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REMEDIAL ACTION PLAN BUILDING 425 NS MAYPORT FL
7/31/2003
TETRA TECH

Remedial Action Report
for
Site 425

Naval Station Mayport
Mayport, Florida



Southern Division
Naval Facilities Engineering Command
Contract Number N62467-94-D-0888
Contract Task Order 0123

July 2003

**REMEDIAL ACTION REPORT
FOR
SITE 425**

**NAVAL STATION MAYPORT
MAYPORT, FLORIDA**

**COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION-NAVY (CLEAN) CONTRACT**

**Submitted to:
Southern Division
Naval Facilities Engineering Command
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**CONTRACT NUMBER N62467-94-D-0888
CONTRACT TASK ORDER 0123**

JULY 2003

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The professional opinions rendered in this decision document identified as Remedial Action Report for Building 425, Naval Station Mayport, Mayport, Florida were developed in accordance with commonly accepted procedures consistent with applicable standards of practice. Decision documents were prepared under the supervision of the signing engineer and are based on information obtained from others. If conditions are determined to exist differently than those described in this document, then the undersigned professional engineer should be notified to evaluate the effects of any additional information on the project described in this document.



July 31, 2008
Gregory S. Roof, P.E.
Professional Engineering Number 50842
Tetra Tech NUS, Inc. Engineering No. 7988



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ACRONYMS

AFVR	Aggressive Fluid Vapor Recovery
AST	Aboveground Storage Tank
CLEAN	Comprehensive Long-term Environmental Action Navy
CTO	Contract Task Order
EcoVac	EcoVac Services, Inc.
FDEP	Florida Department of Environmental Protection
ft	Feet
lbs	Pounds
msl	Mean Sea Level
Navy	United States Navy
NS	Naval Station
PCW	Petroleum Contact Water
ppm	Parts per Million
PVC	Polyvinyl Chloride
RA	Remedial Action
RAP	Remedial Action Plan
SAR	Site Assessment Report
TPH	Total Petroleum Hydrocarbons
TiNUS	Tetra Tech NUS, Inc.
VOC	Volatile Organic Compounds

EXECUTIVE SUMMARY

Tetra Tech NUS, Inc. (TtNUS) has completed this report documenting the remedial action (RA) for Building 425 at Naval Station (NS) Mayport, Mayport, Florida. The RA was conducted in general accordance with the requirements of Chapter 62-770, Florida Administrative Code and the Remedial Action Plan (RAP) (TtNUS, 2002).

The RAP evaluated various free product removal alternatives and determined that Aggressive Fluid Vapor Recovery (AFVR) was best suited for this site. The use of AFVR offers a low cost alternative to operations and maintenance, no permanent system is needed, and both the vapor phase and mobile free product is removed simultaneously. These phases are removed from the subsurface using vacuum truck pumps to create high flow rates and vacuum pressures. TtNUS performed AFVR at the site, which included the following tasks:

- Completed three aggressive fluid vapor recovery (AFVR) events at monitoring well MW-04.
- Installed 10 piezometers to determine the extent of free product and evaluated the effectiveness of the RA.
- Prepared a report documenting findings.

Prior to each AFVR event, free product thickness was measured in well MW-04. The well was then subjected to the AFVR process for approximately 8 hours for each event removing petroleum and contaminated water until the vacuum tanker (2497 gallon capacity) was full. Due to the emulsion of the free product in the vacuum tank, the amount of free product removed could not be estimated. Based on emissions data provided by EcoVac Services, Inc. (EcoVac), a total of 16.4 pounds (lbs) of petroleum hydrocarbons were removed from the subsurface during the AFVR events. Free product was not present in the well at the end of the AFVR events.

The AFVR events were not successful in preventing free product rebound. As a result, the NS Mayport Partnering Team directed additional assessment of the area surrounding MW-04 for free product. A total of 10 piezometers were installed and monitored over a period of four events. Free product was detected in only one of the 10 piezometers.

Due the limited extent of contamination at this site, the United States Navy (Navy) has determined that a source removal via excavation is appropriate. Excavation work will be conducted to remove any available remaining impacted soils from the capillary fringe that may be the source of the observed free product rebound.

1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE

An RA was performed by TtNUS for the Navy Southern Division, Naval Facilities Engineering Command under Contract Task Order (CTO) 0123, for the Comprehensive Long-term Environmental Action Navy (CLEAN) Contract Number N62467-94-D-0888. The RA was conducted at Building 425 which is located at NS Mayport, Duval County, Florida. The Florida Department of Environmental Protection (FDEP) Facility Identification Number is FL168626008.

The purpose of this RA was to perform free product recovery and to obtain site closure. The following remedial actions and assessments were completed at Building 425:

- Completed three AFVR events and monitored the effectiveness of the actions.
- Installed piezometers to determine area of free product.
- Monitored piezometers for presence or absence of free product.
- Prepared a report describing results of the RA.

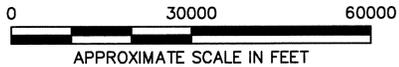
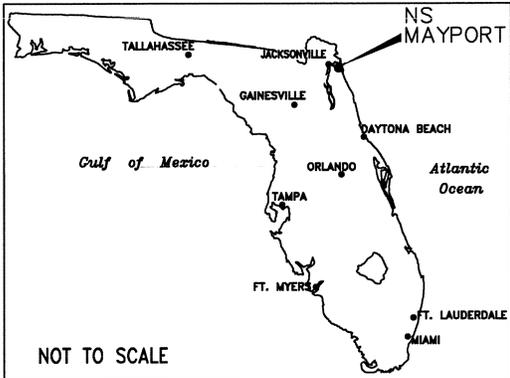
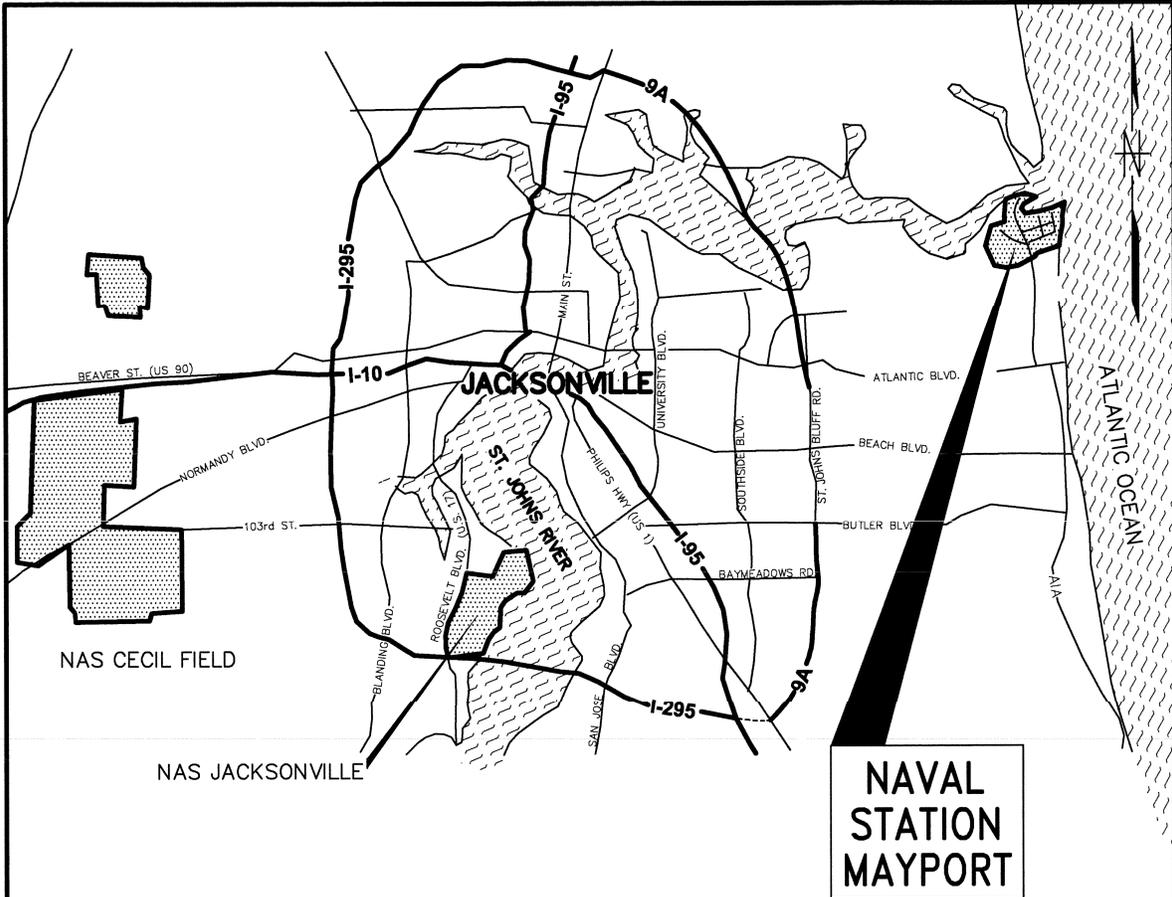
1.2 SITE DESCRIPTION AND SETTING

1.2.1 Location

NS Mayport is located within the corporate limits of the city of Jacksonville, Florida in Duval County, approximately 12 miles to the northeast of downtown Jacksonville, and adjacent to the town of Mayport, Florida. A Regional Area Map is provided as Figure 1-1. The Naval Station complex is located on the northern end of a peninsula bounded by the Atlantic Ocean to the east and the St. Johns River to the north. NS Mayport occupies the entire northern part of the peninsula except for the town of Mayport, which is located to the west between the Station and the St. Johns River.

1.2.2 Site Description

Building 425 is the Bachelor Officer's Quarters located in the northeastern section of NS Mayport as shown on Figure 1-2. It is comprised of two separate structures that are connected by a walkway. The source area for the current investigation is a grass covered area that abuts the northwest corner of the lobby and is west of the walkway that connects the two buildings. A site plan is presented as Figure 1-3.

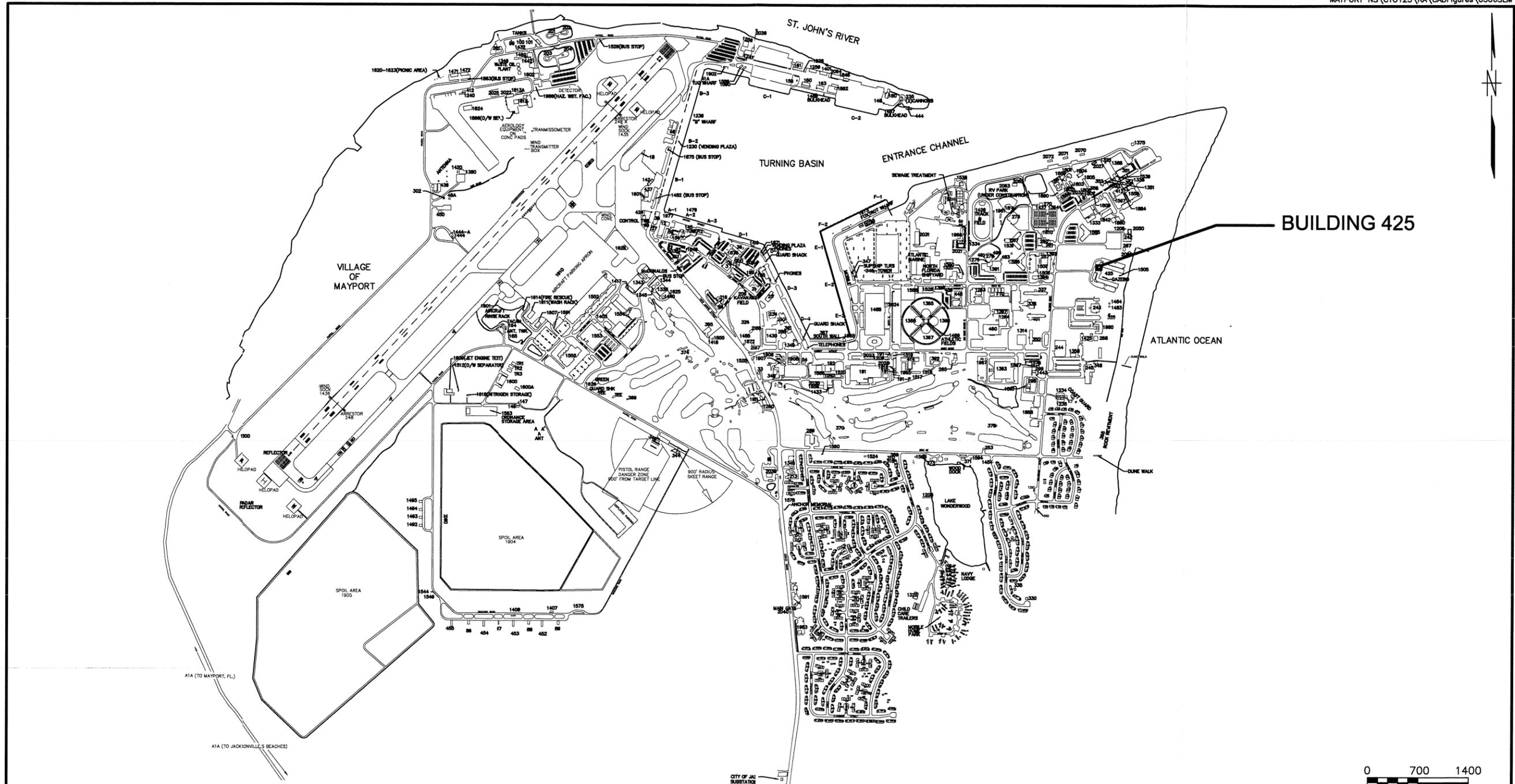


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REGIONAL AREA MAP
REMEDIAL ACTION REPORT
BUILDING 425
NAVAL STATION MAYPORT
MAYPORT, FLORIDA

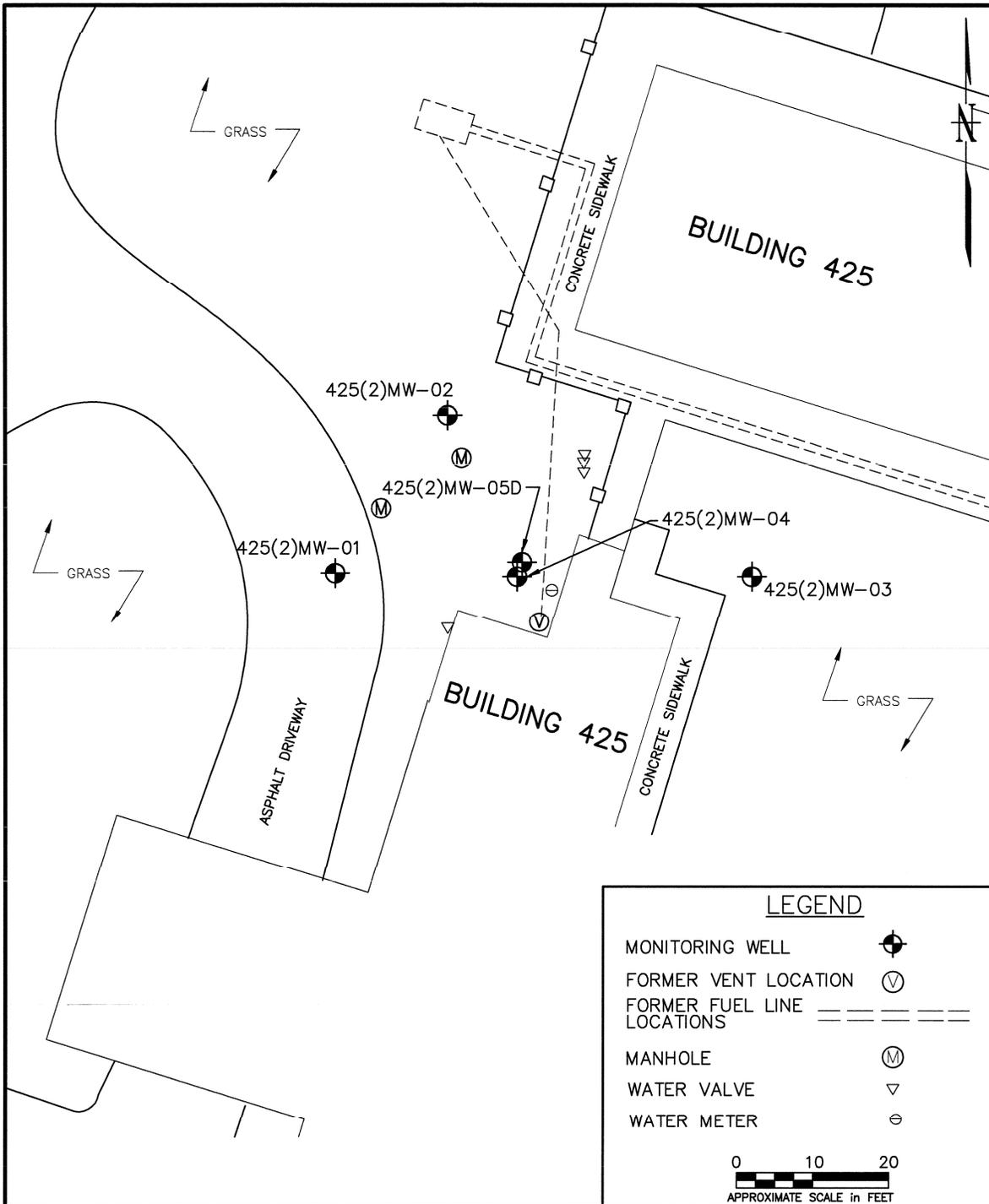
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NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES	DRAWN BY	DATE		SITE LOCATION MAP REMEDIAL ACTION REPORT BUILDING 425 NAVAL STATION MAYPORT MAYPORT, FLORIDA		CONTRACT NO.	0506
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											FIGURE 1-2	0	

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SITE PLAN
 REMEDIAL ACTION REPORT
 BUILDING 425
 NAVAL STATION MAYPORT
 MAYPORT, FLORIDA

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1.3 SITE HISTORY

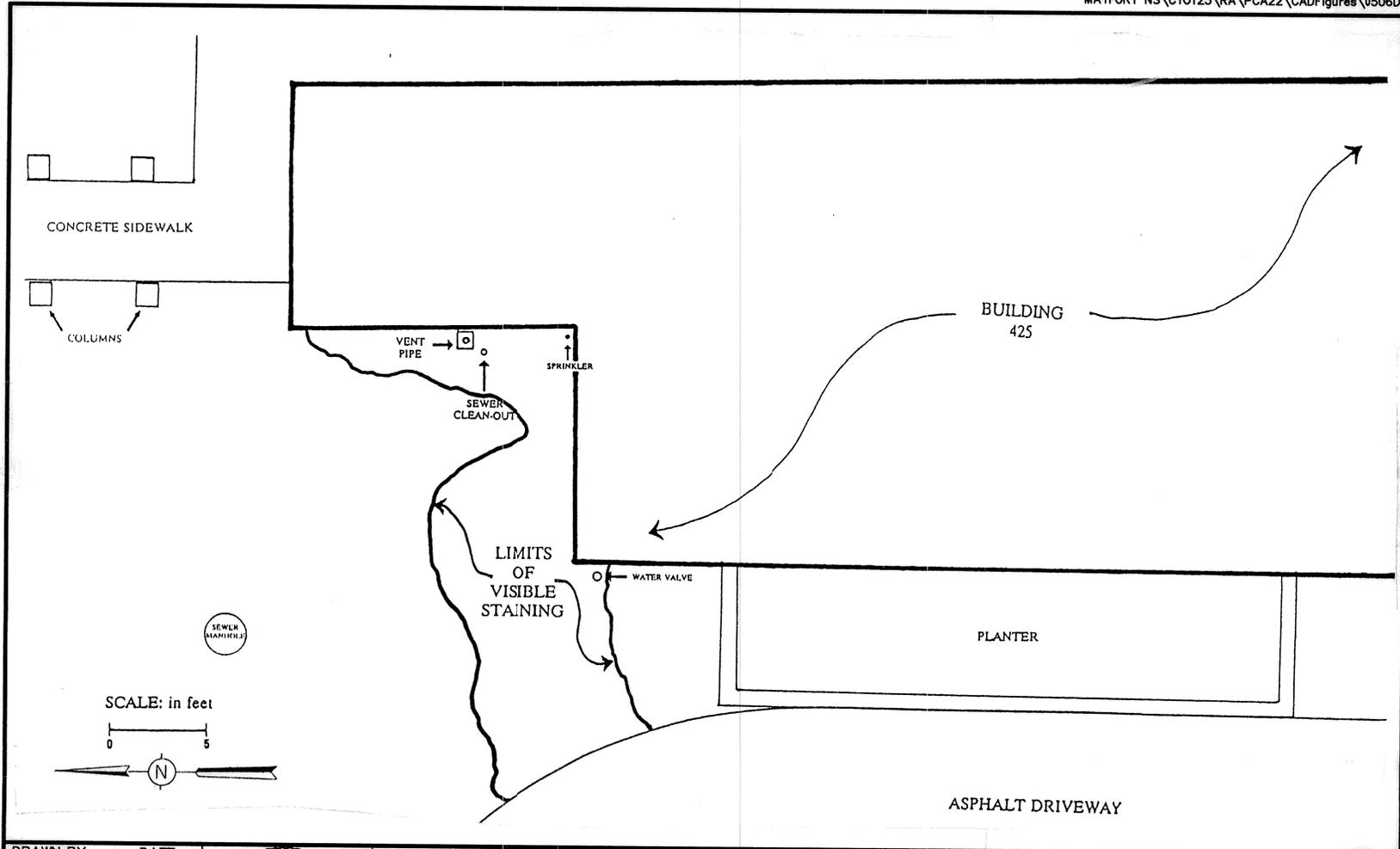
Building 425 is the location of two separate releases involving a 1000-gallon aboveground storage tank (AST) used for fuel oil storage. The releases occurred in two different areas designated as Area 1 and Area 2 and shown on Figure 1-4. A release of 500 gallons of fuel oil reportedly occurred in Area 1 when an electrical contractor severed a product line. A January 1996 report prepared by Coastal Sciences, Inc. documents the release. Subsequently, the AST was relocated to Area 2.

Based on a February 1996, Fuel Spill Clean-Up Report prepared by Coastal Science Associates, Inc. (Coastal, 1996), a release in Area 2 occurred in late February of 1996 when a faulty float valve in a day tank malfunctioned. The faulty valve back-pressured the 1,000 gallon fuel oil tank resulting in a discharge from the vent pipe located near the corner of the building. The petroleum discharging from the vent line impacted an area near the northwestern corner of Building 425 and flowed west, approximately 30 ft following the contour of the land. The quantity of fuel oil released in Area 2 was estimated to be 600 to 700 gallons and impacted approximately 55 to 60 cubic yards soil that were removed during an initial remedial action. Some impacted soil was not removed due to its proximity to the building foundation. Product was observed during the excavation and a figure depicting the excavated area from the Fuel Spill Clean-Up Report is provided as Figure 1-5. Note in this figure, the vent pipe is located differently from where it has been depicted on all other figures associated with the site. TtNUS assumes that this location is incorrect. The excavation drawings show the vent pipe in the corner of the building.

Due to the release of petroleum at the northwestern corner of Building 425, a Site Assessment Report (SAR) was prepared by TtNUS and submitted to the FDEP in December 2000. It was recommended that no further action be granted for Area 1 and that a RAP be prepared for Area 2 because of the presence of free phase hydrocarbons (free product). In a letter (FDEP, 2001a) dated February 22, 2001, the FDEP directed that the Navy prepare a RAP for Area 2. Since FDEP's letter directed the remediation of contaminated soil and not free product, the Navy and TtNUS conferenced with FDEP and a decision was reached that free product removal rather than impacted soils would be the remedial objective of the Area 2 RAP. A copy of a letter is dated February 22, 2001, is provided in Appendix A.

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1-7



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SCALE NOT TO SCALE	



DIESEL SPILL LOCATION
REMEDIAL ACTION REPORT
BUILDING 425
NAVAL STATION MAYPORT
MAYPORT, FLORIDA

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CTO 0123

A RAP (TtNUS, 2002) dated July 2002 was prepared by TtNUS and submitted to the Navy and the FDEP. The RAP evaluated various free product removal activities and determined that AFVR was recommended based on knowledge of site lithology, soil permeability, cost, and AFVR applications at other sites with similar soil conditions. Based on the recommendations from the RAP, it was decided by the NS Mayport Partnering Team that AFVR would be used to remove free phase product from the surficial aquifer in Area 2. This action was initiated on July 17, 2002, when the first AFVR event as detailed in this report began.

2.0 REMEDIAL ACTION EVENTS AND RESULTS

2.1 GROUNDWATER ELEVATION MEASUREMENTS

Prior to each AFVR event (July 17, 2002; August 19, 2002; and September 23, 2002), depth-to water was measured from the top-of-casing at four site monitoring wells [MPT-425-MW-01 (MW-01), MW-02, MW-03, and MW-04] using an oil/water interface probe. The top-of casing elevations for the monitoring wells were surveyed relative United States Geological Survey benchmark by a registered surveyor during site assessment activities in December 2000. The relative water table elevation at each location was calculated by subtracting the depth-to-water measurement from the surveyed top-of-casing elevation, and a groundwater flow direction (potentiometric) map was generated from the water table elevation data.

The direction of groundwater flow in the uppermost surficial aquifer underlying the site was calculated to be to the north/northeast. Groundwater elevation data taken on July 17, 2002; August 19, 2002; and September 23, 2002, are presented in Table 2-1. Groundwater flow maps based on the depth-to-water measurements on July 17, 2002, and August 19, 2002, are provided as Figure 2-1 and Figure 2-2, respectively. Three separate groundwater elevation measurements were taken and two of the measurements (July 17, 2002, and September 23, 2002) depict the groundwater flow to be toward the east while the third measurement taken on August 19, 2002, depicts a northern flow direction. The groundwater flow direction determined in December 2000 (TtNUS SAR) calculated the groundwater flow direction to be toward the northwest and is presented as Figure 2-3. Given the close proximity to the Atlantic Ocean and the varied groundwater flow directions, the changes in groundwater directions may be due to tidal influence.

2.2 AGGRESSIVE FLUID VAPOR RECOVERY EVENTS

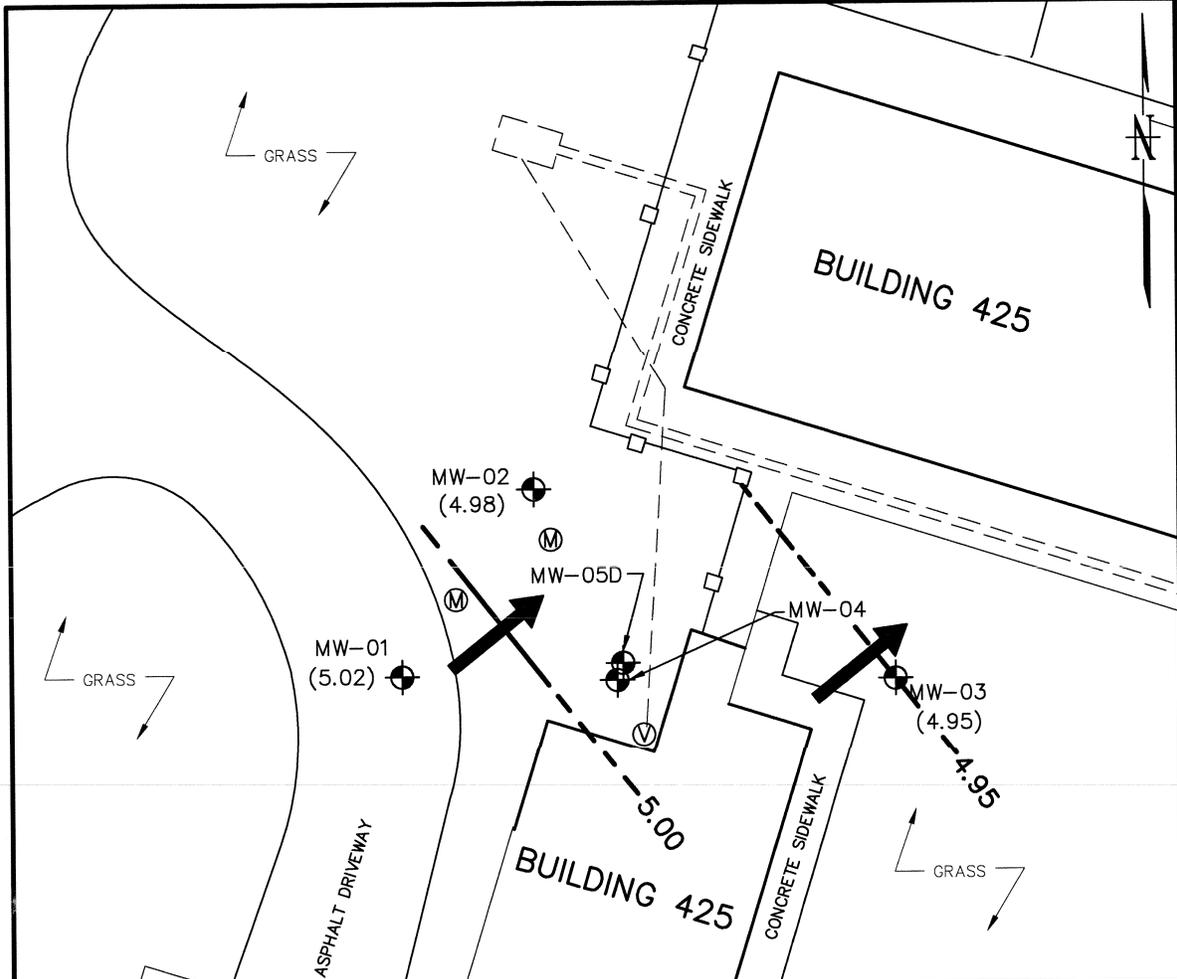
On July 17, 2002; August 19, 2002; and September 23, 2002, AFVR was performed at groundwater monitoring well MPT-425-MW-04 located at Building 425. AFVR is an innovative technology that allows the simultaneous removal of multiple phases (i.e., dissolved, vapor, absorbed, and liquid) of petroleum compounds. These phases are removed from the subsurface utilizing high flow rates and vacuum pressures created by the pumps of a vacuum truck. EcoVac, under subcontract to TtNUS, performed the AFVR events. The differential vapor pressure and groundwater elevations in nearby monitoring wells were measured by EcoVac to assess the radius of influence.

**Table 2-1
Groundwater Elevation Measurements**

Remedial Action Report for Building 425
Naval Station Mayport
Mayport, Florida

Well ID	Top-of-Casing Elevation (ft msl)	Depth to Water Elevation (ft)	Depth to Water Elevation (ft)	Depth to Water Elevation (ft)	Depth Elevation (ft msl)	Depth Elevation (ft msl)	Depth Elevation (ft msl)
	Date	07/17/02	08/19/02	09/23/02	07/17/02	08/19/02	09/23/02
MPT-425-MW-01	12.57	7.55	7.89	6.98	5.02	4.68	5.59
MPT-425-MW-02	12.67	7.69	8.03	7.12	4.98	4.64	5.55
MPT-425-MW-03	12.86	7.91	8.20	7.31	4.95	4.66	4.45
MPT-425-MW-04	12.57	FP	FP	FP	FP	FP	FP

Notes:
msl = mean sea level
ft = feet or foot
FP = free product present no water level taken



LEGEND

- MONITORING WELL
- (5.02) WATER TABLE ELEVATION (FT MSL)
- 5.00' EQUIPOTENTIAL LINE (FT MSL) (DASHED WHERE INFERRED)
- INFERRED DIRECTION OF GROUNDWATER FLOW
- FORMER FUEL LINE LOCATIONS
- FORMER VENT LOCATION
- MANHOLE

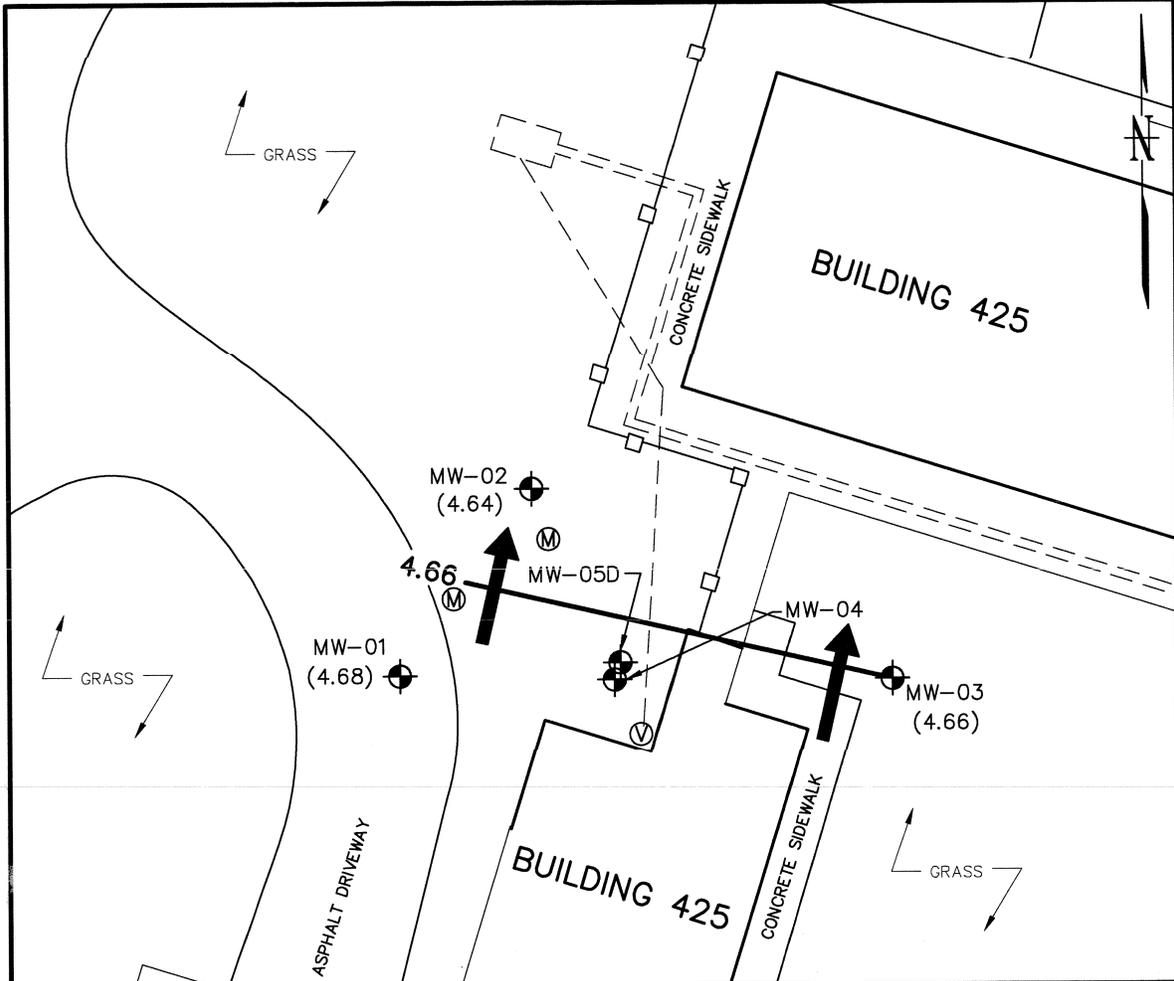
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APPROXIMATE SCALE in FEET

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GROUNDWATER ELEVATION
CONTOUR MAP, JULY 2002
REMEDIAL ACTION REPORT
BUILDING 425
NAVAL STATION MAYPORT
MAYPORT, FLORIDA

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REV.	0

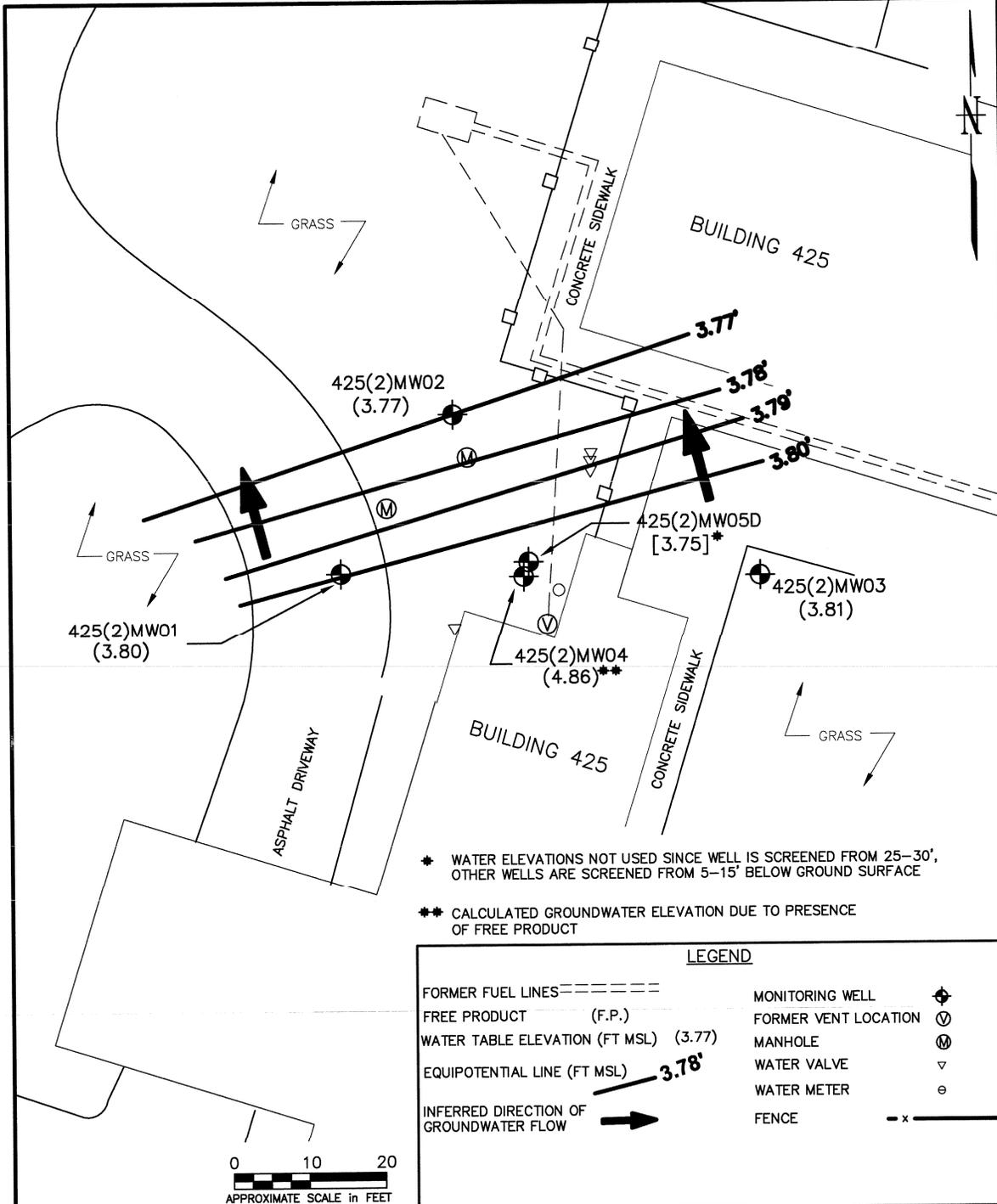


LEGEND

- MONITORING WELL
- (4.68) WATER TABLE ELEVATION (FT MSL)
- 4.66 EQUIPOTENTIAL LINE (FT MSL)
(DASHED WHERE INFERRED)
- INFERRED DIRECTION OF GROUNDWATER FLOW
- FORMER FUEL LINE LOCATIONS
- FORMER VENT LOCATION
- MANHOLE

0 10 20
APPROXIMATE SCALE in FEET

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* WATER ELEVATIONS NOT USED SINCE WELL IS SCREENED FROM 25-30', OTHER WELLS ARE SCREENED FROM 5-15' BELOW GROUND SURFACE

** CALCULATED GROUNDWATER ELEVATION DUE TO PRESENCE OF FREE PRODUCT

LEGEND	
FORMER FUEL LINES	=====
FREE PRODUCT (F.P.)	---
WATER TABLE ELEVATION (FT MSL) (3.77)	—————
EQUIPOTENTIAL LINE (FT MSL) 3.78'	—————
INFERRED DIRECTION OF GROUNDWATER FLOW	➔
MONITORING WELL	⊕
FORMER VENT LOCATION	⊕
MANHOLE	⊗
WATER VALVE	∇
WATER METER	⊙
FENCE	- x -

DRAWN BY	DATE
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COST/SCHED-AREA	
SCALE	
AS NOTED	



GROUNDWATER ELEVATION
CONTOUR MAP, JUNE 2000
REMEDIAL ACTION REPORT
BUILDING 425
U.S. NAVAL STATION MAYPORT
MAYPORT, FLORIDA

CONTRACT NO.	0506
APPROVED BY	DATE
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REV.	0

Each AFVR event at Building 425, Area 2, lasted between six and eight hours and the events were spaced approximately 30 days apart. At the completion of each event, petroleum contact water (PCW) was retained in a vacuum truck and transported to Industrial Water Services of Jacksonville, a Florida licensed disposal facility. Manifests documenting the disposal location, date, and volume of the PCW are presented in Appendix B.

Air emissions monitoring was performed during each event to determine an estimate of emissions produced during each effort. The formula for determining the concentration of emissions is provided in Appendix C.

Air monitoring was performed via an organic vapor analyzer equipped with a flame ionization detector. The sampling port for off-gas air monitoring was located 3.5 ft off the ground in a 12-ft tall, 3-inch diameter emissions stack. The FDEP daily limit for air emissions is 13.7 lbs or 1.71 lbs per eight hour day for total petroleum hydrocarbons (TPH). The air emissions were measured for the purpose of calculating the rate during each event. The daily rate of 13.7 lbs per day was not exceeded during any of the three events. After each event, the fluid in the tank of the AFVR truck was measured for the presence of free product. No measurable volume of free product was observed from these events.

2.2.1 AFVR Event I

On July 17, 2002, a TtNUS representative and Ecovac representatives were on site for the first of three events. Prior to beginning, 0.25 ft of product was measured in MW-04. The AFVR event took 6.7 hours, a total of 13.6 lbs of TPH was volatilized, and 2,498 gallons of PCW were removed. The TPH emissions reading peaked at 7,400 parts per million (ppm) and declined to 1,100 ppm. The radiuses of pressure influence and groundwater draw down created by this AFVR event were measured during operations in surrounding monitoring wells. Based on these readings, the area of influence appears to have been approximately 24 ft, sufficient to reach beneath the adjacent building. Table 2-2 details the results of the events. A summary report for Event 1 prepared by EcoVac is provided in Appendix D.

Two weeks were allowed to pass before measuring the free product in monitoring well MW-04. On August 1, 2002, MW-04 was gauged and a reading of 0.2 ft of product was recorded.

**Table 2-2
AFVR Summary**

Remedial Action Report for Building 425
Naval Station Mayport
Mayport, Florida

AFVR Date	Range of Emissions Measurements (ppm)	Average VOC Emissions Rate (lbs per hour)	Radius of Pressure Influence (ft)	Radius of Groundwater Drawdown (ft)	Volume of PCW Collected (gal)	Free Product (MW-04) Pre-AFVR (ft)	Free Product (MW-04) Post-AFVR (ft)
7/18/2002	7,400 – 1,100	0.271	24	30	2,498	0.25	0.2
8/20/2002	400 – 100	0.011	30	30	2,275	0.01	0.00
9/24/2002	2,600 – 80	0.065	30	30	2,719	0.17	0.2

Notes:

The FDEP emissions rate should not exceed 1.71 lbs per hour.
 Prior to beginning each event, MW-04 and other wells were measured for free product.
 Post AFVR product measurements were no sooner than two weeks after the AFVR event.
 gal = gallons
 Radius of Pressure = area of influenced by the vacuum pressure created at MW-04.
 Radius of Groundwater Drawdown = area of decreasing groundwater levels due to the removal of groundwater at MW-04.

2.2.2 AFVR Event II

On August 19, 2002, the second of three AFVR events was completed. Prior to beginning, a free product measurement of 0.01 ft of free product was recorded in monitoring well MW-04. The AFVR event took approximately 8 hours and recovered 2,275 gallons of PCW. Emission concentrations ranged from 400 ppm to 100 ppm. The TPH removed during the eight hour event was estimated at 0.9 lbs, which is less than the FDEP maximum permissible emission rate of 13.7 lbs per day for volatile organic compounds (VOCs). The radius of pressure influence created by this AFVR event was approximately 30 ft. Table 2-2 details the results of the AFVR events. A summary report for Event 2 prepared by EcoVac is provided in Appendix D.

Two weeks were allowed to pass before measuring the free product in monitoring well MW-04. On September 3, 2002, monitoring well MW-04 was gauged and contained no free product; however, a petroleum odor was detected.

2.2.3 AFVR Event III

On September 24, 2002, the third of three AFVR events began. Prior to beginning, a free product measurement of 0.17 ft was recorded in monitoring well MW-04. The AFVR event took approximately 8 hours and recovered 2,719 gallons of PCW. Emission concentrations ranged from 2,600 ppm to 80 ppm. The TPH removed during the eight hour event was 1.9 lbs, which is less than the FDEP maximum permissible emission rate of 13.7 lbs per day for VOCs. The radius of pressure influence created by this AFVR was approximately 30 ft. Table 2-2 details the results of the AFVR events. A summary report of Event 3 prepared by EcoVac is provided as Appendix D.

On October 31, 2002, a 0.2 ft of free product was measured at monitoring well MW-04.

2.3 AFVR RESULTS

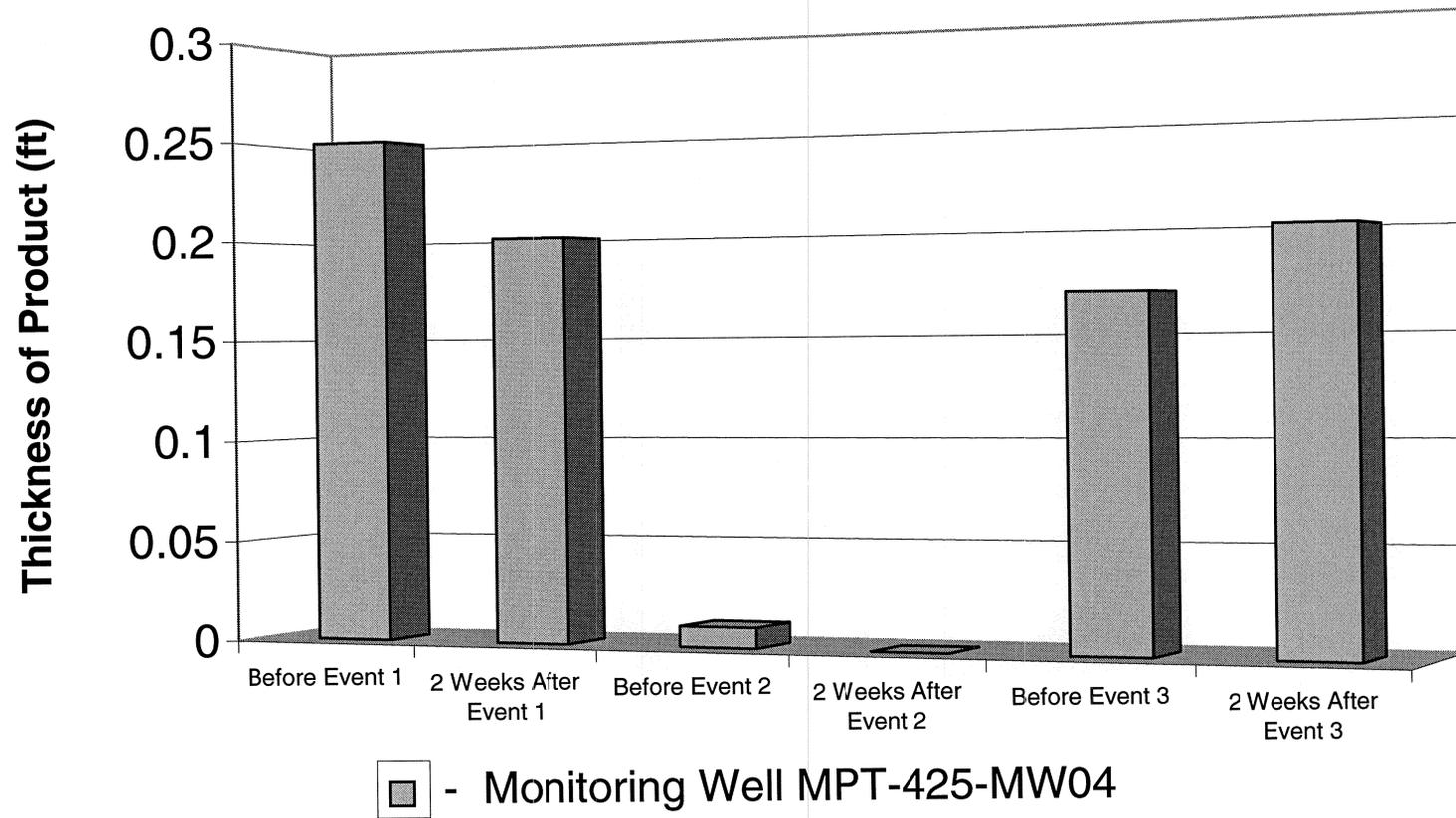
Three AFVR events were performed by EcoVac and supervised by a TtNUS representative on July 18, 2002; August 20, 2002; and September 24, 2002. The results of each AFVR event detailing the hydrocarbon removal rate, zone of influence, and the volume of PCW removed are provided in Appendix D. A total of 16.4 lbs of TPH were removed from the subsurface during AFVR operations. Photographs documenting activities during the three AFVR events are provided as Appendix E.

The AFVR technology was successful in removing petroleum hydrocarbons from the subsurface. In three events however, it was not successful in preventing free product rebound. A graph indicating the free

product thickness in MW-04 both prior to and after each event is provided in Figure 2-4. Review of the figure indicates that measured free product thickness in the well decreased after each event but later rebounded.

**FIGURE 2-4
MONITORING WELL PRODUCT THICKNESS MEASUREMENTS**

**REMEDIAL ACTION REPORT
BUILDING 425
NAVAL STATION MAYPORT, MAYPORT FLORIDA**



3.0 ADDITIONAL ASSESSMENT AND RESULTS

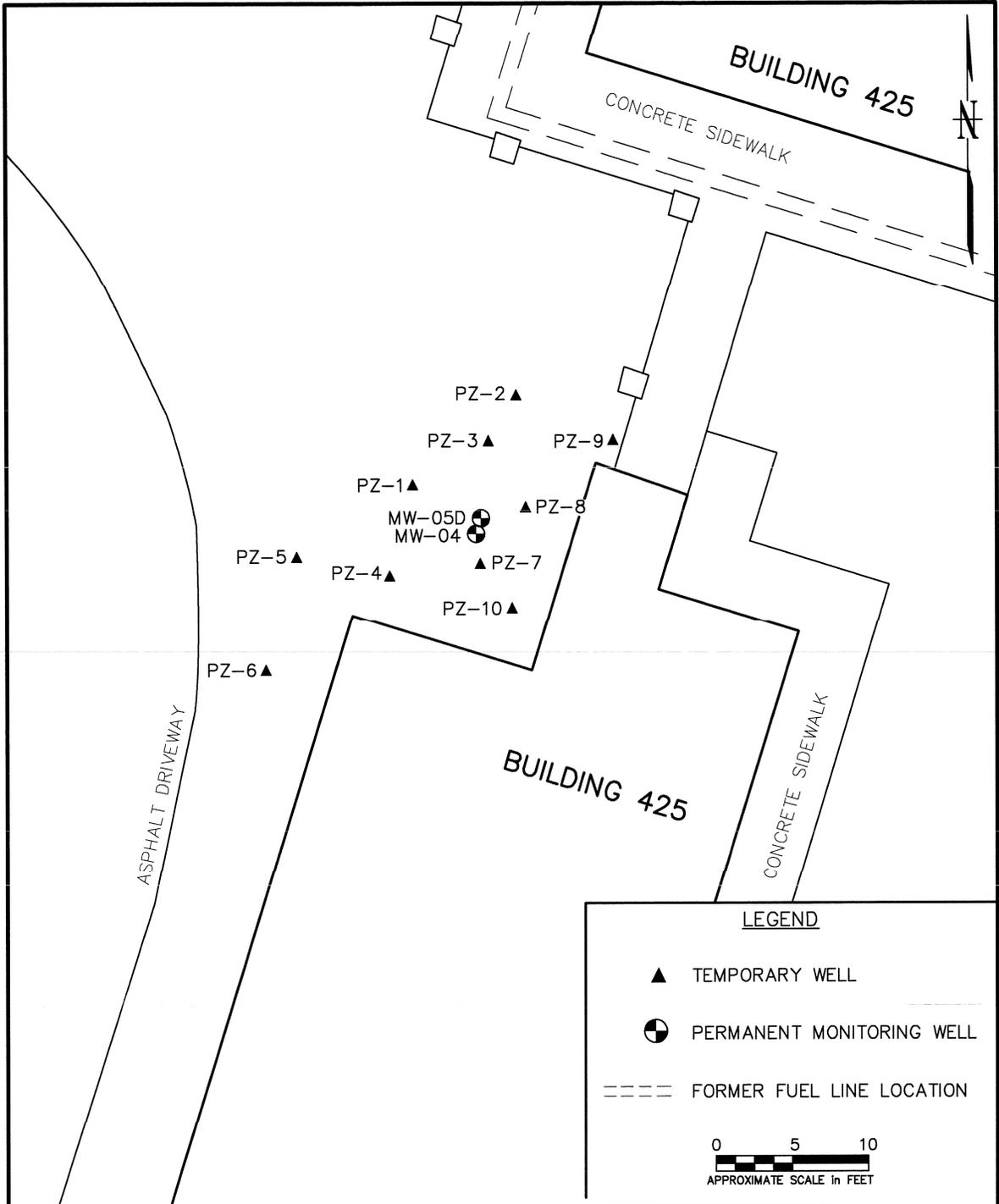
3.1 PIEZOMETER INSTALLATION

The results of the AFVR events were presented to the NS Mayport Partnering team on October 8, 2002. Based on the continued presence of free product in monitoring well MW-04, it was decided that an additional investigation of the source area was warranted. On October 29, and 30, 2002, ten piezometers were installed to evaluate free product occurrence. Soil borings were completed using a stainless steel hand auger to an approximate depth of 10 ft below land surface in the vicinity of monitoring well MW-04. Piezometers were installed by TtNUS representatives within each boring. The 10-ft long piezometers were constructed of single section, two-inch diameter Schedule 40 polyvinyl chloride (PVC). The bottom 9 ft of the PVC section was constructed of 0.010-inch mill-slotted well screen and the upper ft was solid PVC. Pre-washed 20/30 silica sand was poured into the annular space between the borehole and piezometer from total depth to land surface. No field evidence of contaminated soil was noted in vadose zone soils in any of the borings. Saturated soil from piezometer PZ-10 located adjacent to the building footer contained an oil odor. Soil boring logs for the piezometers are presented as Appendix F and a diagram of a typical piezometer is provided as Figure 3-1.

On October 31, 2002, the piezometers were developed using a Teflon hand bailer and the purge water was containerized for disposal. Piezometers were purged dry five times during development to help draw free product, if present, through the formation.

3.2 PRODUCT ASSESSMENT RESULTS

After the AFVR operations and the piezometer installation were complete, four separate product measurement events were conducted. The 10 piezometers and monitoring well MW-04 were measured between October and November of 2002 and February and March of 2003. During each event, free product was recorded in monitoring well MW-04. The only other detection of free product was obtained from piezometer PZ-10 during the February and March measurements. Varied product level measurements were evident in MW-04. Monitoring well MW-04 is recorded to have product thickness measurements ranging between 0.2 ft and 0.1 ft during the time period of October 2002 to March 2003. Measurements taken from PZ-10 on February 14, and March 19, 2003, indicated product level thickness measurements of 0.1 ft and 0.2 ft. Results are summarized in Table 3-1 and illustrated in Figure 3-2. Piezometer PZ-10 is the closest piezometer to the northwestern corner of Building 425 and is adjacent to the building footer. Two other piezometers line the building foundation (PZ-8 and PZ-4) were found to contain no free product. The foundation extends out from the wall approximately 3 ft. It is documented in



DRAWN BY LLK	DATE 1/06/03
CHECKED BY	DATE
COST/SCHED-AREA	
SCALE AS NOTED	



PIEZOMETER LOCATIONS
BUILDING 425
REMEDIAL ACTION REPORT
NAVAL STATION MAYPORT
MAYPORT, FLORIDA

CONTRACT NO.	0506
APPROVED BY	DATE
APPROVED BY	DATE
DRAWING NO.	FIGURE 3-1
REV.	0

the 1996, Coastal Science Associates, Inc. Fuel Spill Clean-Up report (Coastal, 1996) that product impacted soil was left in the area of the building foundation. Free product was not observed in any of the other piezometers, including PZ-7, which is located between MW-04 and PZ-10.

**Table 3-1
Free Product Thickness Measurements**

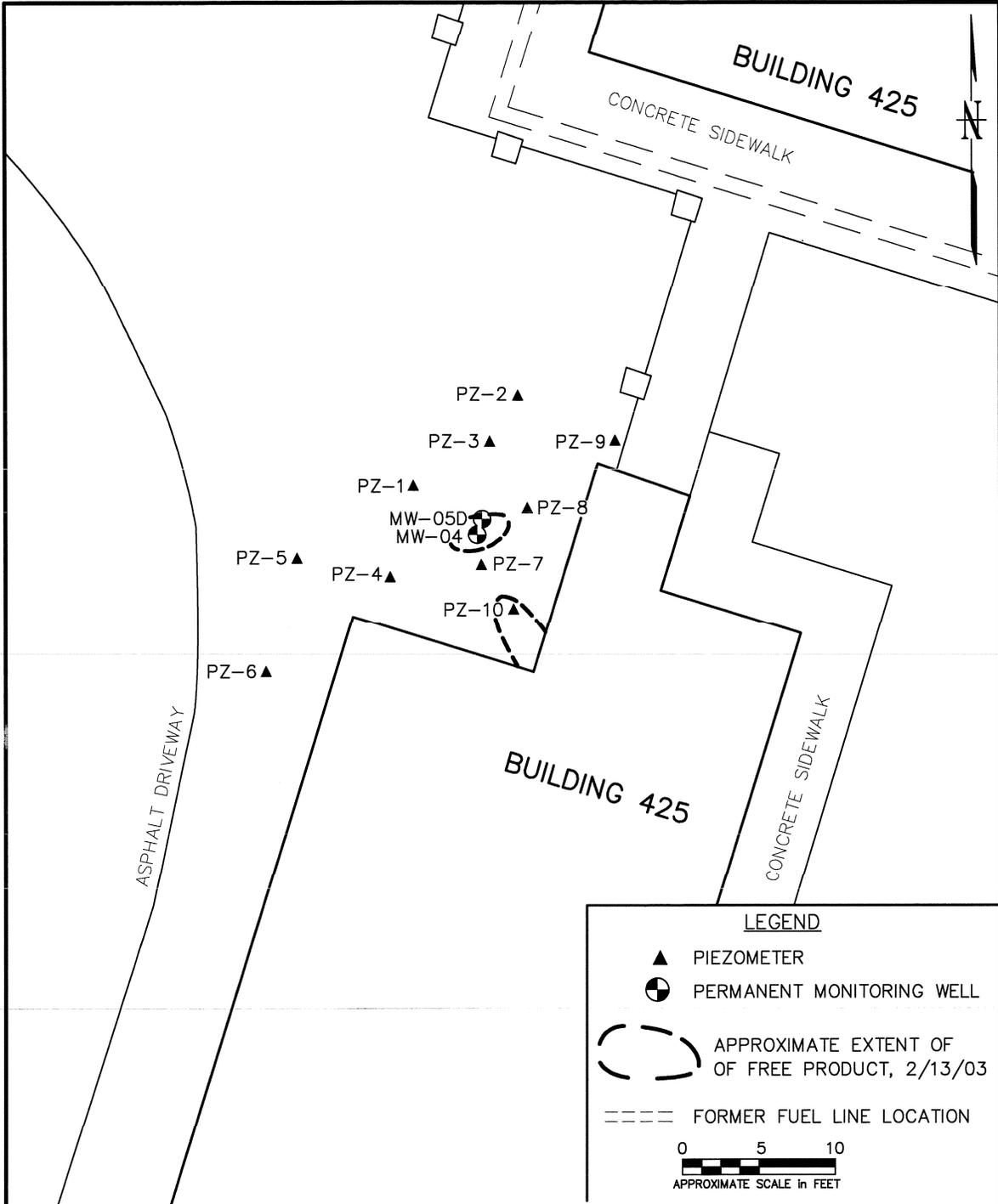
Remedial Action Report for Building 425
Naval Station Mayport
Mayport, Florida

ID/Date	07/17/02 (ft)	08/19/02 (ft)	09/23/02 (ft)	10/31/02 (ft)	11/04/02 (ft)	02/14/03 (ft)	03/19/03 (ft)
PZ-1	NP	NP	NP	0	0	0	0
PZ-2	NP	NP	NP	0	0	0	0
PZ-3	NP	NP	NP	0	0	0	0
PZ-4	NP	NP	NP	0	0	0	0
PZ-5	NP	NP	NP	0	0	0	0
PZ-6	NP	NP	NP	0	0	0	0
PZ-7	NP	NP	NP	0	0	0	0
PZ-8	NP	NP	NP	0	0	0	0
PZ-9	NP	NP	NP	0	0	0	0
PZ-10	NP	NP	NP	0	0	0.1	0.2
MW-04	0.25	0.01	0.17	0.2	0.15	NM	0.1

Notes:

0 = no measurable free product
 NP = Piezometers were not installed until after September 23, 2002.
 NM = no measurements taken at this location.

The cause of the variability in free product measurements is not known. It is possible that soils in the capillary fringe in the vicinity of MW-04 and PZ-10 may be impacted and may release free product over time. It is suspected that groundwater fluctuations, possibly caused by tidal effects, are "flushing" impacted soils in the capillary zone releasing free product.



DRAWN BY LLK	DATE 1/06/03		AREAS OF FREE PRODUCT REMEDIAL ACTION REPORT BUILDING 425 NAVAL STATION MAYPORT MAYPORT, FLORIDA	CONTRACT NO. 0506	
CHECKED BY	DATE			APPROVED BY	DATE
COST/SCHED-AREA	SCALE AS NOTED			APPROVED BY	DATE
				DRAWING NO. FIGURE 3-2	REV. 0

4.0 CONCLUSIONS AND RECOMMENDATIONS

The results of the remedial actions performed by TtNUS at Building 425 are summarized as follows:

- The site is underlain by a surficial aquifer comprised of fill material and natural formation sand. The vadose zone is comprised of clean backfill from the initial remedial action. No confining layers were encountered within the upper 10 ft.
- Groundwater flow direction is varied and may be influenced by tidal effects.
- Free product was detected at varying thicknesses in the source area monitoring well (MW-04) and in one piezometer (PZ-10) located near the Building 425 foundation.
- Three AFVR events resulted in temporary decreases in free product measurements in well MW-04, but were not successful in preventing free product rebound. Additional assessment of the area via the installation of piezometers indicates that free product occurrence remains limited to the immediate vicinity of well MW-04 and PZ-10.

Based on the reoccurrence of free product, the Navy has determined that an alternative approach will be taken. The Navy intends to conduct a limited excavation to address the occurrence of free product at Building 425. The excavation will be designed to remove impacted soils that remain in the capillary fringe and are the likely source of free product rebound. After completion of the excavation work, groundwater monitoring will be conducted to evaluate the effectiveness of the removal action and to obtain site closure.

REFERENCES

Coastal (Coastal Science Associates, Inc.), 1996. Fuel Spill Clean-Up Report. February.

FDEP (Florida Department of Environmental Protection), Chapter 62-770, Florida Administrative Code.

FDEP, 2001a. Letter Regarding Site Assessment Report for Building 425, Naval Station Mayport, Florida. February.

FDEP, 2001b. DEP-SOP-001/01. Section FS-2000, General Aqueous Sampling.

TtNUS (Tetra Tech NUS, Inc.), 2000. Site Assessment Report for Building 425, Naval Station Mayport, Mayport, Florida. Prepared for Southern Division, Naval Facilities Engineering Command, North Charleston, South Carolina. December.

TINUS, 2002. Remedial Action Plan for Building 425, Naval Station Mayport, Mayport, Florida. Prepared for Southern Division, Naval Facilities Engineering Command, North Charleston, South Carolina. July.

APPENDIX A

FDEP CORRESPONDENCE



Department of Environmental Protection

Jeb Bush
Governor

Twin Towers Building
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

David B. Struhs
Secretary

February 22, 2001

Ms. Beverly Washington
Department of the Navy, Southern Division
Naval Facilities Engineering Command
2155 Eagle Drive, PO Box 190010
North Charleston, SC 29419-9010

file: 425sar1.doc

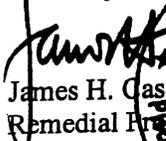
RE: Site Assessment Report for Building 425, Naval Station, Mayport, Florida

Dear Ms. Washington:

I have reviewed the above document dated December 2000 (received December 14, 2000). The site was divided into two subsites, Area 1 and Area 2. Documentation contained in the report confirmed that no further assessment is necessary for Area 1. Additional documentation contained in the report pertaining to Area 2 confirms that the requirements of Chapter 62-770.600, F.A.C. have been met. Please prepare a Remedial Action Plan for the petroleum-contaminated soil at Area 2.

If you need further clarification or any additional information, please feel free to contact me at 850-921-4230.

Sincerely,


James H. Gason, P.G.*
Remedial Project Specialist
FLORIDA
PROFESSIONAL GEOLOGIST

Feb. 22
Date

CC: Randy Bishop, NAVSTA Mayport
Terry Hansen, TetraTech, Tallahassee

TJB B JJC ffe ESN ffe

"Protect, Conserve and Manage Florida's Environment and Natural Resources"

Printed on recycled paper.

APPENDIX B

INVESTIGATIVE DERIVED WASTE DISPOSAL MANIFESTS

081902

NON-HAZARDOUS WASTE MANIFEST		1. Generator's US EPA ID No.	Manifest Doc. No.	2. Page 1 of 1
3. Generator's Name and Mailing Address <i>MAYPOUT NAVAL STATION Building 425 MAYPOUT, FL.</i>				
4. Generator's Phone ()				
5. Transporter 1 Company Name <i>Allrac Services</i>	6. US EPA ID Number <i>GA.R0.0.00.26.5.9.1</i>	A. Transporter's Phone <i>(770) 592-1001</i>		
7. Transporter 2 Company Name	8. US EPA ID Number	B. Transporter's Phone		
9. Designated Facility Name and Site Address <i>IWS 1640 Talley Road Ave. JACKSONVILLE, FL 32206</i>	10. US EPA ID Number	C. Facility's Phone <i>(800) 447-3592</i>		
11. Waste Shipping Name and Description		12. Containers No.	13. Total Quantity	14. Unit Wt/Vol
a. <i>Non-Hazardous; Non-Regulated Groundwater Containing Hydrocarbons</i>		<i>001</i>	<i>TT</i>	<i>2275 G</i>
b.				
c.				
d.				
D. Additional Descriptions for Materials Listed Above		E. Handling Codes for Wastes Listed Above		
15. Special Handling Instructions and Additional Information <i>Profile # 021868</i>				
16. GENERATOR'S CERTIFICATION: I certify the materials described above on this manifest are not subject to federal regulations for reporting proper disposal of Hazardous Waste.				
Printed/Typed Name <i>Charles Metz (for Navy)</i>		Signature <i>Charles Metz</i>		Month Day Year <i>08 19 02</i>
17. Transporter 1 Acknowledgement of Receipt of Materials				
Printed/Typed Name <i>Kim J. Vitovic JR</i>		Signature <i>Kim Vitovic JR</i>		Month Day Year <i>08 19 02</i>
18. Transporter 2 Acknowledgement of Receipt of Materials				
Printed/Typed Name		Signature		Month Day Year
19. Discrepancy Indication Space				
20. Facility Owner or Operator: Certification of receipt of waste materials covered by this manifest except as noted in Item 19.				
Printed/Typed Name <i>Jon Cross</i>		Signature <i>Jon Cross</i>		Month Day Year <i>08 19 02</i>

Please print or type
(Form designed for use on elite (12-pitch) typewriter.)

NON-HAZARDOUS WASTE MANIFEST		1. Generator's US EPA ID No.	Manifest Doc. No. 02923	2. Page 1 of 1
3. Generator's Name and Mailing Address Mayport Naval Station Bldg. 425 Mayport, FL				
4. Generator's Phone ()				
5. Transporter 1 Company Name Allvac Services	6. US EPA ID Number GAR00002659.1	A. Transporter's Phone (770)592-1001		
7. Transporter 2 Company Name	8. US EPA ID Number	B. Transporter's Phone		
9. Designated Facility Name and Site Address IWS 1610 Talleyrand Ave. Jacksonville, FL 32206	10. US EPA ID Number	C. Facility's Phone (800) 447-3592		
11. Waste Shipping Name and Description		12. Containers	13. Total Quantity	14. Unit Wt/Vol
a. Non-HAZ.; Non-Reg. Groundwater PCW (Petroleum Contact Water)		No. Type		
		001 TT	2719	G
b.				
c.				
d.				
D. Additional Descriptions for Materials Listed Above		E. Handling Codes for Wastes Listed Above		
15. Special Handling Instructions and Additional Information This PCW does NOT contain levels of HAZARDOUS Constituents Above those found in the source of the PCW. Profile # 021868				
16. GENERATOR'S CERTIFICATION: I certify the materials described above on this manifest are not subject to federal regulations for reporting proper disposal of hazardous waste.				
Printed/Typed Name Charles Metz		Signature Charles Metz		Month Day Year 09 23 02
17. Transporter 1 Acknowledgement of Receipt of Materials				
Printed/Typed Name Karl J. Vitore Jr.		Signature Karl Vitore Jr.		Month Day Year 09 23 02
18. Transporter 2 Acknowledgement of Receipt of Materials				
Printed/Typed Name		Signature		Month Day Year
19. Discrepancy Indication Space				
20. Facility Owner or Operator: Certification of receipt of waste materials covered by this manifest except as noted in Item 19.				
Printed/Typed Name Al Bott		Signature		Month Day Year 09 23 02

GENERATOR

TRANSPORTER

FACILITY

NON-HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No.

NA

Manifest Doc. No.

21868

2. Page 1

of 1

3. Generator's Name and Mailing Address

Area 2 - Building 425
U.S. Naval Station
Mayport, FL
David Siefken

4. Generator's Phone

(904) 281-0400

5. Transporter 1 Company Name

EcoVac Services

6. US EPA ID Number

A. Transporter's Phone

770-592-1001

7. Transporter 2 Company Name

8. US EPA ID Number

B. Transporter's Phone

9. Designated Facility Name and Site Address

IWS

10. US EPA ID Number

C. Facility's Phone

JACKSONVILLE, FL

11. Waste Shipping Name and Description

a. Non-Hazardous, Non-Regulated U.S.T
Corrective Action Groundwater

12. Containers
No. Type

13. Total
Quantity

14. Unit
WVVol

001 T.T 2498. G

b.

c.

d.

IWS Approval # 021868

D. Additional Descriptions for Materials Listed Above

E. Handling Codes for Wastes Listed Above

15. Special Handling Instructions and Additional Information

16. GENERATOR'S CERTIFICATION: I certify the materials described above on this manifest are not subject to federal regulations for reporting proper disposal of Hazardous Waste.

Printed/Typed Name

As Agent for
US Navy

Signature

[Signature]

Month Day Year

7/1/02

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name

George Waddell

Signature

[Signature]

Month Day Year

7/1/02

18. Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name

Signature

Month Day Year

19. Discrepancy Indication Space

20. Facility Owner or Operator: Certification of receipt of waste materials covered by this manifest except as noted in Item 19.

Printed/Typed Name

Jon LeRoss

Signature

[Signature]

Month Day Year

07/1/02

TRANSPORTER #1

GENERATOR

TRANSPORTER

FACILITY

APPENDIX C

FDEP APPROVED AIR EMISSIONS FORMULA

Emissions Calculations Based on OVA Readings (Form 2)

Remedial Action Plan
Building 425
Naval Station Mayport
Mayport, Florida

1st Event

INPUT

Average Ambient Air Temperature During MDES Event	°F	80
Relative Humidity During MDES Event	%	40
Velocity of Emissions at Stack (V)	feet/sec	18
Diameter of Stack	feet	0.25
Stack Temperature in Degrees Rankin (Ro), $R_o = F_o + 460$	R°	555
Average OVA Reading (measured from stack)	ppm	700

CALCULATIONS:

For lb. of water per lb. of dry air use temperature and humidity (B_{ws}) values obtained from Psychrometric Chart		0.012
Water Vapor % by Volume (B_{ws})	% vapor	0.01886
Velocity of Emissions at Stack (V)	feet/sec	18
Cross Sectional Area of discharge stack at sampling location (A)	feet ²	0.0490625
Flow at Dry Standard Cubic Feet Per Minute (Qstd)	DSCFM	49.4588
Average OVA reading measured directly from stack (PPM _w)	ppm	700
OVA reading from stack as "dry" concentration (PPM _d)	ppm	713.459
Number of carbons in calibration gas, for FID, methane (K)		1
Vol. concentration of VOC emissions as carbon, dry basis, STP (PPM _c)	ppm _v	713.459
Mass concentration of VOC emissions as carbon ($C_{c:m}$)	mg/dsm ³	355.988
Mass concentration of VOC emissions as carbon, dry basis, STP (C_c)	lb/dscf	2.2224E-05
Pollutant mass removal rate of VOCs as carbon (PMR _c)	lb/hr	0.06595
Pollutant mass removal rate of VOCs as gasoline (PMR _g)	lb/hr	0.07633

Emissions Rate of VOC's as gasoline in lbs/hr = 0.07633

Prepared by: _____ Checked by: _____

Notes:

1.) Average OVA reading obtained from Form 1, entered into Input Column: Average OVA reading measured directly from stack. Data entry location annotated by bold writing.

Equation to Determine Flow

$$B_{ws} = (B_{wsw}/18\text{-lbmole H}_2\text{O}) / [1/28.84\text{ lb-mole dry air}] + (B_{wsw}/18\text{ lb-mole H}_2\text{O})$$
$$Q_{std} = (60\text{ sec/min}) (1-B_{ws}) (V) (A) (528\text{ R}^\circ / T_s)$$

Where:

Q_{std} = flow at DSCFM
 B_{wsw} = lb. of water per lb. of dry air
 B_{ws} = water vapor % by volume
 V = velocity in ft/sec
 A = cross sectional area of discharge stack in sq. ft. at sampling location
 T_s = stack temperature in degrees Rankin (R°), $R^\circ = F^\circ + 460$

Step 1: Determine lb. of water per lb. of dry air (B_{wsw}).

for B_{wsw} : Use psychrometric chart and obtain lb. of water per lb. of dry air by using temperature and relative humidity.

$$B_{wsw} = \mathbf{0.012} \quad \text{from psychrometric chart (assume } 90^\circ \text{ F and } 40\% \text{ relative humidity)}$$

Step 2: Determine water vapor percent by volume (B_{ws}).

for B_{ws} : $= (B_{wsw}/18\text{ lb-mole H}_2\text{O}) / [1/28.84\text{ lb-mole dry air}] + (B_{wsw}/18\text{ lb-mole H}_2\text{O})$
 $B_{ws} = (0.012/18\text{ lb-mole H}_2\text{O}) / [1/28.84\text{ lb-mole dry air}] + (0.012/18\text{ lb-mole H}_2\text{O})$
 $B_{ws} = \mathbf{0.01886}$ water vapor % by volume

Step 3: Determine flow at dry standard cubic feet per minute, DSCFM, (Q_{std}).

for Q_{std} : $= (60\text{ sec/min}) (1-B_{ws}) (V) (A) (528\text{ R}^\circ / T_s)$
 $V = 18\text{ ft/sec}$ (V is an input parameter measured from stack)
 $A = 0.04906\text{ ft}^2$ (A is an input parameter measured from stack)
(diameter of stack = 0.4 feet = $\pi r^2 = 3.14 * (0.2)^2$)
 $T_s = 580\text{ R}^\circ$ (T_s is an input parameter measured from stack)
(temp. at stack = $120\text{ F}^\circ = 460 + 120 = 580\text{ R}^\circ$)

$$Q_{std} = (60\text{ sec/min}) (1-0.01886398) (8.3\text{ ft/sec}) (0.1256\text{ ft}^2) (528\text{ R}^\circ / 580\text{ R}^\circ)$$

$$Q_{std} = \mathbf{47.3270} \quad \text{DSCFM}$$

Equations to Determine Pollutant Mass Removal Rate as Gasoline (PMR_g)

$$\begin{aligned} \text{PPM}_w &= \text{PPM}_{\text{measured}} \\ \text{PPM}_d &= (\text{PPM}_w) / (1 - B_{ws}) \\ \text{PPM}_c &= (\text{PPM}_d) (K) \\ C_{c:m} &= \text{PPM}_c (M_c / K_3) \\ C_c &= C_{c:m} (62.43 \times 10^{-9} \text{ lb-m}^3 / \text{mg-ft}^3) \\ \text{PMR}_c &= C_c (Q_{\text{std}}) (60 \text{ min/hr}) \\ \text{PMR}_g &= (\text{PMR}_c) (M_g / M_{cg}) \end{aligned}$$

Where:

$$\begin{aligned} \text{PPM}_{\text{measured}} &= \text{obtained directly from OVA or TVA (use average value)} \\ \text{PPM}_w &= \text{"wet" concentration} \\ \text{PPM}_d &= \text{"dry" concentration} \\ K &= \text{number of carbons in calibration gas (methane } K=1, \text{ propane } K=3, \text{ hexane } K=6) \\ \text{PPM}_c &= \text{PPM}_v, \text{ volumetric concentration of VOC emissions as carbon, dry basis, at STP} \\ C_{c:m} &= \text{mg/dsm}^3, \text{ mass concentration of VOC emissions as carbon} \\ M_c &= 12.01 \text{ mg/mg-mole, molecular wt. of carbon} \\ K_3 &= 24.07 \text{ dsm}^3/10^6 \text{ mg-mole, mass to volume factor at STP} \\ C_c &= \text{lb/dscf, mass concentration of VOC emissions as carbon, dry basis, at STP} \\ \text{PMR}_c &= \text{lb/hr, pollutant mass removal rate of VOCs as carbon} \\ \text{PMR}_g &= \text{lb/hr, pollutant mass removal rate of VOCs as gasoline} \\ M_g &= 103 \text{ mg/mg-mole, molecular weight of gasoline} \\ M_{cg} &= 89 \text{ mg/mg-mole, weight of carbon in gasoline molecule} \end{aligned}$$

Step 4: Obtain average PPM reading from Form 1, this is the "wet" concentration (PPM_w).

for PPM_w: = PPM_{measured} (Form 1, average OVA reading)
for example calculation, say average concentration of 1000 ppm

$$\text{PPM}_w = \quad \mathbf{7400} \quad \text{ppm}$$

Step 5: Determine the "dry" concentration (PPM_d).

for PPM_d: (PPM_w) / (1 - B_{ws})

$$\begin{aligned} \text{PPM}_d &= (1000 \text{ ppm}) / (1 - 0.0189) \\ \text{PPM}_d &= \quad \mathbf{7542.277} \quad \text{ppm} \end{aligned}$$

Step 6: Determine the volumetric concentration of VOC emissions as carbon (PPM_c).

for PPM_c: (PPM_d) * (K)

$$\begin{aligned} \text{PPM}_c &= (1019.227 \text{ ppm}) * (1) \\ &\text{where calibration gas for F.I.D. is typically methane, therefore } K = \quad \mathbf{1} \\ \text{PPM}_c &= \quad \mathbf{7542.277} \end{aligned}$$

Step 7: Determine the mass concentration of VOC emissions as carbon ($C_{c,m}$).

for $C_{c,m}$: $(PPM_c) * (M_c/K_3)$

$$C_{c,m} = (1019.227) * (12.01 \text{ mg/mg-mole} / 24.07 \text{ dsm} / 10^6 \text{ mg-mole})$$

where $M_c = 12.01 \text{ mg/mg-mole}$, the molecular weight of carbon

where $K_3 = 24.07 \text{ dsm}^3 / 10^6 \text{ mg-mole}$, mass to volume conversion factor at STP

$$C_{c,m} = \mathbf{3763.305} \text{ mg/dsm}^3$$

Step 8: Determine the mass concentration of VOC emissions as carbon, dry basis, at STP (C_c).

for C_c : $(C_{c,m}) * (62.43 \times 10^{-9} \text{ lb-m}^3/\text{mg-ft}^3)$

$$C_c = (508.555 \text{ mg/dsm}^3) * (62.43 \times 10^{-9} \text{ lb-m}^3/\text{mg-ft}^3)$$

where $62.43 \times 10^{-9} \text{ lb-m}^3/\text{mg-ft}^3$ is the conversion factor

$$C_c = \mathbf{0.00023494} \text{ lb/dscf}$$

Step 9: Determine the pollutant mass removal rate of VOCs as carbon (PMR_c).

for PMR_c : $(C_c) * (Q_{std}) (60 \text{ min/hr})$

$$PMR_c = (3.1749E-05 \text{ lb/dscf}) * (55.868 \text{ dscfm}) * (60 \text{ min/hr})$$

$$PMR_c = \mathbf{0.6671} \text{ lb/hr}$$

Step 10: Determine the pollutant mass removal rate of VOCs as gasoline (PMR_g).

for PMR_g : $(PMR_c) * (M_g/M_{cg})$

$$PMR_g = (0.1064 \text{ lb/hr as carbon}) * (103 \text{ mg/mg-mole} / 89 \text{ mg/mg-mole})$$

$$PMR_g = \mathbf{0.77209} \text{ lb/hr}$$

APPENDIX D

AFVR EVENT REPORTS

ECOVAC SERVICES

The World Leader in Mobile Dual-Phase/Multi-Phase Extraction

July 22, 2002

Mr. Mark Peterson
TetraTech NUS
7018 A.C. Skinner Parkway
Suite 250
Jacksonville, Florida 32256

**Subject: Enhanced Fluid Recovery (EFR[®]) Results
Building 425
Mayport Naval Station
Mayport, Florida**

Dear Mr. Peterson:

Please find attached the data summary for the initial EFR[®] event conducted at the subject site on July 17, 2002. The following summarizes the results of this EFR[®] event.

SUMMARY OF RESULTS

Separate phase hydrocarbons (SPH) were detected in one monitor well (MW04 - 0.25 feet) prior to conducting this EFR[®] event. This EFR[®] event was performed for a duration of 6.7 hours at one extraction point, consisting of monitor well MW04. This event was terminated after 6.7 hours to avoid exceeding the 13.7 pound daily hydrocarbon air emissions limit. A calculated total of 13.6 pounds of petroleum hydrocarbons (approximately equivalent to 6.1 pounds carbon - 1.9 equivalent gallons of fuel oil) was removed during this EFR[®] event. SPH was not detected in the monitor wells upon completion of this event.

The hydrocarbon removal rate ranged from 1.0 to 8.2 pounds per hour, with a general trend of decreasing removal rates throughout this EFR[®] event. Offgas concentrations ranged from 1,100 to 7,400 parts per million by volume (PPM_v). Vapor flow rates ranged from 29 to 54 cubic feet per minute (CFM) [22 to 51 dry standard cubic feet per minute (DSCFM)] during this EFR[®] event. The vacuum readings recorded at MW04 ranged from 3 to 5 inches of mercury, as detailed in the EFR[®] Field Data Sheet.

Mr. Mark Peterson
July 22, 2002
Page 2

Differential pressure readings were recorded throughout this event to assess the vacuum influence induced by EFR[®] in the vadose zone. Vacuum influence was detected at distances up to 24 feet from extraction well MW04. The differential pressure data are detailed in the attached table and summarized below:

<u>Monitor Well</u>	<u>Maximum Change</u>	<u>Approximate Distance From MW04</u>
MW05D	0.00 inches of water	2 feet
MW02	-0.03 inches of water	22 feet
MW01	-0.09 inches of water	24 feet
MW03	0.00 inches of water	30 feet

Groundwater levels were recorded to assess the groundwater drawdown induced by EFR[®]. Downward inflections of the water table were detected at all adjacent wells, however, these data may have been biased by tidal fluctuations. The groundwater drawdown data are detailed in the attached table and summarized below:

<u>Monitor Well</u>	<u>Maximum Change</u>	<u>Approximate Distance From MW04</u>
MW05D	-0.06 feet	2 feet
MW01	-0.26 feet	22 feet
MW02	-0.27 feet	24 feet
MW03	-0.14 feet	30 feet

Approximately 2,498 gallons of liquid (SPH was not detected in the vacuum truck tank prior to offloading) were recovered during this EFR[®] event and transported to Industrial Water Services' treatment facility (Jacksonville, Florida) for disposal.

Thank you for this opportunity to team with TetraTech NUS in serving the environmental needs of the U.S. Navy. We look forward to working with you again in the future to provide innovative and cost effective environmental solutions at this and other sites.

Sincerely,

EcoVac Services

David M. Goodrich, P.G.

EFR[®] FIELD DATA SHEET

Client: TetraTech NUS		Facility Name: Area 2 - Building 425					Facility ID#:		Event #: 1						
Facility Address: U.S. Naval Station Mayport - Mayport, Florida		Technician: M. Patterson					Date: 7/17/02								
Extraction Well(s)	Time hh:mm	Extraction Well-head Vacuum (in. Hg)					Offgas Velocity ft/min	Flow Rate CFM	Stack Gas Temp. °F	Flow Rate DSCFM	Offgas Conc. PPM _v	Hydro-Carbon Removal Rate (lbs/hour)	Interval Hydro-Carbons Removed (pounds)	Carbon Removal Rate (lbs/hour)	Interval Carbon Removed (pounds)
		1	2	3	4	5									
Start Time:	8:00														
MW04	8:15	21	5				1,100	54	92	51	7,400	8.2	2.1	4.3	1.1
"	8:30	20	5				1,000	49	110	45	5,000	5.0	1.3	2.5	0.6
"	8:45	20	5				950	47	118	42	3,600	3.5	0.9	1.7	0.4
"	9:00	20	5				900	44	134	37	3,000	2.7	0.7	1.2	0.3
"	9:30	20	5				900	44	140	35	2,600	2.4	1.2	1.0	0.5
"	10:00	20	5				900	44	140	35	2,400	2.2	1.1	1.0	0.5
"	10:30	20	5				900	44	140	35	2,000	1.8	0.9	0.8	0.4
**note	11:00	23	3				600	29	150	22	2,700	1.6	0.8	0.7	0.3
"	11:30	23	3				600	29	140	24	2,400	1.5	0.7	0.6	0.3
"	12:00	23	3				600	29	136	24	2,200	1.3	0.7	0.6	0.3
"	12:30	23	3				600	29	136	24	2,200	1.3	0.7	0.6	0.3
**note	13:00	22	4				750	37	140	30	2,000	1.5	0.8	0.7	0.3
"	13:30	20	5				900	44	150	33	1,500	1.4	0.7	0.6	0.3
"	14:00	20	5				900	44	158	31	1,300	1.2	0.6	0.4	0.2
"	14:40	20	5				900	44	156	31	1,100	1.0	0.7	0.4	0.3

Well #:	MW04
Breather Port:	0
Stinger Depth:	4.5

Well Gauging Data:			Before EFR [®] Event			After EFR [®] Event			Corr. DTW Change (ft)	Vacuum Truck Information	
Well No.	Diam.	TD (ft)	DTS (ft)	DTW (ft)	SPH (ft)	DTS (ft)	DTW (ft)	SPH (ft)		Subcontractor:	Truck Operator:
MW01	2"		-	7.55	0.00	-	7.81	0.00	-0.26	AllVac	
MW02	2"		-	7.69	0.00	-	7.96	0.00	-0.27	B Waddell	
MW03	2"		-	7.91	0.00	-	8.05	0.00	-0.14	143 Becker*	
MW04	2"		7.55	7.80	0.25	-	7.89	0.00	-0.30	Twin LC-44s	
MW0SD	2"		-	7.84	0.00	-	7.90	0.00	-0.06	2,894	
									Stack I.D. (inches): 3.0		
									Recovery/Disposal Information		
									Gal. Liquid/Event: 2,498		
									Disposal Facility: IWS		
									Lbs. Hydrocarbons: 13.6		
									Cumul. Lbs. Hydrocarb.: 13.6		
									Lbs. Carbon/Event: 6.1		
									Cumul. Lbs. Carbon: 6.1		
									Equiv. Gal./Event: 1.9		
									Cumul. Equiv. Gal.: 1.9		
									Calibration Gas: 500 ppm Hexane		
									Gas Mol. Wgt. (g/mole): 130		



Comments:
 * Operated one vacuum pump at 700 RPM throughout the event
 ** Reduced liquid flow from well by partially closing gate valve from 10:45 to 12:45
 Opened gate valve to fully open between 12:45 and 13:30
 Event terminated after 6.7 hours to avoid exceeding 13.7 pound daily hydrocarbon limit

Differential Pressure and Groundwater Drawdown Data Recorded During EFR®
 Event #: 1 Date: 7/17/02
 Facility Name: Area 2 - Building 425
 Facility Address: U.S. Naval Station Mayport - Mayport, Florida

DIFFERENTIAL PRESSURE DATA

		Well Designation:			
		MW05D	MW02	MW01	MW03
Nearest Extraction Well:		MW04	MW04	MW04	MW04
Approximate Distance:		2 feet	22 feet	24 feet	30 feet
Time	Elapsed Time	Differential Pressure Readings (inches of water):			
8:30	0.5 hr.	0.00	-0.03	-0.09	0.00
9:00	1 hr.	0.00	-0.01	-0.07	0.00
9:30	1.5 hrs.	0.00	-0.02	-0.06	0.00
10:00	2 hrs.	0.00	0.00	-0.04	0.00
10:30	2.5 hrs.	0.00	0.00	-0.05	0.00
11:00	3 hrs.	-	0.00	-0.04	0.00
Maximum Change:		0.00	-0.03	-0.09	0.00

GROUNDWATER DRAWDOWN DATA

		Well Designation:			
		MW05D	MW01	MW02	MW03
Nearest Extraction Well:		MW04	MW04	MW04	MW04
Approximate Distance:		2 feet	22 feet	24 feet	30 feet
Time	Elapsed Time	Depth to Liquid (feet below top of casing):			
Prior to EFR®		7.84	7.55	7.69	7.91
11:00	3 hrs.	7.88	7.77	7.88	8.02
12:00	4 hrs.	7.87	7.74	7.83	8.00
13:00	5 hrs.	7.86	7.67	7.81	7.96
14:00	6 hrs.	7.90	7.80	7.94	8.05
14:40	6.7 hrs.	7.90	7.81	7.96	8.05
Maximum Change:		-0.06	-0.26	-0.27	-0.14

ECOVAC SERVICES

The World Leader in Mobile Dual-Phase/Multi-Phase Extraction

September 4, 2002

Mr. Mark Peterson
TetraTech NUS
7018 A.C. Skinner Parkway
Suite 250
Jacksonville, Florida 32256

**Subject: Enhanced Fluid Recovery (EFR[®]) Results
Event No. 2
Building 425
Mayport Naval Station
Mayport, Florida**

Dear Mr. Peterson:

Please find attached the data summary for the second EFR[®] event conducted at the subject site on August 19, 2002. The previous EFR[®] event was performed at the subject site on July 17, 2002. The following summarizes the results of EFR[®] at this site.

SUMMARY OF RESULTS

Separate phase hydrocarbons (SPH) were detected in one monitor well (MW04 - 0.01 feet) prior to conducting this EFR[®] event. This SPH thickness represents a decrease from the SPH thickness detected in monitor well MW04 (0.25 feet) prior to the initial event. This EFR[®] event was performed for a duration of eight hours at one extraction point, consisting of monitor well MW04. SPH was not detected in the monitor wells upon completion of this event.

A calculated total of 0.9 pound of petroleum hydrocarbons (approximately equivalent to 0.4 pound carbon - 0.1 equivalent gallon of fuel oil) was removed during this EFR[®] event. This removal of petroleum hydrocarbons represents a decrease from the removal achieved during the initial event (i.e. a calculated total of 13.6 pounds of petroleum hydrocarbons - approximately 1.9 equivalent gallons of fuel oil).

The hydrocarbon removal rate ranged from 0.06 to 0.28 pound per hour during this EFR[®] event. The removal rate generally decreased from 0.3 to 0.1 pound per hour during the initial 1.5 hours of extraction and remained stable at 0.1 pound per hour during the final 6.5 hours of this event. These removal rates represent a decrease from the removal rates achieved during the initial event (i.e. 1.0 to 8.2 pounds per hour).

Offgas concentrations ranged from 100 to 400 parts per million by volume (PPM_v). The offgas concentrations recorded during the previous event ranged from 1,100 to 7,400 PPM_v. Vapor

Mr. Mark Peterson
September 4, 2002
Page 2

flow rates ranged from 29 to 39 cubic feet per minute (CFM) [26 to 34 dry standard cubic feet per minute (DSCFM)] during this EFR[®] event. The vapor flow rates recorded during the previous event ranged from 29 to 54 CFM. The vacuum readings recorded at MW04 remained stable at 6 inches of mercury throughout this event, as detailed in the EFR[®] Field Data Sheet.

Differential pressure readings were recorded throughout this event to assess the vacuum influence induced by EFR[®] in the vadose zone. Vacuum influence was detected at distances up to 24 feet from extraction well MW04. The differential pressure data are detailed in the attached table and summarized below:

<u>Monitor Well</u>	<u>Maximum Change</u>	<u>Approximate Distance From MW04</u>
MW05D	-0.02 inches of water	2 feet
MW02	-0.03 inches of water	22 feet
MW01	-0.06 inches of water	24 feet
MW03	-0.03 inches of water	30 feet

Groundwater levels were recorded to assess the groundwater drawdown induced by EFR[®]. Downward inflections of the water table were detected at all adjacent wells, however, these data may have been biased by tidal fluctuations. The groundwater drawdown data are detailed in the attached table and summarized below:

<u>Monitor Well</u>	<u>Maximum Change</u>	<u>Approximate Distance From MW04</u>
MW05D	-0.04 feet	2 feet
MW02	-0.23 feet	22 feet
MW01	-0.23 feet	24 feet
MW03	-0.19 feet	30 feet

Approximately 2,275 gallons of liquid (SPH was not detected in the vacuum truck tank prior to offloading) were recovered during this EFR[®] event and transported to Industrial Water Services' treatment facility (Jacksonville, Florida) for disposal.

Thank you for the continued opportunity to team with TetraTech NUS in serving the environmental needs of the U.S. Navy. We look forward to working with you again in the future to provide innovative and cost effective environmental solutions at this and other sites.

Sincerely,

EcoVac Services



David M. Goodrich, P.G.

EFR[®] FIELD DATA SHEET

Client: TetraTech NUS				Facility Name: Area 2 - Building 425				Facility ID#:				Event #: 2				
Facility Address: U.S. Naval Station Mayport - Mayport, Florida								Technician: K. Vitovic				Date: 8/19/02				
Extraction Well(s)	Time hh:mm	Extraction Well-head Vacuum (in. Hg)						Offgas Velocity ft/min	Flow Rate CFM	Stack Gas Temp. °F	Flow Rate DSCFM	Offgas Conc. PPM _v	Hydro-Carbon Removal Rate (lbs/hour)	Interval Hydro-Carbons Removed (pounds)	Carbon Removal Rate (lbs/hour)	Interval Carbon Removed (pounds)
		Inlet	MW04													
Start Time:	8:30															
MW04	8:45	23	6					700	34	106	32	400	0.28	0.07	0.14	0.04
"	9:00	23	6					750	37	118	33	340	0.26	0.06	0.13	0.03
"	9:15	23	6					700	34	124	30	160	0.11	0.03	0.05	0.01
"	9:30	23	6					750	37	124	32	200	0.15	0.04	0.07	0.02
"	10:00	23	6					750	37	122	32	160	0.12	0.06	0.06	0.03
"	10:30	23	6					800	39	124	34	140	0.11	0.06	0.05	0.03
"	11:00	23	6					750	37	124	32	140	0.11	0.05	0.05	0.03
"	11:30	23	6					700	34	126	30	160	0.11	0.06	0.05	0.03
"	12:30	23	6					700	34	128	29	160	0.11	0.11	0.05	0.05
"	13:30	23	6					700	34	126	30	140	0.10	0.10	0.05	0.05
"	14:30	23	6					700	34	126	30	140	0.10	0.10	0.05	0.05
"	15:30	23	6					600	29	124	26	100	0.06	0.06	0.03	0.03
"	16:30	23	6					600	29	122	26	100	0.06	0.06	0.03	0.03
Well #:		MW04														
Breather Port:		0														
Stinger Depth:		5														
Well Gauging Data:			Before EFR [®] Event			After EFR [®] Event			Corr. DTW Change (ft)	Vacuum Truck Information						
Well No.	Diam.	TD (ft)	DTS (ft)	DTW (ft)	SPH (ft)	DTS (ft)	DTW (ft)	SPH (ft)		Subcontractor:	AllVac					
MW01	2"		-	7.89	0.00	-	8.12	0.00	-0.23	Truck Operator:	K. Vitovic					
MW02	2"		-	8.03	0.00	-	8.26	0.00	-0.23	Truck No.:	147					
MW03	2"		-	8.20	0.00	-	8.39	0.00	-0.19	Vacuum Pump:	Twin LC-44s					
MW04	2"		7.91	7.92	0.01	-	8.27	0.00	-0.36	Tank Capacity (gal.):	2,894					
MW05D	2"		-	8.13	0.00	-	8.17	0.00	-0.04	Stack I.D. (inches):	3.0					
										Recovery/Disposal Information						
										Gal. Liquid/Event:	2,275					
										Disposal Facility:	IWS					
										Lbs. Hydrocarbons:	0.9					
										Cumul. Lbs. Hydrocarb.:	14					
										Lbs. Carbon/Event:	0.4					
										Cumul. Lbs. Carbon:	6.5					
										Equiv. Gal./Event:	0.1					
										Cumul. Equiv. Gal.:	2.0					
										Calibration Gas:	500 ppm Hexane					
										Gas Mol. Wgt. (g/mole):	130					
		Comments: * Operated one vacuum pump at 700 RPM throughout the event														

Differential Pressure and Groundwater Drawdown Data Recorded During EFR®
 Event #: 2 Date: 8/19/02
 Facility Name: Area 2 - Building 425
 Facility Address: U.S. Naval Station Mayport - Mayport, Florida

DIFFERENTIAL PRESSURE DATA

		Well Designation:			
		<u>MW05D</u>	<u>MW02</u>	<u>MW01</u>	<u>MW03</u>
Nearest Extraction Well:		MW04	MW04	MW04	MW04
Approximate Distance:		2 feet	22 feet	24 feet	30 feet
<u>Time</u>	<u>Elapsed Time</u>	Differential Pressure Readings (inches of water):			
9:00	0.5 hr.	0.00	0.00	-0.04	0.00
9:30	1.0 hr.	-0.01	-0.03	-0.06	0.00
10:00	1.5 hrs.	-0.02	0.00	-0.05	-0.03
10:30	2.0 hrs.	0.00	-0.02	-0.04	0.00
11:30	3.0 hrs.	0.00	0.00	-0.03	0.00
Maximum Change:		-0.02	-0.03	-0.06	-0.03

GROUNDWATER DRAWDOWN DATA

		Well Designation:			
		<u>MW05D</u>	<u>MW02</u>	<u>MW01</u>	<u>MW03</u>
Nearest Extraction Well:		MW04	MW04	MW04	MW04
Approximate Distance:		2 feet	22 feet	24 feet	30 feet
<u>Time</u>	<u>Elapsed Time</u>	Depth to Liquid (feet below top of casing):			
Prior to EFR®		8.13	8.03	7.89	8.20
12:30	4.0 hrs.	8.17	8.22	8.07	8.33
13:30	5.0 hrs.	8.17	8.24	8.08	8.34
14:30	6.0 hrs.	8.17	8.25	8.09	8.37
15:30	7.0 hrs.	8.17	8.26	8.12	8.39
Maximum Change:		-0.04	-0.23	-0.23	-0.19

ECOVAC SERVICES

The World Leader in Mobile Dual-Phase/Multi-Phase Extraction

October 16, 2002

Mr. Mark Peterson
TetraTech NUS
7018 A.C. Skinner Parkway
Suite 250
Jacksonville, Florida 32256

**Subject: Enhanced Fluid Recovery (EFR[®]) Results
Event No. 3
Building 425
Mayport Naval Station
Mayport, Florida**

Dear Mr. Peterson:

Please find attached the data summary for the third EFR[®] event conducted at the subject site on September 23, 2002. The previous EFR[®] events were performed at the subject site on July 17, 2002 and August 19, 2002. The following summarizes the results of EFR[®] at this site.

SUMMARY OF RESULTS

Separate phase hydrocarbons (SPH) were detected in one monitor well (MW04 - 0.17 feet) prior to conducting this EFR[®] event. This SPH thickness represents an increase from the SPH thickness detected in monitor well MW04 (0.01 feet) prior to the second event. Historical SPH thicknesses are detailed in the attached Cumulative EFR[®] Data Table and Graph. This EFR[®] event was performed for a duration of eight hours at one extraction point, consisting of monitor well MW04. SPH was detected in monitor well MW04 (0.09 feet) upon completion of this event.

A calculated total of 1.9 pound of petroleum hydrocarbons (approximately equivalent to 0.9 pound carbon - 0.3 equivalent gallon of fuel oil) was removed during this EFR[®] event. This removal of petroleum hydrocarbons represents an increase from the removal achieved during the second event (i.e. a calculated total of 0.9 pound of petroleum hydrocarbons - approximately 0.1 equivalent gallon of fuel oil) and represents a decrease from the removal achieved during the initial event (i.e. a calculated total of 14 pounds of petroleum hydrocarbons - approximately 1.9 equivalent gallons of fuel oil).

The hydrocarbon removal rate ranged from 0.06 to 1.84 pounds per hour with a trend of decreasing removal rates throughout this EFR[®] event. These removal rates ranged higher than the removal rates achieved during the second event (i.e. 0.06 to 0.28 pound per hour) and ranged lower than the removal rates achieved during the initial event (i.e. 1.0 to 8.2 pounds per hour).

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Mr. Mark Peterson
October 16, 2002
Page 2

Offgas concentrations ranged from 80 to 2,600 parts per million by volume (PPM_v). The offgas concentrations recorded during the previous events ranged from 100 to 7,400 PPM_v. Vapor flow rates remained stable at 34 cubic feet per minute (CFM) [27 to 33 dry standard cubic feet per minute (DSCFM)] during this EFR[®] event. The vapor flow rates recorded during the previous events ranged from 29 to 54 CFM. The vacuum readings recorded at MW04 remained stable at 2 inches of mercury throughout this event, as detailed in the EFR[®] Field Data Sheet.

Differential pressure readings were recorded throughout this event to assess the vacuum influence induced by EFR[®] in the vadose zone. The differential pressure data are detailed in the attached table and summarized below:

<u>Monitor Well</u>	<u>Maximum Change</u>	<u>Approximate Distance From MW04</u>
MW05D	-0.02 inches of water	2 feet
MW02	-0.02 inches of water	22 feet
MW01	-0.04 inches of water	24 feet
MW03	-0.02 inches of water	30 feet

Groundwater levels were recorded to assess the groundwater drawdown induced by EFR[®]. Downward inflections of the water table were detected at all adjacent wells, however, these data may have been biased by tidal fluctuations. The groundwater drawdown data are detailed in the attached table and summarized below:

<u>Monitor Well</u>	<u>Maximum Change</u>	<u>Approximate Distance From MW04</u>
MW05D	-0.05 feet	2 feet
MW02	-0.27 feet	22 feet
MW01	-0.24 feet	24 feet
MW03	-0.19 feet	30 feet

Approximately 2,719 gallons of liquid (SPH was not detected in the vacuum truck tank prior to offloading) were recovered during this EFR[®] event and transported to Industrial Water Services' treatment facility (Jacksonville, Florida) for disposal.

Thank you for the continued opportunity to team with TetraTech NUS in serving the environmental needs of the U.S. Navy. We look forward to working with you again in the future to provide innovative and cost effective environmental solutions at this and other sites.

Sincerely,

EcoVac Services



David M. Goodrich, P.G.

EFR[®] FIELD DATA SHEET

Client: TetraTech NUS				Facility Name: Area 2 - Building 425				Facility ID#:				Event #: 3				
Facility Address: U.S. Naval Station Mayport - Mayport, Florida								Technician: K. Vitovic				Date: 9/23/02				
Extraction Well(s)	Time hh:mm	Extraction Well-head Vacuum (in. Hg)						Offgas Velocity ft/min	Flow Rate CFM	Stack Gas Temp. ° F	Flow Rate DSCFM	Offgas Conc. PPM _v	Hydro- Carbon Removal Rate (lbs/hour)	Interval Hydro- Carbons Removed (pounds)	Carbon Removal Rate (lbs/hour)	Interval Carbon Removed (pounds)
		Inlet	MW04													
Start Time:	8:00															
MW04	8:15	25	2					700	34	88	33	2,600	1.84	0.46	0.96	0.24
"	8:30	25	2					700	34	94	33	2,000	1.41	0.35	0.73	0.18
"	8:45	25	2					700	34	106	32	1,400	0.99	0.25	0.50	0.12
"	9:00	25	2					700	34	118	31	820	0.58	0.14	0.28	0.07
"	9:30	25	2					700	34	124	30	500	0.35	0.18	0.17	0.08
"	10:00	25	2					700	34	128	29	160	0.11	0.06	0.05	0.03
"	10:30	25	2					700	34	128	29	160	0.11	0.06	0.05	0.03
"	11:00	25	2					700	34	128	29	140	0.10	0.05	0.05	0.02
"	12:00	25	2					700	34	130	29	140	0.10	0.10	0.05	0.05
"	13:00	25	2					700	34	130	29	100	0.07	0.07	0.03	0.03
"	14:00	25	2					700	34	138	28	100	0.07	0.07	0.03	0.03
"	15:00	25	2					700	34	140	28	100	0.07	0.07	0.03	0.03
"	16:00	25	2					700	34	142	27	80	0.06	0.06	0.02	0.02
Well #:		MW04														
Breather Port:		0														
Stinger Depth:		7														
Well Gauging Data:			Before EFR [®] Event			After EFR [®] Event			Corr. DTW Change (ft)	Vacuum Truck Information						
Well No.	Diam.	TD (ft)	DTS (ft)	DTW (ft)	SPH (ft)	DTS (ft)	DTW (ft)	SPH (ft)		Subcontractor:	AllVac					
MW01	2"		-	6.98	0.00	-	7.22	0.00	-0.24	Truck Operator:	K. Vitovic					
MW02	2"		-	7.12	0.00	-	7.38	0.00	-0.26	Truck No.:	147					
MW03	2"		-	7.31	0.00	-	7.50	0.00	-0.19	Vacuum Pump:	Twin LC-44s					
MW04	2"		6.97	7.14	0.17	7.22	7.31	0.09	-0.24	Tank Capacity (gal.):	2,894					
MW05D	2"		-	7.30	0.00	-	7.35	0.00	-0.05	Stack I.D. (inches):	3.0					
										Recovery/Disposal Information						
										Gal. Liquid/Event:	2,719					
										Disposal Facility:	IWS					
										Lbs. Hydrocarbons:	1.9					
										Cumul. Lbs. Hydrocarb.:	16					
										Lbs. Carbon/Event:	0.9					
										Cumul. Lbs. Carbon:	7.4					
										Equiv. Gal./Event:	0.3					
										Cumul. Equiv. Gal.:	2.3					
										Calibration Gas:	500 ppm Hexane					
										Gas Mol. Wgt. (g/mole):	130					
		Comments: * Operated one vacuum pump at 800 RPM throughout the event														

Differential Pressure and Groundwater Drawdown Data Recorded During EFR®
 Event #: 3 Date: 9/23/02
 Facility Name: Area 2 - Building 425
 Facility Address: U.S. Naval Station Mayport - Mayport, Florida

DIFFERENTIAL PRESSURE DATA

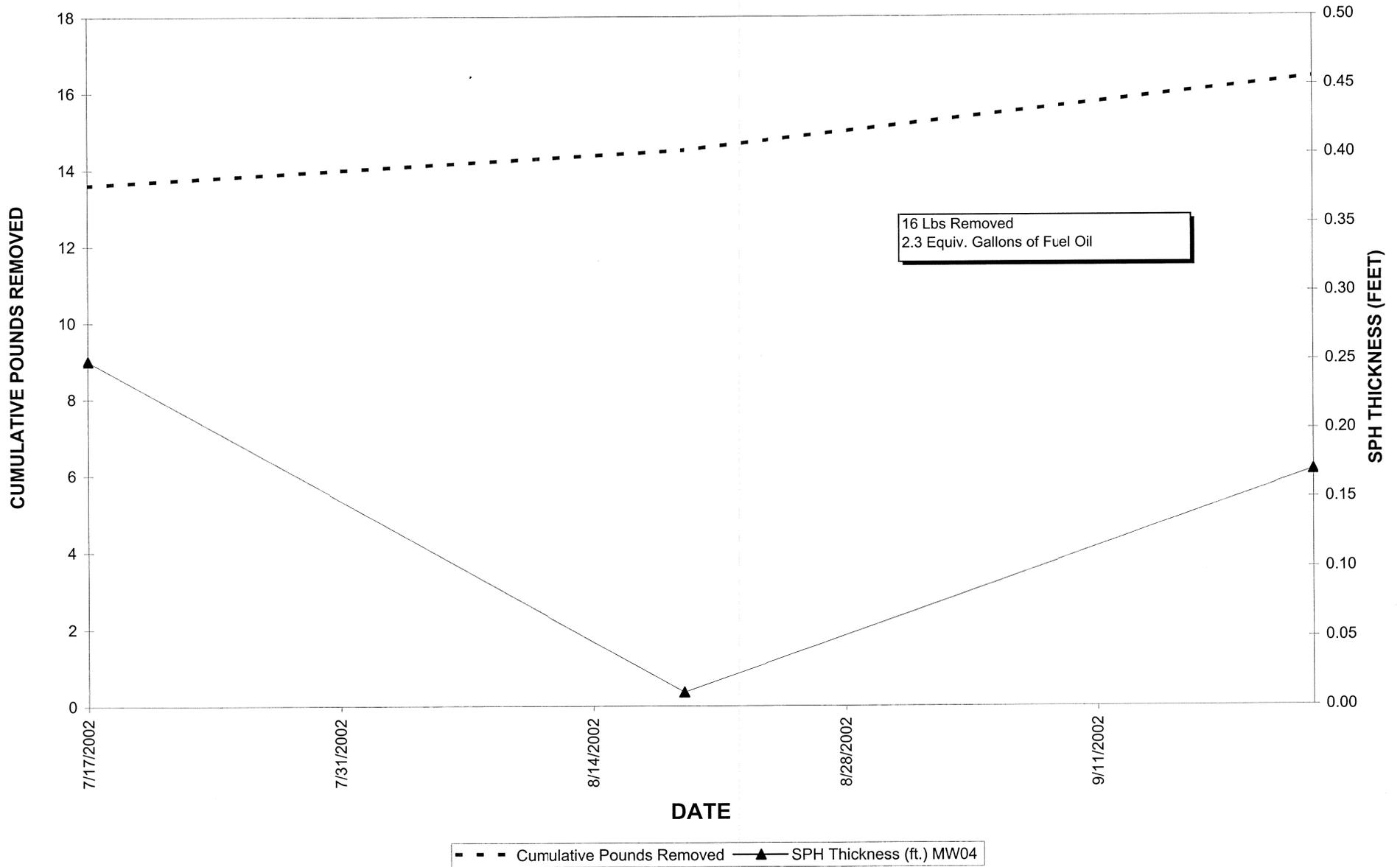
		Well Designation:			
		<u>MW05D</u>	<u>MW02</u>	<u>MW01</u>	<u>MW03</u>
Nearest Extraction Well:		MW04	MW04	MW04	MW04
Approximate Distance:		2 feet	22 feet	24 feet	30 feet
<u>Time</u>	<u>Elapsed Time</u>	Differential Pressure Readings (inches of water):			
9:00	1.0 hr.	0.00	-0.02	-0.02	0.00
10:00	2.0 hrs.	-0.01	0.00	-0.04	0.00
11:00	3.0 hrs.	-0.01	0.00	-0.01	0.00
12:00	4.0 hrs.	-0.02	0.00	-0.03	-0.02
13:00	5.0 hrs.	0.00	0.00	-0.02	0.00
Maximum Change:		-0.02	-0.02	-0.04	-0.02

GROUNDWATER DRAWDOWN DATA

		Well Designation:			
		<u>MW05D</u>	<u>MW02</u>	<u>MW01</u>	<u>MW03</u>
Nearest Extraction Well:		MW04	MW04	MW04	MW04
Approximate Distance:		2 feet	22 feet	24 feet	30 feet
<u>Time</u>	<u>Elapsed Time</u>	Depth to Liquid (feet below top of casing):			
Prior to EFR®		7.30	7.12	6.98	7.31
14:00	6.0 hrs.	7.35	7.39	7.22	7.48
15:00	7.0 hrs.	7.35	7.38	7.22	7.50
Maximum Change:		-0.05	-0.27	-0.24	-0.19

CUMULATIVE EFR[®] GRAPH

Mayport Naval Station
Building 425
Mayport, Florida



APPENDIX E

PHOTOGRAPHS



Photograph 1. A photo of the site facing northeast showing the AFVR truck and recovery well MW-04 during the AFVR event.



Photograph 2. A view of MW-04 and the back of the AFVR truck.



Photograph 3. A photograph showing the top of the stinger and flow control valve.



Photograph 4. An overhead view of the stinger, watch glass, and pressure gauge.



Photograph 5. A view facing west showing the emissions stack and AFVR truck.



Photograph 6. A photograph taken while monitoring the emissions during AFVR operations.



Photograph 7. A view looking south at the piezometers and Building 425.



Photograph 8. A closer view showing the locations of the piezometers.

APPENDIX F

SOIL BORING LOGS

