

**DECOMMISSIONING PLAN
TOBICO MARCH SGA
KAWKAWLIN, MICHIGAN**

APPENDIX I

Leachate Data, Technical Memo #5

JANUARY 2004



DATE: October 18, 2002
PROJECT: Tobico Marsh State Game Area
SUBJECT: Groundwater Sampling Events
PREPARED BY: Joseph DeGrazia, MACTEC Engineering and Consulting of Michigan, Inc.

INTRODUCTION

This technical memorandum describes the field activities performed by MACTEC Engineering and Consulting of Michigan, Inc. (MACTEC) during the monitoring well groundwater sampling events at the Tobico Marsh State Game Area (SGA) site located in the Bay City, Michigan. The two groundwater sampling events occurred in May and June 2002.

Groundwater samples were submitted to Paragon Analytics, Inc. located in Fort Collins, Colorado, for analysis of radiological parameters: thorium series (Th-228, Th-230, and Th-232), potassium 40, uranium series (U-234, U-235, and U-238), radium 226, and radium 228.

SCOPE OF WORK

For each field activity, MACTEC collected nine groundwater samples from monitoring wells inside the site (MW-1, MW-8, and MW-9) and monitoring wells located immediately outside the site (MW-2, MW-3, MW-4, MW-5A, MW-7, and MW-43).

SCHEDULE

The first groundwater sampling event was conducted from May 6 through May 7, 2002. The second event was conducted from June 3 through June 6, 2002. The second event required additional time due to problems with the self-contained breathing apparatuses (SCBAs) used as part of the Level B PPE.

PERSONNEL

The following MACTEC personnel were on site during portions or all of the field work activities:

<u>Name (company)</u>	<u>Title or Position</u>
Joseph DeGrazia	Field Operations Leader
Tom Fox	Staff Technician
Tertius Mills	Staff Technician
Chris Workman	Staff Technician

FIELD PROCEDURES

Based on historic chemical data for the site, both groundwater sampling events were performed in Level B PPE. The specific details for each event are provided in the following paragraphs.

Sampling Methodology

Groundwater samples were collected using the low-flow sampling method. First, static water levels were taken at each well. Disposable tubing was lowered into each well approximately 2 feet above the bottom of the well bottom. This location is approximately the mid-point of the well screen. Prior to collecting the sample, groundwater stabilization indicators were monitored using a Horiba U-10. Stabilization indicator parameters were monitoring for pH, conductivity, turbidity, and temperature. All parameters were required to be within 10 percent of subsequent readings before a sample could be collected. In addition to monitoring the stabilization parameters, groundwater drawdown was kept at a minimum (less than 0.3 feet, as per EPA guidance document “Low Stress (low flow) Purging and Sampling Procedure For The Collection Of Groundwater Samples From Monitoring Wells”).

For additional information on groundwater parameters, please refer to the groundwater sampling record sheets.

RESULTS

May 2002 Groundwater Sampling Event

The analytical results from the May groundwater sampling event indicated no exceedances of radiological parameters from the sampled monitoring wells. Radiological parameters included analysis for: thorium isotopes, uranium isotopes, radium 226, and radium 228. Monitoring wells that were tested included MW-1, MW-2, MW-3, MW-4, MW-5A, MW-7, MW-8, MW-9, and MW-43. Groundwater analytical results are summarized in Table TM5-1.

June 2002 Groundwater Sampling Event

The June 2002 groundwater sampling event was conducted to verify results taken during the May 2002 groundwater sampling event. Monitoring wells sampled, the sampling method, and radiological parameters tested were identical for both sampling events. Groundwater analytical results indicated no exceedances of radiological parameters from the monitoring wells sampled. These results were similar to the results from the May sampling event. Groundwater analytical results are summarized in Table TM5-1.

Summary

Based on the results from the May 2002 sampling and the verification sampling performed in June 2002, it is evident that neither groundwater nor leachate within the cell at the Tobico Marsh SGA site contains elevated concentrations of: thorium series (Th-228, Th-230, and Th-232), potassium 40, uranium series (U-234, U-235, and U-238), radium 226, and radium 228.

TABLES

TABLE TM5-1
GROUNDWATER ANALYTICAL RESULTS
TOBICO MARSH STATE GAME AREA
May and June 2002

Well ID	Date	Test	Nuclide	Result +/- 2 s TPU	MDC	Qualifier
MW-1	05/07/02	TH-ISO	Th-228	0.053 +/- 0.074	0.14	U
			Th-230	0.080 +/- 0.043	0.049	LT
			Th-232	0.012 +/- 0.019	0.036	U
	06/04/02		Th-228	0.06 +/- 0.07	0.12	U
			Th-230	0.03 +/- 0.033	0.05	U
MW-2	05/06/02	TH-ISO	Th-232	0.03 +/- 0.26	0.03	U
			Th-228	-0.002 +/- 0.74	0.16	U
			Th-230	0.086 +/- 0.049	0.056	LT
	06/06/02		Th-232	0.017 +/- 0.022	0.017	LT
			Th-228	0.36 +/- 0.20	0.29	Y2
MW-3	05/06/02	TH-ISO	Th-230	0.43 +/- 0.15	0.11	Y2
			Th-232	0.44 +/- 0.15	0.07	Y2
			Th-228	0.009 +/- 0.059	0.14	U
	06/06/02		Th-230	0.117 +/- 0.066	0.071	LT
			Th-232	0.024 +/- 0.031	0.057	U
MW-4	05/07/02	TH-ISO	Th-228	0.06 +/- 0.051	0.08	U
			Th-230	0.08 +/- 0.032	0.02	LT
			Th-232	0.01 +/- 0.013	0.0083	LT
	06/04/02		Th-228	0.029 +/- 0.074	0.17	U
			Th-230	0.030 +/- 0.035	0.058	U
MW-5A	05/06/02	TH-ISO	Th-232	0.012 +/- 0.031	0.058	U
			Th-228	0.07 +/- 0.076	0.15	U
			Th-230	0.02 +/- 0.029	0.05	U
	06/06/02		Th-232	0.06 +/- 0.05	0.06	LT
			Th-228	0.025 +/- 0.071	0.14	U
MW-7	05/06/02	TH-ISO	Th-230	0.037 +/- 0.032	0.049	U
			Th-232	-0.007 +/- 0.019	0.049	U
			Th-228	0.03 +/- 0.081	0.18	U
	06/05/02		Th-230	0.05 +/- 0.05	0.07	U
			Th-232	0.007 +/- 0.029	0.06	U
MW-8	05/07/02	TH-ISO	Th-228	0.064 +/- 0.079	0.15	U
			Th-230	0.034 +/- 0.033	0.055	U
			Th-232	0.010 +/- 0.020	0.041	U
	06/04/02		Th-228	0.1 +/- 0.095	0.18	U
			Th-230	0.12 +/- 0.062	0.04	LT
MW-9	05/06/02	TH-ISO	Th-232	0.01 +/- 0.026	0.04	U
			Th-228	-0.002 +/- 0.044	0.13	U
			Th-230	0.48 +/- 0.050	0.077	U
	06/04/02		Th-232	0.007 +/- 0.040	0.064	U
			Th-228	0.08 +/- 0.081	0.15	U
MW-43	05/07/02	TH-ISO	Th-230	0.06 +/- 0.049	0.05	LT
			Th-232	0.008 +/- 0.029	0.02	U
			Th-228	0.029 +/- 0.087	0.17	U
	06/06/02		Th-230	0.073 +/- 0.042	0.036	LT
			Th-232	0.010 +/- 0.022	0.044	U
MW-100 (Duplicate MW-1)	05/07/02	TH-ISO	Th-228	0.08 +/- 0.066	0.11	U
			Th-230	0.05 +/- 0.028	0.03	LT
			Th-232	0.008 +/- 0.013	0.02	U
	06/04/02		Th-228	0.072 +/- 0.092	0.19	U
			Th-230	0.098 +/- 0.061	0.067	LT
MW-100 (Duplicate MW-1)	05/07/02	TH-ISO	Th-232	0.020 +/- 0.030	0.055	U
			Th-228	0.15 +/- 0.11	0.17	U
			Th-230	0.15 +/- 0.068	0.07	LT
	06/06/02		Th-232	0.02 +/- 0.043	0.07	U
			Th-228	0.24 +/- 0.13	0.20	
MW-100 (Duplicate MW-1)	05/07/02	TH-ISO	Th-230	0.058 +/- 0.037	0.091	U
			Th-232	0.021 +/- 0.037	0.031	U
			Th-228	0.36 +/- 0.32	0.53	U
	06/06/02		Th-230	0.42 +/- 0.17	0.14	
			Th-232	-0.02 +/- 0.096	0.21	U

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TOBICO MARSH STATE GAME AREA
May and June 2002

Well ID	Date	Test	Nuclide	Result +/- 2 s TPU	MDC	Qualifier
MW-1	05/07/02	U-ISO	U-234	0.55 +/- 0.15	0.082	
			U-235	0.052 +/- 0.047	0.070	U
			U-238	0.52 +/- 0.15	0.065	
	06/04/02		U-234	0.39 +/- 0.12	0.05	
			U-235	0.05 +/- 0.043	0.050	LT
MW-2	05/06/02	U-ISO	U-234	0.099 +/- 0.062	0.068	LT
			U-235	0.023 +/- 0.034	0.068	U
			U-238	0.034 +/- 0.038	0.062	U
	06/06/02		U-234	0.42 +/- 0.12	0.05	
			U-235	0.03 +/- 0.034	0.05	U
MW-3	05/06/02	U-ISO	U-234	3.10 +/- 0.55	0.076	
			U-235	0.155 +/- 0.076	0.067	LT
			U-238	2.38 +/- 0.44	0.061	
	06/06/02		U-234	3.1 +/- 0.51	0.05	
			U-235	0.21 +/- 0.087	0.06	
MW-4	05/07/02	U-ISO	U-238	2.35 +/- 0.41	0.02	
			U-234	2.71 +/- 0.47	0.059	
			U-235	0.138 +/- 0.067	0.054	LT
	06/04/02		U-238	2.26 +/- 0.41	0.067	
			U-234	2.84 +/- 0.48	0.04	
MW-5A	05/06/02	U-ISO	U-235	0.11 +/- 0.065	0.05	LT
			U-238	2.59 +/- 0.45	0.02	
			U-234	0.047 +/- 0.046	0.068	U
	06/06/02		U-235	0.007 +/- 0.033	0.074	U
			U-238	0.028 +/- 0.037	0.068	U
MW-7	05/06/02	U-ISO	U-234	0.006 +/- 0.025	0.05	U
			U-235	0.02 +/- 0.029	0.05	U
			U-238	0.01 +/- 0.03	0.06	U
	06/05/02		U-234	0.098 +/- 0.066	0.081	LT
			U-235	0.011 +/- 0.035	0.086	U
MW-8	05/07/02	U-ISO	U-238	0.067 +/- 0.057	0.086	U
			U-234	0.05 +/- 0.041	0.05	U
			U-235	0.003 +/- 0.024	0.04	U
	06/04/02		U-238	0.07 +/- 0.045	0.03	LT
			U-234	0.213 +/- 0.092	0.069	
MW-9	05/07/02	U-ISO	U-235	0.029 +/- 0.035	0.057	U
			U-238	0.50 +/- 0.15	0.057	
			U-234	0.06 +/- 0.073	0.13	U
	06/04/02		U-235	0 +/- 0.052	0.04	U
			U-238	0.1 +/- 0.077	0.04	LT
MW-43	05/07/02	U-ISO	U-234	0.27 +/- 0.14	0.12	
			U-235	0.027 +/- 0.056	0.087	U
			U-238	0.16 +/- 0.10	0.047	LT
	06/06/02		U-234	0.34 +/- 0.13	0.09	
			U-235	0.11 +/- 0.072	0.06	LT
MW-100 (Duplicate MW-1)	05/07/02	U-ISO	U-238	0.07 +/- 0.065	0.09	U
			U-234	0.064 +/- 0.046	0.050	LT
			U-235	0.036 +/- 0.034	0.042	U
	06/06/02		U-238	0.042 +/- 0.041	0.066	U
			U-234	0.03 +/- 0.036	0.060	U
MW-100 (Duplicate MW-1)	05/07/02	U-ISO	U-235	-0.005 +/- 0.025	0.07	U
			U-238	0.006 +/- 0.025	0.05	U
			U-234	0.33 +/- 0.11	0.045	
	06/06/02		U-235	0.041 +/- 0.040	0.060	U
			U-238	0.252 +/- 0.097	0.060	
MW-100 (Duplicate MW-1)	06/06/02	U-ISO	U-234	2.91 +/- 0.47	0.06	
			U-235	0.16 +/- 0.071	0.47	LT
			U-238	2.32 +/- 0.39	0.04	

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Well ID	Date	Test	Nuclide	Result +/- 2 s TPU	MDC	Qualifier
MW-1	05/07/02	9320	Ra-228	0.37 +/- 0.51	0.84	
	06/04/02			0.82 +/- 0.51	0.8	LT
MW-2	05/06/02	9320	Ra-228	NS	NA	
	06/06/02			0.34 +/- 0.42	0.68	U
MW-3	05/06/02	9320	Ra-228	0.77 +/- 0.54	0.85	
	06/06/02			-0.21 +/- 0.55	0.94	
MW-4	05/07/02	9320	Ra-228	0.50 +/- 0.51	0.82	
	06/04/02			0.33 +/- 0.46	0.75	U
MW-5A	05/06/02	9320	Ra-228	0.18 +/- 0.49	0.81	
	06/06/02			0.06 +/- 0.44	0.7	U
MW-7	05/06/02	9320	Ra-228	0.49 +/- 0.49	0.78	
	06/05/02			0.58 +/- 0.61	0.99	U
MW-8	05/07/02	9320	Ra-228	0.75 +/- 0.46	0.71	
	06/04/02			0.39 +/- 0.46	0.75	
MW-9	05/07/02	9320	Ra-228	0.79 +/- 0.49	0.77	
	06/04/02			0.12 +/- 0.49	0.82	U
MW-43	05/07/02	9320	Ra-228	0.74 +/- 0.51	0.81	
	06/06/02			0.41 +/- 0.43	0.70	
MW-100 (Duplicate MW-1)	05/07/02	9320	Ra-228	1.05 +/- 0.51	0.78	
	06/06/02			0.79 +/- 0.50	0.79	

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TOBICO MARSH STATE GAME AREA
May and June 2002**

Well ID	Date	Test	Nuclide	Result +/- 2 s TPU	MDC	Qualifier
MW-1	05/07/02	903.1	Ra-226	0.26 +/- 0.10	0.091	LT, Y1
	06/04/02			0.27 +/- 0.17	0.22	LT
MW-2	05/06/02	903.1	Ra-226	0.24 +/- 0.16	0.23	LT, Y1
	06/06/02			0.13 +/- 0.31	0.54	U
MW-3	05/06/02	903.1	Ra-226	0.32 +/- 0.16	0.22	LT
	06/06/02			0.14 +/- 0.35	0.62	U
MW-4	05/07/02	903.1	Ra-226	0.16 +/- 0.14	0.23	U, Y1
	06/04/02			0.47 +/- 0.23	0.26	LT
MW-5A	05/06/02	903.1	Ra-226	0.36 +/- 0.16	0.21	LT
	06/06/02			0.12 +/- 0.16	0.26	U
MW-7	05/06/02	903.1	Ra-226	0.264 +/- 0.100	0.025	LT
	06/05/02			-0.07 +/- 0.21	0.41	U
MW-8	05/07/02	903.1	Ra-226	0.31 +/- 0.13	0.16	LT, Y1
	06/04/02			0.61 +/- 0.36	0.54	LT
MW-9	05/07/02	903.1	Ra-226	0.25 +/- 0.15	0.21	LT
	06/04/02			0.22 +/- 0.18	0.26	U
MW-43	05/07/02	903.1	Ra-226	0.13 +/- 0.11	0.17	U
	06/06/02			0.11 +/- 0.16	0.28	U
MW-100 (Duplicate MW-1)	05/07/02	903.1	Ra-226	0.23 +/- 0.10	0.11	LT, Y1
	06/06/02			0.11 +/- 0.22	0.38	U, Y1

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May and June 2002**

QUALIFIERS

U	: Result is less than samle specific MDC.
LT	: Result is less than Requested MDC, greater than sample specific MDC.
Y1	: Chemical Yield is in control at 100-110%. Quantitve Yield is assumed.
TPU	: Total Propagated Uncertainty
MDC	: Minimum Detectable Concentration
TH-ISO	: Isopotic Thorium
U-ISO	: Isotopic Uranium
9320	: Radium 228
903.1(M)	: Radium 226
NS	: Not Sampled
NA	: Not Applicable