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## **APPENDIX D. SAMPLING RESULTS**

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This appendix provides detailed sampling results from the *Final Site Investigation Report, 446th Missile Squadron, Grand Forks Air Force Base, North Dakota, May 1999* (USAF, 1999d). The sampling data have been scanned into electronic files directly from that *Report*, so the original table numbering is used in this Appendix.

The following tables are included for each Flight:

1. MAF Sludge Sample Bacteriological Results
2. MAF Sludge and Soil Sample Nutrient Results
3. MAF Sludge Sample Analytical Results
4. MAF Surface Water Sample Analytical Results
5. MAF and LF Soil Sample Field Measurements and Analytical Results

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## **446<sup>th</sup> MISSILE SQUADRON, Flight A**

### **Contents**

- 5-1. Flight A: MAF Sludge Bacteriological Results
- 5-2. Flight A: MAF Sludge Analytical Results
- 5-3. Flight A: MAF Surface Water and Soil Field Measurements and Analytical Results
- 5-4. Flight A: LF Soil Field Measurements and Analytical Results

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**Table 5-1. Flight A: MAF Sludge Bacteriological Results**

Sample I.D.	Fecal Coliform		Regulatory Limit <sup>1</sup> (MPN/gram)
	(MPN/kg)	(MPN/gram)	
Sludge Sample #1	0	0	
Sludge Sample #2	0	0	
Sludge Sample #3	0	0	
Sludge Sample #4	0	0	
Sludge Sample #5	7,070	7.07	
Sludge Sample #6	25,200	25.2	
Sludge Sample #7	0	0	
Sludge Sample Duplicate	0	0	
Geometric Mean (MPN/gram)		13.3	

<sup>1</sup> Geometric mean regulatory limit for a Class A sludge presented in 40 CFR, Part 503, Section 503.32 (a) (7).

MPN/kg = most probable number per kilogram

Notes: Samples were collected 9/10/98.  
Fecal coliforms were analyzed by the Grand Forks, North Dakota Water Treatment Plant laboratory.  
Analytical Reports are included in Appendix D.

**Table 5-2. Flight A: MAF Sludge Analytical Results**

Analyte	Sample I.D. and Date Sampled				Regulatory Limit <sup>3</sup> (mg/kg)
	A-0SD-01 (9/10/98)		A-0SD-02 (9/10/98)		
	Result	Q	Result	Q	
Ammonia as N	48		11		
Nitrate as N	5.4		NA		
Nitrite as N	ND(2.9)	U	NA		
Total Kjeldahl N <sup>1</sup>	0.08		0.08		
Percent Moisture <sup>2</sup>	82.9		75.4		
Percent Solids <sup>2</sup>	17.1		24.6		
Antimony	ND(29)	U	ND(20)	U	
Arsenic	8.3		11		41
Beryllium	1.2		1.3		
Cadmium	ND(2.9)	U	ND(2.0)	U	39
Chromium	20		27		
Copper	43		43		1,500
Lead	16		14		300
Mercury	ND(0.58)	U	ND(0.41)	U	17
Molybdenum	ND(2.9)	U	ND(2.0)	U	
Nickel	32		41		420
Phosphorus	2.2		3.4		
Potassium	3,800		5,100		
Selenium	ND(5.8)	UJ	ND(4.1)	UJ	100
Silver	ND(2.9)	U	ND(2.0)	U	
Thallium	ND(0.58)	UJ	ND(0.41)	UJ	
Zinc	160		170		2,800
Total Nitrogen	2,800		NA		
Total Phosphorus	1,300		NA		
Total Potassium	10,000		NA		
Percent Moisture	79.6		NA		

<sup>1</sup> Total Kjeldahl Nitrogen units: percent nitrogen (%N)

<sup>2</sup> Percent Moisture and Percent Solids are by weight

<sup>3</sup> Regulatory limits presented in 40 CFR, Part 503, Section 503.13 (b) (3)

mg/kg = milligrams per kilogram

J = estimated concentration

N = nitrogen

NA = not analyzed or not applicable

ND = not detected

Q = data qualifier

U = compound was analyzed but not detected

Notes: All values for sludge samples are in milligrams per kilogram (mg/kg) on a dry basis unless otherwise indicated.

Number in parentheses [i.e., (0.58)] indicates the laboratory detection limit in mg/kg.

Total nitrogen, total phosphorus, total potassium, and percent moisture were analyzed by the North Dakota State University Soils Laboratory in Fargo, North Dakota.

All other parameters were analyzed by Analytica, Inc. of Broomfield, Colorado.

Analytical Reports are included in Appendix D.

**Table 5-3. Flight A: MAF Surface Water and Soil Field Measurements and Analytical Results**

Analyte	Wastewater Sample I.D. and Date Sampled				SDWA MCLs (mg/l)	Soil Sample I.D. and Date Sampled		EPA RBCs (mg/kg)
	A-0SW-01 (9/10/98) (Secondary Lagoon)		A-0SW-02 (9/10/98) (Primary Lagoon)			A-0SS-01 (9/10/98)		
	Result	Q	Result	Q		Result	Q	
Field Temperature (°C)	21.9		19.2			NA		
Field pH	9.99		10.62			NA		
Available Nitrogen <sup>1</sup>	NA		NA			3		
Available Phosphorus <sup>2</sup>	NA		NA			6		
Available Potassium <sup>2</sup>	NA		NA			290		
Laboratory pH	10		10			7.9		
Electrical Conductivity <sup>3</sup>	NA		NA			0.62		
Percent Moisture <sup>4</sup>	NA		NA			4.30		
TSS	ND(5.0)	U	ND(5.0)	U		NA		
BOD	ND(1.0)	U	ND(1.0)	U		NA		
O/G	2.2		2.4			NA		
Antimony	ND(0.05)	U	ND(0.05)	U	0.006	ND(5.2)	U	31
Arsenic	0.0038	J	0.0077		0.05	3.1		23
Beryllium	ND(0.002)	U	ND(0.002)	U	0.004	0.54		0.15
Cadmium	ND(0.005)	U	ND(0.005)	U	0.005	ND(0.52)	U	39
Chromium	ND(0.01)	U	ND(0.01)	U	0.1	11		390
Copper	ND(0.005)	U	ND(0.005)	U	1.3	12		3,100
Lead	ND(0.005)	U	ND(0.005)	U	0.015	7.4		400
Mercury	ND(0.0002)	U	ND(0.0002)	U	0.002	ND(0.1)	U	23
Molybdenum	ND(0.005)	U	ND(0.005)	U	0.18	ND(0.52)	U	390
Nickel	ND(0.01)	U	ND(0.01)	U	0.1	19		1,600
Phosphorus	0.22		0.12			1.3	UJ<	
Potassium	6.8		4.6			1,600		
Selenium	ND(0.002)	UJ	ND(0.002)	UJ	0.05	ND(1.0)	UJ	390
Silver	ND(0.005)	U	ND(0.005)	U	0.1	ND(0.52)	U	390
Thallium	ND(0.005)	UJ	ND(0.005)	UJ	0.002	0.10	J	
Zinc	ND(0.005)	U	ND(0.005)	U	5	45		23,000

<sup>1</sup> Available nitrogen (N): NO<sub>3</sub> as N, pounds per acre per depth (lbs/acre/depth)

<sup>2</sup> Available Phosphorus (P) and Potassium (K): parts per million (ppm)

<sup>3</sup> Electrical Conductivity (EC): milli-mhos per centimeter (mmhos/cm)

<sup>4</sup> Percent Moisture is by weight

°C = degrees Celsius

BOD = biochemical oxygen demand

J = estimated concentration

J< = estimated concentration with a low bias

mg/kg = milligrams per kilogram

mg/l = milligrams per liter

MCL = maximum contaminant level

NA = not analyzed or not applicable

ND = not detected

O/G = oil and grease

Q = data qualifier

RBC = risk based concentration for soil established by EPA Region III

SDWA = Safe Drinking Water Act

TSS = total suspended solids

U = compound was analyzed but not detected

Notes: pH values are in standard units.

All values for water samples are in milligrams per liter (mg/l) unless otherwise indicated.

All values for soil samples are in milligrams per kilogram (mg/kg) on a dry basis unless otherwise indicated.

Number in parentheses [i.e., (1.0)] indicates the laboratory detection limit in mg/l or mg/kg.

Available nitrogen, available phosphorus, available potassium, soil pH and electrical conductivity were analyzed by the North Dakota State University Soils Laboratory in Fargo, North Dakota.

All other parameters were analyzed by Analytica, Inc. of Broomfield, Colorado.

Analytical Reports are included in Appendix D.



Table 5-4. Flight A: LF Soil Field Measurements and Analytical Results

Analyte	Sample I.D. and Date Sampled															
	A-1SS-01 (9/16/98)		A-1SS-D3 (9/16/98)		A-2SS-01 (9/17/98)		A-3SS-01 (9/17/98)		A-3SS-01 (12/3/98)		A-3WP-01 (12/3/98)		A-3AS-01 (12/3/98)		A-4SS-01 (9/17/98)	
	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
Field PID	8.1		NA		64.5		NA		NA		NA		NA		102.4	
Percent Moisture	10.0		23.3		18.9		20.3		21.4		NA		18.4		19.8	
DRO	ND(1.1)	U	ND(1.3)	U	ND(1.2)	U	NA		NA		NA		NA		45	
GRO	ND(0.11)	U	ND(0.13)	U	ND(0.12)	U	NA		NA		NA		NA		ND(0.12)	U
PCB-1221	ND(0.037)	U	ND(0.043)	U	ND(0.040)	U	NA		NA		ND(19.000)	U	ND(0.41)	U	ND(0.042)	U
PCB-1232	ND(0.018)	U	ND(0.022)	U	ND(0.020)	U	NA		NA		ND(9.500)	U	ND(0.20)	U	ND(0.021)	U
PCB-1242	ND(0.018)	U	ND(0.022)	U	ND(0.020)	U	NA		NA		ND(9.500)	U	ND(0.20)	U	ND(0.021)	U
PCB-1248	ND(0.018)	U	ND(0.022)	U	ND(0.020)	U	NA		NA		ND(9.500)	U	ND(0.20)	U	ND(0.021)	U
PCB-1254	0.022		ND(0.022)	U	ND(0.020)	U	NA		NA		19.000	J<	1.5		ND(0.021)	U
PCB-1280	ND(0.018)	U	ND(0.022)	U	ND(0.020)	U	NA		NA		ND(9.500)	U	ND(0.20)	U	ND(0.021)	U
PCB-1016	ND(0.018)	U	ND(0.022)	U	ND(0.020)	U	NA		NA		ND(9.500)	U	ND(0.20)	U	ND(0.021)	U
Antimony	ND(5.6)	U	ND(6.5)	UJ<	ND(6.0)	U	ND(6.3)	UJ<	ND(6.4)	U	NA		NA		ND(6.2)	U
Arsenic	3.6		5.6		4.2		ND(6.3)	U	ND(6.4)	U	NA		NA		4.1	
Beryllium	0.44		0.43		0.51		0.29		0.32		NA		NA		0.56	
Cadmium	ND(0.56)	U	0.69		ND(0.6)	U	ND(0.62)	U	ND(0.64)	U	NA		NA		ND(0.62)	U
Chromium	9.0		9.4		15		10		9.2		NA		NA		14	
Copper	11		36		13		10		11		NA		NA		12	
Lead	60	J	8.2	J<	10		40		34		NA		NA		9.8	
Mercury	ND(0.13)	U	ND(0.13)	U	ND(0.12)	U	NA		NA		NA		NA		ND(0.12)	U
Molybdenum	1.0		0.68		ND(0.6)	U	NA		NA		NA		NA		ND(0.62)	U
Nickel	15		18		20		15		19		NA		NA		19	
Phosphorus	2.7		2.1		20		NA		NA		NA		NA		22	
Potassium	1,100		1,400		1,900		1,800		NA		NA		NA		1,900	
Selenium	ND(0.11)	UJ	ND(1.3)	UJ	ND(1.2)	U	ND(1.3)	U	ND(1.3)	U	NA		NA		ND(7.2)	U
Silver	ND(0.56)	U	ND(0.65)	U	ND(0.6)	U	ND(0.63)	U	ND(0.64)	U	NA		NA		ND(0.62)	U
Thallium	ND(0.11)	UJ	ND(0.13)	UJ<	ND(0.12)	UJ	ND(1.3)	U	ND(1.3)	U	NA		NA		ND(0.12)	UJ
Zinc	35		62		49		60		63		NA		NA		47	

Table 5-4. Flight A: LF Soil Field Measurements and Analytical Results (continued)

Analyte	Sample I.D. and Date Sampled																				
	A-5SS-01 (9/16/98)		AF-5SS <sup>1</sup> (9/16/98)		A-6SS-01 (9/16/98)		A-7SS-01 (9/16/98)		A-8SS-01 (9/16/98)		A-8SS-D2 (9/16/98)		A-9SS-01 (9/16/98)		A-9SS-D1 (9/16/98)		A-10SS-01 (9/16/98)		A-10SS-R <sup>1</sup> (9/16/98)		
	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	
Field PID	8.0		NA		14.1		13.0		167.2		NA		230		126.1					NA	
Percent Moisture	18.1		18.0		13.1		10.2		14.6		15.6		16.7		14.1					14.1	
DRO	ND(0.12)	U	ND(0.12)	U	ND(0.12)	U	ND(0.12)	U	ND(0.12)	U	ND(0.12)	U	ND(0.12)	U	ND(0.12)	U				ND(0.12)	U
GRO	ND(0.042)	U	ND(0.042)	U	ND(0.038)	U	ND(0.037)	U	ND(0.039)	U	ND(0.039)	U	ND(0.040)	U	ND(0.039)	U				ND(0.039)	U
PCB-1221	ND(0.021)	U	ND(0.020)	U	ND(0.019)	U	ND(0.019)	U	ND(0.020)	U	ND(0.020)	U	ND(0.020)	U	ND(0.019)	U				ND(0.019)	U
PCB-1232	ND(0.021)	U	ND(0.020)	U	ND(0.019)	U	ND(0.019)	U	ND(0.020)	U	ND(0.020)	U	ND(0.020)	U	ND(0.019)	U				ND(0.019)	U
PCB-1242	ND(0.021)	U	ND(0.020)	U	ND(0.019)	U	ND(0.019)	U	ND(0.020)	U	ND(0.020)	U	ND(0.020)	U	ND(0.019)	U				ND(0.019)	U
PCB-1248	ND(0.021)	U	ND(0.020)	U	ND(0.019)	U	ND(0.019)	U	ND(0.020)	U	ND(0.020)	U	ND(0.020)	U	ND(0.019)	U				ND(0.019)	U
PCB-1254	ND(0.021)	U	0.87		ND(0.019)	U	ND(0.019)	U	ND(0.020)	U	ND(0.020)	U	0.045		ND(0.019)	U				ND(0.019)	U
PCB-1260	ND(0.021)	U	ND(0.020)	U	ND(0.019)	U	ND(0.019)	U	ND(0.020)	U	ND(0.020)	U	ND(0.020)	U	ND(0.019)	U				ND(0.019)	U
PCB-1016	ND(0.021)	U	ND(0.020)	U	ND(0.019)	U	ND(0.019)	U	ND(0.020)	U	ND(0.020)	U	ND(0.020)	U	ND(0.019)	U				ND(0.019)	U
Antimony	ND(6.1)	U	0.17		ND(0.05)	U	ND(5.6)	U	ND(5.9)	U	30		2.0		1.1					ND(5.8)	U
Arsenic	4.6		4.0		4.6		3.7		3.7		3.1		6.2		5.8					5.1	
Beryllium	0.38		0.39		0.47		ND(0.22)	U	0.36		0.59		0.49		0.31					0.37	
Cadmium	ND(0.62)	U	0.35		0.26		ND(0.56)	U	ND(0.59)	U	0.76		0.41		0.10					ND(0.56)	U
Chromium	6.8		7.7		9.3		10		6.6		4.7		11		6.3					8.6	
Copper	12		12		15		13		11		19		17		11					14	
Lead	9.9		8.8		13		12		19		10		11		11					9.0	
Mercury	ND(0.12)	U	ND(0.12)	U	ND(0.12)	U	ND(0.11)	U	ND(0.12)	U	ND(0.12)	U	ND(0.12)	U	ND(0.12)	U				ND(0.12)	U
Molybdenum	ND(0.62)	U	0.82		0.51		2.2		ND(0.59)	U	3.1		1.3		0.54					1.2	
Nickel	17		18		18		11		16		39		23		18					18	
Phosphorus	4.7		9.3		9.7		7.6		19		ND(0.59)	U	31		27					19	
Potassium	1,200		1,300		1,500		790		1,200		1,300		1,800		1,300					1,400	
Selenium	ND(1.2)	UJ	ND(1.2)	UJ	ND(1.2)	UJ	ND(1.1)	UJ	ND(1.2)	UJ	ND(1.2)	UJ	ND(1.2)	UJ	ND(1.2)	UJ				ND(1.2)	UJ
Silver	ND(0.62)	U	0.098		0.046		ND(0.56)	U	ND(0.59)	U	3.0		ND(0.005)	U	ND(0.005)	U				ND(0.56)	U
Thallium	ND(0.12)	UJ	ND(0.12)	UJ	ND(0.12)	UJ	0.12	J	0.13	J	0.17	J	0.12	J	0.12	J				ND(0.12)	UJ
Zinc	42		45		43		25		58		120		54		37					42	

<sup>1</sup> This sample is a duplicate of the previous investigative sample.

D1, D2 = discretionary samples  
 DRO = diesel range organics  
 GRO = gasoline range organics  
 J = estimated concentration

J< = estimated concentration with low bias  
 NA = not analyzed or not applicable  
 ND = not detected  
 PCB = polychlorinated biphenyls

PID = photoionization detector  
 Q = data qualifier  
 R = duplicate sample  
 U = compound was analyzed but not detected

Notes:  
 All values for soil samples are in milligrams per kilogram (mg/kg) on a dry basis unless otherwise indicated.  
 Percent Moisture is by weight.  
 Number in parentheses [i.e., (0.021)] indicates the laboratory detection limit in mg/kg  
 All parameters were analyzed by Analytica, Inc. of Broomfield, Colorado.  
 Analytical Reports are included in Appendix D.

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## **446<sup>th</sup> MISSILE SQUADRON, Flight B**

### **Contents**

- 6-1. Flight B: MAF Sludge Bacteriological Results
- 6-2. Flight B: MAF Sludge Analytical Results
- 6-3. Flight B: MAF Surface Water and Soil Field Measurements and Analytical Results
- 6-4. Flight B: LF Soil Field Measurements and Analytical Results

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**Table 6-1. Flight B: MAF Sludge Bacteriological Results**

Sample I.D.	Fecal Coliform		Regulatory Limit <sup>1</sup> (MPN/gram)
	(MPN/kg)	(MPN/gram)	
Sludge Sample #1	2,940	2.94	
Sludge Sample #2	0	0	
Sludge Sample #3	0	0	
Sludge Sample #4	2,300	2.3	
Sludge Sample #5	0	0	
Sludge Sample #6	0	0	
Sludge Sample #7	19,300	19.3	
Geometric Mean (MPN/gram)		5.07	<b>1,000</b>

<sup>1</sup> Geometric mean regulatory limit for a Class A sludge presented in 40 CFR, Part 503, Section 503.32 (a) (7).

MPN/kg = most probable number per kilogram

Notes: Samples were collected 9/09/98.

Fecal coliforms were analyzed by the Grand Forks, North Dakota Water Treatment Plant laboratory.

Analytical Reports are included in Appendix D.

**Table 6-2. Flight B: MAF Sludge Analytical Results**

Analyte	Sample I.D. and Date Sampled		Regulatory Limit <sup>3</sup> (mg/kg)
	B-0SD-01 (9/09/98)		
	Result	Q	
Ammonia as N	66		
Nitrate as N	3.1		
Nitrite as N	ND(2.0)	U	
Total Kjeldahl N <sup>1</sup>	0.18		
Percent Moisture <sup>2</sup>	75.5		
Percent Solids <sup>2</sup>	24.5		
Antimony	ND(20)	U	41
Arsenic	4.4		
Beryllium	ND(0.82)	U	39
Cadmium	ND(2.0)	U	
Chromium	6.5		1,500
Copper	21		300
Lead	9.6		17
Mercury	ND(0.41)	U	
Molybdenum	ND(2.0)	U	420
Nickel	14		
Phosphorus	4.6		
Potassium	1,800		100
Selenium	ND(0.82)	UJ	
Silver	ND(2.0)	U	
Thallium	ND(0.41)	UJ	2,800
Zinc	94		
Total Nitrogen	2,300		
Total Phosphorus	600		
Total Potassium	10,000		
Percent Moisture	72.2		

<sup>1</sup> Total Kjeldahl Nitrogen units: percent Nitrogen (% N)

<sup>2</sup> Percent Moisture and Percent Solids are by weight

<sup>3</sup> Regulatory limits presented in 40 CFR, Part 503, Section 503.13 (b) (3)

J = estimated concentration

mg/kg = milligrams per kilogram

N = nitrogen

ND = not detected

Q = data qualifier

U = compound was analyzed but not detected

Notes: All values for sludge samples are in milligrams per kilogram (mg/kg) on a dry basis unless otherwise indicated.

Number in parentheses [i.e., (2.0)] indicates the laboratory detection limit in mg/kg.

Total nitrogen, total phosphorus, total potassium and percent moisture were analyzed by the North Dakota State University Soils Laboratory in Fargo, North Dakota.

All other parameters were analyzed by Analytica, Inc. of Broomfield, Colorado.

Analytical Reports are included in Appendix D.

**Table 6-3. Flight B: MAF Surface Water and Soil Field Measurements and Analytical Results**

Analyte	Wastewater Sample I.D. and Date Sampled				SDWA MCLs (mg/l)	Soil Sample I.D. and Date Sampled		EPA RBCs (mg/kg)
	B-0SW-01 (9/09/98) (Secondary Lagoon)		B-0SW-02 (9/09/98) (Primary Lagoon)			B-0SS-01 (9/09/98)		
	Result	Q	Result	Q		Result	Q	
Field Temperature (°C)	16.6		16.6			NA		
Field pH	7.97		7.92			NA		
Available Nitrogen <sup>1</sup>	NA		NA			39		
Available Phosphorus <sup>2</sup>	NA		NA			9		
Available Potassium <sup>2</sup>	NA		NA			635		
Laboratory pH	8.8		7.8			7.6		
Electrical Conductivity <sup>3</sup>	NA		NA			0.60		
Percent Moisture <sup>4</sup>	NA		NA			8.4		
TSS	22		24			NA		
BOD	4.8		8.99			NA		
O/G	1.4		1.8			NA		
Antimony	ND(0.05)	U	ND(0.05)	U	0.006	ND(5.5)	U	31
Arsenic	0.0054	J	0.0024	J	0.05	3.5		23
Beryllium	ND(0.002)	U	ND(0.002)	U	0.004	0.40		0.15
Cadmium	ND(0.005)	U	ND(0.005)	U	0.005	0.55		39
Chromium	ND(0.01)	U	ND(0.01)	U	0.1	6.8		390
Copper	ND(0.005)	U	ND(0.005)	U	1.3	13		3,100
Lead	ND(0.001)	UJ	ND(0.005)	U	0.015	6.9		400
Mercury	ND(0.0002)	U	ND(0.0002)	U	0.002	ND(0.11)	U	23
Molybdenum	0.0052		ND(0.005)	U	0.18	ND(0.55)	U	390
Nickel	0.012		ND(0.01)	U	0.1	15		1,600
Phosphorus	1.7		4.0			1.3		
Potassium	17		16			2,100		
Selenium	ND(0.002)	UJ	ND(0.002)	UJ	0.05	ND(1.1)	UJ	390
Silver	ND(0.005)	U	ND(0.005)	U	0.1	ND(0.55)	U	390
Thallium	ND(0.001)	U	ND(0.001)	U	0.002	ND(0.11)	UJ	
Zinc	ND(0.005)	U	ND(0.005)	U	5	67		23,000

<sup>1</sup> Available nitrogen (N): NO<sub>3</sub> as N, pounds per acre per depth (lbs/acre/depth)

<sup>2</sup> Available Phosphorus (P) and Potassium (K): parts per million (ppm)

<sup>3</sup> Electrical Conductivity (EC): milli-mhos per centimeter (mmhos/cm)

<sup>4</sup> Percent Moisture is by weight

°C	=	degrees Celsius	ND	=	not detected
BOD	=	biological oxygen demand	O/G	=	oil and grease
J	=	estimated concentration	Q	=	data qualifier
MCL	=	maximum contaminant level	RBC	=	risk based concentrations (EPA Region III)
mg/kg	=	milligrams per kilogram	SDWA	=	Safe Drinking Water Act
mg/l	=	milligrams per liter	TSS	=	total suspended solids
NA	=	not analyzed or not applicable	U	=	compound was analyzed but not detected

Notes: pH values are in standard units.

All values for water samples are in milligrams per liter (mg/l) unless otherwise indicated.

Number in parentheses [i.e., (0.01)] indicates the laboratory detection limit in mg/l or mg/kg.

All values for soil samples are in milligrams per kilogram (mg/kg) on a dry basis unless otherwise indicated.

Available nitrogen, available phosphorus, available potassium, soil pH and electrical conductivity were analyzed by the North Dakota State University Soils Laboratory in Fargo, North Dakota.

All other parameters were analyzed by Analytica, Inc. of Broomfield, Colorado.

Analytical Reports are included in Appendix D.



Table 6-4. Flight B: LF Soil Field Measurements and Analytical Results

Analyte	Sample I.D. and Date Sampled															
	B-11SS-01 (9/17/98)		B-11SS-B (9/17/98)		B-11WP-01 (9/17/98)		B-11SS-02 (9/17/98)		B-12SS-01 (9/17/98)		B-12SS-01 (9/17/98)		B-13SS-01 (9/17/98)		B-13SS-R (9/17/98)	
	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
Field PID	8.6		NA		NA		NA		167		8.7		13.2		7.7	
Percent Moisture	10.0		19.9		27.6		14.7		11.6		10.2		17.3		17.8	
DRO	ND(0.11)	U	NA		NA		NA		ND(0.11)	U	ND(11)	U	ND(12)	U	NA	
GRO	ND(0.037)	UJ<	NA		NA		NA		ND(0.038)	U	ND(0.037)	U	ND(0.040)	U	NA	
PCB-1221	ND(0.018)	U	NA		ND(0.046)	U	ND(0.039)		ND(0.019)	U	ND(0.019)	U	ND(0.020)	U	NA	
PCB-1232	ND(0.018)	U	NA		ND(0.023)	U	ND(0.020)		ND(0.019)	U	ND(0.019)	U	ND(0.020)	U	NA	
PCB-1242	ND(0.018)	U	NA		ND(0.023)	U	ND(0.020)		ND(0.019)	U	ND(0.019)	U	ND(0.020)	U	NA	
PCB-1248	ND(0.018)	U	NA		ND(0.023)	U	ND(0.020)		ND(0.019)	U	ND(0.019)	U	ND(0.020)	U	NA	
PCB-1254	ND(0.018)	U	NA		ND(0.023)	U	ND(0.020)		ND(0.019)	U	ND(0.019)	U	ND(0.020)	U	NA	
PCB-1260	ND(0.018)	U	NA		ND(0.023)	U	ND(0.020)		ND(0.019)	U	ND(0.019)	U	ND(0.020)	U	NA	
PCB-1016	ND(0.018)	U	NA		ND(0.023)	U	ND(0.020)		ND(0.019)	U	ND(0.019)	U	ND(0.020)	U	NA	
Antimony	ND(5.6)	U	ND(6.2)	U	NA		NA		ND(5.7)	U	ND(5.6)	U	ND(6.0)	U	ND(6.1)	U
Arsenic	2.4		4.4		NA		NA		3.4		3.9		4.8		5.4	
Beryllium	0.48		0.45		NA		NA		0.64		0.50		0.51		0.36	
Cadmium	ND(0.56)	U	ND(0.62)	U	NA		NA		ND(0.57)	U	ND(0.56)	U	ND(0.6)	U	0.69	
Chromium	12		10		NA		NA		12		13		12		6.4	
Copper	10		11		NA		NA		12		13		11		11	
Lead	6.5		7.6		NA		NA		9.0		8.2		9.8		8.8	
Mercury	ND(0.11)	U	ND(0.12)	U	NA		NA		ND(0.11)	U	ND(0.11)	U	ND(0.12)	U	0.16	
Molybdenum	0.64		1.2		NA		NA		1.7		1.4		0.93		1.5	
Nickel	16		20		NA		NA		20		20		21		21	
Phosphorus	14		6.6		NA		NA		16		3.5		1.8		1.3	
Potassium	1,500		1,700		NA		NA		1,700		1,800		1,700		1,100	
Selenium	ND(1.1)	U	ND(1.2)	U	NA		NA		ND(1.1)	U	ND(1.1)	U	ND(1.2)	U	ND(1.2)	U
Silver	ND(0.56)	U	ND(0.62)	U	NA		NA		ND(0.57)	U	ND(0.56)	U	ND(0.6)	U	ND(0.61)	U
Thallium	ND(0.11)	U	0.14		NA		NA		ND(0.11)	U	0.11		0.12		0.17	
Zinc	40		40		NA		NA		50		47		42		37	

Table 6-4. Flight B: LF Soil Field Measurements and Analytical Results (continued)

Analyte	Sample I.D. and Date Sampled											
	B-14SS-01 (9/17/98)		B-14SS-D3 (9/17/98)		B-15SS-01 (9/17/98)		BF-15SS' (9/17/98)		B-16SS-01 (9/17/98)		B-16SS-D2 (9/17/98)	
	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
Field PID	551		NA		196		NA		14.1		NA	
Percent Moisture	18.5		21.5		10.8		13.0		17.0		18.2	
DRO	ND(0.12)	U	ND(0.13)	U	ND(0.11)	U	ND(0.11)	U	ND(0.11)	UJ<	ND(0.12)	U
GRO	ND(0.12)	U	ND(0.13)	U	ND(0.11)	U	ND(0.11)	U	ND(0.11)	U	ND(0.12)	U
PCB-1221	ND(0.041)	U	ND(0.042)	U	ND(0.037)	U	ND(0.038)	U	ND(0.040)	U	ND(0.041)	U
PCB-1232	ND(0.020)	U	ND(0.021)	U	ND(0.019)	U	ND(0.019)	U	ND(0.020)	U	ND(0.020)	U
PCB-1242	ND(0.020)	U	ND(0.021)	U	ND(0.019)	U	ND(0.019)	U	ND(0.020)	U	ND(0.020)	U
PCB-1248	ND(0.020)	U	ND(0.021)	U	ND(0.019)	U	ND(0.019)	U	ND(0.020)	U	ND(0.020)	U
PCB-1254	ND(0.020)	U	ND(0.021)	U	ND(0.019)	U	ND(0.019)	U	ND(0.020)	U	ND(0.020)	U
PCB-1260	ND(0.020)	U	ND(0.021)	U	ND(0.019)	U	ND(0.019)	U	ND(0.020)	U	ND(0.020)	U
PCB-1016	ND(0.020)	U	ND(0.021)	U	ND(0.019)	U	ND(0.019)	U	ND(0.020)	U	ND(0.020)	U
Antimony	ND(6.1)	U	ND(6.4)	U	ND(5.6)	U	ND(5.7)	UJ<	ND(6.0)	U	ND(6.1)	U
Arsenic	4.5		3.7		3.7		3.6		4.5		5.6	
Beryllium	0.63		0.64		0.41		0.37		0.60		0.76	
Cadmium	ND(0.61)	U	ND(0.64)	U	0.58		0.57		ND(0.6)	U	ND(0.61)	U
Chromium	16		17		11		8.6		13		17	
Copper	14		13		9.3		9.2		14		13	
Lead	8.1	J	7.8	J	11		10		12		8.3	J
Mercury	ND(0.12)	U	ND(0.13)	U	ND(0.11)	U	ND(0.11)	U	ND(0.12)	U	ND(0.12)	U
Molybdenum	0.64		ND(0.64)	U	0.61		ND(0.57)	U	1.0		0.80	
Nickel	22		20		16		16		26		26	
Phosphorus	9.8		1.2		ND(0.56)	U	0.58		13		ND(0.61)	U
Potassium	2,100		2,200		1,300		1,100	J<	2,100		2,400	
Selenium	ND(1.2)	UJ	ND(1.3)	U	ND(1.1)	UJ	ND(1.1)	U	ND(1.2)	U	ND(1.2)	U
Silver	ND(0.61)	U	ND(0.64)	U	ND(0.56)	U	ND(0.57)	U	ND(0.6)	U	ND(0.61)	U
Thallium	0.17	J	0.41	J	0.15	J	ND(0.11)	UJ	0.14	J	ND(0.12)	UJ
Zinc	57		63		38		36		65		95	

Table 6-4. Flight B: LF Soil Field Measurements and Analytical Results (continued)

Analyte	Sample I.D. and Date Sampled												
	B-17SS-01 (9/17/98)		B-18SS-01 (9/17/98)		B-19SS-01 (9/17/98)		B-19SS-02 (9/17/98)		B-20SS-01 (9/17/98)		B-20SS-R (9/17/98)		
	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	
Field PID	108.6		NA		4.0		6.7		NA		24.8		NA
Percent Moisture	5.80	UJ<	17.4		11.9		13.3		10.4		24.7		20.5
DRO	ND(11)		NA		28		ND(12)		U		ND(13)		U
GRO	ND(0.11)	U	NA		ND(0.11)	U	ND(0.12)	U	ND(0.11)	U	ND(0.13)	U	NA
PCB-1221	ND(0.035)	U	NA		ND(0.038)	U	ND(0.77)	U	ND(0.037)	U	ND(0.044)	U	NA
PCB-1232	ND(0.018)	U	NA		ND(0.019)	U	ND(0.38)	U	ND(0.019)	U	ND(0.022)	U	NA
PCB-1242	ND(0.018)	U	NA		ND(0.019)	U	ND(0.38)	U	ND(0.019)	U	ND(0.022)	U	NA
PCB-1248	ND(0.018)	U	NA		ND(0.019)	U	ND(0.38)	U	ND(0.019)	U	ND(0.022)	U	NA
PCB-1254	0.15		NA		0.021		3.8		ND(0.019)	U	ND(0.022)	U	NA
PCB-1260	ND(0.018)	U	NA		ND(0.019)	U	ND(0.38)	U	ND(0.019)	U	ND(0.022)	U	NA
PCB-1016	ND(0.018)	U	NA		ND(0.019)	U	ND(0.38)	U	ND(0.019)	U	ND(0.022)	U	NA
Antimony	9.5		ND(6.1)	U	ND(5.7)	U	ND(5.8)	UJ<	ND(5.6)	U	ND(6.6)	U	ND(6.3)
Arsenic	3.3		3.7		3.1		3.2		J<		3.1		3.8
Beryllium	0.35		0.52		0.42		0.48		0.33		0.45		0.64
Cadmium	ND(0.53)	U	0.73		0.66		ND(0.58)	U	ND(0.56)	U	ND(0.66)	U	ND(0.63)
Chromium	5.2		13		9.2		12		8.6		12		18
Copper	6.8		12		11		11		7.0		15		15
Lead	13		260	J	23		8.2		9.8		27		19
Mercury	ND(0.11)	U	ND(0.12)	U	ND(0.11)	U	ND(0.12)	U	ND(0.11)	U	ND(0.13)	U	ND(0.13)
Molybdenum	ND(0.53)	U	1.0		ND(0.57)	U	1.3		0.57		ND(0.66)	U	0.65
Nickel	7.8		15		17		18		12		16		20
Phosphorus	4.3		4.0		ND(0.57)	U	14		11		0.67		3.6
Potassium	850		1,800		1,700		1,600		1,200		2,000		2,200
Selenium	ND(1.7)	UJ	ND(1.2)	U	ND(1.1)	U	ND(1.2)	U	ND(1.1)	U	ND(1.3)	U	ND(1.3)
Silver	0.70		ND(0.61)	U	ND(0.57)	U	ND(0.58)	U	ND(0.56)	U	ND(0.66)	U	ND(0.63)
Thallium	0.12	J	0.15	J	ND(0.11)	UJ	0.12	J<	ND(0.11)	U	ND(0.13)	U	0.19
Zinc	26		56		57		41		27		52		63

1 This sample is a duplicate of the previous investigative sample

B = background sample  
 D1, D2, D3 = discretionary sample  
 DRO = diesel range organics  
 GRO = gasoline range organics  
 J = estimated concentration

J< = estimated concentration with low bias  
 NA = not analyzed or not applicable  
 ND = not detected  
 PCB = polychlorinated biphenyls

PID = photoionization detector  
 Q = data qualifier  
 U = compound was analyzed but not detected  
 R, RA = random sample

Notes: All values for soil samples are in milligrams per kilogram (mg/kg) on a dry basis unless otherwise indicated.  
 Percent moisture is by weight.  
 Number in parentheses [i.e., (0.11)] indicates the laboratory detection limit in mg/kg.  
 All parameters were analyzed by Analytica, Inc. of Broomfield, Colorado.  
 Analytical Reports are included in Appendix D.

## **446<sup>th</sup> MISSILE SQUADRON, Flight C**

### **Contents**

- 7-1. Flight C: MAF Sludge Bacteriological Results
- 7-2. Flight C: MAF Sludge Analytical Results
- 7-3. Flight C: MAF Surface Water and Soil Field Measurements and Analytical Results
- 7-4. Flight C: LF Soil Field Measurements and Analytical Results

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**Table 7-1. Flight C: MAF Sludge Bacteriological Results**

Sample I.D.	Fecal Coliform		Regulatory Limit <sup>1</sup> (MPN/gram)
	(MPN/kg)	(MPN/gram)	
Sludge Sample #1	0	0	
Sludge Sample #2	0	0	
Sludge Sample #3	0	0	
Sludge Sample #4	0	0	
Sludge Sample #5	2,270	2.27	
Sludge Sample #6	0	0	
Sludge Sample #7	0	0	
Sludge Sample Duplicate	0	0	
Geometric Mean (MPN/gram)		2.27	

<sup>1</sup> Geometric mean regulatory limit for a Class A sludge presented in 40 CFR, Part 503, Section 503.32 (a) (7).

MPN/kg = most probable Number per kilogram

Notes: Samples were collected 9/15/98.

Fecal coliforms were analyzed by the Grand Forks, North Dakota Water Treatment Plant laboratory.

Analytical Reports are included in Appendix D.

**Table 7-2. Flight C: MAF Sludge Analytical Results**

Analyte	Sample I.D. and Date Sampled				Regulatory Limit <sup>4</sup> (mg/kg)
	C-0SD-01 (9/15/98)		CF-0SD-01 <sup>1</sup> (9/15/98)		
	Result	Q	Result	Q	
Ammonia as N	43		280		
Nitrate as N	ND(1.7)	U	ND(2.3)	U	
Nitrite as N	ND(3.4)	U	ND(4.5)	U	
Total Kjeldahl N <sup>2</sup>	0.08		0.11		
Percent Moisture <sup>3</sup>	70.9		78.0		
Percent Solids <sup>3</sup>	29.1		22.0		
Antimony	ND(17)	U	ND(23)	U	
Arsenic	7.1		7.2		41
Beryllium	1.3		1.1		
Cadmium	ND(1.7)	U	ND(2.3)	U	39
Chromium	27		25		
Copper	26		29		1,500
Lead	16		18	U	300
Mercury	ND(0.34)	U	ND(0.45)	U	17
Molybdenum	2.6		ND(2.3)		
Nickel	29		36		420
Phosphorus	ND(1.7)	U	4.1		
Potassium	3,900		4,100		
Selenium	ND(3.4)	U	ND(4.5)	U	100
Silver	ND(1.7)	U	ND(2.3)	U	
Thallium	ND(0.34)	U	ND(0.45)	U	
Zinc	96		110		2,800
Total Nitrogen	2,400		NA		
Total Phosphorus	600		NA		
Total Potassium	13,500		NA		
Percent Moisture	36.5		NA		

<sup>1</sup> This sample is a duplicate of the previous investigative sample.

<sup>2</sup> Total Kjeldahl Nitrogen units: percent Nitrogen (% N)

<sup>3</sup> Percent Moisture and Percent Solids are by weight

<sup>4</sup> Regulatory limits presented in 40 CFR, Part 503, Section 503.13 (b) (3)

mg/kg = milligrams per kilogram

N = nitrogen

NA = not analyzed or not applicable

ND = not detected

Q = data qualifier

U = Compound was analyzed but not detected

Notes: All values for sludge samples are in milligrams per kilogram (mg/kg) on a dry basis unless otherwise indicated.

Number in parentheses [i.e., (2.3)] indicates the laboratory detection limit in mg/kg.

Total nitrogen, total phosphorus, total potassium and percent moisture were analyzed by the North Dakota State University Soils Laboratory in Fargo, North Dakota.

All other parameters were analyzed by Analytica, Inc. of Broomfield, Colorado.

Analytical Reports are included in Appendix D.

**Table 7-3. Flight C: MAF Surface Water and Soil Field Measurements and Analytical Results**

Analyte	Wastewater Sample I.D. and Date Sampled						SDWA MCLs (mg/l)	Soil Sample I.D. and Date Sampled				EPA RBCs (mg/kg)
	C-0SW-01 (9/12/98) (Primary Lagoon)		C-0SW-02 (9/12/98) (Secondary Lagoon)		CF-0SW-025 (9/12/98)			C-0SS-01 (9/12/98)		CF-0SS-015 (9/12/98)		
	Result	Q	Result	Q	Result	Q		Result	Q	Result	Q	
Field Temperature (°C)	19.3		18.9		NA			NA		NA		
Field pH	9.67		9.90		NA			NA		NA		
Available Nitrogen <sup>1</sup>	NA		NA		NA			4		NA		
Available Phosphorus <sup>2</sup>	NA		NA		NA			5		NA		
Available Potassium <sup>3</sup>	NA		NA		NA			250		NA		
Laboratory pH	9.60		9.74		9.69			7.7		NA		
Electrical Conductivity <sup>3</sup>	NA		NA		NA			0.35		NA		
Percent Moisture <sup>4</sup>	NA		NA		NA			12.3		11.7		
TSS	ND(5.0)	U	33		ND(5.0)	U		NA		NA		
BOD	ND(1.0)	U	1.0		1.4			NA		NA		
O/G	1.7		1.5		7.3			NA		NA		
Antimony	ND(0.05)	U	ND(0.05)	U	ND(0.05)	U	0.006	ND(5.7)	U	ND(5.7)	U	31
Arsenic	0.0052	J	0.012		0.012		0.05	2.5		2.5		23
Beryllium	ND(0.002)	U	ND(0.002)	U	ND(0.002)	U	0.004	0.55		0.52		0.15
Cadmium	ND(0.005)	U	ND(0.005)	U	ND(0.005)	U	0.005	ND(0.57)	U	ND(0.57)	U	39
Chromium	ND(0.01)	U	ND(0.01)	U	ND(0.01)	U	0.1	9.4		9.1		390
Copper	ND(0.005)	U	ND(0.005)	U	ND(0.005)	U	1.3	7.5		7.8		3,100
Lead	ND(0.005)	U	ND(0.001)	UJ	ND(0.001)	UJ	0.015	8.9		6.9		400
Mercury	ND(0.0002)	U	ND(0.0002)	U	ND(0.0002)	U	0.002	ND(0.11)	U	ND(0.11)	U	23
Molybdenum	ND(0.005)	U	ND(0.005)	U	ND(0.005)	U	0.18	ND(0.57)	U	ND(0.57)	U	390
Nickel	ND(0.01)	U	ND(0.01)	U	ND(0.01)	U	0.1	17		15		1,600
Phosphorus	0.32		0.34		0.38			ND(0.57)	U	ND(0.57)	U	
Potassium	5.5		6.3		6.4			1,400		1,400		
Selenium	ND(0.002)	UJ	ND(0.002)	UJ	ND(0.002)	UJ	0.05	ND(1.1)	UJ	ND(1.1)	UJ	390
Silver	ND(0.005)	U	ND(0.005)	U	ND(0.005)	U	0.1	ND(0.57)	U	ND(0.57)	U	390
Thallium	ND(0.001)	UJ	ND(0.001)	UJ	ND(0.001)	UJ	0.002	ND(0.57)	UJ	ND(0.57)	UJ	
Zinc	0.0061		0.0074		0.0053		5	36		36		23,000

<sup>1</sup> Available nitrogen (N): NO<sub>3</sub> as N, pounds per acre per depth (lbs/acre/depth)

<sup>2</sup> Available Phosphorus (P) and Potassium (K): parts per million (ppm)

<sup>3</sup> Electrical Conductivity (EC): milli-mhos per centimeter (mmhos/cm)

<sup>4</sup> Percent Moisture is by weight

<sup>5</sup> This sample is a duplicate of the previous investigative sample.

°C = degrees Celsius

BOD = biological oxygen demand

J = estimated concentration

MCL = maximum contaminant level

mg/kg = milligrams per kilogram

mg/l = milligrams per liter

NA = not analyzed or not applicable

ND = not detected

O/G = oil and grease

Q = data qualifier

RBC = risk based concentrations (EPA Region III)

SAP = sampling and analysis plan

SDWA = Safe Drinking Water Act

TSS = total suspended solids

U = compound analyzed but not detected

Notes: All values for water samples are in milligrams per liter (mg/l) unless otherwise indicated; pH values are in standard units.

All values for soil samples are in milligrams per kilogram (mg/kg) on a dry basis unless otherwise indicated.

Number in parentheses [i.e., (1.0)] indicates the laboratory detection limit in mg/l or mg/kg.

Available nitrogen, available phosphorus, available potassium, soil pH and electrical conductivity were analyzed by the North Dakota State University Soils Laboratory in Fargo, North Dakota. All other parameters were analyzed by Analytica, Inc. of Broomfield, Colorado. Analytical Reports are included in Appendix D.



Table 7-4. Flight C: LF Soil Field Measurements and Analytical Results

Analyte	Sample I.D. and Date Sampled																	
	C-21SS-01 (9/11/98)		C-21SS-B (9/11/98)		C-21WP-01 (9/11/98)		C-22SS-01 (9/11/98)		C-23SS-01 (9/11/98)		C-23WP-01 (9/11/98)		C-24SS-01 (9/11/98)		C-25SS-01 (9/14/98)		C-25SS-D3 (9/14/98)	
	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
Field PID	40.7		NA		NA		9.1		NA		NA		50.4		86.3		15.9	
Percent Moisture	7.40		8.3		16.6		15.8		12.9		27.0		9.30		15.2		15.6	
DRO	ND(1.1)	U	NA		NA		ND(1.2)	U	100		NA		230		ND(1.2)	U	16	
GRO	ND(0.11)	U	NA		NA		ND(0.12)	U	ND(0.11)	U	NA		ND(0.11)	UJ<	ND(0.12)	U	ND(0.12)	U
PCB-1221	ND(0.036)	U	NA		ND(0.28)	U	ND(0.040)	U	ND(0.038)	U	ND(0.140)	UJ<	ND(0.037)	U	ND(0.039)	U	ND(0.039)	U
PCB-1232	ND(0.018)	U	NA		ND(0.14)	U	ND(0.020)	U	ND(0.019)	U	ND(0.068)	UJ<	ND(0.018)	U	ND(0.020)	U	ND(0.020)	U
PCB-1242	ND(0.018)	U	NA		ND(0.14)	U	ND(0.020)	U	ND(0.019)	U	ND(0.068)	UJ<	ND(0.018)	U	ND(0.020)	U	ND(0.020)	U
PCB-1248	ND(0.018)	U	NA		ND(0.14)	U	ND(0.020)	U	ND(0.019)	U	ND(0.068)	UJ<	ND(0.018)	U	ND(0.020)	U	ND(0.020)	U
PCB-1254	ND(0.018)	U	NA		ND(0.14)	U	ND(0.020)	U	ND(0.019)	U	ND(0.068)	UJ<	ND(0.018)	U	ND(0.020)	U	ND(0.020)	U
PCB-1260	ND(0.018)	U	NA		0.38	J<	0.029		0.033		ND(0.068)	UJ<	0.13		ND(0.020)	U	ND(0.020)	U
PCB-1016	ND(0.018)	U	NA		ND(0.14)	U	ND(0.020)	U	ND(0.019)	U	ND(0.068)	UJ<	ND(0.018)	U	ND(0.020)	U	ND(0.020)	U
Antimony	ND(5.4)	U	ND(5.5)	U	NA		ND(5.9)	U	ND(5.7)	U	NA		21		ND(5.9)	U	ND(5.9)	UJ<
Arsenic	3.1		3.3		NA		5.5		4.8		NA		4.1		4.6		2.7	J<
Beryllium	0.31		0.29		NA		0.31		0.34		NA		0.35		0.34		0.57	
Cadmium	ND(0.54)	U	ND(0.55)	U	NA		0.65		ND(0.57)	U	NA		1.1		ND(0.59)	U	ND(0.59)	U
Chromium	5.3		6.4		NA		5.5		6.8		NA		9.1		6.9		13	
Copper	9.1		13		NA		11		14		NA		30		12		9.0	
Lead	3.7		7.9		NA		8.8		7.0		NA		49		20		7.5	J<
Mercury	ND(0.11)	U	ND(0.11)	U	NA		ND(0.12)	U	ND(0.11)	U	NA		ND(0.11)	U	ND(0.12)	U	ND(0.12)	U
Molybdenum	0.98		ND(0.55)	U	NA		1.7		2.6		NA		2.7		7.0		ND(0.59)	U
Nickel	15		14		NA		15		19		NA		22		15		20	
Phosphorus	3.5		4.4		NA		6.2		1.4		NA		65		10		ND(0.59)	UJ<
Potassium	850		810		NA		880		1,200		NA		860		830		1,300	
Selenium	ND(1.1)	UJ	ND(1.1)	UJ	NA		ND(1.2)	UJ	ND(1.1)	UJ	NA		ND(1.1)	UJ	ND(1.2)	UJ	X	
Silver	ND(0.54)	U	ND(0.55)	U	NA		ND(0.59)	U	ND(0.57)	U	NA		2.6		ND(0.59)	U	ND(0.59)	U
Thallium	ND(0.54)	UJ	0.65		NA		0.65		ND(0.57)	UJ	NA		ND(0.55)	UJ	ND(0.59)	UJ	0.24	J
Zinc	32		31		NA		36		45		NA		57		33		37	

Table 7-4. Flight C: LF Soil Field Measurements and Analytical Results (continued)

Analyte	Sample I.D. and Date Sampled																	
	C-25WP (9/14/98)		C-26SS-02 (9/14/98)		C-26SS-01 (9/11/98)		C-27SS-01 (9/11/98)		C-28SS-01 (9/11/98)		C-29SS-01 (9/11/98)		C-30SS-01 (9/11/98)		C-30SS-D1/D2 (9/11, 18/98)		C-30SS-R (9/11/98)	
	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
Field PID	NA		NA		24		28.3		8.9		14.6		28.9		NA		NA	
Percent Moisture	6.30		13.3		14.1		13.9		9.80		11.1		17.0		9.20		22.9	
DRO	NA		NA		370		560	J>	ND(1.1)	U	ND(1.1)	U	ND(1.2)	U	ND(1.1)	U	NA	
GRO	NA		NA		ND(0.12)	U	ND(0.12)	U	ND(0.11)	U	ND(0.11)	U	ND(0.12)	U	ND(0.11)	U	NA	
PCB-1221	ND(18.000)	UJ<	ND(0.077)	U	ND(0.039)	U	ND(0.12)	U	ND(0.11)	U	ND(0.037)	U	ND(0.040)	U	NA		NA	
PCB-1232	ND(6.900)	UJ<	ND(0.038)	U	ND(0.019)	U	ND(0.039)	U	ND(0.037)	U	ND(0.037)	U	ND(0.040)	U	NA		NA	
PCB-1242	ND(6.900)	UJ<	ND(0.038)	U	ND(0.019)	U	ND(0.18)	U	ND(0.18)	U	ND(0.019)	U	ND(0.020)	U	NA		NA	
PCB-1248	ND(6.900)	UJ<	ND(0.038)	U	ND(0.019)	U	ND(0.18)	U	ND(0.18)	U	ND(0.019)	U	ND(0.020)	U	NA		NA	
PCB-1254	74.000	UJ<	0.59		ND(0.019)	U	ND(0.019)	U	ND(0.018)	U	ND(0.019)	U	ND(0.020)	U	NA		NA	
PCB-1260	ND(6.900)	UJ<	ND(0.038)	U	0.02		0.046		ND(0.018)	U	0.087		0.026		NA		NA	
PCB-1016	ND(6.900)	UJ<	ND(0.038)	U	ND(0.019)	U	ND(0.18)	U	ND(0.018)	U	ND(0.019)	U	ND(0.020)	U	NA		NA	
Antimony	NA		NA		ND(5.8)	U	ND(5.8)	U	ND(6.1)	U	ND(5.8)	U	ND(6.0)	U	ND(5.5)	U	ND(6.5)	U
Arsenic	NA		NA		4.3		3.6		5.0		2.4		3.1		2.7		2.8	
Beryllium	NA		NA		0.45		0.30		0.41		0.33		0.41		0.43		0.52	
Cadmium	NA		NA		ND(0.58)	U	ND(0.61)	U	ND(0.61)	U	ND(0.55)	U	ND(0.6)	U	0.65		ND(0.65)	U
Chromium	NA		NA		11		8.9		6.3		5.0		7.4		7.9		9.9	
Copper	NA		NA		15		11		12		8.7		12		11		14	
Lead	NA		NA		8.5		17		15		5.5		6.5		14		9.6	
Mercury	NA		NA		ND(0.12)	U	ND(0.12)	U	ND(0.11)	U	ND(0.11)	U	ND(0.12)	U	ND(0.11)	U	ND(0.13)	U
Molybdenum	NA		NA		ND(0.58)	U	0.99		0.60		0.98		0.95		1.0		0.73	
Nickel	NA		NA		19		14		15		10		20		21		22	
Phosphorus	NA		NA		9.3		29		ND(0.55)	U	3.2		ND(0.6)	U	0.64		0.52	J1
Potassium	NA		NA		1,400		1,100		890		820		1,100		1,300		1,300	
Selenium	NA		NA		ND(1.2)	UJ	ND(1.2)	UJ	ND(1.1)	UJ	ND(1.1)	UJ	ND(1.2)	UJ	ND(1.1)	UJ	ND(1.3)	UJ
Silver	NA		NA		ND(0.58)	U	ND(0.58)	U	ND(0.55)	U	ND(0.56)	U	ND(0.6)	U	ND(0.59)	U	ND(0.65)	U
Thallium	NA		NA		0.58		0.73		0.61		ND(0.56)	UJ	ND(0.6)	UJ	0.12		0.17	J
Zinc	NA		NA		48		36		42		23		51		51		58	

B = background sample  
 D1/D2 = discretionary sample  
 D3/D1 = discretionary sample  
 DRO = diesel range organics  
 GRO = gasoline range organics  
 J = estimated concentration  
 J> = estimated concentration with high bias  
 J< = estimated concentration with low bias  
 NA = not analyzed or not applicable  
 ND = not detected  
 PID = photoionization detector  
 PCB = polychlorinated biphenyls  
 Q = data qualifier  
 R = random sample  
 U = compound was analyzed but not detected  
 X = laboratory analytical data rejected during validation

Notes: All values for soil samples are in milligrams per kilogram (mg/kg) on a dry basis unless otherwise indicated.  
 Percent Moisture is by weight.  
 Number in parentheses [i.e., (0.11)] indicates the laboratory detection limit in mg/kg.  
 All parameters were analyzed by Analytica, Inc. of Broomfield, Colorado.  
 Analytical Reports are included in Appendix D.

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## **446<sup>th</sup> MISSILE SQUADRON, Flight D**

### **Contents**

- 8-1. Flight D: MAF Sludge Bacteriological Results
- 8-2. Flight D: MAF Sludge Analytical Results
- 8-3. Flight D: MAF Surface Water and Soil Field Measurements and Analytical Results
- 8-4. Flight D: LF Soil Field Measurements and Analytical Results

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**Table 8-1. Flight D: MAF Sludge Bacteriological Results**

Sample I.D.	Fecal Coliform		Regulatory Limit <sup>1</sup> (MPN/gram)
	(MPN/kg)	(MPN/gram)	
Sludge Sample #1	16,600	16.6	
Sludge Sample #2	27,200	27.2	
Sludge Sample #3	11,600	11.6	
Sludge Sample #4	0	0	
Sludge Sample #5	2,630	2.63	
Sludge Sample #6	84,000	84	
Sludge Sample #7	0	0	
Geometric Mean (MPN/gram)		16.3	<b>1,000</b>

<sup>1</sup> Geometric mean regulatory limit for a Class A sludge presented in 40 CFR, Part 503, Section 503.32 (a) (7).

MPN/kg = most probable number per kilogram

Notes: Samples were collected 9/10/98.

Fecal coliforms were analyzed by the Grand Forks, North Dakota Water Treatment Plant laboratory.

Analytical Reports are included in Appendix D.

**Table 8-2. Flight D: MAF Sludge Analytical Results**

Analyte	Sample I.D. and Date Sampled						Regulatory Limit <sup>4</sup> (mg/kg)
	D-0SD-01 (9/10/98)		DF-0SD-01 <sup>1</sup> (9/10/98)		D-0SD-02 (9/10/98)		
	Result	Q	Result	Q	Result	Q	
Ammonia as N	100		120		97		
Nitrate as N	6.6		ND(3.4)	U	ND(2.9)	U	
Nitrite as N	ND(2.9)	U	ND(3.4)	U	ND(2.9)	U	
Total Kjeldahl N <sup>2</sup>	0.09		0.07		0.08		
Percent Moisture <sup>3</sup>	82.7		85.4		82.8		
Percent Solids <sup>3</sup>	17.3		14.6		17.2		
Antimony	ND(29)	U	ND(34)	U	ND(29)	U	41
Arsenic	2.7	J	3.4	J	2.3	J	
Beryllium	ND(1.2)	U	ND(1.4)	U	ND(1.2)	U	39
Cadmium	ND(2.9)	U	ND(3.4)	U	ND(2.9)	U	
Chromium	14		15		7.6		1,500
Copper	26		36		19		300
Lead	15		23		10		17
Mercury	ND(0.58)	U	ND(0.68)	U	ND(0.58)	U	
Molybdenum	ND(2.9)	U	ND(3.4)	U	ND(2.9)	U	420
Nickel	16		22		15		
Phosphorus	18		11		3.5		
Potassium	2,600		3,600		2,200		100
Selenium	ND(5.8)	UJ	ND(6.8)	UJ	ND(1.2)	UJ	
Silver	ND(2.9)	U	ND(3.4)	U	ND(2.9)	U	
Thallium	ND(0.58)	UJ	ND(0.68)	UJ	ND(0.58)	U	2,800
Zinc	98		130		72		
Total Nitrogen	4,100		NA		NA		
Total Phosphorus	800		NA		NA		
Total Potassium	8,100		NA		NA		
Percent Moisture	85.0		NA		NA		

<sup>1</sup> This sample is a duplicate of the previous investigative sample.

<sup>2</sup> Total Kjeldahl Nitrogen units: percent Nitrogen (% N)

<sup>3</sup> Percent Moisture and Percent Solids are by weight

<sup>4</sup> Regulatory limits presented in 40 CFR, Part 503, Section 503.13 (b) (3)

J = estimated concentration

mg/kg = milligrams per kilogram

N = nitrogen

NA = not analyzed or not applicable

ND = not detected

Q = data qualifier

U = compound was analyzed but not detected

Notes: All values for sludge samples are in milligrams per kilogram (mg/kg) on a dry basis unless otherwise indicated. Number in parentheses [i.e., (2.9)] indicates the laboratory detection limit in mg/kg. Total nitrogen, total phosphorus, total potassium and percent moisture were analyzed by the North Dakota State University Soils Laboratory in Fargo, North Dakota. All other parameters were analyzed by Analytica, Inc. of Broomfield, Colorado. Analytical Reports are included in Appendix D.

**Table 8-3. Flight D MAF: Surface Water and Soil Field Measurements and Analytical Results**

Analyte	Wastewater Sample I.D. and Date Sampled				SDWA MCLs (mg/l)	Soil Sample I.D. and Date Sampled				EPA RBCs (mg/kg)
	D-0SW-01 (9/12/98) (Primary Lagoon)		D-0SW-02 (9/12/98) (Secondary Lagoon)			D-0SS-01 (9/10/98)		DF-0SS-01 <sup>5</sup> (9/10/98)		
	Result	Q	Result	Q		Result	Q	Result	Q	
Field Temperature (°C)	18.2		17.5			NA		NA		
Field pH	8.11		8.91			NA		NA		
Available Nitrogen <sup>1</sup>	NA		NA			4		NA		
Available Phosphorus <sup>2</sup>	NA		NA			4		NA		
Available Potassium <sup>2</sup>	NA		NA			320		NA		
Laboratory pH	7.70		8.71			8.1		NA		
Electrical Conductivity <sup>3</sup>	NA		NA			0.54		NA		
Percent Moisture <sup>4</sup>	NA		NA			5.0		5.8		
TSS	140		330			NA		NA		
BOD	5.3		ND(1.0)	U		NA		NA		
O/G	3.7		2.0			NA		NA		
Antimony	ND(0.05)	U	ND(0.05)	U	0.006	ND(5.3)	U	ND(5.3)	U	31
Arsenic	ND(0.002)	UJ	0.0029	J	0.05	3.9		4.2		23
Beryllium	ND(0.002)	U	ND(0.002)	U	0.004	0.44		0.47		0.15
Cadmium	ND(0.005)	U	ND(0.005)	U	0.005	ND(0.53)	U	ND(0.53)	U	39
Chromium	ND(0.01)	U	ND(0.01)	U	0.1	9.0		11		390
Copper	ND(0.005)	U	0.0053		1.3	12		12		3,100
Lead	ND(0.005)	UJ	0.009		0.015	6.4		6.2		400
Mercury	ND(0.0002)	U	ND(0.0002)	U	0.002	ND(0.11)	U	ND(0.11)	U	23
Molybdenum	ND(0.005)	U	ND(0.005)	U	0.18	ND(0.53)	U	ND(0.53)	U	390
Nickel	ND(0.01)	U	ND(0.01)	U	0.1	17		18		1,600
Phosphorus	3.1		1.2			2.2		1.8		
Potassium	8.5		19			1,600		1,700		
Selenium	ND(0.002)	UJ	ND(0.002)	UJ	0.05	ND(1.1)	UJ	ND(1.1)	UJ	390
Silver	ND(0.005)	U	ND(0.005)	U	0.1	ND(0.53)	U	ND(0.53)	U	390
Thallium	ND(0.001)	UJ	ND(0.001)	UJ	0.002	0.14	J	0.12	J	
Zinc	0.014		0.026		5	42		45		23,000

<sup>1</sup> Available nitrogen (N): NO<sub>3</sub> as N, pounds per acre per depth (lbs/acre/depth)

<sup>2</sup> Available Phosphorus (P) and Potassium (K): parts per million (ppm)

<sup>3</sup> Electrical Conductivity (EC): milli-mhos per centimeter (mmhos/cm)

<sup>4</sup> Percent Moisture is by weight

<sup>5</sup> This sample is a duplicate of the previous investigative sample.

°C = degrees Celsius

BOD = biological oxygen demand

J = estimated concentration

MCL = maximum contaminant level

mg/kg = milligrams per kilogram

mg/l = milligrams per liter

NA = not analyzed or not applicable

ND = not detected

O/G = oil and grease

Q = data qualifier

RBC = risk based concentrations (EPA Region III)

SDWA = Safe Drinking Water Act

TSS = total suspended solids

U = compound analyzed but not detected

Notes: pH values are in standard units.

All values for water samples are in milligrams per liter (mg/l) unless otherwise indicated.

All values for soil samples are in milligrams per kilogram (mg/kg) on a dry basis unless otherwise indicated.

Number in parentheses [i.e., (1.1)] indicates the laboratory detection limit in mg/l or mg/kg.

Available nitrogen, available phosphorus, available potassium, soil pH and electrical conductivity were analyzed by the North Dakota State University Soils Laboratory in Fargo, North Dakota.

All other parameters were analyzed by Analytica, Inc. of Broomfield, Colorado.

Analytical Reports are included in Appendix D.



Table 8-4. Flight D: LF Soil Field Measurements and Analytical Results

Analyte	Sample I.D. and Date Sampled													
	D-31SS-01 (9/14/98)		D-32SS-01 (9/14/98)		D-32SS-01 (12/2/98)		D-32WP-01 (12/2/98)		D-32AS-01 (12/2/98)		D-33SS-01 (9/14/98)		D-34SS-01 (9/14/98)	
	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
Field PID	63.7		23.6		NA		NA		NA		20.8		14.1	
Percent Moisture	12.2		10.0		15.7		21.6		20.3		15.0		7.50	
DRO	ND(11)	U	ND(11)	UJ<	NA		NA		NA		ND(12)	UJ<	ND(100)	UJ<
GRO	ND(0.11)	U	ND(0.11)	U	NA		NA		NA		ND(0.12)	U	ND(0.11)	U
PCB-1221	ND(0.038)	U	ND(0.038)	U	NA		ND(4.300)	U	ND(0.21)	UJ<	ND(0.039)	U	ND(0.036)	U
PCB-1232	ND(0.019)	U	ND(0.018)	U	NA		ND(2.100)	U	ND(0.10)	UJ<	ND(0.020)	U	ND(0.018)	U
PCB-1242	ND(0.019)	U	ND(0.018)	U	NA		ND(2.100)	U	ND(0.10)	UJ<	ND(0.020)	U	ND(0.018)	U
PCB-1248	ND(0.019)	U	ND(0.018)	U	NA		ND(2.100)	U	ND(0.10)	UJ<	ND(0.020)	U	ND(0.018)	U
PCB-1254	ND(0.019)	U	ND(0.018)	U	NA		6.100		0.95	UJ<	ND(0.020)	U	0.037	
PCB-1260	ND(0.019)	U	ND(0.018)	U	NA		ND(2.100)	U	ND(0.11)	UJ<	ND(0.020)	U	ND(0.018)	U
PCB-1016	ND(0.019)	U	ND(0.018)	U	NA		ND(2.100)	U	ND(0.11)	UJ<	ND(0.020)	U	ND(0.018)	U
Antimony	ND(5.7)	U	ND(5.6)	U	ND(5.9)	U	NA		NA		ND(5.9)	U	ND(5.4)	U
Arsenic	3.7		2.1		ND(5.9)	U	NA		NA		3.0		4.2	
Beryllium	0.46		0.34		0.25		NA		NA		0.31		0.24	
Cadmium	ND(0.57)	U	0.83		ND(0.59)	U	NA		NA		ND(0.59)	U	ND(0.54)	U
Chromium	8.2		6.1		8.0		NA		NA		13		9.2	
Copper	12		10		7.1		NA		NA		23		23	
Lead	8.8		9.3		44		NA		NA		6.5		30	
Mercury	ND(0.11)	U	ND(0.11)	U	NA		NA		NA		ND(0.12)	U	ND(0.11)	U
Molybdenum	0.84		0.98		NA		NA		NA		2.0		0.69	
Nickel	18		16		13		NA		NA		18		11	
Phosphorus	2.9		5.6		NA		NA		NA		2.7		5.1	
Potassium	1,300		860		NA		NA		NA		830		1,100	
Selenium	1.1		ND(1.1)	U	ND(12)	U	NA		NA		ND(1.2)	U	ND(1.1)	U
Silver	ND(0.57)	U	ND(0.56)	U	ND(0.59)	U	NA		NA		ND(0.59)	U	ND(0.54)	U
Thallium	0.11		ND(0.56)	U	ND(12)	U	NA		NA		ND(0.59)	U	0.13	
Zinc	42		33		32		NA		NA		44		37	

Table 8-4. Flight D: LF Soil Field Measurements and Analytical Results (continued)

Analyte	Sample I.D. and Date Sampled																
	D-35SS-01 (9/14/98)		D-35SS-D2 (9/14/98)		D-36SS-01 (9/14/98)		D-37SS-01 (9/14/98)		D-38SS-01 (9/14/98)		D-39SS-D3 (9/14/98)		D-40SS-01 (9/14/98)		D-40SS-R (9/14/98)		
	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	
Field PID	82.8		NA		6.0		7.5		7.0		8.1		NA		6.0		NA
Percent Moisture	12.1		14.8		11.4		12.6		10.4		15.3		10.5		16.2		5.90
DRO	ND(11)	UJ<	ND(12)	UJ<	ND(11)	UJ<	ND(11)	UJ<	ND(11)	U	ND(12)	U	ND(11)	U	ND(12)	UJ<	NA
GRO	ND(0.11)	U	ND(0.12)	U	ND(0.11)	U	ND(0.11)	U	ND(0.37)	U	ND(0.12)	U	ND(0.11)	U	ND(0.12)	U	NA
PCB-1221	ND(0.038)	U	ND(0.039)	U	ND(0.038)	U	ND(0.038)	U	ND(0.019)	U	ND(0.037)	U	ND(0.037)	U	ND(0.040)	U	NA
PCB-1232	ND(0.019)	U	ND(0.020)	U	ND(0.019)	U	ND(0.019)	U	ND(0.019)	U	ND(0.019)	U	ND(0.019)	U	ND(0.020)	U	NA
PCB-1242	ND(0.019)	U	ND(0.020)	U	ND(0.019)	U	ND(0.019)	U	ND(0.019)	U	ND(0.019)	U	ND(0.019)	U	ND(0.020)	U	NA
PCB-1248	ND(0.019)	U	ND(0.020)	U	ND(0.019)	U	ND(0.019)	U	ND(0.019)	U	ND(0.019)	U	ND(0.019)	U	ND(0.020)	U	NA
PCB-1254	ND(0.019)	U	ND(0.020)	U	0.120		ND(0.019)	U	ND(0.019)	U	ND(0.019)	U	ND(0.019)	U	0.370		NA
PCB-1260	ND(0.019)	U	ND(0.020)	U	ND(0.019)	U	ND(0.019)	U	ND(0.019)	U	ND(0.019)	U	ND(0.019)	U	ND(0.020)	U	NA
PCB-1016	ND(0.019)	U	ND(0.020)	U	ND(0.019)	U	ND(0.019)	U	ND(0.019)	U	ND(0.019)	U	ND(0.019)	U	ND(0.020)	U	NA
Antimony	ND(5.7)	U	ND(5.9)	U	ND(5.6)	U	ND(5.7)	U	ND(5.6)	U	0.68		ND(0.05)	U	ND(6.0)	U	0.23
Arsenic	4.0		2.6		2.6		3.7		4.4		4.8		3.1		3.6		3.8
Beryllium	0.33		0.43		0.30		0.34		0.37		0.33		0.37		0.50		0.44
Cadmium	ND(0.57)	U	ND(0.59)	U	ND(0.56)	U	ND(0.57)	U	ND(0.56)	U	0.58		ND(0.005)	U	ND(0.6)	U	0.30
Chromium	7.5		6.8		7.5		8.6		8.9		7.8		7.9		7.7		10
Copper	8.9		11		9.0		11		13		11		10		13		12
Lead	7.8		13		5.2		5.2		7.3		8.0		7.6		17		6.8
Mercury	ND(0.11)	U	ND(0.12)	U	ND(0.11)	U	ND(0.11)	U	ND(0.11)	U	ND(0.12)	U	ND(0.11)	U	ND(0.12)	U	ND(0.17)
Molybdenum	0.78		ND(0.59)	U	1.7		0.96		0.83		0.59		0.078		0.67		0.95
Nickel	14		18		13		13		14		14		15		21		17
Phosphorus	5.0		5.8		5.2		3.5		22		3.7		2.8		9.3		3.4
Potassium	870		1,400		960		1,000		1,200		1,100		1,200		1,500		1,300
Selenium	ND(1.1)	U	ND(1.2)	U	ND(1.1)	U	ND(1.1)	U	ND(1.1)	U	ND(1.2)	U	ND(1.1)	U	ND(1.2)	U	ND(1.7)
Silver	ND(0.57)	U	ND(0.59)	U	ND(0.56)	U	ND(0.57)	U	ND(0.56)	U	ND(0.005)	U	ND(0.005)	U	ND(0.6)	U	ND(0.005)
Thallium	ND(0.57)	U	ND(0.12)	U	ND(0.56)	U	ND(0.57)	U	ND(0.71)	U	0.15		ND(0.11)	U	ND(0.6)	U	ND(0.11)
Zinc	27		64		30		32		38		36		38		74		40

<sup>1</sup> This sample is a duplicate of the previous investigative sample.

D2, D3 = discretionary samples  
 DRO = diesel range organics  
 GRO = gasoline range organics  
 J = estimated concentration

J< = estimated concentration with low bias  
 PCB = polychlorinated biphenyls  
 PID = photoionization detector  
 NA = not analyzed or not applicable

ND = not detected  
 Q = data qualifier  
 R = random sample  
 U = compound was analyzed but not detected

Notes: All values for soil samples are in milligrams per kilogram (mg/kg) on a dry basis unless otherwise indicated.  
 Number in parentheses [i.e., (1.1)] indicates the laboratory detection limit in mg/kg.  
 Percent Moisture is by weight.

All parameters were analyzed by Analytica, Inc. of Broomfield, Colorado.  
 Analytical Reports are included in Appendix D.

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## **446<sup>th</sup> MISSILE SQUADRON, Flight E**

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- 9-1. Flight E: MAF Sludge Bacteriological Results
- 9-2. Flight E: MAF Sludge Analytical Results
- 9-3. Flight E: MAF Surface Water and Soil Field Measurements and Analytical Results
- 9-4. Flight E: LF Soil Field Measurements and Analytical Results

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**Table 9-1. Flight E: MAF Sludge Bacteriological Results**

Sample I.D.	Fecal Coliform		Regulatory Limit <sup>1</sup> (MPN/gram)
	(MPN/kg)	(MPN/gram)	
Sludge Sample #1	0	0	
Sludge Sample #2	170,000	170	
Sludge Sample #3	68,400	68.4	
Sludge Sample #4	1,330	1.33	
Sludge Sample #5	19,400	19.4	
Sludge Sample #6	0	0	
Sludge Sample #7	15,200	15.2	
Geometric Mean (MPN/gram)		21.5	<b>1,000</b>

<sup>1</sup> Geometric mean regulatory limit for a Class A sludge presented in 40 CFR, Part 503, Section 503.32 (a) (7).

MPN/kg = Most Probable Number per kilogram

Notes: Samples were collected 9/15/98.  
Fecal coliforms were analyzed by the Grand Forks, North Dakota Water Treatment Plant laboratory.  
Analytical Reports are included in Appendix D.

**Table 9-2. Flight E: MAF Sludge Analytical Results**

Analyte	Sample I.D. and Date Sampled		Regulatory Limit <sup>3</sup> (mg/kg)
	E-0SD-01 (9/15/98)		
	Result	Q	
Ammonia as N	5.8		
Nitrate as N	ND(0.77)	U	
Nitrite as N	ND(0.77)	U	
Total Kjeldahl N <sup>1</sup>	0.11		
Percent Moisture <sup>2</sup>	34.8		
Percent Solids <sup>2</sup>	65.2		
Antimony	ND(7.7)	U	<b>41</b>
Arsenic	3.8		
Beryllium	ND(0.31)	U	<b>39</b>
Cadmium	ND(0.77)	U	
Chromium	9.3		<b>1,500</b>
Copper	14		<b>300</b>
Lead	7.2		<b>17</b>
Mercury	ND(0.15)	U	
Molybdenum	0.84		<b>420</b>
Nickel	14		
Phosphorus	1.3		
Potassium	1,400		<b>100</b>
Selenium	ND(1.5)	U	
Silver	ND(0.77)	U	
Thallium	ND(0.15)	U	<b>2,800</b>
Zinc	46		
Total Nitrogen	900		
Total Phosphorus	600		
Total Potassium	7,600		
Percent Moisture	68.1		

<sup>1</sup> Total Kjeldahl Nitrogen units: percent Nitrogen (% N)

<sup>2</sup> Percent Moisture and Percent Solids are by weight

<sup>3</sup> Regulatory limits presented in 40 CFR, Part 503, Section 503.13 (b) (3)

mg/kg = milligrams per kilogram

N = nitrogen

NA = not analyzed

ND = not detected

Q = Data Qualifier

U = Compound was analyzed but not detected

**Notes:** All values for sludge samples are in milligrams per kilogram (mg/kg) on a dry basis unless otherwise indicated.

Number in parentheses [i.e., (0.15)] indicates the laboratory detection limit in mg/kg.

Total nitrogen, total phosphorus, total potassium and percent moisture were analyzed by the North Dakota State University Soils Laboratory in Fargo, North Dakota.

All other parameters were analyzed by Analytica, Inc. of Broomfield, Colorado.

Analytical Reports are included in Appendix D.

**Table 9-3. Flight E: MAF Surface Water and Soil Field Measurements and Analytical Results**

Analyte	Wastewater Sample I.D. and Date Sampled				SDWA MCLs (mg/l)	Soil Sample I.D. and Date Sampled				EPA RBCs (mg/kg)
	E-0SW-01 (9/12/98) (Primary Lagoon)		EF-0SW-01 <sup>5</sup> (9/12/98)			E-0SS-01 (9/12/98)		EF-0SS-01 <sup>5</sup> (9/12/98)		
	Result	Q	Result	Q		Result	Q	Result	Q	
Field Temperature (°C)	19.5		NA			NA		NA		
Field pH	9.20		NA			NA		NA		
Available Nitrogen <sup>1</sup>	NA		NA			7		7		
Available Phosphorus <sup>2</sup>	NA		NA			17		23		
Available Potassium <sup>2</sup>	NA		NA			410		440		
Laboratory pH	9.26		NA			8.1		8.1		
Electrical Conductivity <sup>3</sup>	NA		NA			4.00		4.50		
Percent Moisture <sup>4</sup>	NA		NA			11.0		11.8		
TSS	ND(5.0)	U	5.0			NA		NA		
BOD	ND(1.0)	U	ND(1.0)	U		NA		NA		
O/G	2.4		ND(1.0)	U		NA		NA		
Antimony	ND(0.05)	U	ND(0.05)	U	0.006	0.93		ND(5.7)	UJ<	31
Arsenic	0.015	UJ<	0.011	U	0.05	2.7		2.3	UJ<	23
Beryllium	ND(0.002)	U	ND(0.002)	U	0.004	0.44		0.35		0.15
Cadmium	ND(0.005)	U	ND(0.005)	U	0.005	0.48		ND(0.57)	U	39
Chromium	ND(0.01)	U	ND(0.01)	U	0.1	8.7		6.9		390
Copper	ND(0.005)	U	ND(0.005)	U	1.3	13		9.8		3,100
Lead	ND(0.005)	UJ	ND(0.005)	UJ	0.015	4.5		5.9		400
Mercury	ND(0.0002)	U	ND(0.0002)	U	0.002	ND(0.11)	U	ND(0.11)	U	23
Molybdenum	0.024		0.021		0.18	0.38		ND(0.57)	U	390
Nickel	ND(0.01)	U	ND(0.01)	U	0.1	19		12		1,600
Phosphorus	0.20		0.21			45		28		
Potassium	15		15			1,600		1,300		
Selenium	ND(0.002)	UJ<	ND(0.002)	UJ	0.05	ND(1.1)	UJ	[1.1]	X	390
Silver	ND(0.005)	U	ND(0.005)	U	0.1	0.13		ND(0.57)	U	390
Thallium	ND(0.005)	UJ<	ND(0.005)	UJ	0.002	ND(0.56)	UJ	ND(0.57)	UJ	
Zinc	ND(0.005)	U	ND(0.005)	U	5	42		34		23,000

<sup>1</sup> Available nitrogen (N): NO<sub>3</sub> as N, pounds per acre per depth (lbs/acre/depth)

<sup>2</sup> Available Phosphorus (P) and Potassium (K): parts per million (ppm)

<sup>3</sup> Electrical Conductivity (EC): milli-mhos per centimeter (mmhos/cm)

<sup>4</sup> Percent Moisture is by weight

<sup>5</sup> This sample is a duplicate of the previous investigative sample.

BOD = biological oxygen demand

J = estimated concentration

J< = estimated concentration with a low bias

MCL = maximum contaminant level

mg/kg = milligrams per kilogram

mg/l = milligrams per liter

NA = not analyzed or not applicable

ND = not detected

O/G = oil and grease

Q = data Qualifier

R = laboratory analytical data rejected during data validation

RBC = risk based concentrations (EPA Region III)

SDWA = Safe Drinking Water Act

TSS = total suspended solids

U = compound was analyzed but not detected

X = laboratory analytical data rejected during data validation

Notes: pH values are in standard units.

All values for water samples are in milligrams per liter (mg/l) unless otherwise indicated.

All values for soil samples are in milligrams per kilogram (mg/kg) on a dry basis unless otherwise indicated.

Number in parentheses [i.e., (0.05)] indicates the laboratory detection limit in mg/l or mg/kg.

Available nitrogen, available phosphorus, available potassium, soil pH and electrical conductivity were analyzed by the North Dakota State University Soils Laboratory in Fargo, North Dakota.

All other parameters were analyzed by Analytica, Inc. of Broomfield, Colorado.

Analytical Reports are included in Appendix D.



Table 9-4. Flight E: LF Soil Field Measurements and Analytical Results

Analyte	Sample I.D. and Date Sampled															
	E-41SS-01 (9/18/98)		E-41SS-02' (9/18/98)		E-41SS-B (9/18/98)		E-42SS-01 (9/18/98)		E-43SS-01 (9/18/98)		E-43SS-D1 (9/18/98)		E-44SS-01 (9/18/98)		E-44SS-D2 (9/18/98)	
	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
Field PID	4.0		NA		NA		5.8		5.1		NA		8.3		NA	
Percent Moisture	13.0		15.8		10.6		9.30		8.60		6.70		12.6		3.30	
DRO	ND(12)	U	ND(12)	U	NA		ND(11)	U	ND(11)	U	ND(11)	U	ND(11)	U	24,000	
GRO	ND(0.11)	U	ND(0.12)	U	NA		ND(0.11)	U	ND(0.11)	U	ND(0.11)	U	ND(0.11)	U	200 J>	
PCB-1221	ND(0.038)	U	ND(0.040)	U	NA		ND(0.037)	U	ND(0.036)	U	ND(0.036)	U	ND(0.038)	U	ND(0.034)	U
PCB-1232	ND(0.019)	U	ND(0.020)	U	NA		ND(0.018)	U	ND(0.018)	U	ND(0.018)	U	ND(0.019)	U	ND(0.017)	U
PCB-1242	ND(0.019)	U	ND(0.020)	U	NA		ND(0.018)	U	ND(0.018)	U	ND(0.018)	U	ND(0.019)	U	ND(0.017)	U
PCB-1248	ND(0.019)	U	ND(0.020)	U	NA		ND(0.018)	U	ND(0.018)	U	ND(0.018)	U	ND(0.019)	U	ND(0.017)	U
PCB-1254	0.17		ND(0.020)	U	NA		ND(0.018)	U	ND(0.018)	U	ND(0.018)	U	0.031		ND(0.017)	U
PCB-1260	ND(0.019)	U	ND(0.020)	U	NA		ND(0.018)	U	ND(0.018)	U	ND(0.018)	U	ND(0.019)	U	ND(0.017)	U
PCB-1016	ND(0.019)	U	ND(0.020)	U	NA		ND(0.018)	U	ND(0.018)	U	ND(0.018)	U	ND(0.019)	U	ND(0.017)	U
Antimony	ND(5.7)	U	ND(5.9)	U	ND(5.6)	U	ND(5.5)	U	ND(5.5)	U	ND(5.4)	U	ND(5.7)	U	9.9	
Arsenic	5.6		5.3		4.8		4.1		4.6		3.9		4.4		6.8	
Beryllium	0.33		0.34		0.31		0.31		0.33		ND(0.21)	U	0.35		0.21	
Cadmium	ND(0.57)	U	ND(0.59)	U	ND(0.56)	U	ND(0.55)	U	ND(0.55)	U	ND(0.54)	U	ND(0.57)	U	ND(0.52)	U
Chromium	9.9		9.6		8.8		8.4		8.7		5.1		11		4.7	
Copper	11		13		11		11		10		5.3		14		9.6	
Lead	8.7		8.3		6.2		6.4		15		28		7.5		5.2	
Mercury	ND(0.11)	U	ND(0.12)	U	ND(0.11)	U	ND(0.11)	U	ND(0.11)	U	ND(0.11)	U	ND(0.11)	U	ND(0.1)	U
Molybdenum	1.4		1.2		1.3		1.5		1.0		1.1		1.2		1.6	
Nickel	14		15		13		15		10		9.5		15		16	
Phosphorus	8.8		15		8.2		14		16		30		12		1.1	U
Potassium	1,300		1,300		1,200		1,200		1,200		750		1,700		740	
Selenium	ND(1.1)	U	ND(1.2)	U	ND(1.1)	U	ND(1.1)	U	ND(1.1)	U	ND(1.1)	U	ND(1.1)	U	ND(1.0)	U
Silver	ND(0.57)	U	ND(0.59)	U	ND(0.56)	U	ND(0.55)	U	ND(0.55)	U	ND(0.54)	U	ND(0.57)	U	1.0	
Thallium	ND(0.11)	U	0.20	J	0.11	J	0.20	J	0.16	J	ND(0.11)	U	ND(0.11)	U	0.11	J
Zinc	40		44		31		35		26		16		42		25	

Table 9-4. Flight E: LF Soil Field Measurements and Analytical Results (continued)

Analyte	Sample I.D. and Date Sampled																
	E-45SS-01 (9/18/98)		E-46SS-01 (9/18/98)		E-46WP-01 (9/18/98)		E-51WP-01 (9/18/98)		E-46SS-02 (9/18/98)		E-51SS-02 (9/18/98)		E-47SS-01 (9/18/98)		E-47SS-D4 (9/18/98)		
	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	
Field PID	5.8		NA		NA		NA		NA		NA		NA		343		NA
Percent Moisture	8.50		9.90		11.0		16.6		4.40		5.2		12.2		14.9		14.9
DRO	ND(11)	U	13		ND(11)	U	NA		NA		NA		ND(11)	U	ND(12)	U	ND(12)
GRO	ND(0.11)	U	ND(0.11)	U	ND(0.11)	U	NA		NA		NA		ND(0.11)	U	ND(0.12)	U	ND(0.12)
PCB-1221	ND(0.036)	U	ND(0.037)	U	ND(0.037)	U	ND(0.040)	U	ND(0.035)	U	ND(0.035)	U	ND(0.038)	U	ND(0.039)	U	ND(0.039)
PCB-1232	ND(0.018)	U	ND(0.018)	U	ND(0.019)	U	ND(0.020)	U	ND(0.017)	U	ND(0.018)	U	ND(0.019)	U	ND(0.020)	U	ND(0.020)
PCB-1242	ND(0.018)	U	ND(0.018)	U	ND(0.019)	U	ND(0.020)	U	ND(0.017)	U	ND(0.018)	U	ND(0.019)	U	ND(0.020)	U	ND(0.020)
PCB-1248	ND(0.018)	U	ND(0.018)	U	ND(0.019)	U	ND(0.020)	U	ND(0.017)	U	ND(0.018)	U	ND(0.019)	U	ND(0.020)	U	ND(0.020)
PCB-1254	ND(0.018)	U	ND(0.018)	U	ND(0.019)	U	0.30		ND(0.017)	U	0.096		ND(0.019)	U	ND(0.020)	U	ND(0.020)
PCB-1260	ND(0.018)	U	ND(0.018)	U	ND(0.019)	U	ND(0.020)	U	ND(0.017)	U	ND(0.018)	U	ND(0.019)	U	ND(0.020)	U	ND(0.020)
PCB-1016	ND(0.018)	U	ND(0.018)	U	ND(0.019)	U	ND(0.020)	U	ND(0.017)	U	ND(0.018)	U	ND(0.019)	U	ND(0.020)	U	ND(0.020)
Antimony	ND(5.5)	U	ND(5.5)	U	ND(5.6)	U	NA		NA		NA		ND(5.7)	UJ<	ND(5.9)	U	ND(5.9)
Arsenic	5.1		5.0		4.2		NA		NA		NA		NA		4.8		4.6
Beryllium	0.34		0.36		0.55		NA		NA		NA		NA		0.56		0.55
Cadmium	ND(0.57)	U	ND(0.55)	U	ND(0.56)	U	NA		NA		NA		NA		ND(0.57)	U	ND(0.59)
Chromium	10		23		14		NA		NA		NA		NA		14		13
Copper	14		13		13		NA		NA		NA		NA		14		15
Lead	6.2		7.8		7.6		NA		NA		NA		NA		11		12
Mercury	ND(0.11)	U	ND(0.11)	U	ND(0.11)	U	NA		NA		NA		NA		ND(0.11)	U	ND(0.12)
Molybdenum	1.6		2.1		ND(0.56)	U	NA		NA		NA		NA		1.3		ND(0.59)
Nickel	15		14		14		NA		NA		NA		NA		18		16
Phosphorus	3.6		3.1		16		NA		NA		NA		NA		16		ND(0.59)
Potassium	1,400		1,300		2,000		NA		NA		NA		NA		1,800		1,800
Selenium	ND(1.1)	U	ND(1.1)	U	ND(1.1)	U	NA		NA		NA		NA		ND(1.1)	U	ND(1.2)
Silver	ND(0.55)	U	ND(0.55)	U	ND(0.56)	U	NA		NA		NA		NA		ND(0.57)	U	ND(0.59)
Thallium	0.14	J	0.11	J	0.12	J	NA		NA		NA		NA		ND(0.11)	UJ	0.21
Zinc	37		38		38		NA		NA		NA		NA		51		56

Table 9-4. Flight E: LF Soil Field Measurements and Analytical Results (continued)

Analyte	Sample I.D. and Date Sampled																	
	E-48SS-01 (9/18/98)		E-48SS-02 <sup>1</sup> (9/18/98)		E-48SS-01 (12/4/98)		E-48WP-01 (12/4/98)		E-48AS-01 (12/4/98)		E-49SS-01 (9/18/98)		E-49SS-B (9/18/98)		E-50SS-01 (9/18/98)		E-50SS-D3 (9/18/98)	
	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
Field PID	142.5	NA	12.0	NA	NA	NA	NA	NA	NA	NA	50.3	9.1	23.6	7.4				
Percent Moisture	13.9	U	ND(1.1)	U	17.1	U	22.2	U	10.6	U	8.10	20.7	8.40	11.1				
DRO	ND(12)	U	ND(0.12)	U	NA	U	NA	U	NA	U	ND(11)	U	ND(11)	U				
GRO	ND(0.12)	U	ND(0.11)	U	NA	U	NA	U	NA	U	ND(0.11)	U	NA	U				
PCB-1221	ND(0.039)	U	ND(0.038)	U	NA	U	ND(4.300)	U	ND(3.7)	U	ND(0.036)	U	NA	U				
PCB-1232	ND(0.019)	U	ND(0.019)	U	NA	U	ND(2.100)	U	ND(1.9)	U	ND(0.018)	U	NA	U				
PCB-1242	ND(0.019)	U	ND(0.019)	U	NA	U	ND(2.100)	U	ND(1.9)	U	ND(0.018)	U	NA	U				
PCB-1248	ND(0.019)	U	ND(0.019)	U	NA	U	ND(2.100)	U	ND(1.9)	U	ND(0.018)	U	NA	U				
PCB-1254	ND(0.019)	U	ND(0.019)	U	NA	U	38,000	J<	7.9	U	ND(0.018)	U	NA	U				
PCB-1260	ND(0.019)	U	ND(0.019)	U	NA	U	ND(2.100)	U	ND(1.9)	U	ND(0.018)	U	NA	U				
PCB-1016	ND(0.019)	U	ND(0.019)	U	NA	U	ND(2.100)	U	ND(1.9)	U	ND(0.018)	U	NA	U				
Antimony	ND(5.8)	U	ND(5.7)	U	ND(6.0)	U	NA	U	NA	U	ND(5.4)	U	ND(6.3)	U				
Arsenic	5.9	U	5.0	U	ND(6.0)	U	NA	U	NA	U	3.9	6.9	4.5	4.6				
Beryllium	0.43	U	0.43	U	0.29	U	NA	U	NA	U	0.36	0.48	0.38	0.47				
Cadmium	ND(0.58)	U	ND(0.57)	U	0.71	U	NA	U	NA	U	ND(0.54)	U	ND(0.63)	U				
Chromium	11	U	12	U	9.2	U	NA	U	NA	U	9.4	13	11	14				
Copper	13	U	14	U	12	U	NA	U	NA	U	12	11	11	13				
Lead	7.8	U	7.5	U	11	U	NA	U	NA	U	12	5.5	9.4	40				
Mercury	ND(0.12)	U	ND(0.11)	U	NA	U	NA	U	NA	U	ND(0.11)	U	ND(0.13)	U				
Molybdenum	0.74	U	0.73	U	NA	U	NA	U	NA	U	ND(0.54)	U	ND(0.63)	U				
Nickel	14	U	15	U	14	U	NA	U	NA	U	13	12	14	14				
Phosphorus	21	U	2.8	U	NA	U	NA	U	NA	U	7.7	3.8	15	5.2				
Potassium	1,500	U	1,600	U	NA	U	NA	U	NA	U	1,400	2,000	1,300	1,700				
Selenium	ND(1.2)	U	ND(1.1)	U	ND(12)	U	NA	U	NA	U	ND(1.1)	U	ND(1.1)	U				
Silver	ND(0.58)	U	ND(0.57)	U	ND(0.60)	U	NA	U	NA	U	ND(0.54)	U	ND(0.63)	U				
Thallium	0.13	J	0.12	J	ND(12)	U	NA	U	NA	U	0.16	ND(0.13)	UJ	0.16				
Zinc	39	U	40	U	385	U	NA	U	NA	U	36	34	34	58				

<sup>1</sup> This sample is a duplicate of the previous investigative sample.

- D1, D2, D3, D4 = discretionary samples
- DRO = diesel range organics
- GRO = gasoline range organics
- J = estimated concentration

- J< = estimated concentration with low bias
- PCB = polychlorinated biphenyls
- PID = photoionization detector
- NA = not analyzed or not applicable
- ND = not detected
- Q = data qualifier
- R = random sample
- U = compound was analyzed but not detected

Notes: All values for soil samples are in milligrams per kilogram (mg/kg) on a dry basis unless otherwise indicated. Number in parentheses [i.e., (1.1)] indicates the laboratory detection limit in mg/kg. Percent Moisture is by weight. All parameters were analyzed by Analytica, Inc. of Broomfield, Colorado. Analytical Reports are included in Appendix D.