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Title: Remedial Action Plan (Site 4)
ARF Final 02 Nov 1992

Remedial Action Plan for Soils Remediation
Wisconsin Air National Guard
Truax Field
Madison, Wisconsin

Prepared by:
Dames & Moore

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1.0 INTRODUCTION

Dames & Moore was retained by Mead & Hunt on behalf of the Wisconsin Air National Guard (WANG) to prepare a Feasibility Study/Remedial Action Plan for the WANG site in Madison, Wisconsin. The purpose of the feasibility analysis is to evaluate potential options for remediating subsurface hydrocarbon contaminated soils found at the site, which are technically and economically feasible. The purpose of the Remedial Action Plan is to outline activities associated with implementing the proposed remedial options.

The remediation activities presented in this document address only the soils associated with two areas of the site. The first area, indicated as Area 1 on Plate 1, is beneath the northwest edge of the apron. The second area (Area 2 on Plate 1), is located immediately southwest of building 412. Other areas on the facility are currently included in separate investigations. One or more of these investigations may abut the Dames & Moore area of remediation. Although both soils and groundwater have been impacted at the site, groundwater will be considered separately, at a later time. There are two primary reasons for this:

- The WANG needs to move forward with apron reconstruction to facilitate the conversion from A-10 aircraft to F-16 aircraft. Groundwater remediation can be accomplished with a minimum of surface disturbance; however, soil remediation will likely require extensive excavation. Therefore, the soil remediation is being expedited before the groundwater remediation, so that conversion to F-16s can proceed; and
- Because groundwater is flowing, groundwater contamination is likely to be more areally extensive than is soil contamination. Subsequent to the completion of the other site investigations, the full areal extent of groundwater contamination will be evaluated, and a comprehensive treatment program will be designed and implemented.

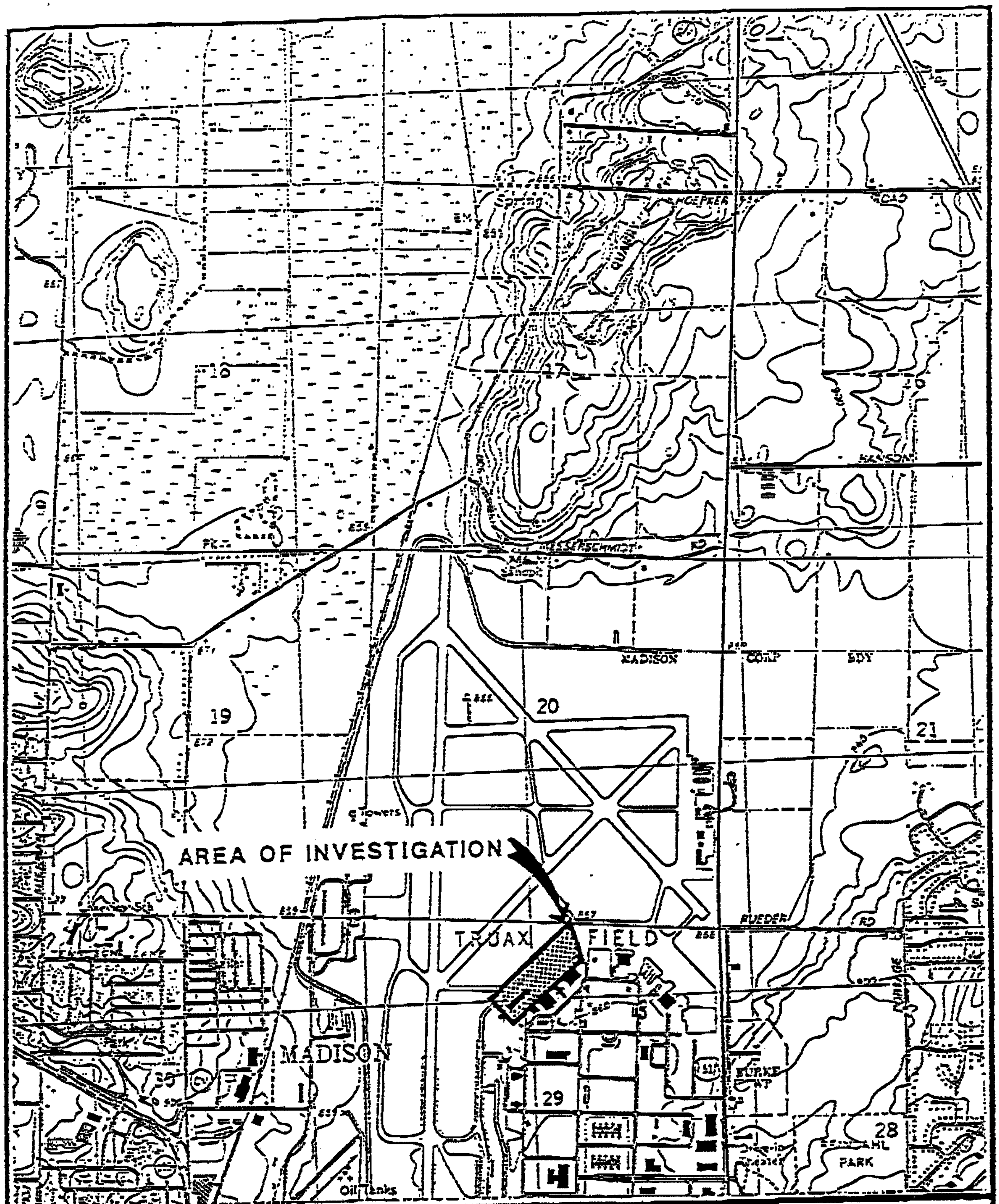
2.0 BACKGROUND

The WANG operates a facility at Truax Field in Madison, Wisconsin (see Figure 1). In preparation for apron reconstruction to accommodate the conversion from A-10 to F-16 aircraft, Mead & Hunt conducted a geotechnical investigation. During their investigation, Mead & Hunt collected soil samples on which head space analyses were performed using an Hnu photoionization detector (PID). The headspace analyses indicated the possible presence of hydrocarbons in the soils beneath the apron. Due to a shallow water table at the site, the potential for groundwater contamination was also recognized.

Mead & Hunt retained Dames & Moore to perform a subsurface environmental investigation. The objectives of this investigation were to define the nature and extent of soil and groundwater contamination. Dames & Moore performed an investigation at the site from April 13 through April 16, 1992. The investigation consisted of advancing 19 geologic borings, installation of five monitor wells, and laboratory analyses of soil and groundwater samples.

The results of the investigation identified two areas of hydrocarbon contaminated soils centered around the WANG facility apron in the areas indicated on Plate 1. Moderate concentrations of volatile and semivolatile organic constituents were detected in the soils in each of the two areas. Organic constituents were detected in soil samples collected from the unsaturated zone from the ground surface to the water table at a depth of approximately 5 feet. Subsequent tasks, including the advancement of eight soil borings and the installation of one monitor well were performed on August 6, 1992. Results of the soil sample laboratory analysis from the May investigation are presented in Table 1; soil analyses from the August investigation are presented in Table 2.

Dames & Moore's investigation indicates that groundwater flow conditions are variable across the site area. Hydrogeologic data collected at the site indicate that horizontal groundwater flow is northwest across most of the investigation area, although a southeast groundwater flow direction is indicated over the southeast portion of the site. Groundwater samples collected from



BASE MAP SOURCE:
USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLE,
DE FOREST, WISCONSIN, DATED 1983

SCALE: 1" = 2000'

WISCONSIN AIR NATIONAL GUARD
TRUAX APRON RECONSTRUCTION
SOIL CONTAMINATION INVESTIGATION

FIGURE 1
SITE LOCATION MAP

DWN. BY SLH	PROJ. NO. 24410-001
DATE MAY 1992	DAMES & MOORE

TABLE 1
SOIL ANALYSES
WISCONSIN AIR NATIONAL GUARD

PARAMETER	LOCATION									
	W-25	D-74	D-75[1]	D-75[1]	D-76	D-77	D-78	D-79	D-80	D-81
n-Butylbenzene			42.	65.		33.				
sec-Butylbenzene			26.	43.						
Chloromethane					0.6	5.8	0.4			
Dichlorofluoromethane	4.6		11.		1.0	21.	0.5			
Ethylbenzene			17.	33.						
Isopropylbenzene			17.	23.						
Naphthalene			61.	81.		49.				
n-Propylbenzene			12.	19.						
1,2,4-Trimethylbenzene			44.	76.		26.				
1,3,5-Trimethylbenzene			22.	45.		17.				
Xylenes			41.	77.		4.7				

All concentrations are in mg/kg.
[1]Two samples were analyzed from D-75.

TABLE 5
RESULTS OF SOIL ANALYSES

Parameter	Boring Number										
	B-55		B-56		B-57		B-58[1]			B-59	
	1-2.5 ft	6-7.5 ft	1-2.5 ft	3.5-5 ft	3.5-5 ft	6-7.5 ft	3.5-5 ft	6-7.5 ft	8.5-10 ft	3.5-5 ft	6-7.5 ft
Benzene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
n-Butylbenzene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	89.
tert-Butylbenzene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	29.
Chlorobenzene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.11	<0.1	<0.1	0.2	<0.1
1,2-Dichloroethane	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Ethylbenzene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.3	<0.1	<0.1	0.2	20.
Isopropylbenzene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	3.1	<0.1	<0.1	<0.1	29.
Naphthalene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	4.8	0.2	0.2	<.01	8.6
n-Propylbenzene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	2.5	<0.1	<0.1	<0.1	55.
1,2,4-Trimethylbenzene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	25.	0.2	0.2	1.3	159.
1,3,5-Trimethylbenzene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	12.	0.3	0.3	0.8	78.
Total xylenes	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	3.5	0.1	0.1	0.8	37.

[1] Due to limited volumes in the split spoon samples, a duplicate was not possible. In lieu of a duplicate, 3 adjacent samples were analyzed from boring B-58.

RESULTS OF SOIL ANALYSES

Parameter	Boring Number									
	B-60		B-61		B-62		B-63		B-64	
	3.5-5 ft	8.5-10 ft	1-2.5 ft	3.5-5 ft	3.5-5 ft	6-7-7.5 ft	3.5-5 ft	6-7.5 ft	1-2.5 ft	3.5-5 ft
Benzene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
n-Butylbenzene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
tert-Butylbenzene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chlorobenzene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,2-Dichloroethane	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Ethylbenzene	<0.1	<0.1	<0.1	<0.1	4.2	6.2	<0.1	<0.1	<0.1	<0.1
Isopropylbenzene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Naphthalene	<0.1	<0.1	<0.1	<0.1	6.4	8.8	<0.1	<0.1	<0.1	<0.1
n-Propylbenzene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,2,4-Trimethylbenzene	0.2	<0.1	<0.1	<0.1	16.	22.	<0.1	<0.1	<0.1	<0.1
1,3,5-Trimethylbenzene	0.2	<0.1	<0.1	<0.1	12.	13.	<0.1	<0.1	<0.1	<0.1
Total xylenes	0.1	<0.1	<0.1	<0.1	14.	15.	<0.1	<0.1	< 0.1	<0.1

RESULTS OF SOIL ANALYSES

Parameter	Boring Number									
	B-65		B-66		B-67		B-68		B-69	
	3.5-5 ft	8.5-10 ft	3.5-5 ft	6-7.5 ft	3.5-5 ft	6.7-7.5 ft	6-7.5 ft	8.5-10 ft	3.5-5 ft	6-7.5 ft
Benzene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	0.1	<0.1	<0.1
n-Butylbenzene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
tert-Butylbenzene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chlorobenzene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,2-Dichloroethane	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Ethylbenzene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Isopropylbenzene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Naphthalene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
n-Propylbenzene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,2,4-Trimethylbenzene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,3,5-Trimethylbenzene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total xylenes	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	< 0.1	<0.1

RESULTS OF SOIL ANALYSES

Parameter	Boring Number									
	B-70		B-71		B-72		B-73		W-20	
	1-2.5 ft	3.5-5 ft	1-2.5 ft	8.5-10 ft	1-2.5 ft	3.5-5 ft	1-2.5 ft	3.5-5 ft	5-6.5 ft	10-11.5 ft
Benzene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
n-Butylbenzene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
tert-Butylbenzene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chlorobenzene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,2-Dichloroethane	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Ethylbenzene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Isopropylbenzene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Naphthalene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
n-Propylbenzene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,2,4-Trimethylbenzene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,3,5-Trimethylbenzene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total xylenes	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

RESULTS OF SOIL ANALYSES

Parameter	Boring Number					
	W-21		W-22		W-23	
	1-2.5 ft	3.5-5 ft	1-2.5 ft	8.5-10 ft	1-2.5 ft	3.5-5 ft
Benzene	[redacted]	<0.1	<0.1	0.2	<0.1	<0.1
n-Butylbenzene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
tert-Butylbenzene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chlorobenzene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,2-Dichloroethane	<0.1	<0.1	<0.1	3.8	<0.1	<0.1
Ethylbenzene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Isopropylbenzene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Naphthalene	<0.1	<0.1	<0.1	2.4	<0.1	<0.1
n-Propylbenzene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,2,4-Trimethylbenzene	[redacted]	<0.1	<0.1	0.3	<0.1	<0.1
1,3,5-Trimethylbenzene	[redacted]	<0.1	<0.1	0.1	<0.1	<0.1
Total xylenes	[redacted]	<0.1	<0.1	<0.1	<0.1	<0.1

monitor wells installed at the site indicate elevated levels of aromatic hydrocarbons and trace concentrations of polynuclear aromatic hydrocarbons near the southwestern end of the apron. The data also indicate that groundwater contamination associated with this plume may be localized; however, data from other site investigations currently under way need to be considered along with the results of the Dames & Moore data in order to make a definitive interpretation of the extent of groundwater contamination. Results of the groundwater sample laboratory analysis from the May investigation are presented in Table 3; results from the August investigation are presented in Table 4.

Dames & Moore performed an additional investigation at the site in August 1992 to define further the extent of soil and groundwater contamination along the southeast portion of the apron. This investigation included advancing eight additional borings and the installation of one additional monitor well. These borings were advanced along an abandoned subsurface jet fuel line and a along a trench used to divert storm water runoff. Results of this investigation are presented in Dames & Moore's report dated September 17, 1992. Analytical results for soil samples collected from the borings along the trench and abandoned pipeline, and a groundwater sample collected from the monitor well installed in this area, indicate the presence of a localized area of soil and groundwater contamination along the south end of building 412.

TABLE 2
GROUNDWATER ANALYSES

PARAMETER	LOCATION		
	W-15	W-17	W-25
Benzene	32.		
n-Butylbenzene	5.8		
Ethylbenzene	12.		
Isopropylbenzene	4.5		
Napthalene	12.		
n-Propylbenzene	4.0		
1,2,4-Trimethylbenzene	11.		
1,3,5-Trimethylbenzene	6.2		
Xylenes, Total	21.		
Methyl-t-butylether	1.3		
Toluene	1.7		1.3

All concentrations are in $\mu g/L$.

TABLE 6
RESULTS OF GROUNDWATER ANALYSES

PARAMETER	W-7[1]	W-9[1]	W-15[1]	W-17[1]	W-20[2]	W-21[2]	W-21[2] (Duplicate)	W-22S[1]	W-22D[2]	W-23[2]
Benzene	< 1.0	2.9	2800.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	< 1.0	1.4	820.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Naphthalene	< 1.0	2.1	170.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	< 1.0	< 1.0	160.0	< 1.0	1.7	16.	15.	1.3	< 1.0	< 1.0
1,2,4-Trimethylbenzene	< 1.0	1.5	390.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3,5-Trimethylbenzene	< 1.0	< 1.0	130.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total xylenes	< 1.0	< 1.0	1100.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

All concentrations in μg/L.

[1] Sampled on May 20, 1992
[2] Sampled on April 20, 1992

3.0 REMEDIAL OPTIONS ANALYSIS

A number of options exist for remediating the contaminated soils at the Air National Guard site. These options are generally applicable to hydrocarbon contaminated soils, and include:

- In-situ biological treatment;
- In-situ vacuum extraction;
- Thermal treatment;
- Excavation of contaminated soil followed by off-site treatment and/or off-site disposal;
- soil washing; and
- No action.

3.1 Description of Options and Initial Evaluation

3.1.1 In-Situ Biological Treatment

Biological treatment, or bioremediation, is a technique for treating contamination by microbial degradation. The basic concept involves altering environmental conditions to enhance microbial metabolism of the organic contaminants, resulting in the breakdown and detoxification of those contaminants. The feasibility of biological treatment as an in-situ treatment is dictated by 1) biodegradability of the organic contaminants in question; 2) environmental site factors which affect microbial activity such as soil pH, temperature, oxygen content, and available nutrients; 3) soil conditions such as permeability and heterogeneity, which affect the ability of microbes to spread throughout the soil horizon; and 4) site conditions (e.g. nutrients are difficult to apply if an area is paved). A biological treatment system must be monitored constantly to ensure that these environmental factors are maintained in the optimal range for microbial activity.

A major disadvantage of a biological treatment system at the WANG site is that the area of contamination is relatively small and the level of contamination low. Consequently, such an involved and costly process as bioremediation would not be justified. Additionally, the pavement and large amount of traffic in the areas of concern would make it impossible to add the nutrients that are necessary for microbial growth.

3.1.2 In-Situ Vacuum Extraction

Vacuum extraction is an effective means for in-situ removal of VOCs from the unsaturated zone of the soil. In this procedure, a vacuum is placed on the soil through an installed air extraction well or perforated horizontal pipe. The organic contaminants are volatilized and vented to the atmosphere either with or without treatment, depending upon regulations and the amount of contaminant present.

Since the contaminated soil at the WANG site consists mostly of silty sand fill and sand, and all the constituents in the soil are volatile or semi-volatile, this site would be suited to vacuum extraction as a means of remediation. In-situ air stripping is most effective in soils with high permeability and low organic content. Compounds with high vapor pressure and lower solubility are more efficiently removed.

The costs associated with implementing this process are generally lower than other remedial techniques. However, exhaust gas treatment if required, can raise the cost of the system dramatically. Based upon existing data and consultation with the Wisconsin Department of Natural Resources (WDNR), no air permit would likely be needed. Costs associated with this option include capital costs for vent piping, blowers, fans, and monitoring and control devices; installation costs; operation and maintenance, and engineering and design costs. In addition, a pilot study would need to be performed prior to final operation to verify the effectiveness of the system.

Site conditions, however, will cause a significant disadvantage for the use of soil vapor extraction. Because much of the system will be beneath the apron, any modifications to the system that may be required at a future time will be extremely expensive.

3.1.3 Thermal Treatment

Thermal treatment is a process by which the affected soils are removed from the ground and exposed to excessive heat in one of various types of incinerators available. During the incineration process, contaminants are volatilized or destroyed depending on the intensity of the heat.

A number of solids-processing incinerators are currently available for use. These include high temperature large-scale incinerators used at commercial facilities and low temperature strippers. The low temperature thermal stripper is available as a transportable unit for on-site processing. This unit allows volatilization of the contaminants without heating the soil matrix to combustion temperatures. The soil is introduced into an on-site portable unit and heated. The volatiles are then captured and incinerated in an afterburner before being emitted to the atmosphere. On-site thermal stripping would be a cost effective option for the amount of contaminated soil and the low concentrations of contaminants in the soil at the WANG facility.

3.1.4 Excavation of Contaminated Soil Followed by Off-Site Treatment and/or Off-Site Disposal

In this treatment system, the contaminated soil is excavated and then treated off-site and disposed in an acceptable manner. The area of excavation is then backfilled with clean fill. If treatment of the soil is not necessary (i.e., if the soil is non-hazardous), the soil can be disposed in an NR 500 landfill following excavation. Excavation and off-site disposal is a reasonable remedial option for this site; however, this option could result in potential future liability to the WANG, because the contaminated soils are not remediated, just moved from the site to another site.

3.1.5 Isolation/Containment

Isolation/containment is a process used to isolate buried wastes to prevent or minimize infiltration and consequent leaching of the contaminants. The process is necessary whenever contaminated materials are to be buried or left in place at a site. In general, isolation/containment is used when extensive subsurface contamination precludes excavation and removal of wastes due to potential hazards or unrealistic costs. Surface covers or caps are used to prevent infiltration or runoff. Most cap designs are multi-layered. Single layered caps are usually acceptable only in rare cases such as temporary capping until further remediation takes place, or in areas where evapotranspiration greatly exceeds precipitation, or where there is great depth to groundwater. A multi-layered cap is usually a 3-layered system consisting of an upper vegetative layer, underlain by a drainage layer over a low permeability layer. The type of materials used in the cap depends upon the nature of the waste being covered, local climate and hydrogeology, and the projected future use of the site.

Subsurface physical barriers placed around the contamination in the areas could be used to minimize the spread of contaminants in the groundwater. Grout curtains or slurry cutoff walls can be constructed around the areas to limit the lateral migration of contaminants by redirecting the flow of groundwater around the contaminated areas. These barriers are usually constructed by pumping or injecting a cement or bentonite slurry in the ground to form a more impermeable layer around the area to be contained. Isolating/containment alone would not be an acceptable option at this site because destruction of the compounds is not accomplished.

3.1.6 Passive Remediation (No Action)

The no action alternative assumes that the contamination will naturally correct itself. This is technically feasible because natural processes will ultimately remove the compounds from the soil over some indeterminate amount of time. This alternative also assumes that no contaminants are introduced through disposal.

The no action alternative does not appear to be a viable option for this site. Analytical results for soil samples collected in this area indicate elevated concentrations of VOCs. In addition, no specific regulations currently exist defining remediation standards (i.e., concentration levels) of VOCs in soil (The WDNR is currently developing an environmental rule, Wisconsin Administrative Code, chapter NR700, which will govern corrective actions taken under the state's Hazardous Substance Spill Law and Environmental Repair Law). The lack of specific standards, coupled with the possible threat to groundwater at some future date due to downward migration of these contaminants, makes this an undesirable option.

3.2 Preferred Alternative

Upon review of possible remediation alternatives, several options appear to be viable. However, because the WANG desires to expedite the removal and remediation of the soils, and because they wish to avoid the potential liabilities associated with landfilling, the preferred alternative is excavation followed by on-site thermal desorption. To a limited extent (soils beneath building 412), passive remediation will also be employed.

3.2.1 Excavation Followed by On-Site Thermal Desorption

A mobile thermal desorber processing unit will be mobilized to the site. Set up is anticipated to take approximately two days and will require a minimum space of 150 by 150 feet at the site. The unit operates from a generator run by propane or alternatively, natural gas if available at the site. In addition, approximately 20 gallons per minute of water will be required for wetting the soil for conditioning and dust control. Additional equipment, such as shredders or pulverizers may be required to condition the clay fraction of the soils for even and efficient heating and treatment.

An independent contractor will be required to excavate and stockpile the soils for treatment. Excavation can proceed at once or in stages, depending on site activities and schedule determined by the WANG, and the amount of space available for stockpiling soil. Dames &

Moore's contractor anticipates that 35 tons/hour or 400 to 700 tons/day of soil can be processed. Additional space will be needed to stockpile processed soil awaiting backfilling until analytical results are received verifying that the soils meet the cleanup objective. Once the soils are certified clean, the soils will be backfilled, compacted, and tested according to Mead & Hunt's specifications. The remediation is anticipated to take approximately 2½ to 3 months to complete.

4.0 SCOPE OF WORK

The contaminant distributions in the soil indicate that the former pipeline and underground trench are likely sources for the contaminants found in these areas. It is our understanding that the concrete apron is to be removed and replaced with a new apron.

Task 1 Sampling and Analysis Plan

A sampling and analysis plan is required prior to implementing remedial activities. The sampling and analysis plan defines attainment objectives, or procedures and criteria which guide the remedial action process to achieve a predetermined cleanup standard. Meeting these objectives will enable the site to be judged sufficiently clean. The first objective is to establish a cleanup standard prior to performing remediation activities. Cleanup standards for petroleum products in soil have not been established in Wisconsin. Therefore, it is necessary to meet with WDNR project staff prior to performing remedial activities to negotiate a cleanup objective or standard. Verification samples collected at the time of remediation will be compared to this cleanup standard to establish whether or not the site has been adequately remediated.

The second objective for this site is to define the area which will require excavation. An initial estimate of the extent of excavation has been made, based on geologic and laboratory analytical data collected from the soil borings advanced on the apron by Dames & Moore. The areas proposed for excavation are shown on Plate 1. Area 1 has approximate dimensions of 750 by 130 feet and will be excavated to the water table at an estimated depth of 5 feet. This will involve removing approximately 18,000 cubic yards (yd^3) of soil materials. Area 2 has approximate dimensions of 220 by 70 feet and will also be excavated to the water table at approximately 5 feet below ground surface. The volume of soil removed from Area 2 will be approximately 3,000 yd^3. The total estimated volume of soil to be removed from these two areas is 21,000 yd^3. Additional refinement to the size of Area 2 will be made later, due to the presence of underground utilities in that area.

Task 2 Verification Sampling

A final objective is to establish the number and method of verification samples to be collected after excavation. This will be collected to determine if the limits of excavation are sufficient for removing those soils contaminated exceeding the negotiated cleanup standard. Dames & Moore proposes a method of determining the full extent of soil excavation and remediation. This method is described below.

On-Site Screening

During excavation, soil will be staged in 15 yd^3 parcels. One representative sample from each parcel will be collected by removing approximately 3 to 4 inches of soil and collecting the sample. A head space analysis will be performed on that sample using a field gas chromatograph, calibrated to benzene, toluene, ethylbenzene, xylenes, 1,2-dichloroethane, trichloroethene and tetrachloroethane. If head space detects occur, the parcel will be considered contaminated, and subsequently treated. If no detects occur, a second head space sample will be collected and analyzed from another location in the parcel. If the second sample yields detects, the parcel will be treated. If the second sample is non-detect, the parcel will be considered clean, and will define the limit of excavation at the location from which it was excavated.

In Area 1, this method will be used to determine the extent of excavation beneath the apron. The area off the apron will be remediated under a separate contract. It is unclear at this time which remediation will occur first; however, it is our understanding that any soil remediation off the apron will also involve soil excavation. We recommend that prior to backfilling the first excavation, a bentonite barrier be placed between the two areas in the lower 2 to 3 feet of the excavation to prevent contaminants from the yet to be remediated area from spreading to the clean backfill.

In Area 2, building 412 will be the boundary for one side of the excavation, as indicated on Plate 1. Because of the shallow depth to groundwater at the site, and because the building foundation extends nearly to the groundwater, we consider the contaminated soils beneath the building to be contained. Consequently, due to the expense of soil treatment beneath the building, we recommend that these soils be treated by means of passive bioremediation. To the east and west, we recommend that excavation proceed only to the pavement, because these areas are not intended to be rebuilt for the F-16 aircraft. To the southeast of Area 2 (the vicinity of well W-8), Hazwrap has been performing an environmental investigation. We recommend that, if our field and laboratory screening indicates that soil contamination extends beneath the pavement, and that if Hazwrap's screening also indicates that soil contamination extends beneath the pavement to the southeast, an investigation of the soils in that area should be undertaken and a remedial method should be selected. Until that time, however, the pavement will restrict the movement of contaminants in that area; consequently, we recommend that no further action be taken at this time.

Laboratory Screening

Dames & Moore proposes to collect and analyze verification samples along the southeast wall of the excavation in Area 1 to verify that the lateral extent of soil contamination has been removed. Samples will be collected at a rate of 1 sample per 100 feet of excavation perimeter. It should be noted that verification samples will not be collected northeast of the excavation to determine if cleanup objectives have been met because this area is being studied under a separate investigation. Verification samples will not be collected at the base of the excavation because soils will be removed in the proximity of the water table. Dames & Moore will collect and analyze soil samples from both the northeast and southeast walls of the excavation in Area 2 to verify cleanup objectives in this area.

Representative samples will also be collected from soil stockpiles after the soils have been processed through the on-site thermal desorber unit. Dames & Moore proposes to analyze one laboratory soil sample for each 500 yd^3 of soil processed. Soil samples obtained from the excavation, as well as after burn samples, will be collected to verify that cleanup objective have been met. The soil samples will be analyzed for benzene, toluene, ethylbenzene, xylenes, 1,2-dichloroethane, trichloroethene and tetrachloroethane.

Task 3 Backfilling and Compacting

After the excavated soils have been processed through the on-site thermal desorber, and laboratory results indicate that the soils are suitable for backfilling, the soils will be returned to the excavation. The soils will be compacted, and geotechnical tests will be performed as necessary for the construction of the apron. Dames & Moore assumes that any moisture, density, or compaction tests required will be performed by Mead & Hunt.

Task 4 Supervision of Remediation Activities

Supervision and documentation of site activities will be required during the remediation process. Qualified individuals will be required to oversee and coordinate excavation, stockpiling and other material handling procedures. A qualified individual will also be required on-site to make field decisions and perform verification sampling. Detailed documentation will be required for report preparation to ensure site closure.

Task 5 Report Preparation

Dames & Moore will prepare a final report detailing the thermal desorption process and document site activities and verification methods. The report will present the findings and conclusions of the soil remediation.

Ron Saense
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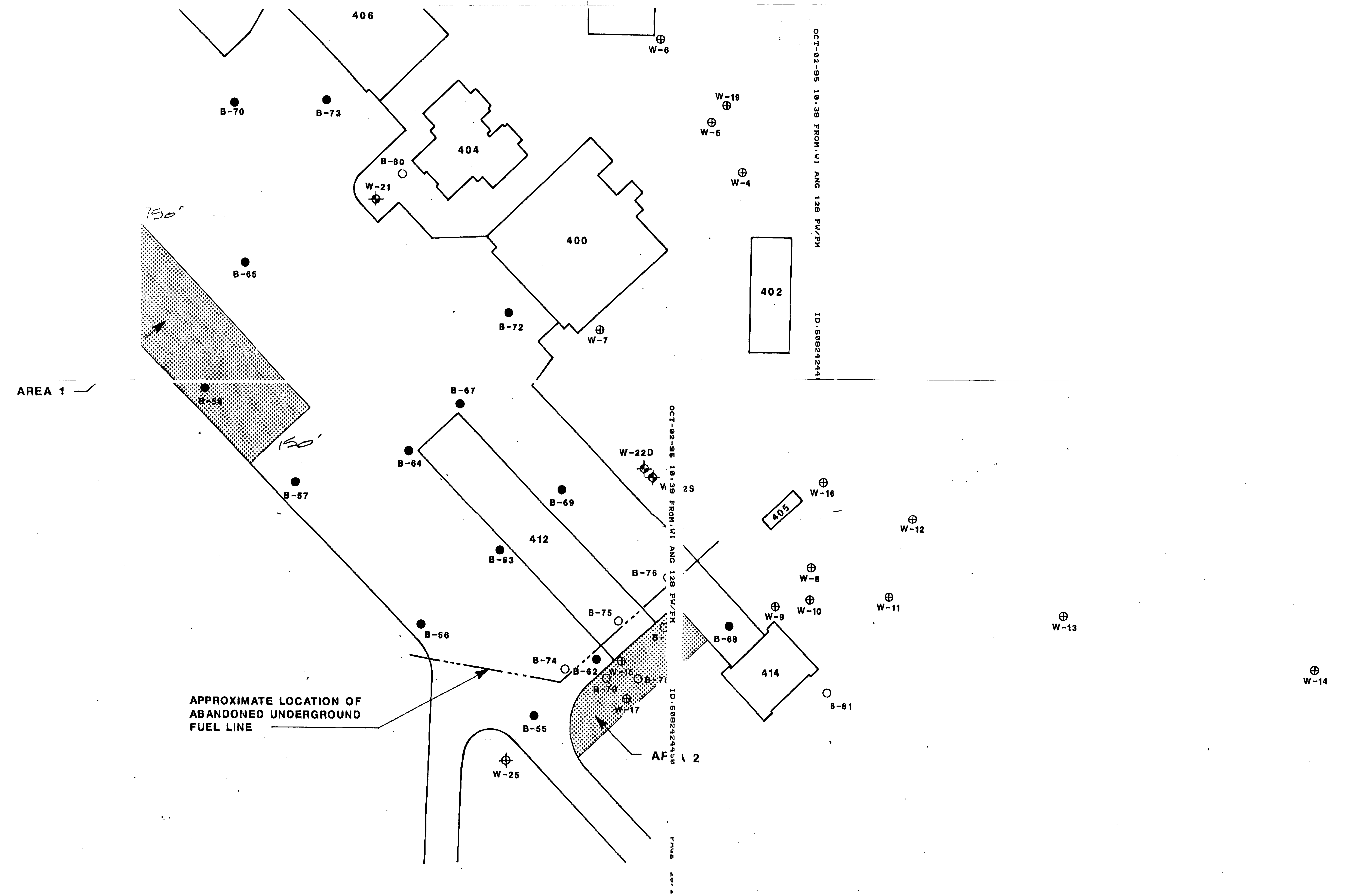
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AREA 1
APPROXIMATE LOCATION OF
ABANDONED UNDERGROUND
FUEL LINE