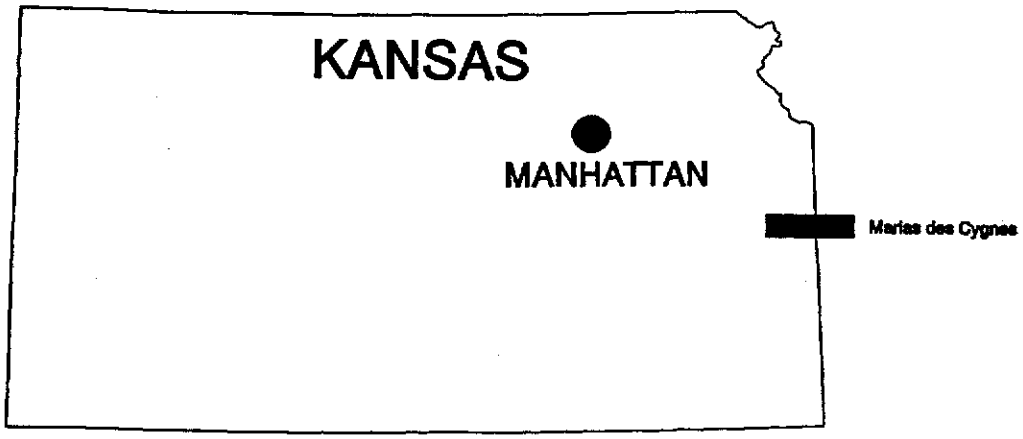
Contaminant Report Number: R6/508M/92

U.S. FISH & WILDLIFE SERVICE
REGION 6

CONTAMINANTS PROGRAM

CONTAMINANTS SURVEY OF THE PROPOSED MARAIS DES CYGNES NATIONAL WILDLIFE REFUGE



U.S. FISH AND WILDLIFE SERVICE
Fish and Wildlife Enhancement
315 Houston Street
Manhattan, Kansas 66502

CONTAMINANTS SURVEY OF THE PROPOSED MARAIS DES CYGNES NATIONAL WILDLIFE REFUGE

by

George T. Allen

U. S. Fish and Wildlife Service
315 Houston Street
Manhattan, Kansas 66502

and

Tom Nash

U. S. Fish and Wildlife Service
608 East Cherry
Columbia, Missouri 65205

May 1992

SUMMARY

- We sampled sediments and fish at 16 locations at the proposed Marais des Cygnes National Wildlife Refuge in Kansas and Missouri.

- All of the samples were analyzed for metals and organochlorine compounds. Selected sediment samples also were analyzed for aliphatic hydrocarbons.

- There are no apparent serious contaminants concerns with the proposed acquisition, with the exception of two dump sites. The former municipal dump for Pleasanton, in section 26 of Township 21S, Range 25E in Kansas has not been cleaned up. Therefore, the land it is on should be excluded from acquisition. A former dump in section 6, Township 39N, Range 33W in Missouri is under investigation by the U.S. Environmental Protection Agency, and acquisition of the land should be considered only after the report of the EPA contractor in spring 1992.

ABBREVIATIONS AND CONVERSION FACTORS

Abbreviations

micrograms per gram	mcg/g
not detected (i.e. below analytical detection limits)	ND

Conversions

micrograms per gram	ppm

ACKNOWLEDGMENTS

We appreciate the assistance of Ken Powell of the Manhattan, Kansas office of the Fish and Wildlife Service in sample collection. Dave Janes of the Division of Realty in the Denver Regional Office of the Fish and Wildlife Service was very helpful in our preparations for this work, and we appreciate his efforts. John Moore of the Patuxent Analytical Control Facility advised us about appropriate sample analyses and made the arrangements for those analyses. We also thank Patty McDonald and Lainie Weber-Thomas of the Control Facility for their work on cataloging and reporting of the laboratory analyses. Dan Welsh, Pedro Ramirez, Wayne Weir, and Joe Hunn provided helpful reviews of the draft of this report.

CONTENTS

FIGURES

TABLES

INTRODUCTION

A background contaminants survey is part of the acquisition process for all new National Wildlife Refuges. The U.S. Fish and Wildlife Service (Service) has proposed acquisition of approximately 9300 acres along the Marais des Cygnes River in Linn County, Kansas and approximately 4000 acres in Bates County, Missouri for addition to the National Wildlife Refuge System. We visited the site and sampled representative areas for contaminants analyses in November 1991. This report presents data from those collections.

STUDY AREA AND METHODS

The outline of the proposed acquisition area, major topographic features, and sampling locations are shown in Figure 1. The senior author visited the area several times in 1990 and 1991 prior to the sample collection period, and concluded that, with one exception, there are no obvious concerns about hazardous materials dumps or haphazard use or disposal of agricultural chemicals or other contaminants. Therefore, the preacquisition contaminants sampling focused on drainages to the Marais des Cygnes River and on representative pits from past coal mining.

We collected sediment composites from 16 locations and individual fish or fish composites from seven locations from 5 through 8 November 1991 (Figure 1). We attempted to collect sediment samples comprised largely of silt and clay. The sediment composites were placed in chemically clean jars and frozen. The results of analyses of sediment samples are affected by grain size and organic carbon (Neff 1984), so those factors were analyzed for each sediment sample.

Each fish was measured, weighed, double wrapped in aluminum foil, and kept on ice in the field. Thereafter, they were frozen until they were prepared for analysis. We considered aluminum contamination from wrapping samples in foil to be negligible. Samples were submitted to the analytical laboratories in November 1991. We received the results of analyses in January and February 1992. The species collected and the measurements of individual fish in the samples are shown in Table 1.

The sediment and fish samples were analyzed for metal and organochlorine concentrations by the Patuxent Analytical Control Facility (PACF) of the Service. Total arsenic, mercury, and selenium were analyzed using atomic absorption spectroscopy. Sediments were analyzed using induction coupled plasma emission spectroscopy (ICP) without preconcentration to test for aluminum, barium, beryllium, boron, cadmium, chromium,

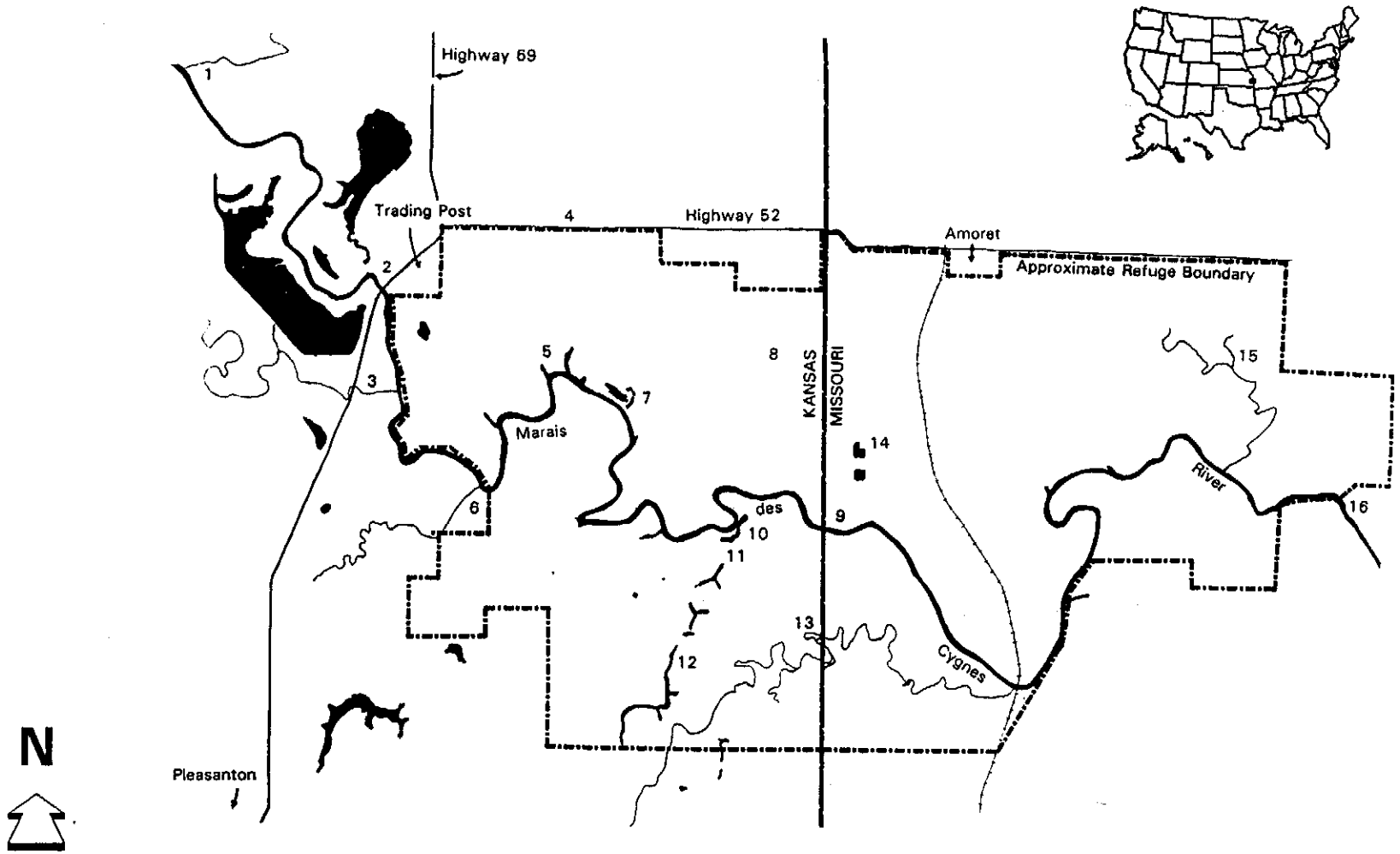


Figure 1. Marais des Cygnes sampling locations, November 1991.

Table 1. Fish collected at the proposed Marais des Cygnes acquisition, Kansas and Missouri, November 1991.

Location	Species Collected	Length (cm)	Mass (g)
2	River Carpsucker (*Carpiodes carpio*)	51	1700
		51	1900
		43	1150
		37.5	650
		36.5	650
2	Common Carp (*Cyprinus carpio*)	45	1200
7	Smallmouth Buffalo (*Ictiobus bubalus*)	36	700
		35	600
7	Largemouth Bass (*Micropterus salmoides*)	31	600
10	Bigmouth Buffalo (*Ictiobus cyprinellus*)	49.5	1700
10	Smallmouth Buffalo	38.5	800
		36.5	600
		36	600
		34.5	600
11	Smallmouth Buffalo	39	850
12	Bigmouth Buffalo	54	2350
		49	1950
14	Largemouth Bass	43	1200
		41.5	1100
16	River Carpsucker	48.5	1450
		42	900
		39.5	850
		39	750
		37	650
		33	600
16	Common Carp	58	3150

copper, iron, lead, magnesium, manganese, molybdenum, nickel, strontium,tin, vanadium, and zinc. The samples were analyzed without preconcentration for the best detection of boron. Detection limits for metals analyzed are shown in Table 2.

Organochlorine compound concentrations were determined using electron capture gas chromatography. PACF analyzed for the following organochlorine compounds: alpha-benzene hexachloride (BHC), beta-BHC, delta-BHC, gamma-BHC, hexachlorobenzene, alpha-chlordane, gamma-chlordane, cis-nonachlor, trans-nonachlor, oxychlordane, heptachlor epoxide, dieldrin, endrin, mirex, o,p'-DDT, p,p'-DDT, o,p'-DDE, p,p'-DDE, o,p'-DDD, p,p'-DDD, and PCB-1254. Wet weight concentrations were reported for organochlorines. The detection limit was 0.01 mcg/g wet weight for all organochlorines except PCB 1254, for which the detection limit was 0.05 mcg/g. Lipid-normalization of organic compounds does not improve data reporting (Huckins *et al.* 1988, Schmitt *et al.* 1990), so we do not report lipid concentrations.

Selected sediment composites also were analyzed for aliphatic hydrocarbon compounds by the Geochemical and Environmental Research Group of Texas A&M University (TAM). Aliphatic concentrations were determined with capillary gas chromatography for $n\text{-}C^{10}$ through $n\text{-}C^{17}$, phytane, $n\text{-}C^{18}$, pristane, and $n\text{-}C^{19}$ through $n\text{-}C^{34}$. The detection limit for aliphatic compounds was 0.01 mcg/g.

No anomalies were reported in the samples. Each sample collected was large enough for the laboratory to determine the concentration of each element or compound at the limit of the analytical equipment. Laboratory quality control was reviewed by PACF. Precision and accuracy of the laboratory analyses were confirmed with procedural blanks, duplicate analyses, test recoveries of spiked materials, and reference material analyses. Round-robin tests among Service and contract analytical labs also were part of the quality control. Concentration data were not adjusted to reflect spike recoveries. Tests of reference standards were not done for organic compounds.

Duplicate analyses for arsenic, mercury, and selenium had a maximum relative difference of 13.5%. Duplicate ICP analyses had a relative difference of 37.5% or less when both analyses found a concentration above the detection limit. Spike recoveries for metals ranged from 78.5% to 98.5% for arsenic, mercury and selenium, and from 74.4% to 113.2% for ICP analyses, with the exception of a 29.3% recovery in one analysis for barium. Analyses of reference standards reported concentrations from 65.3% to 140.1% of the

Table 2. Approximate detection limits in mcg/g for metals in samples from the proposed Marais des Cygnes acquisition, Kansas and Missouri, November 1991.

Element	Sediment	Fish
aluminum	7-9	4-5
arsenic	0.07-0.09	0.33-0.40
barium	0.7-0.8	0.4-0.5
beryllium	0.7-0.9	0.4
boron	7-9	4-5
cadmium	0.7-0.9	0.4
chromium	0.7-0.9	0.4-0.5
copper	0.4	0.7-0.9
iron	14-19	4-6
lead	1-2	0.7-0.9
magnesium	7-9	4-5
manganese	7-9	4-5
mercury	0.07-0.09	0.17-0.20
molybdenum	1.0	0.6-0.8
nickel	0.7-0.9	0.4-0.5
selenium	0.13-0.16	0.34-.040
strontium	0.7-0.9	0.4-0.5
tin	7-9	4-5
vanadium	0.7-0.9	0.4-0.5
zinc	7-9	4-5

expected values, with the exceptions of some very low recoveries for aluminum, arsenic (only one analysis of three was low), barium, chromium, strontium, and tin.
The maximum relative percent difference in duplicate organochlorine analyses was 11.92%, with the exceptions of analyses for dieldrin and beta BHC, which differed by 44.20% and 108.17%, respectively. Duplicate differences were highly influenced by the concentrations, which were very close to the detection limits. Organochlorine spike recoveries were 77.40% to 120.32%

The largest difference for aliphatic hydrocarbon duplicate analyses was 0.0747 mcg/g. Spike recoveries for aliphatics in sediments and tissues at TAM over time have averaged from 86.21% to 102.69%.

Wet weight concentrations are determined in the laboratories and converted to dry weight concentrations. Therefore, wet weight concentrations presented in this report are as precise as the dry weight concentrations. Data reported by the laboratories were rounded off for this report.

RESULTS AND DISCUSSION

The results of total organic carbon and grain size analyses are shown in Table 3. The sediment samples from most locations were 70% or more silt and clay.

METALS

Concentrations of arsenic and selenium in sediment samples are shown in Table 4. Mercury was not detected in any sediment sample. Selenium concentrations in sediments were lower than, or comparable to, U.S. and regional values (Table 5). However, arsenic concentrations in the sediment samples from locations 3, 4, 10, 11, 15, and 16 were elevated compared to U.S. norms. These locations represent much of the acquisition area, and only site 16 was on the Marais des Cygnes River. Arsenic was not detected in any fish composite. Mercury, and selenium concentrations in fish samples are shown in Table 6. The mercury concentrations in the largemouth bass from sites 7 and 14 were comparable to the 85th percentile concentrations in fish collected for the National Contaminant Biomonitoring Program (NCBP) from 1976-77 through 1984 (Schmitt and Brumbaugh 1990). Elemental and organic mercury are persistent and can be bioconcentrated and biomagnified in food chains (Eisler 1987, Phillips and Russo 1978). That may be the reason for the higher concentrations in the bass, which is a predator. The observed concentrations probably do not warrant serious concern. The concentrations of selenium in all fish composites were comparable to, or lower than, the means from the NCBP. Concentrations of arsenic, mercury, and selenium in biota in the acquisition area do not present a hazard, but the source of the arsenic in sediments should be identified, if possible. If the source is other than naturally high arsenic concentrations in the soil, the input should be curtailed.

Most sediment concentrations of metals analyzed by ICP were not elevated (Table 7). The concentration of lead at sampling location 4 was high, but this site was immediately adjacent to state highway 52, so the lead could have been from leaded gasoline. An examination of lead concentrations in that intermittent drainage is warranted.

The manganese concentrations at locations 1, 4, and 13 were much higher than those from other locations we sampled. Manganese levels in fish are well regulated (Cross et al. 1973, Giesy and Wiener 1977, Goodyear and Boyd 1972, Wiener and Giesy 1979), so the concentrations at the three sites probably do not present a hazard. However, they should be investigated.

Concentrations of all metals in fish analyzed by ICP are shown in Table 8. Beryllium, boron, cadmium, lead, and nickel were not detected in any fish composite. All concentrations were within background norms.

Table 3. Total organic carbon and grain size in sediment samples from the proposed Marais des Cygnes acquisition, Kansas and Missouri, November 1991.

Location	Total Organic Carbon (%) dry weight	Grain Size (%) Sand	Silt	Clay
1	1.06	0.96	51.51	47.53
2	0.56	49.18	34.94	15.88
3	0.66	15.55	48.30	36.16
4	1.24	31.03	43.75	25.21
5	1.05	11.55	55.00	33.45
6	1.56	3.60	52.36	44.04
7	0.31	38.03	38.30	23.67
8	1.12	3.56	51.74	44.70
9	0.75	26.63	37.86	35.51
10	0.87	14.22	49.50	36.28
11	5.21	38.26	39.56	22.18
12	1.23	0.98	70.61	28.41
13	0.83	12.99	47.12	39.89
14	1.24	4.18	60.46	35.37
15	2.05	4.65	67.76	27.60
16	0.79	19.59	37.80	42.61

CHLORINATED HYDROCARBONS

Non-polar organic contaminants such as PCBs and polycyclic aromatic hydrocarbons are adsorbed more strongly to finer grain particles, and are less available to biota, and their availability to biota also is inversely related to total organic carbon concentrations of the sediment (Neff 1984). No chlorinated hydrocarbons were detected in any sediment sample, so their bioavailability does not appear to be a problem at Marais des Cygnes.

The results of fish composite analyses are in Table 9. Endrin, mirex, and hexachlorobenzene were not found in any fish composite. Although comparable to the means from the NCBP (Table 10), the concentrations of chlordane compounds in fish we collected indicate that concentrations of these compounds in eastern Kansas rivers are not declining rapidly. The National Academy of Sciences and National Academy of Engineering [(NAS/NAE) 1973] recommended that to protect aquatic life, the whole body wet weight concentration of all cyclodiene compounds together should not exceed 0.10 mcg/g. The total chlordane compound concentrations in the fish composites from sites 15 and 16 in Missouri were 0.127 and 0.228 mcg/g, respectively. The

Table 4. Arsenic and selenium concentrations in sediment samples from the proposed Marais des Cygnes acquisition, Kansas and Missouri, November 1991.

Location	Percent Moisture	Concentration (mcg/g)			
		Arsenic		Selenium	
		Dry Weight	Wet Weight	Dry Weight	Wet Weight
1	40.98	5.03	2.97	ND	ND
2	29.50	5.69	4.01	ND	ND
3	32.52	10.34	6.98	ND	ND
4	40.69	25.97	15.40	0.31	0.18
5	34.13	7.02	4.63	ND	ND
6	40.10	4.78	2.86	ND	ND
7	33.00	3.85	2.58	ND	ND
8	34.83	3.05	1.99	0.40	0.26
9	36.27	4.97	3.17	ND	ND
10	40.89	8.36	4.94	ND	ND
11	45.27	13.49	7.38	1.06	0.58
12	49.76	3.49	1.75	ND	ND
13	36.27	7.32	4.67	ND	ND
14	38.24	1.79	1.11	0.24	0.15
15	45.63	9.05	4.92	0.38	0.21
16	30.88	24.01	16.60	ND	ND

Table 5. Soil or sediment element concentrations from the U.S. Except as noted, concentrations are in mcg/g.

Element	Location				
	Conterminous United States soils[a,e]	Western United States soils[a,e]	Northern Great Plains soils[b,e]	North-Central United States sediments[c,f]	Western U.S. DOI study area sediments[d,g]
Aluminum	4.7%	5.8%	5.6%	NA	1.8-9.8%
Antimony	0.48	0.47	NA	NA	NA
Arsenic	5.2	5.5	7.1	4.4[h], 2.4[i]	0.6-120
Barium	440	580	1100	NA	67-2200
Beryllium	0.63	0.68	1.6	NA	ND-3.0
Boron	26	23	41	NA	ND-390
Cadmium	NA	NA	NA	0.52[h], 0.26[i]	NA
Chromium	37	41	45	NA	3.0-330
Copper	17	21	19	NA	3.0-520
Iron	1.8%	2.1%	2.1%	NA	0.4-6.3%
Lead	16	17	16	13[h], 6.6[i]	ND-500
Magnesium	0.44%	0.74%	0.66%	NA	0.04-4.8%
Manganese	330	380	460	NA	66-4500
Mercury	0.58	0.046	0.023	0.03[h], 0.03[i]	ND-18
Molybdenum	0.59	0.85	3.8	NA	ND-73
Nickel	13	15	18	NA	ND-170
Selenium	0.26	0.23	0.45	0.89[h], 0.52[i]	ND-85
Strontium	120	200	NA	NA	59-1600
Tin	0.89	0.90	160	NA	NA
Vanadium	58	70	54	NA	5-310
Zinc	48	55	63	NA	10-1600

---

[a] Shacklette and Boerngen 1984
[b] Severson and Tidball 1979
[c] Martin and Hartman 1984
[d] Severson et al. 1987 and Harms et al. 1990, DOI = U.S. Department of the Interior drainwater studies
[e] geometric means
[f] unspecified means
[g] only range of values given
[h] mean for pothole wetlands
[i] mean for riverine wetlands

Table 6. Mercury and selenium concentrations in fish samples from the proposed Marais des Cygnes acquisition, Kansas and Missouri, November 1991.

Location	Species (Number)	Percent Moisture	Concentration (mcg/g) Mercury Dry Weight	Mercury Wet Weight	Selenium Dry Weight	Selenium Wet Weight
2	River Carpsucker	74.61	0.52	0.13	0.73	0.19
2	Common Carp	76.19	0.23	0.05	1.49	0.36
7	Smallmouth Buffalo	72.02	0.24	0.07	0.86	0.24
7	Largemouth Bass	72.64	0.66	0.18	0.86	0.24
10	Bigmouth Buffalo	78.06	ND	ND	0.84	0.18
10	Smallmouth Buffalo	76.19	ND	ND	1.92	0.46
11	Smallmouth Buffalo	74.56	ND	ND	1.97	0.50
12	Bigmouth Buffalo	75.54	ND	ND	0.80	0.19
14	Largemouth Bass	75.30	0.66	0.16	1.34	0.33
16	River Carpsucker	72.62	0.20	0.05	0.76	0.21
16	Common Carp	73.27	0.36	0.09	0.82	0.22

Table 7. Element concentrations from ICP scans in sediment samples from the proposed Marais des Cygnes acquisition, Kansas and Missouri, November 1991.

Location	Element Concentration (mcg/g) Aluminum Dry Weight	Aluminum Wet Weight	Barium Dry Weight	Barium Wet Weight	Beryllium Dry Weight	Beryllium Wet Weight	Boron Dry Weight	Boron Wet Weight
1	12368	7300	144	85	ND	ND	11.01	6.5
2	5390	3800	142	100	ND	ND	11.21	7.9
3	9633	6500	193	130	0.82	0.55	11.12	7.5
4	10116	6000	742	440	1.85	1.10	16.02	9.5
5	12450	8200	197	130	0.97	0.64	7.44	4.9
6	11686	7000	145	87	ND	ND	ND	ND
7	5821	3900	60	40	ND	ND	ND	ND
8	13042	8500	152	99	0.87	0.57	ND	ND
9	10357	6600	124	79	0.57	0.48	10.51	6.7
10	9981	5900	91	54	0.88	0.52	13.87	8.2
11	11329	6200	170	93	0.90	0.49	10.23	5.6
12	17714	8900	179	90	0.96	0.48	13.93	7.0
13	10828	6900	173	110	0.97	0.62	7.53	4.8
14	7933	4900	126	78	ND	ND	11.17	6.9
15	13979	7600	221	120	1.12	0.61	13.98	7.6
16	7379	5100	111	77	ND	ND	7.23	5.0

Table 7 (continued). Element concentrations from ICP scans in sediment samples from the proposed Marais des Cygnes acquisition, Kansas and Missouri, November 1991.

Location	Element Concentration (mcg/g)							
	Chromium		Copper		Iron		Lead	
	Dry Weight	Wet Weight	Dry Weight	Wet Weight	Dry Weight	Wet Weight	Dry Weight	Wet Weight
1	15.76	9.3	18.64	11.0	20331	12000	15.08	8.9
2	15.60	11.0	9.22	6.5	18440	13000	24.11	17.0
3	14.52	9.8	14.82	10.0	23712	16000	14.82	10.0
4	21.92	13.0	26.98	16.0	65752	39000	87.67	52.0
5	16.70	11.0	15.18	10.0	25810	17000	18.22	12.0
6	15.19	9.1	14.02	8.4	20033	12000	12.52	7.5
7	9.70	6.5	4.93	3.3	11344	7600	9.70	6.5
8	15.34	10.0	11.81	7.7	18412	12000	12.12	7.9
9	15.38	9.8	12.40	7.9	20400	13000	17.26	11.0
10	13.70	8.1	13.20	7.8	23683	14000	16.75	9.9
11	17.91	9.8	25.58	14.0	42027	23000	25.58	14.0
12	19.90	10.0	23.88	12.0	27864	14000	11.34	5.7
13	15.22	9.7	13.18	8.4	26677	17000	25.11	16.0
14	9.88	6.1	10.20	6.3	11819	7300	12.79	7.9
15	17.29	9.4	16.92	9.2	27589	15000	13.79	7.5
16	10.56	7.3	23.15	16.0	15915	11000	11.14	7.7

Location	Element Concentration (mcg/g)							
	Magnesium		Manganese		Molybdenum		Nickel	
	Dry Weight	Wet Weight	Dry Weight	Wet Weight	Dry Weight	Wet Weight	Dry Weight	Wet Weight
1	2880	1700	5625	3320	1.68	0.99	18.64	11.0
2	1376	970	1277	900	ND	ND	14.18	10.0
3	2519	1700	919	620	ND	ND	20.75	14.0
4	2023	1200	6238	3700	ND	ND	40.46	24.0
5	2885	1900	805	530	1.67	1.10	19.74	13.0
6	2671	1600	634	380	ND	ND	18.36	11.0
7	851	570	142	95	ND	ND	10.00	6.7
8	1995	1300	322	210	2.61	1.7	15.34	10.0
9	2354	1500	627	400	ND	ND	17.26	11.0
10	3214	1900	694	410	ND	ND	18.61	11.0
11	4934	2700	548	300	1.33	0.73	32.89	18.0
12	5573	2800	677	340	ND	ND	29.85	15.0
13	2668	1700	1569	1000	ND	ND	23.54	15.0
14	1781	1100	243	150	1.25	0.77	13.11	8.1
15	4046	2200	791	430	ND	ND	22.07	12.0
16	2026	1400	463	320	ND	ND	14.47	10.0

Table 7 (concluded). Element concentrations from ICP scans in sediment samples from the proposed Marais des Cygnes acquisition, Kansas and Missouri, November 1991.

Location	Element Concentration (mcg/g)							
	Strontium		Tin		Vanadium		Zinc	
	Dry Weight	Wet Weight	Dry Weight	Wet Weight	Dry Weight	Wet Weight	Dry Weight	Wet Weight
1	42.36	25.0	ND	ND	28.8	17	50.8	30
2	19.86	14.0	12.20	8.60	21.3	15	32.6	23
3	31.12	21.0	ND	ND	22.2	15	50.4	34
4	25.29	15.0	ND	ND	77.6	46	69.1	41
5	31.88	21.0	ND	ND	33.4	22	56.2	37
6	26.71	16.0	ND	ND	23.4	14	51.8	31
7	9.40	6.3	ND	ND	14.9	10	16.4	11
8	42.96	28.0	ND	ND	23.0	15	38.4	25
9	34.52	22.0	ND	ND	23.5	15	42.4	27
10	32.14	19.0	ND	ND	22.0	13	40.6	24
11	32.89	18.0	ND	ND	27.4	15	53.0	29
12	25.87	13.0	ND	ND	25.9	13	47.8	24
13	29.82	19.0	ND	ND	28.2	18	50.2	32
14	19.43	12.0	ND	ND	19.4	12	29.1	18
15	110.36	60.0	ND	ND	31.3	17	51.5	28
16	20.26	14.0	ND	ND	17.4	12	43.4	30

Table 8. Element concentrations from ICP scans of fish samples samples from the proposed Marais des Cygnes acquisition, Kansas and Missouri, November 1991.

Location	Species (Number)	Element Concentration (mcg/g)							
		Aluminum		Barium		Chromium		Copper	
		Dry Weight	Wet Weight	Dry Weight	Wet Weight	Dry Weight	Wet Weight	Dry Weight	Wet Weight
2	River Carpsucker	37.80	9.6	3.94	1.0	ND	ND	1.69	0.43
2	Common Carp	20.16	4.8	7.98	1.9	ND	ND	3.57	0.85
7	Smallmouth Buffalo	117.96	33.0	18.59	5.2	0.35	0.10	1.54	0.43
7	Largemouth Bass	9.50	2.6	2.01	0.55	ND	ND	1.35	0.37
10	Bigmouth Buffalo	31.45	6.9	12.31	2.7	ND	ND	2.42	0.53
10	Smallmouth Buffalo	21.00	5.0	10.92	2.6	ND	ND	1.34	0.32
11	Smallmouth Buffalo	157.21	40.0	6.29	1.6	ND	ND	1.97	0.50
12	Bigmouth Buffalo	21.46	5.3	7.36	1.8	ND	ND	1.96	0.48
14	Largemouth Bass	98.61	27.0	0.93	0.23	ND	ND	1.13	0.28
16	River Carpsucker	52.37	14.0	7.67	2.1	0.44	0.12	0.88	0.24
16	Common Carp	37.80	9.6	7.48	2.0	0.60	0.16	1.35	0.36

Table 8 (concluded). Element concentrations from ICP scans of fish samples from the proposed Marais des Cygnes acquisition, Kansas and Missouri, November 1991.

Location	Species (Number)	Element Concentration (mcg/g) Iron Dry Weight	Iron Wet Weight	Magnesium Dry Weight	Magnesium Wet Weight	Manganese Dry Weight	Manganese Wet Weight	Molybdenum Dry Weight	Molybdenum Wet Weight
2	River Carpsucker	78.8	20	2442	620	27.17	6.9	ND	ND
2	Common Carp	117.6	28	1890	450	10.92	2.6	ND	ND
7	Smallmouth Buffalo	168.0	47	2109	590	30.74	8.6	ND	ND
7	Largemouth Bass	58.5	16	1645	450	ND	ND	ND	ND
10	Bigmouth Buffalo	91.2	20	1687	370	25.07	5.5	1.37	0.30
10	Smallmouth Buffalo	67.2	16	2100	500	21.84	5.2	ND	ND
11	Smallmouth Buffalo	161.1	41	1887	480	33.41	8.5	ND	ND
12	Bigmouth Buffalo	53.2	13	1635	400	12.68	3.1	ND	ND
14	Largemouth Bass	56.7	14	1903	470	ND	ND	ND	ND
16	River Carpsucker	233.7	64	1972	540	28.12	7.7	ND	ND
16	Common Carp	74.8	20	1945	520	26.19	7.0	ND	ND

Location	Species (Number)	Element Concentration (mcg/g) Strontium Dry Weight	Strontium Wet Weight	Tin Dry Weight	Tin Wet Weight	Vanadium Dry Weight	Vanadium Wet Weight	Zinc Dry Weight	Zinc Wet Weight
2	River Carpsucker	59.07	15.0	ND	ND	ND	ND	43.3	11.0
2	Common Carp	42.00	10.0	ND	ND	ND	ND	197.4	47.0
7	Smallmouth Buffalo	64.34	18.0	ND	ND	ND	ND	46.5	13.0
7	Largemouth Bass	51.17	14.0	ND	ND	ND	ND	33.6	9.2
10	Bigmouth Buffalo	72.94	16.0	ND	ND	ND	ND	59.3	13.0
10	Smallmouth Buffalo	54.60	13.0	ND	ND	ND	ND	54.6	13.0
11	Smallmouth Buffalo	70.74	18.0	ND	ND	ND	ND	51.1	13.0
12	Bigmouth Buffalo	77.69	19.0	ND	ND	ND	ND	40.9	10.0
14	Largemouth Bass	37.25	9.2	ND	ND	ND	ND	31.6	7.8
16	River Carpsucker	36.52	10.0	9.50	2.6	0.37	0.1	29.6	8.1
16	Common Carp	28.80	7.7	ND	ND	ND	ND	35.9	9.6

Table 9. Chlorinated hydrocarbon concentrations in fish samples from the proposed Marais des Cygnes acquisition, Kansas and Missouri, November 1991.

Location	Species	Percent Moisture	Percent Lipid	Concentration (mcg/g wet weight) alpha BHC	beta BHC	gamma BHC
2	River Carpsucker	69.08	1.90	0.011	0.015	0.011
2	Common Carp	75.69	2.12	0.011	0.015	0.011
7	Smallmouth Buffalo	76.92	2.70	0.013	0.012	0.011
7	Largemouth Bass	78.22	1.27	0.011	0.014	0.011
10	Bigmouth Buffalo	81.68	2.43	0.011	0.013	0.011
10	Smallmouth Buffalo	72.95	2.75	0.011	0.014	0.011
11	Smallmouth Buffalo	74.40	2.57	0.011	0.014	0.011
12	Bigmouth Buffalo	71.29	7.30	0.011	ND	0.011
14	Largemouth Bass	74.26	3.05	0.011	0.013	0.011
16	River Carpsucker	71.57	5.86	0.011	ND	0.011
16	Common Carp	72.77	6.42	ND	ND	0.011

Location	Species	Concentration (mcg/g wet weight) alpha-Chlordane	gamma-Chlordane	cis-Nonachlor	trans-Nonachlor	Oxychlordane
2	River Carpsucker	0.021	0.018	0.015	0.030	0.011
2	Common Carp	0.016	0.014	0.012	0.019	0.010
7	Smallmouth Buffalo	0.011	0.012	ND	0.011	ND
7	Largemouth Bass	0.011	0.012	ND	0.012	ND
10	Bigmouth Buffalo	0.012	0.012	ND	0.014	ND
10	Smallmouth Buffalo	0.010	0.012	ND	0.012	ND
11	Smallmouth Buffalo	0.011	0.012	ND	0.012	ND
12	Bigmouth Buffalo	0.016	0.015	0.012	0.019	ND
14	Largemouth Bass	0.011	0.012	ND	0.013	ND
16	River Carpsucker	0.029	0.025	0.020	0.041	0.012
16	Common Carp	0.055	0.040	0.033	0.078	0.022

Location	Species	Concentration (mcg/g wet weight) heptachlor epoxide	o,p'-DDT	p,p'-DDT	o,p'-DDE	p,p'-DDE
2	River Carpsucker	ND	0.013	0.015	0.013	0.048
2	Common Carp	ND	ND	ND	0.013	0.039
7	Smallmouth Buffalo	ND	ND	ND	0.012	0.033
7	Largemouth Bass	ND	ND	ND	0.012	0.035
10	Bigmouth Buffalo	ND	ND	ND	0.012	0.038
10	Smallmouth Buffalo	ND	ND	ND	0.012	0.033
11	Smallmouth Buffalo	ND	ND	ND	0.012	0.034
12	Bigmouth Buffalo	ND	0.013	0.016	0.012	0.045
14	Largemouth Bass	ND	0.014	ND	0.012	0.037
16	River Carpsucker	0.012	0.013	0.018	0.016	0.065
16	Common Carp	0.013	0.016	0.025	0.018	0.012

Table 9 (concluded). Chlorinated hydrocarbon concentrations in fish samples from the proposed Marais des Cygnes acquisition, Kansas and Missouri, November 1991.

Location	Species	Concentration (mcg/g wet weight) o,p'-DDD	p,p'-DDD	Dieldrin	PCB-1254
2	River Carpsucker	0.011	0.015	ND	0.076
2	Common Carp	0.011	0.014	ND	0.055
7	Smallmouth Buffalo	0.010	0.013	ND	ND
7	Largemouth Bass	ND	ND	ND	0.179
10	Bigmouth Buffalo	0.010	0.013	ND	ND
10	Smallmouth Buffalo	ND	0.013	ND	ND
11	Smallmouth Buffalo	0.010	0.013	ND	ND
12	Bigmouth Buffalo	0.012	0.016	ND	0.056
14	Largemouth Bass	ND	ND	0.014	ND
16	River Carpsucker	0.014	0.021	0.052	0.186
16	Common Carp	0.015	0.030	0.016	0.401

Table 10. Geometric mean chlordane/heptachlor compound concentrations from the NPMP and the NCBP (mcg/g wet weight)[a].

Compound	Collection Period 1976-1977	1978-1979	1980-1981	1984
heptachlor[a]	0.01	0.02	0.01	0.01
cis-chlordane	0.06	0.07	0.03	0.03
trans-chlordane	0.02	0.02	0.02	0.02
cis-nonachlor	0.01	0.03	0.02	0.02
trans-nonachlor	0.03	0.05	0.04	0.03
oxychlordane	NA	0.01	0.01	0.01
total[c]	0.12	0.20	0.13	0.12

[a] From Schmitt *et al.* 1990.
[b] Heptachlor epoxide plus traces of heptachlor
[c] Does not include methoxychlor

tproportion of trans-nonachlor inhose samples suggests that much of the chlordane was due to relatively recent input.

Arruda *et al.* (1987) suggested that much of the chlordane contamination of aquatic systems in Kansas comes from urban areas. However, there are no urban areas adjacent to the proposed acquisition so the higher concentrations we found at sampling sites 15 and 16 indicate that chlordane compounds may still be in use in agricultural applications or that they might, for example, be leaching from old dumps. Input of those compounds to the land and water in the area should be terminated, if possible, if the refuge is

acquired.

DDT compound concentrations in biota were very low and unlikely to cause any discernible problems. The p,p'-DDT in fish had not been metabolized, and therefore was probably recently introduced. The DDT in fish from sampling sites 2 and 16 could easily have come from upstream sources. That is not so for the fish from sampling site 12, which is an old coal pit.

ALIPHATIC HYDROCARBONS

Overall aliphatic hydrocarbon concentrations in sediments were low (Table 11). N-C^{10} was not detected in any sample. Most aliphatics found at slightly higher concentrations were odd-numbered carbon chains, which probably are natural in origin. There appears to be little need for concern with petroleum contamination in the acquisition area.

OTHER CONCERNS

During our visits to the area, we surveyed as much as possible of the lands to be included in the acquisition. Our visits to the site and discussions with knowledgeable individuals brought two possible problems to light. The former city dump for Pleasanton, Kansas is in the NW ¼ of section 26 in Township 21S, Range 25E. We did not sample in the vicinity of this dump site, but it has not been cleaned up and should be excluded from the lands considered for acquisition.

A former dump site in the NW ¼ of section 6, Township 39N, Range 33W in Missouri is under investigation by the U.S. Environmental Protection Agency (see Appendix). Apparently, the site is not likely to contain high levels of contaminants. The junior author collected samples at the site during a visit on 7 January 1992, but the information from that sampling will be inconclusive (Appendix). Acquisition of this land should be considered only after the report of the EPA contractor is completed in spring 1992.

Table 11. Aliphatic hydrocarbon concentrations in sediment samples from the proposed Marais des Cygnes acquisition, Kansas and Missouri, November 1991.

Location	Concentration (mcg/g wet weight)						
	$n\text{-}C^{11}$	$n\text{-}C^{12}$	$n\text{-}C^{13}$	$n\text{-}C^{14}$	$n\text{-}C^{15}$	$n\text{-}C^{16}$	$n\text{-}C^{17}$
2	ND	ND	ND	ND	0.019	ND	0.014
3	ND	ND	ND	ND	0.013	ND	ND
4	ND	ND	ND	0.012	0.029	0.011	0.065
5	ND	ND	ND	ND	0.017	0.010	0.031
6	ND	ND	ND	ND	0.016	ND	0.045
9	ND	0.001	0.022	0.036	0.051	0.036	0.075
15	ND	ND	ND	ND	0.020	0.015	0.022
16	ND	ND	ND	ND	0.019	0.013	0.021

Location	Concentration (mcg/g wet weight)						
	Pristane	$n\text{-}C^{18}$	Phytane	$n\text{-}C^{19}$	$n\text{-}C^{20}$	$n\text{-}C^{21}$	$n\text{-}C^{22}$
2	ND	ND	ND	ND	ND	ND	ND
3	ND	ND	ND	ND	ND	ND	ND
4	ND	ND	0.011	0.015	ND	0.015	ND
5	ND	ND	ND	0.012	ND	0.016	0.014
6	ND	ND	0.001	0.028	0.013	0.023	0.015
9	0.076	0.036	0.052	0.036	0.028	0.029	0.021
15	ND	ND	ND	ND	0.010	0.018	0.021
16	ND	ND	ND	ND	ND	0.012	ND

Location	Concentration (mcg/g wet weight)						
	$n\text{-}C^{23}$	$n\text{-}C^{24}$	$n\text{-}C^{25}$	$n\text{-}C^{26}$	$n\text{-}C^{27}$	$n\text{-}C^{28}$	$n\text{-}C^{29}$
2	0.020	0.011	0.063	0.167	0.224	0.052	0.598
3	0.015	0.011	0.051	0.145	0.153	0.038	0.354
4	0.033	0.010	0.061	0.148	0.202	0.063	1.402
5	0.031	0.013	0.054	0.129	0.133	0.036	0.403
6	0.041	0.018	0.114	0.160	0.318	0.079	0.883
9	0.031	0.017	0.040	0.132	0.085	0.026	0.237
15	0.044	0.028	0.100	0.167	0.416	0.094	1.245
16	0.015	0.011	0.033	0.142	0.071	0.020	0.189

Location	Concentration (mcg/g wet weight)					
	$n\text{-}C^{30}$	$n\text{-}C^{31}$	$n\text{-}C^{32}$	$n\text{-}C^{33}$	$n\text{-}C^{34}$	Total Aliphatics
2	0.050	0.610	0.042	0.190	0.126	2.186
3	0.046	0.401	0.037	0.128	0.019	1.412
4	0.108	1.063	0.068	0.268	0.473	3.245
5	0.048	0.563	0.054	0.245	0.083	1.880
6	0.063	0.819	0.046	0.317	0.225	3.223
9	0.030	0.260	0.030	0.106	0.045	1.537
15	0.081	1.303	0.081	0.347	0.133	4.145
16	0.025	0.228	0.027	0.108	0.010	1.041

LITERATURE CITED

Arruda, J. A., M. S. Cringan, D. Gilliland, S. G. Haslouer, J. E. Fry, R. Broxterman, and K. L. Brunson. 1987. Correspondence between urban areas and the concentrations of chlordane in fish from the Kansas River. Bulletin of Environmental Contamination and Toxicology 39:563-570.

Cross, F. A., L. H. Hardy, N. Y. Jones, and R. T. Barber. 1973. Relation between total body weight and concentrations of manganese, iron, copper, zinc, and mercury in white muscle of bluefish (*Pomatomus salatrix*) and a bathyl-demersal fish (*Antimora rostrata*). Journal of the Fisheries Research Board of Canada 30:1287-1291.

Eisler, R. 1987. Mercury hazards to fish, wildlife, and invertebrates: A synoptic review. U.S. Fish and Wildlife Service, Washington, D.C. Contaminant Hazard Reviews Report Number 10.

Giesy, J. P., Jr. and J. G. Wiener. 1977. Frequency distributions of trace metal concentrations in five freshwater fishes. Transactions of the American Fisheries Society 106:393-403.

Goodyear, C. P. and C. E. Boyd. 1972. Elemental composition of largemouth bass (*Micropterus salmoides*). Transactions of the American Fisheries Society 101:545-547.

Harms, T. F., K. C. Stewart, P. H. Briggs, P. L. Hageman, and C. S. E. Papp. 1990. Chemical results for bottom material for Department of the Interior irrigation drainage task group studies 1988-1989. U.S. Geological Survey, Denver, Colorado. Open-File Report 90-50.

Huckins, J. N., T. R. Schwartz, J. D. Petty, and L. M. Smith. 1988. Determination, fate, and potential significance of PCBs in fish and sediment samples with emphasis on selected AHH-inducing congeners. Chemosphere 17:1995-2016.

Martin, D. B. and W. A. Hartman. 1984. Arsenic, cadmium, lead, mercury, and selenium in sediments of riverine and pothole wetlands of the north-central United States. Journal of the Association of Official Analytical Chemists 67:1141-1146.

National Academy of Sciences and National Academy of Engineers. 1973. Water quality criteria; 1972. U.S. Environmental Protection Agency, Washington, D.C. Ecological Research Series, EPA-R3-73-033.

Neff, J.M. 1984. Bioaccumulation of Organic Micropollutants from Sediments and Suspended Particulates by Aquatic Animals. Fresenius'

Zeitschrift fuer Analytische Chemie 319: 132-136.

Phillips, G. R. and R. C. Russo. 1978. Metal bioaccumulation in fishes and aquatic invertebrates: a literature review. U.S. Environmental Protection Agency, Duluth, Minnesota. EPA-600/3-78-103.

Shacklette, H. T. and J. G. Boerngen. 1984. Element concentrations in soils and other surficial materials of the conterminous United States. U.S. Geological Survey, Washington, D.C. Professional Paper 1270

Schmitt, C. J. and W. G. Brumbaugh. 1990. National contaminant biomonitoring program: Concentrations of arsenic, cadmium, copper, lead, mercury, selenium, and zinc in U.S. freshwater fish, 1976-1984. Archives of Environmental Contamination and Toxicology 19:731-747.

Schmitt, C. J., J. L. Zajicek, and P. H. Peterman. 1990. National contaminant biomonitoring program: residues of organochlorine chemicals in U. S. freshwater fish, 1976-84. Archives of Environmental Contamination and Toxicology 19:748-782.

Severson, R. C. and R. R. Tidball. 1979. Spatial variation in total element concentration in soils with the northern Great Plains coal region. U.S. Geological Survey Professional Paper 1134-A.

Severson, R. C., S. A. Wilson, and J. M. McNeal. 1987. Analyses of bottom material collected at nine areas in the western United States for the DOI irrigation drainage task group. U.S. Geological Survey, Denver, Colorado. Open-File Report 87-490.

Wiener, J. G. and J. P. Giesy, Jr. 1979. Concentrations of Cd, Cu, Mn, Pb, and Zn in fishes in a highly organic softwater pond. Journal of the Fisheries Research Board of Canada 36:270-279.

APPENDIX

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Fish and Wildlife Enhancement
Columbia Field Office
608 East Cherry Street
Columbia, Missouri 65201

IN REPLY REFER TO:

FWS/AFWE-CMFO

JAN 9 1992

Memorandum

To: Assistant Regional Director (AFWE), Region 3

From: Field Supervisor

Subject: Trip Report - Contaminant Survey of Proposed Marais des Cygnes NWR

Attached is the subject report of a preliminary field investigation and chronology of events concerning a dump site located on the proposed NWR. Should this proposal become a serious consideration, a meeting with the concerned divisions should be scheduled to discuss how the Service will handle the issue of this dump site. This trip report is provided to you at this point as an advance 'for your information'.

Should you have questions, or if we can be of any further assistance, please contact Mr. Tom Nash at FTS 276-1911.

Attachment

cc: FWS; Wayne Weier
FWS; Dr. George Allen, MKFO

TJN:tn:1124/bamaraib

Attachment

PITTSBURG AND MIDWAY MINING COMPANY LANDFILL

Site History:

Area residents used the site as a local dump and periodically burned it.

July 1985:

The site was covered with two feet of soil and fenced.

1986:

It was alleged that pesticides had been dumped at the site.

1987

There was evidence of continued dumping of domestic garbage.

December 1987:

Mo. DNR recommended no further action, since they could not confirm the pesticide allegation.

1990:

P&M Mining Co. created a lake beside the dump. They bulldozed all of the dump area that was located in the lake site back up the hillside into the rest of the dump and covered it with soil, depth unknown.

December 1991:

EPA Region 7 contractor was retained to investigate the area.

January 7, 1992:

Tom Nash, CMFO, met with EPA contractors of the Jacobs Engineering Group. They are conducting a preliminary investigation at a potential hazardous waste site located within the boundaries of the proposed Marais des Cygnes NWR on the Missouri side. Ironically, Tom and George Allen, Manhattan, Kansas Field Office, were directly across the road from this site 2 months prior sampling a pond on a background survey.

This site looked larger than one acre. There was very little evidence of a dump having been located here. There was a small amount of old bottles and miscellaneous plastics on the surface. All the trees on the site had been bulldozed into a long pile in the middle of the area. It

1

is on a hillside and has been revegatated and appears to be stable. The company is very conscientious of controlling any erosion.

The logpile is being used by small game. There were several 'runs' in the grass from the logpile to the lake.

One sediment sample, with duplicate, was taken near the lake's edge and one soil sample, with duplicate, was taken in the logpile. These will be submitted for metals and organochlorine scans. Failure to detect contaminants in these samples will be inconclusive. To accurately determine if there is a problem associated with this landfill an extensive and expensive sampling survey would need to be conducted. This would include but not be limited to groundwater sampling, coring the dump at several locations for dirt samples, and collection of animals especially burrowing animals at the site.

There are numerous sample wells (i.e., pipes) scattered over the P&M lands. Supposedly, there is one at or near the dump site. We were unable to locate it. However, the lab that samples these wells can locate it for us. I recommended that the contractor contact EPA about obtaining a split water sample when the lab collects their samples and have a metals and organochlorine scan performed.

The Jacobs Engineering Group, EPA's contractor, will complete their report this spring.

TJN:tn:1124/bamaraia