.5	0.9	0.5	110	169
7/8/98	NA	NA	NA	NA	NA	NA	NA	NA	NA
7/15/98	NA	NA	NA	NA	NA	NA	NA	NA	NA
7/22/98	NA	NA	NA	NA	NA	NA	NA	NA	NA
7/29/98	1,383	0.07	17	7	5	1.2	0.5	110	620
8/5/98	1,383	0.065	17.5	7.2	2	1.3	0.5	117	139
8/14/98	1,386	0	18	9	40	0.8	0.45	118	
8/18/98	1,383	0	17.5	10	7	1	0.5	115	555
9/4/98	1,377	0.06	17	10	0	1	0.5	110	620
9/18/98	1,379	0.07	18	10	0	1.1	0.5	115	893

TABLE 8 ALARM LOG NAS CORPUS CHRISTI		
Alarm	Alarm Cause	Action Taken Summary
Date time		
		Installed replacement float switch in T-2, program problem
		Reloaded PLC program, system running. Adjusted ambient air to MW-26 to prevent high temp; level control in T-2 not operating system shut down.
		Rewired level switch in T-2; operating only on level control, temporarily corrected problem. 14:23 system started.
		Checking operating efficiency; system high temp alarm while on site on MW-26 at full vacuum. At 10 inches Hg no high temp, 16:50 system in automatic.
		On site to check system, LRVP breaker tripped. Rewired T-2 to allow operation of both temperature and level switch. T-ox high temp while on site. Adjusted vacuum to 8-10 in. Hg at MW-26 11:05 system on.
4/30/97 13:25	LSHH-2 high level T-2	Increased flow of water from T-2 to T-1 at FI/FC-2. Flow increased to remove more hot water from T-2, more potable water is used, flow set at 0.9 to 1.0 gpm.
4/30/97 17:15	LSHH-5 high level T-6	Unable to restart system until Tank T-6 is emptied. John Young notified
		John Young emptied Tank T-6, restarted system after 2,700 gallons was removed from T-6
5/1/97 no alarm call	System checked to verify operation, LRVP circuit breaker tripped	The system was restarted; the problem was believed to have been caused by excessive back pressure; the back pressure on LRVP was reduced to 5.5 psi. The system was restarted.
5/2/97 no alarm call recorded alarm estimated at 23:00	System checked to verify operation; the system had shut down due to high temperature in the thermal oxidizer.	The inlet flow to the thermal oxidizer was adjusted, and the leaking motor valves were repaired. The leaking motor valves were allowing vapor to be pulled from multiple wells. The system was restarted.
5/3/97 no alarm call	System checked to verify operation, LRVP circuit breaker tripped	The system was restarted; the problem was believed to have been caused by excessive back pressure; the back pressure on LRVP was reduced. The system was restarted.
5/4/97 no alarm call recorded	System checked to verify operation; LRVP circuit breaker tripped, and LSHH-2 high level in T-2.	The system was restarted and operated manually; T-6 tank filled during manual operation and shut down system.
	Restart after T-6 was emptied.	3600 gallons removed from T-6. System restarted; the flow from T-2 to T-1 was adjusted to 0.75 gpm. Manually operated on MW-26, high temperature shut down, adjusted vacuum pressure at well MW-26 to 9-10 inches Hg; system operated; dial out tested
5/5/97 15:39	The system was still operating; the alarm was caused by low temperature in thermal oxidizer (TOX). LRVP temporarily shuts off until TOX returns to temp, automatically restarts. (nuisance alarm)	System was operating, adjustments were made to reduce the possibility of high temp alarm on T-ox. The drop tube at MW-26 was raised by 36 inches; vacuum was reduced to 8-10 inches of Hg.

TABLE 8 (Continued) ALARM LOG NAS CORPUS CHRISTI		
Alarm	Alarm Cause	Action Taken Summary
Date time		
5/7/97 21:40	The system was still operating, the alarm was caused by low temperature in thermal oxidizer (TOX), LRVP temporarily shuts off until TOX returns to temp, automatically restarts. (nuisance alarm)	Recommended modifications to PLC, programmer contacted to eliminate call out on low temperature which restarts itself.
5/8/97 5:17		
5/8/97 15:16	LSHH-1 high level in T-1	The submersible pump in T-1 was not operating properly; a service technician was called to service the pump 5/10/97.
	System still down due to T-1.	The submersible pump in T-1 was removed; the tank was filled (approx. 25 gallons) with sediment preventing the pump from operating. A vacuum truck was determined to be necessary to clean out T-1. A vacuum truck will be contacted Monday 5/12/97.
	System still down due to T-1.	Modifications were made to the PLC: prevent alarm call outs on low temperature (auto reset), added an alarm call out if the LRVP circuit breaker trips, and modified the cycle times for the wells complete cycle 8 hours, wells 3, 2, 1.5, 0.75, 0.75 hr.
		A delay was added of 60 sec. before LRVP shut down on low temperature. The low temp shut down set point was changed from 1395 to 1360F.
	System still down due to T-1.	Pumped out T-1 with vacuum truck, approx. 20-30 gal. sediment and 20-35 gal. liquid was removed and placed into drums. Pump was reinstalled and system restarted.
5/15/97 6:40	LSHH-5 high level T-6	System was restarted after T-6 was pumped out. FI/FC-2 was adjusted to 0.5 gpm from 0.65 gpm to reduce the use of potable water.
5/15/97 11:31	LSHH-2 high level in T-2	System was restarted. FI/FC-2 was adjusted to 0.6 gpm from 0.5 gpm; an incremental change was made to try to minimize potable water usage; more water needed to be drained to remove the heat.
5/15/97 15:03	LSHH-2 high level in T-2	System was restarted. FI/FC-2 was adjusted to 0.75 gpm from 0.6 gpm; an incremental change was made to try to minimize potable water usage; more water needed to be drained to remove the heat.
5/16/97 14:29	LSHH-2 high level in T-2	System was restarted. FI/FC-2 was adjusted to 0.9 gpm from 0.75 gpm; an incremental change was made to try to minimize potable water usage; more water needed to be drained to remove the heat.
5/18/97 10:10	LSHH-2 high level in T-2	System was restarted. FI/FC-2 was adjusted to 1.0 gpm from 0.9 gpm; an incremental change was made to try to minimize potable water usage; more water needed to be drained to remove the heat.
5/19/97 22:35	LSHH-5 high level T-6	500 gal. water pumped out of T-6 by John Young. System restarted. Leaks in motor valves were also repaired. Hoses switched set as follows: MV-1--MW-26, MV-2--MW-13, MV-3--MW-20, MV-4--MW-29, MV-5--MW-21.

TABLE 8 (Continued) ALARM LOG NAS CORPUS CHRISTI		
Alarm	Alarm Cause	Action Taken Summary
Date time		
5/21/97 0:10	LSHH-5 high level T-6	2700 gal. water pumped out of T-6 by John Young. System restarted. All wells operated manually; samples collected.
5/23/97 19:55	LSHH-1 blinking thermal oxidizer control fault	Cause was suspected of being storm-related; system was restarted and operated properly
5/24/97 18:45	At site to check system, LSHH 1 blinking, thermal oxidizer alarm, control fault, unknown cause. 5/24/97 18:45 alarm call not received time estimated from chart	System was restarted, monitored for 1 hour and running fine. LRVP sediment filter cleaned.
5/26/97 14:15	At site to check system, LSHH 1 blinking, thermal oxidizer alarm, control fault, unknown cause.	Checked amp draw and fuses; concern over possible lightening damage. PLC program problems suspected, not cause of problem. 16:40 system started operating properly.
5/28/97 11:15	At site to check system, LSHH 1 blinking, thermal oxidizer alarm, flame failure control fault.	Contacted ThermTech; oxidizer indicated flame failure. Cleaned UV scanner and restarted oxidizer only. Removed drop tubes for quarterly monitoring of wells.
5/28/97 20:02	At site to check system, LSHH 1 blinking, thermal oxidizer alarm, flame failure control fault.	Contacted ThermTech; ThermTech recommended adjusting fuel flow. Restarted system, high temp alarm, adjusted flow restarted and operated.
5/30/97 11:30	On-site for maintenance, thermal oxidizer shut down flame failure again.	Contacted ThermTech again; ThermTech suggested checking for water in line leading to thermal oxidizer. Approximately 0.5 gallons of water was drained from line. System restarted 12:25.
5/30/97 13:20	LSHH-3 T-4 product tank full	While on site at 13:20, the LSHH-3 alarm indicating full product tank shut system down; John Young emptied tank. System was restarted 14:00, oil skimmer level adjusted, flow rate into tank adjusted, and weekly maintenance completed.
5/31/97 11:15	LSHH-3 T-4 product tank full	Oil water skimmer was adjusted 5/30; further adjusted skimmer and pump in T-1 flow rate.
6/1/97 0:00	LSHH-3 T-4 product tank full	Water pumped out of T-4 to T-5, increased pressure at valve from T-1 to separator to slow flow rate from 40 to 60 psi.
6/2/97 19:15	High temp shut down thermal oxidizer	
6/7/97 0:05	LSHH-6 high sump level	Pumped down sump, caused by heavy storm
6/7/97 18:30	High temp shut down thermal oxidizer	Adjusted BFV-1
6/8/97 20:28	High level alarm in T-2	Restarted system, appears to be intermittent problem with level switch
6/10/97 8:16	High level alarm in T-2	Removed LSL/H-5, switch internal broken, switch replaced
6/11/97 18:07	Circuit breaker tripped for LRVP	The P-1 pump had become unscrewed causing T-1 to overfill. The ambient valve opened to allow the pump to catch up, as a result the LRVP circuit breaker tripped. Pump was reattached, locktite was used. A throttle valve was installed on ambient valve.

TABLE 8 (Continued) ALARM LOG NAS CORPUS CHRISTI		
Alarm	Alarm Cause	Action Taken Summary
Date time		
6/23/97 16:00	Oxidizer control fault alarm, probable cause due to water into oxidizer	Cause appears to have been moisture, possibly free product into T-ox. Line drained and restarted
6/29/97 20:55	Oxidizer control fault alarm, probable cause due to water into oxidizer	Adjusted water level in T-6 to control flow into LRVP. Low level results in low flow and higher temperatures, therefore more water carries over.
7/3/97 21:59	Thermal oxidizer shut down due to liquid carry over to the thermal oxidizer	Water drained, LRVP would not restart, acid washed to remove scale
7/6/97 6:00	T-6 full	System restarted after NAS emptied tank
7/8/97 17:33	LRVP amp overload	Restarted system
7/10/97 11:32	LRVP amp overload	Adjusted flow into LRVP from 3 gpm to 2 gpm, restarted system
7/12/97 16:11	T-6 full	Called base environmental no response. Contacted ROICC, instructed to wait until tank is verified emptied.
		Received word that the T-6 tank was empty, restarted the system.
7/29/97 13:45	Filter clogged, no vacuum	Filter changed, LRVP restarted
8/2/97 1:10	Thermal oxidizer high temp, MW-20	System restarted, closed valve partially observed system while on MW-20
8/13/97 20:38	LRVP circuit breaker tripped,	Restarted system, high temp occurred, adjusted GV-1 to more closed position
8/14/97 14:13	LRVP circuit breaker tripped,	Restarted system, water flow into LRVP was reduced, a flow rotometer was ordered to better monitor water flow.
8/14/97 17:20	Thermal oxidizer high temp, MW-20	System restarted, closed valve partially observed system while on MW-20, LRVP amps checked, continued to read high, LRVP will probably require thorough cleaning, air temp leaving LRVP high resulting from reduced water flow because of scale buildup..
8/20/97 1:53	LRVP circuit breaker tripped,	LRVP completely disassembled and cleaned, all scale removed. Flow meter also installed to better control flow through LRVP.
		Completed installation of flow meter, system restarted.
8/23/97 9:30	High level in T-2 tank, LSHH-2, LSH/LSL-5 not operating	Loose part removed from level switch and system restarted
8/25/97 22:00		
8/26/97 21:51	Continued problem with T-2 level switch, new switch ordered	System restarted
8/30/97 9:53	High temperature alarm in oxidizer	Well vacuum adjusted, system restarted
9/2/97 17:33	High temperature alarm in oxidizer	Moved well 29 to MV-1, restarted system, monitored through cycle
9/4/97 20:08	LSHH-1 high level alarm in T-1 tank and LSHH-2 high level alarm in T-2 tank	LSHH 1 and 2 alarm, caused by damaged wire on float switch in T-1 tank, wire fixed system restarted.
9/7/97 13:53	LSHH-2 high level alarm in T-2 tank	LSHH-2, level switch problem in T-2 tank, switch replaced with temporary replacement

TABLE 8 (Continued)
ALARM LOG
NAS CORPUS CHRISTI

Alarm	Alarm Cause	Action Taken Summary
Date time		
9/7/97 22:54	LSHH-2 high level alarm in T-2 tank	LSHH-2 inspected level switch in T-2, all seemed operational, restarted system, continued monitoring.
9/9/97 14:38	LSHH-2 high level alarm in T-2 tank	LSHH-2 inspected level switch in T-2, all seemed operational, restarted system, continued monitoring. Temp. switch suspected of causing problems.
9/16/97 21:53	LSHH-2 high level alarm in T-2 tank	Temperature switch determined to be causing part of problem, Temp. switch removed from circuit, level switch was intended to replace temperature switch. Replacement level switch specified.
9/22/97 1:17	Power outage	System restarted
9/23/97 16:00	Power outage	System restarted
9/26/97 5:30	LSHH-5 T-6 high level alarm	NAS Corpus emptied tank, AES restarted system
9/30/97 7:30	LSHH-1 tank T-1 full.	P-1 pump flow blocked, blockage cleared and system restarted.
9/30/97 14:39	LSHH-2 alarm, tank T-2 full	Cause of problem unknown at time, system restarted. Subsequently, the relay board which controls the level switches was replaced for other problems and may have been cause. (see notes 10/14/97)
10/5/97 8:57	LSHH-5 T-6 high level alarm	NAS Corpus emptied tank, system left off for moisture separator installation
10/14/97 20:25	LSHH-2 alarm, tank T-2 full	Problem also detected with sump probes while trouble shooting. Relay board replaced. Wiring from sump probes and LSHH-2 were to the same relay board that was determined to be bad.
10/16/97 5:49	LSHH-5 T-6 high level alarm	NAS Corpus emptied tank, AES restarted system
		Replaced relay board.
11/4/97 11:55	T-4 full	NAS Corpus emptied tank, AES restarted system
11/8/97 4:20	LSHH-5 T-6 high level alarm	NAS Corpus emptied tank, AES restarted system
11/11/97 9:20	P-1 pump required replacement system down for 48.25 hours	Replaced impellers to P-1 pump.
11/14/97 12:30	System down due to low Natural gas pressure.	NAS Corpus Christi working on Natural gas line. System left off at Navy direction.
		Natural gas was restored by NAS Corpus, AES restarted system
11/21/97 23:48		
12/3/97 23:14	LSHH-3, high level alarm in T-4, product tank	Pumped water out of product tank back into T-1 tank to be reprocessed by system. Adjusted flow rate from T-1 tank to reduce flow into T-4 tank. Restarted system
12/5/97 18:28	LSHH-3, high level alarm in T-4, product tank	Pumped out oil water separator, cleaned unit, refilled oil water separator and restarted system.
12/18/97 8:54	Power failure	Restarted system after power was restored
1/6/98 20:05	Power failure	Restarted system after power was restored
1/21/98 0:00	Problem noted with LRVP	Motor removed for repair
2/12/98 21:10	LRVP over amp	The flow was adjusted into the LRVP the amperage was measured as slightly higher than normal.
3/10/98 14:30	LRVP over amp	System restarted
3/11/98 9:39	LRVP over amp	Installed shims and adjusted motor alignment and spring holder in LRVP

TABLE 8 (Continued) ALARM LOG NAS CORPUS CHRISTI		
Alarm	Alarm Cause	Action Taken Summary
Date time		
3/12/98 11:00	LRVP over amp	Shut off power, ordered replacement LRVP
		Completed installation of replacement LRVP and restarted system
4/19/98 22:30	Power Outage	System restarted
4/29/98 20:56	T-6 tank full	The pump was left in the off position after servicing the system on 4/29. The pump was switched to the Auto position and the system was restarted.
5/2/98 7:53	Loss of natural gas pressure	The system was checked and restarted.
5/6/98 9:00	LRVP overload	The T-1 tank had filled and switched to ambient air, causing the LRVP to over amp. The P-1 pump was not working properly. The pump end was replaced with a Grundfos E-10 pump
5/6/98 22:17	LRVP overload	When operating on well 29 with other wells, well 29 causes a short circuit and the vacuum is lost resulting in high air flow causing the LRVP over amp. Well 29 will be operated by itself.
5/15/98 9:05	Power Outage	System was restarted
5/18/98 6:45	Power Outage	System was restarted
5/22/98 9:50	LRVP overload	When operating on well 29 with other wells, well 29 causes a short circuit and the vacuum is lost resulting in high air flow causing the LRVP over amp. The system was switched to operate on wells 20 and 26.
6/1/98 9:00	Low gas pressure	System was restarted
6/2/98 11:14	Low gas pressure	The system was left off at the request of John Young to allow repairs to the gas line to be continued in the area.
6/10/98 0:00	Call for repairs from John Young	AES responded to the site to repair damage to the piping caused by the contractor installing the gas line at the site.
6/26/98 6:15	Low gas pressure	The system was left off at the request of John Young to allow repairs to the gas line to be continued in the area.
7/22/98 20:16	LSHH-4 high level in T-5 tank	The level probe was sticking. The probe was cleaned, the system was tested and restarted.
7/23/98 22:27	LSHH-4 high level in T-5 tank	The level probe was sticking. The probe was cleaned, the system was tested and restarted.
7/27/98 0:00	No alarm call occurred, unit was down due to a CPU fault.	Wiring was checked, fuses and circuit breakers were checked. The CPU unit was reset and the system was restarted. Low power supply is suspected.
8/1/98 9:00	No alarm call occurred, unit was down due to a CPU fault.	Electrical trouble shooting and PLC trouble shooting continued.
8/3/98 0:00	No alarm call occurred, unit was down due to a CPU fault.	Electrical trouble shooting and PLC trouble shooting continued.
8/5/98 0:00	No alarm call occurred, unit was down due to a CPU fault.	Electrical trouble shooting and PLC trouble shooting continued.
8/6/98 0:00	No alarm call occurred, unit was down due to a CPU fault.	Electrical trouble shooting and PLC trouble shooting continued.

TABLE 8 (Continued) ALARM LOG NAS CORPUS CHRISTI		
Alarm	Alarm Cause	Action Taken Summary
Date time		
8/15/98 0:00	No alarm call occurred, unit was down due to a CPU fault.	Electrical trouble shooting and PLC trouble shooting continued.
8/24/98 0:00	No alarm call occurred, unit was down due to a CPU fault.	System left off for installation of UPS system.
8/31/98 0:00	Replaced boards on PLC.	
9/3/98 0:00	Oxidizer shut down due to combustion blower failure.	The system was restarted
9/6/98 0:00	Oxidizer shut down due to power interruption.	The system was left off to replace the combustion blower motor.
		The combustion blower motor was replaced. Level switches in T-2 and T-6 were cleaned. The system was restarted.

APPENDIX B
FIGURES

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FIGURE 1: NAS CORPUS CHRISTI
TOTAL HYDROCARBONS REMOVED VAPOR PHASE
(lb.)

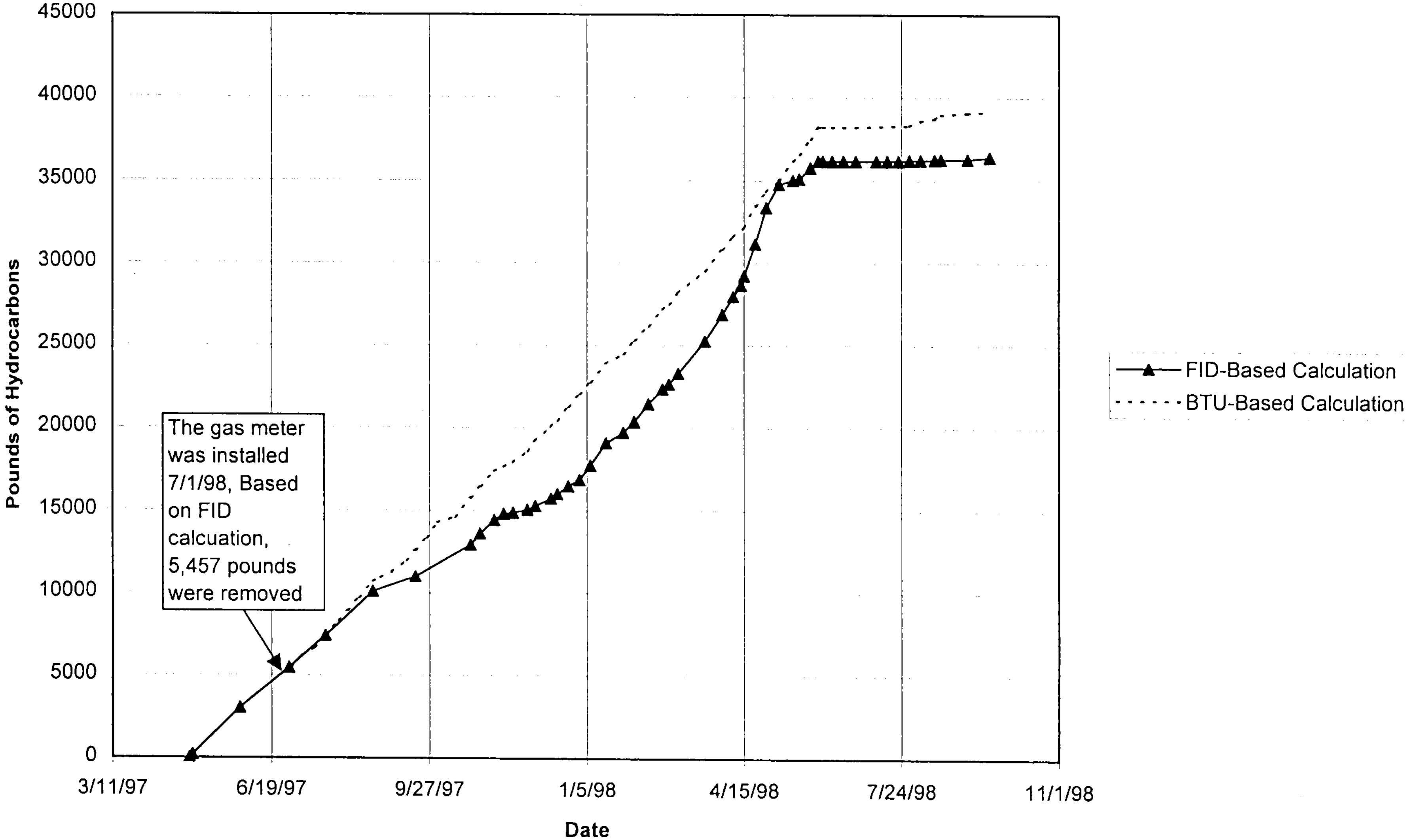
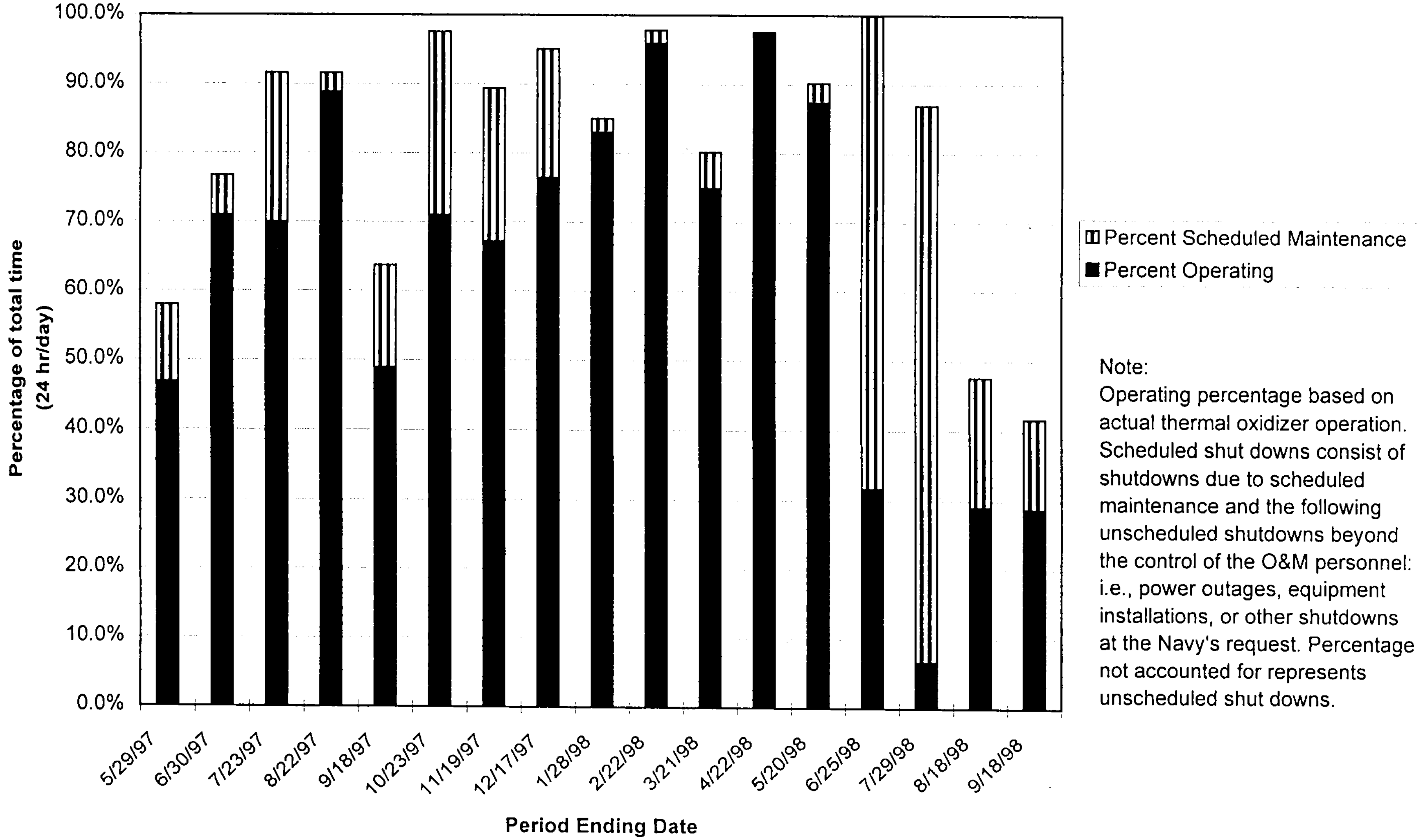


FIGURE 2: NAS CORPUS CHRISTI SYSTEM OPERATION



Note:
Operating percentage based on actual thermal oxidizer operation. Scheduled shut downs consist of shutdowns due to scheduled maintenance and the following unscheduled shutdowns beyond the control of the O&M personnel: i.e., power outages, equipment installations, or other shutdowns at the Navy's request. Percentage not accounted for represents unscheduled shut downs.

FIGURE 3: UNSCHEDULED SHUT DOWN FREQUENCY
NAS CORPUS CHRISTI

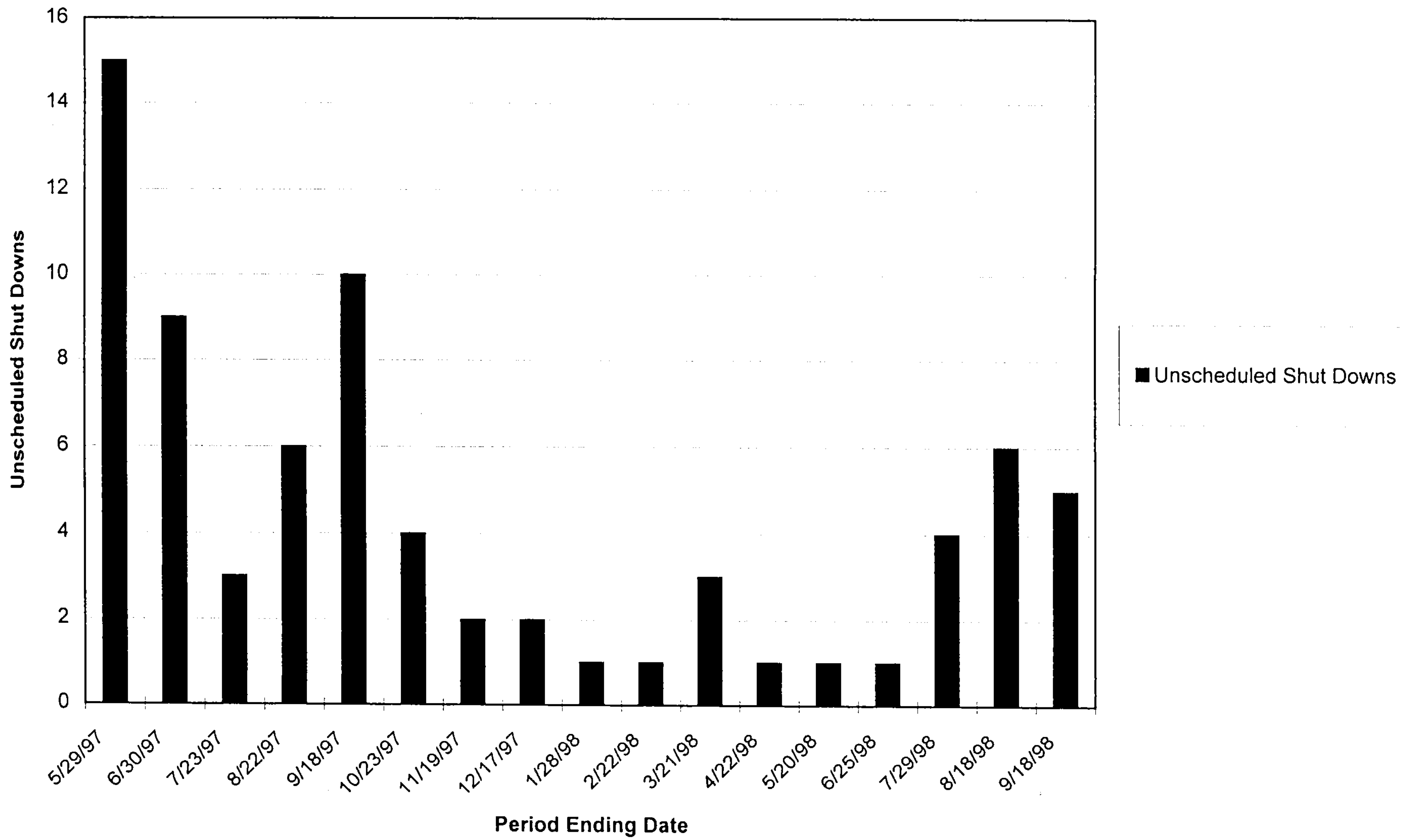


FIGURE 4: FUEL THICKNESS AT NAS CORPUS CHRISTI FUEL FARM 216 RW-03

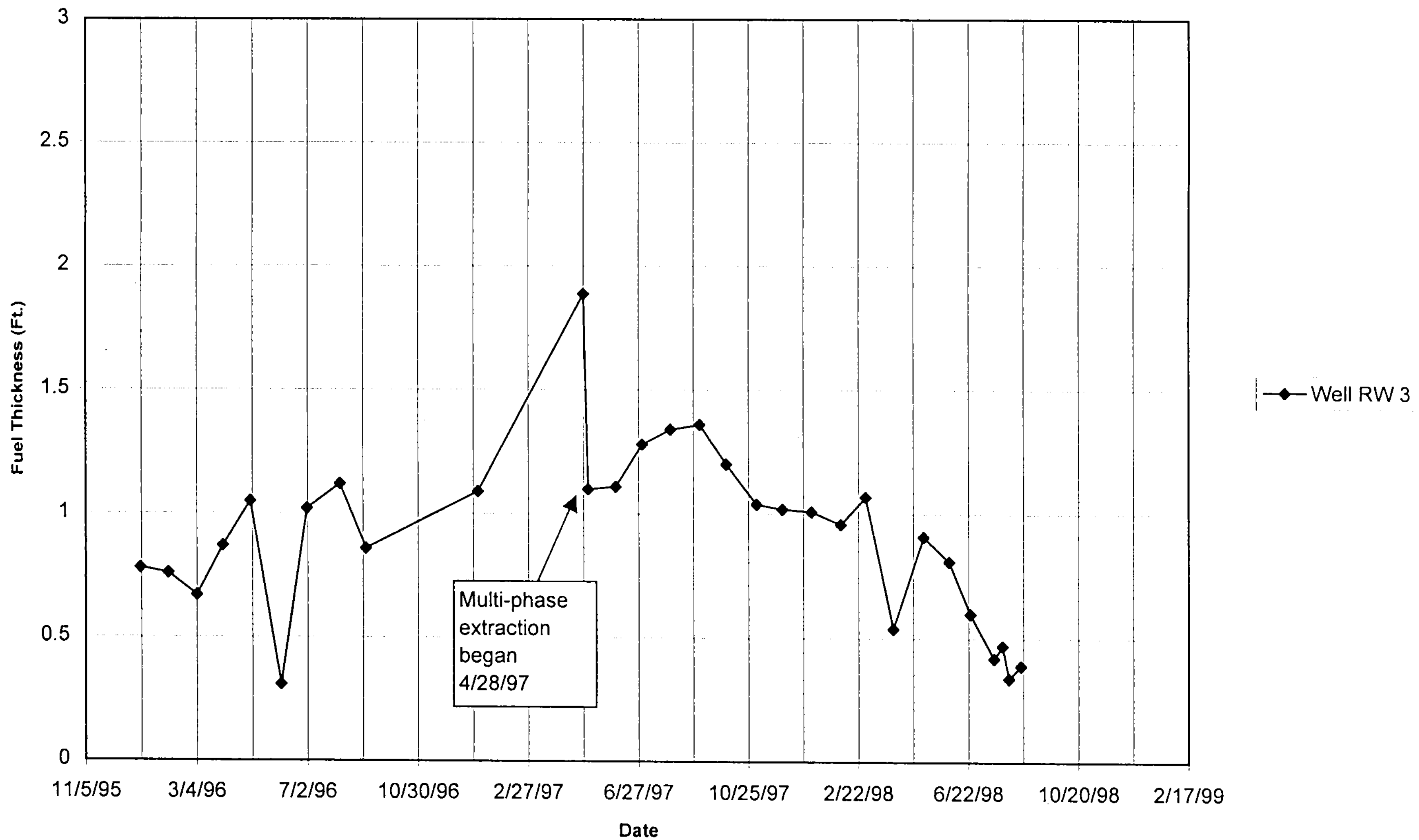


FIGURE 5: FUEL THICKNESS AT NAS CORPUS CHRISTI FUEL FARM 216 MW-13

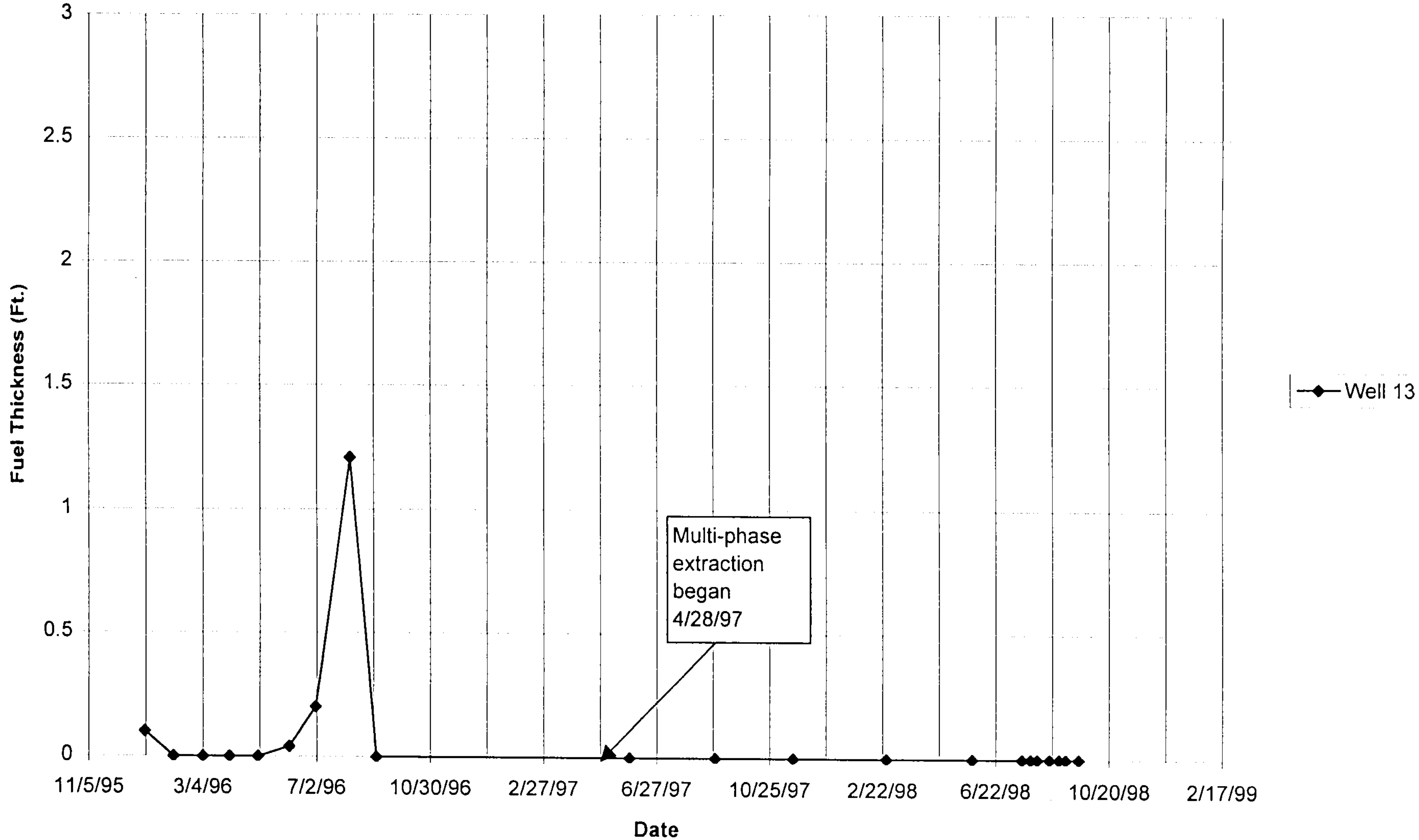


FIGURE 6: FUEL THICKNESS AT NAS CORPUS CHRISTI FUEL FARM 216 MW-14

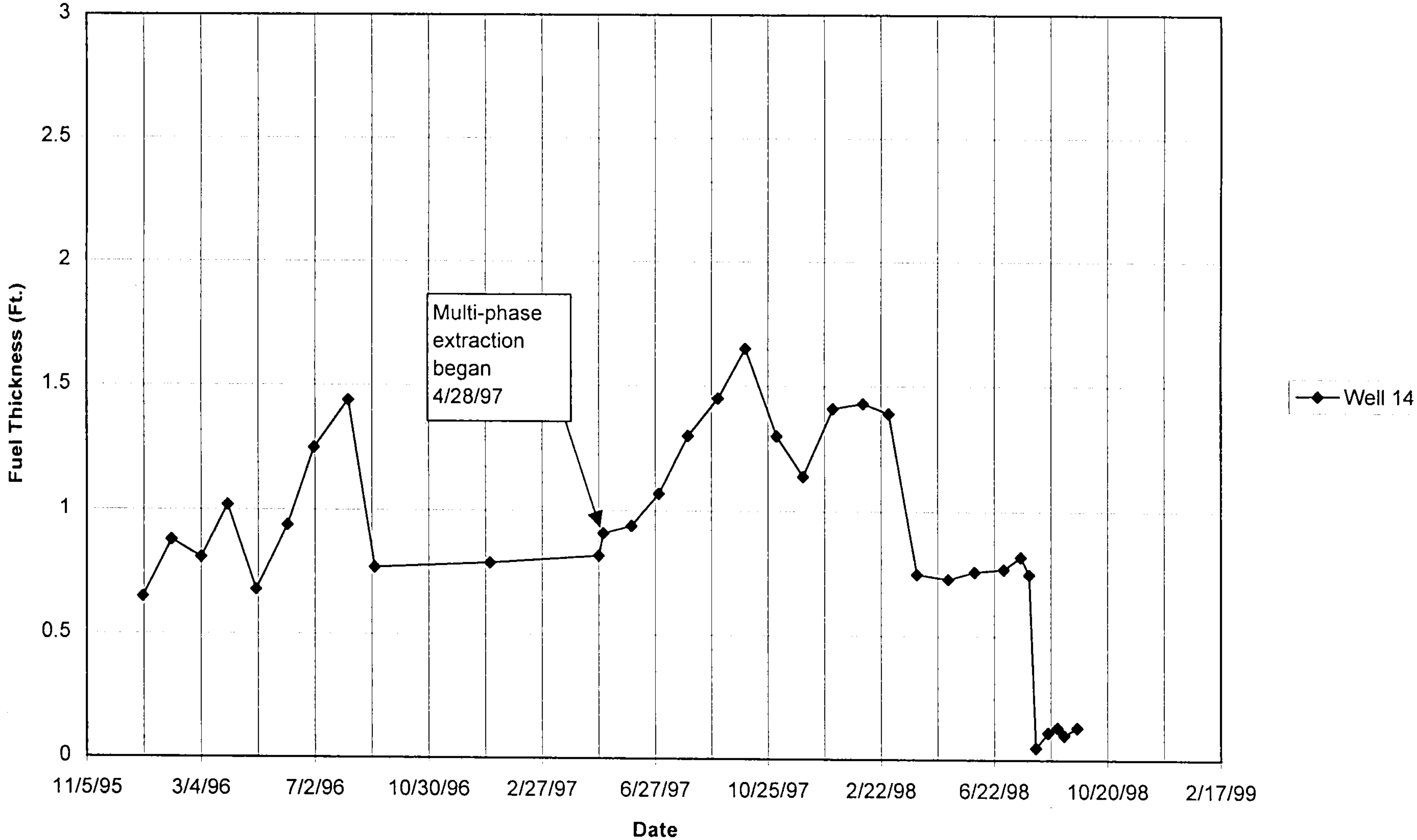


FIGURE 7: FUEL THICKNESS AT NAS CORPUS CHRISTI FUEL FARM 216 MW-20

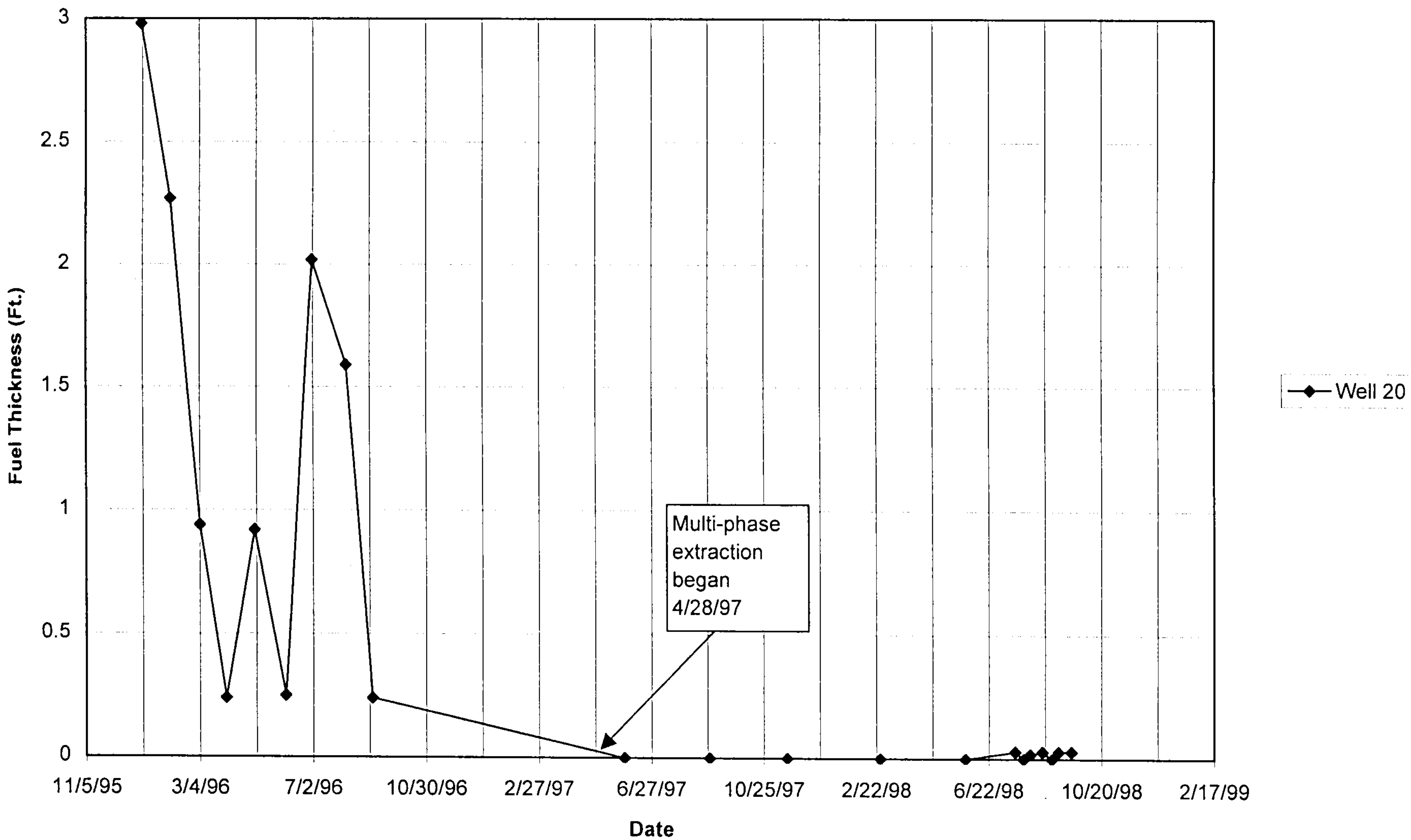


FIGURE 8: FUEL THICKNESS AT NAS CORPUS CHRISTI FUEL FARM 216 MW-21

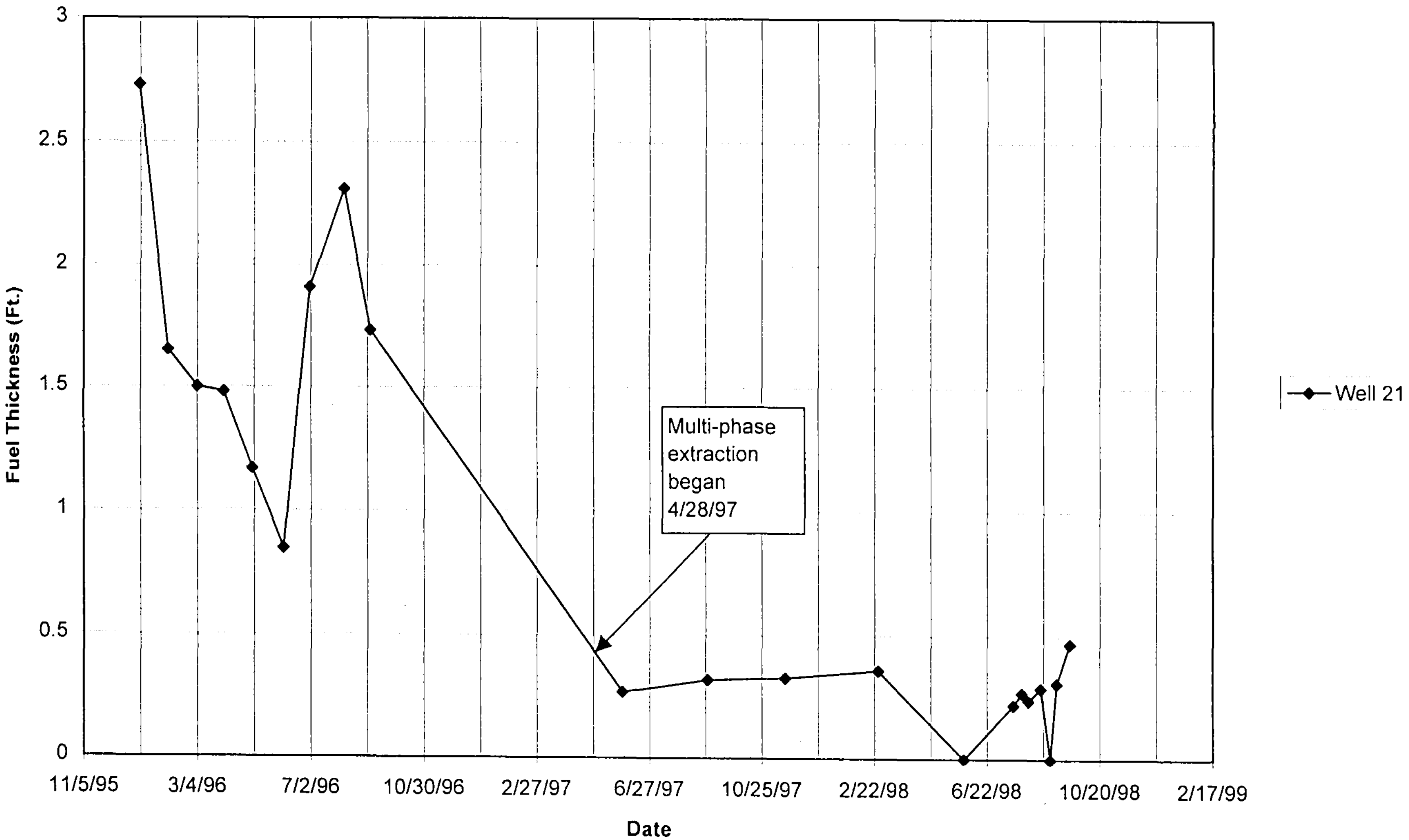


FIGURE 9: FUEL THICKNESS AT NAS CORPUS CHRISTI
FUEL FARM 216 MW-22

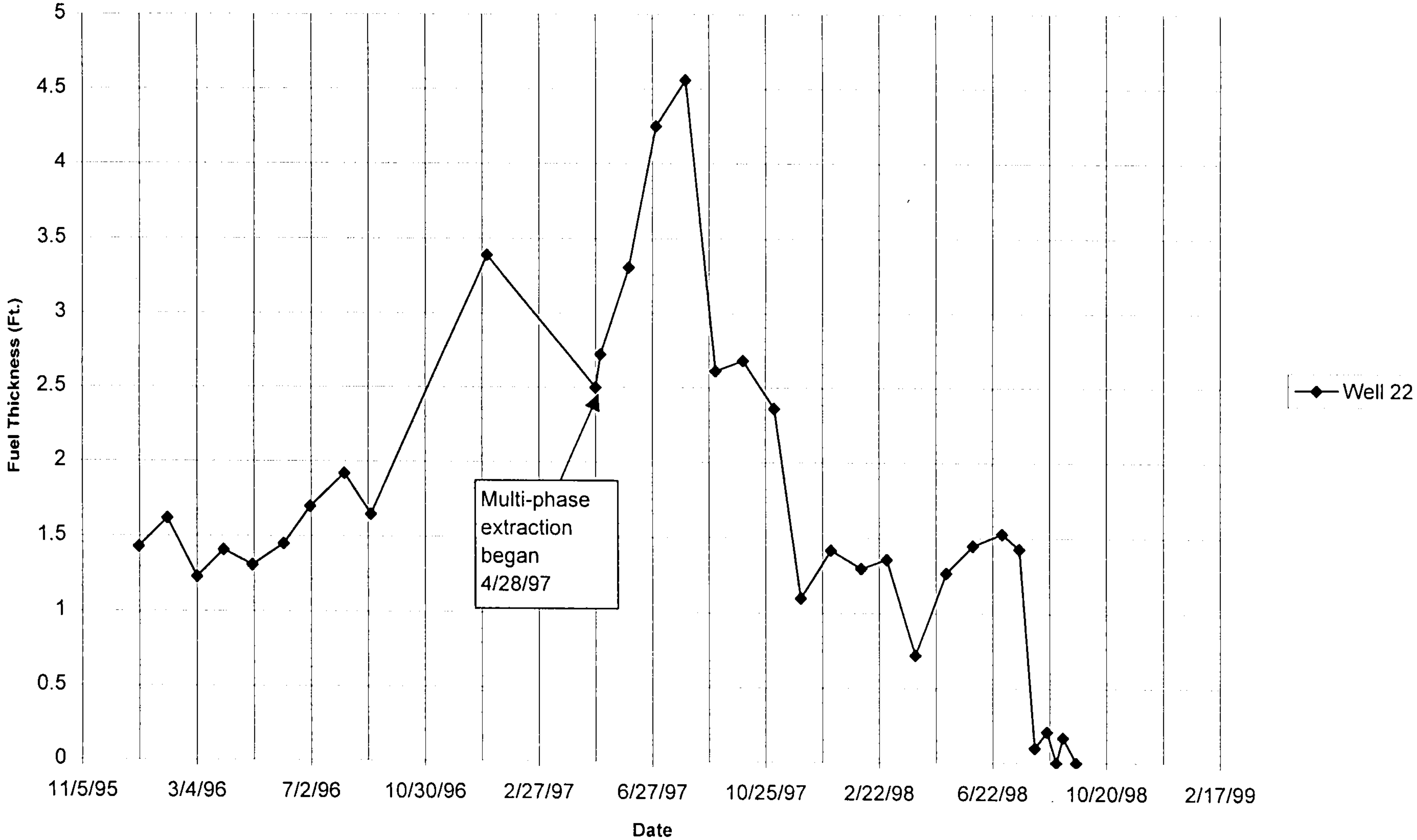


FIGURE 10: FUEL THICKNESS AT NAS CORPUS CHRISTI
FUEL FARM 216 MW-26

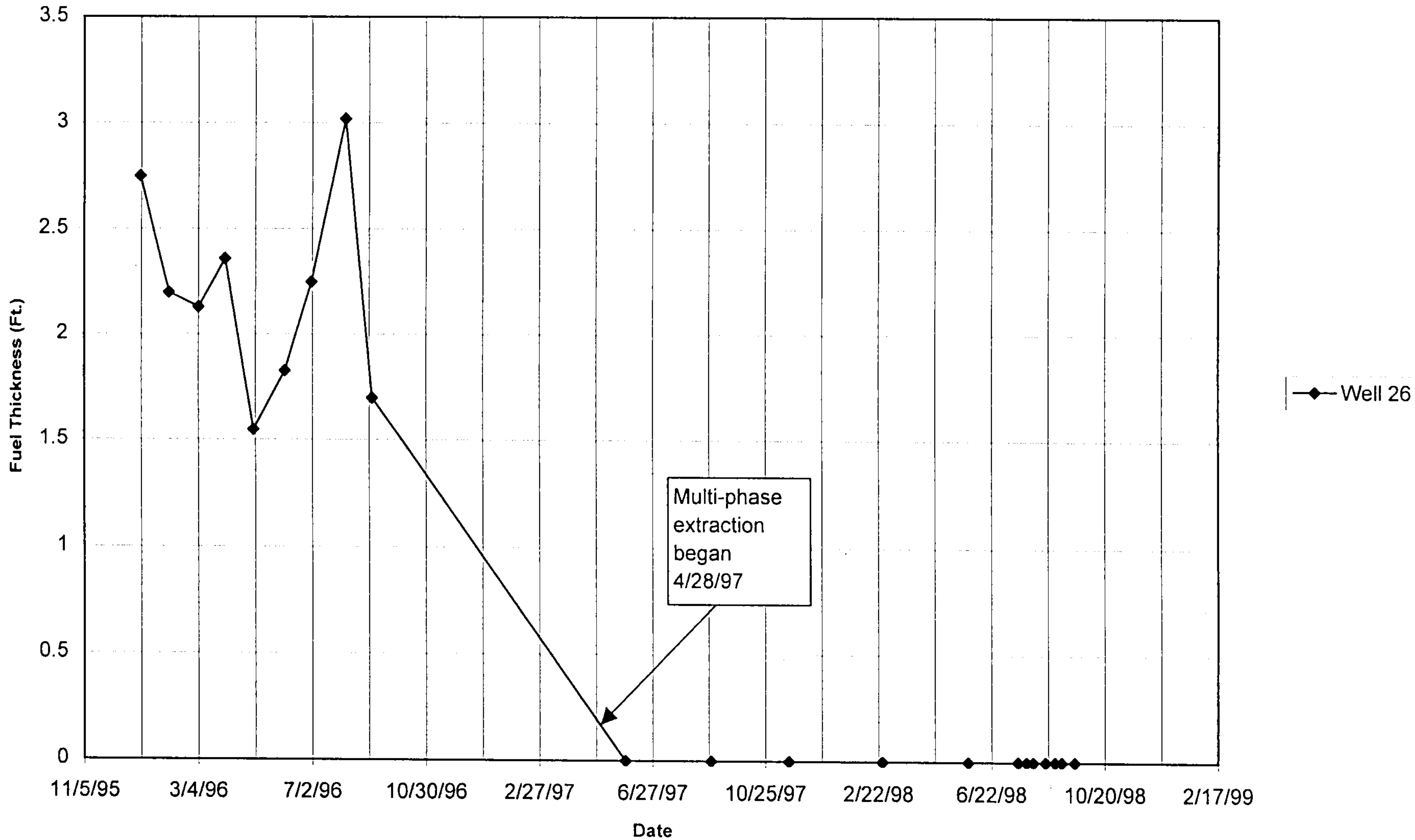


FIGURE 11: FUEL THICKNESS AT NAS CORPUS CHRISTI FUEL FARM 216 MW-29