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THE MEMPHIS DEPOT
TENNESSEE

ADMINISTRATIVE RECORD COVER SHEET

AR File Number 1028

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AR 102

HDR | e2M

Memorandum

To: John Hill, CIV AFCEE/EXA
Mike Dobbs, DES-DDC-EE

From: Kevin Sedlak
Tom Holmes

Date: 19 March 2010

Re: **Work Plan for Off Depot Groundwater Sampling**
Defense Depot Memphis, Tennessee

HDR|e^{2}M has prepared this work plan to describe groundwater monitoring procedures during Years 1 and 2 of the Off Depot Groundwater Remedial Action (RA) at Defense Depot Memphis, Tennessee (DDMT). This work plan was prepared for the Defense Logistics Agency under Contract FA8903-08-D-8771, Task Order 0069 to the Air Force Center for Environmental Excellence.

The selected remedy for Off Depot Groundwater includes:

- Air sparging with soil vapor extraction (AS-SVE) to intercept the majority of the Off-Depot chlorinated volatile organic compound (CVOC) plume and reduce individual CVOC concentrations to below 50 micrograms per liter (µg/L).
- Monitored natural attenuation (MNA) and long-term groundwater monitoring (LTM) to document changes in plume concentrations, to detect potential plume migration to offsite areas or into deeper aquifers, and to track progress toward remediation goals.

Groundwater monitoring will consist of performance monitoring near the AS barrier and LTM throughout the groundwater plume. Groundwater samples are to be collected quarterly during the first year of AS-SVE operation and semiannually during the second year. After the second year, the performance monitoring wells will be incorporated into LTM. The LTM wells will be monitored at semiannual to biennial intervals based on location and past results. Groundwater samples will be analyzed for CVOC parameters. LTM will continue until the groundwater remedial action objectives (RAOs) are achieved.

The groundwater RAOs are:

- Prevent human exposure to contaminated groundwater (i.e., exceeding protective target levels);
- Prevent further offsite migration of volatile organic compounds (VOCs) in groundwater in excess of protective target levels; and
- Remediate fluvial aquifer groundwater to drinking water quality to be protective of the deeper Memphis aquifer

Groundwater monitoring requirements are described in *Long-Term Groundwater Monitoring Plan* (LTM Plan) in Appendix C of the *Off Depot Groundwater Final Remedial*

Design, Rev. 1 (CH2M HILL, 2008) and the *Off Depot Groundwater Remedial Action Work Plan, Rev.2* (HDR|e^{2}M, 2009). Sampling and analytical procedures are described in the *Remedial Action Sampling and Analysis Plan Volume I: Field Sampling Plan and Volume II: Quality Assurance Project Plan, Rev. 1* (RA SAP) (MACTEC, 2005).

Performance monitoring results will be used to assess the effectiveness of the AS/SVE system in cutting off the CVOC plume. The 36 performance monitoring wells are listed on Table 1 and the locations are shown on Figure 1.

LTM will be performed to evaluate overall progress toward the RAOs. The 58 LTM wells were classified in the LTM Plan as background, sentinel or performance wells and were assigned sample frequencies of semiannual (1 well), annual (31 wells) or biennial (26 wells). The well classification criteria are as follows:

- Background - Monitoring wells or piezometers screened in the fluvial or Memphis aquifer; located along or outside of the Dunn Field boundary; located upgradient to or at a distance from contaminant plumes on Dunn Field; no (or only low-level) previous detections of site contaminants in well samples.
- Sentinel Monitoring wells or piezometers screened within the fluvial and intermediate (interpreted to be within the Jackson Formation/Upper Claiborne Group) aquifers; located adjacent to or within a window to the intermediate aquifer.
- Performance - Monitoring wells or piezometers screened in the fluvial aquifer; located within the limits of known contaminant plumes; repeatedly have contaminants in samples; or located in areas targeted for treatment during the RA.

In addition to the 58 wells selected for sampling, 20 wells will be used for water level measurements during LTM events. The LTM wells to be sampled are listed on Table 2 and the water level wells are listed on Table 3. The well locations are shown on Figure 2 and are color-coded by classification or use for water levels only. Several wells classified as sentinel wells in the LTM plan do not fit the stated criteria and are coded as performance wells on Figure 2 (MW-05, MW-33, MW-58, MW-69, MW-78, MW-87, MW-91, MW-145, MW-153, MW-174 and MW-176).

Baseline sampling results for the Off Depot performance monitoring were presented in a memorandum, *Off Depot Well Installation and Baseline Sampling*, dated 5 October 2009. Although startup of the AS/SVE system was delayed until December 2009, the first quarter performance monitoring was conducted in October to coordinate sampling with the final Interim Remedial Action (IRA) event and to provide more recent sample results prior to system operations. The sample results were presented in a memorandum, *October 2009 Performance Monitoring Report*, dated March 16, 2010.

The first Off Depot LTM event and the second quarter performance monitoring event will be conducted in March 2010. Sample events during Off Depot RA Years 1 and 2 are listed on Table 4 for performance monitoring wells and on Table 5 for LTM wells. Although MW-78 is assigned biennial sampling on Table 5, it will be sampled in March 2010 because it was not accessible during the previous IRA sample event in October 2009.

SAMPLING AND ANALYTICAL PROCEDURES

Off Depot groundwater monitoring will be performed in accordance with the RA SAP. Specific Work and Test Procedures (WTPs) to be utilized are included in Appendix A and listed below:

- WTP 1 General Procedures for Field Personnel
- WTP 4 Groundwater Sampling
- WTP 6 Investigation Derived Waste Disposal
- WTP 7 Sample Control and Documentation
- WTP 8 Sample Containers and Preservation
- WTP 9 Sample Packing and Shipping
- WTP 10 Sampling Equipment Decontamination
- WTP 13 Health and Safety Monitoring

Preparation

Preparations for sampling activities are described in WTP 1. The primary activities are coordination with field personnel for sampling and with the subcontract analytical laboratory.

Groundwater samples will be collected from monitoring wells using passive diffusion bags (PDBs) where the saturated screened interval is 5 feet or greater and by low-flow sampling with bladder pumps for other wells. Approximately one month prior to sampling, water levels will be measured to determine the saturated screen interval. If greater than 5 feet, a PDB will be installed if not already present; the PDB will be positioned near the midpoint of the saturated screen. If less than 5 feet, the well will be identified for low flow sampling.

The subcontract analytical laboratory will be notified of the planned sample event, including number of samples and analyses. Sample containers will be scheduled to arrive a few days before sampling begins. Procedures for sample containers and preservation are provided in WTP 8.

Water Level Sweep

Procedures for water level measurements are provided in WTP 4.

Prior to LTM events, water level measurements will be made in all performance monitoring and LTM wells; there are currently 114 wells, including 36 performance monitoring wells, 58 LTM wells and 20 wells listed for water level measurements only.

Measurements will be taken using Solinst Model 101 water level meters with electronic sensors and tapes graduated in 0.01-foot increments. The water level measuring tape will be decontaminated by hand washing and rinsing with de-ionized water before use and between wells.

The probe will be lowered until an audible tone is heard signaling the water surface. The probe is then withdrawn until the tone stops and then lowered very slowly until the tone is heard; the depth is measured at marked top of casing. This measurement is repeated twice and recorded on the field sheet.

The condition of each well will be recorded, including the pad and locks, during the water level sweep. Replacement of well caps or locks, if necessary, will be made the same day.

Groundwater Sampling

Procedures for groundwater sampling, using PDBs or low-flow sampling, are provided in WTP 4.

Sampling will be performed by 2-person crews and supervised by the site manager. Groundwater samples will be collected from most wells using PDBs, although some wells will require low-flow sampling. Water quality parameters are not measured prior to sampling wells with PDBs. Groundwater samples will be analyzed for VOCs by USEPA Method SW8260B.

Passive Diffusion Bags

A PDB sampler consists of a low-density polyethylene tube closed at both ends and filled with de-ionized water. It is positioned in the well at the desired target depth by attaching it to a weighted line or fixed object. The water within the bag is then allowed to equilibrate with the ambient groundwater for at least two weeks before being retrieved. The sampler water is then decanted into 40-mL volatile organic analysis (VOA) vials preserved with hydrochloric acid.

If the well is to be sampled within the next year, a new PDB will be filled with de-ionized water and attached to the rope at the same depth as the original PDB. Changes to the placement depth will be recorded on the field log and reported to the field team leader.

Low Flow Sampling

Low-flow sampling is performed using a portable bladder pump with dedicated Teflon® bladder and Teflon®-lined polyethylene tubing. Following sampling, the bladder and tubing for the well are placed in sealed plastic bags and stored for future sample events.

The pumping rate at the well is set such that the water levels do not decline more than 1.2 inches (0.1 foot). Water quality parameters are measured at 5 to 10 minute intervals during purging using a flow-through cell. The units are calibrated each morning prior to sampling, and if abnormal readings are observed during the day, the instruments are recalibrated in the field. All measurements will be recorded on the field sampling forms.

Purging will continue at the well for up to two hours to meet the stabilization criteria: three successive readings within 0.1 for pH, 10 milliVolts for oxygen reduction potential, 3 percent for specific conductance, 10 percent for dissolved oxygen and <20 nephelometric turbidity units for turbidity. Temperature is also measured and recorded but is not used as a stabilization parameter. The samples are collected in preserved 40-mL VOA vials when stabilization criteria are met or the field team leader approves a variance.

Equipment Decontamination

Procedures for decontamination of sampling equipment are provided in WTP 10.

Field equipment that may become contaminated as a result of field sampling activities will be cleaned prior to use at each well. Equipment rinsate samples will be collected to evaluate decontamination procedures.

Health and Safety

Health and safety during field activities will be monitored in accordance with the procedures in WTP 13 and the *Remedial Action Health and Safety Plan* (HDR|e^{2}M, 2006).

Quality Assurance/Quality Control Samples

Quality Assurance/Quality Control (QA/QC) samples are described in the RA SAP Quality Assurance Project Plan (Volume II, Section 2). Field QC samples will be collected during each sampling event, including duplicates and matrix spikes/matrix spike duplicates (MS/MSD). One duplicate will be collected for approximately every 10 samples (10%) and 1 MS/MSD was collected for every 20 samples (5%). Trip blanks will be included in coolers delivered from the laboratory. Laboratory QA/QC samples included surrogate spikes, method blanks, laboratory control samples, in addition to MS/MSD analysis. The QC samples to be collected during each event are listed on Table 6.

Sample Control and Shipping

Procedures for sample control and shipping are provided in WTPs 7 and 9.

Sample documentation is completed in the field to ensure that the samples collected, labels, chain-of-custody, and request for analysis are in agreement. Custody seals are placed on each cooler before shipment by common carrier. Samples are typically shipped the day collected for overnight delivery to the laboratory.

The samples will be sent to the subcontract laboratory, Microbac Laboratories in Marietta, Ohio, for VOC analysis by USEPA Method SW8260B.

IDW Management

The waste generated during groundwater sampling is classified as either non-investigative waste or investigative derived waste (IDW). Non-investigative waste, such as packaging materials, personal protective equipment, disposable sampling supplies, and other inert refuse, is collected, containerized, and transported to a designated collection bin for disposal at a municipal landfill.

The IDW consists of waste water from equipment decontamination and groundwater from purging prior to sampling. The waste water is collected and added to the fluvial soil vapor extraction condensate water storage tank on Dunn Field. A grab sample is collected as the storage capacity is reached and analyzed for pH, volatile and semi-volatile organic compounds, and metals in accordance with the City of Memphis discharge permit. Following approval from the city, the water is pumped into the IRA conveyance line and discharged to the city sewer.

DATA QUALITY EVALUATION

Data quality evaluation (DQE) will be performed to evaluate the analytical data relative to the data quality objectives described in the RA SAP. Level III DQE of laboratory analytical results will be conducted following each sampling event to ensure the data are satisfactory and defensible and to validate the precision and accuracy of the data. The analytical results will be flagged as usable, usable with qualification, or unusable in accordance with the criteria stated in the RA SAP for each analytical method performed. Upon final review the data will be incorporated into the project database. Laboratory quality control data and the DQE narratives will be included in the annual report.

REPORTING

Summary reports will be submitted approximately two months after each sample event and will include preliminary data results prior to DQE. The reports will include a brief introduction and scope of work, description of field sampling activities, discussion of preliminary analytical results, and a summary of findings. Report tables will include water level measurements and an analytical results summary.

An annual report will fully document the monitoring activities, DQE and analytical results for the sample events; recommendations for monitoring optimization will be made in accordance with the LTM plan. Analytical data will be presented in data summary tables, concentration versus time graphs, and maps showing the extent of contaminant plumes.

TABLES

TABLE 1
PERFORMANCE MONITORING WELLS
OFF DEPOT GROUNDWATER MONITORING WORK PLAN
Dunn Field - Defense Depot Memphis, Tennessee

Well	Aquifer	Northing (feet)	Easting (feet)	Ground Elevation (feet, msl)	Stick Up (feet)	Riser Length (feet)	Screen Length (feet)	Total Well Depth (Feet, btoc)
MW-54	Fluvial	281160.10	801183.32	295.60	-0.25	84.5	10	94 5
MW-70	Fluvial	281029.60	801988.49	302.80	2.19	80.8	10	90.8
MW-76	Fluvial	281311.98	801642.76	303 30	-0.59	73.0	20	93.0
MW-77	Fluvial	281142.96	801815.29	304.70	-0.28	68.0	20	88.0
MW-79	Fluvial	281794 22	800899.03	285 40	-0.37	82.5	20	102.5
MW-148	Fluvial	281377.94	801461.63	294.87	-0.157	70 0	20	90.0
MW-149	Fluvial	281130 04	800982.76	287 44	-0 267	81.4	20	101.4
MW-150	Fluvial	281238.66	801283.61	297.15	-0.332	71 2	20	91.2
MW-151	Fluvial	281290 42	800874.85	284.42	-0 15	77.0	20	97.0
MW-152	Fluvial	281515.56	800892.84	289.82	-0 23	91.0	20	111.0
MW-155	Fluvial	281325 31	801168.93	291.84	-0.19	77.0	20	97.0
MW-157	Fluvial	281050 91	801348.32	286.83	-0 05	57.0	20	77.0
MW-158	Fluvial	281434 42	801005 34	294.38	-0.31	91.0	15	106.0
MW-158A	Fluvial	281443 51	801005 67	294.22	-0 27	77.9	15	92.9
MW-159	Fluvial	281304 29	801006.52	286 58	-0.25	80.4	20	100.4
MW-160	Fluvial	281366.52	801304 26	294.11	-0.11	65.9	20	85.9
MW-161	Fluvial	281120.29	801596.82	296.67	-0 27	61.8	20	81.8
MW-162	Fluvial	281244.22	801596 06	299.89	-0.19	66.3	20	86.3
MW-163	Fluvial	281152.59	801487 27	290.81	-0.18	56.2	20	76.2
MW-164	Fluvial	280997.55	801497 47	287.71	-0.23	55.6	20	75.6
MW-165	Fluvial	281384.63	800855.49	287 35	-0.29	88 6	15	103.6
MW-165A	Fluvial	281383 55	800865 69	287.53	-0.27	71.3	15	86.3
MW-166	Fluvial	281224.99	800928 09	280.96	2.48	83.9	15	98.9
MW-166A	Fluvial	281213.35	800927 36	280.92	2.53	68.3	15	83 3
MW-232	Intermediate	281294.53	801006.27	285 63	-0.45	150.1	21	170.6
MW-241	Fluvial	281389.92	801396 74	293.00	-0.18	73.3	15	88.3
MW-242	Fluvial	281297.31	801228.65	295 94	-0.54	73.2	16	88.7
MW-243	Fluvial	281370 62	801116 45	292.53	-0 27	80.7	20	100.7
MW-244	Fluvial	281333.49	801101.07	289.45	-0 73	76.3	20	96.3
MW-245	Fluvial	281379 56	801035.07	290.55	-0 42	84.7	20	104.7
MW-246	Fluvial	281387 26	800951 62	288.49	-0 32	85.2	20	105.2
MW-247	Fluvial	281319.67	800900.12	286.16	-0.46	80 0	20	100.0
MW-248	Fluvial	281253.66	800720.22	275.93	-0.48	67.5	20	87.5
MW-249	Fluvial	281029.63	800789.83	285.89	-0.36	78.0	20	98 0
MW-250	Intermediate	281045.53	800900.38	290.19	-0.53	168.7	15	183.7
MW-251	Intermediate	281211.70	801021.75	286.16	-0.33	160 2	15	175.2

TABLE 2
LTM WELLS
OFF DEPOT GROUNDWATER MONITORING WORK PLAN
Dunn Field - Defense Depot Memphis, Tennessee

Well	Aquifer	Well Classification	Sample Frequency	Northing (feet)	Easting (feet)	Ground Elevation (feet, msl)	Stick Up (feet)	Riser Length (feet)	Screen Length (feet)	Total Well Depth (feet, btoc)
MW-04	Fluvial	Background	Biennial	281278.87	802369.19	300.00	1.6	60 0	20	80 0
MW-05	Fluvial	Performance	Biennial	281254.49	802084.68	301.30	3.3	60.0	20	80.0
MW-06	Fluvial	Performance	Annual	280604.17	802069.13	288.10	1.0	51.0	20	71.0
MW-13	Fluvial	Background	Biennial	281033.56	802369.21	300.10	-0.1	66.0	15	83 4
MW-14	Fluvial	Background	Biennial	280003 37	802288.95	302.44	-0.2	65.0	15	80.0
MW-15	Fluvial	Performance	Annual	280348 88	801985.36	295.23	-0.1	63.4	15	80 8
MW-31	Fluvial	Performance	Annual	281651.53	801783.90	287.50	2 9	64.1	15	79.2
MW-32	Fluvial	Performance	Annual	280834.37	801615.51	285.60	-0.2	52.7	15	67 8
MW-33	Fluvial	Performance	Biennial	280398.10	801561 30	277 70	3.0	44.6	15	59 7
MW-37	Intermediate	Sentinel	Biennial	280831.22	801616.58	285.50	-0 6	165.7	15	182.8
MW-44	Fluvial	Performance	Annual	281073.71	800601 09	269 40	-0.3	64 0	10	74.0
MW-51	Fluvial	Background	Biennial	282345 86	802828.62	275.50	-0.3	55.0	10	65.0
MW-57	Fluvial	Performance	Annual	280184.05	802006.19	291.10	-0.3	60.0	10	70.5
MW-58	Fluvial	Performance	Biennial	279845.07	802066.44	290.70	-0.2	57.0	10	67.5
MW-65	Fluvial	Background	Biennial	283529 72	803887.68	264.00	-0.8	40.8	10	50.8
MW-69	Fluvial	Performance	Annual	281202.55	802011.49	304.90	2.1	82.1	10	92.1
MW-71	Fluvial	Performance	Annual	280584.68	801804 71	291.90	2.5	65.5	10	75 5
MW-74	Fluvial	Performance	Annual	280991.20	802044 29	304 00	-0.3	70.0	20	90.0
MW-75	Fluvial	Performance	Annual	281080.10	802051 10	304.30	-0.7	71.0	20	91.0
MW-78	Fluvial	Performance	Biennial	282051.71	802065.28	275.40	-0 4	44.5	20	64.5
MW-87	Fluvial	Performance	Annual	280696.36	802038.55	292 80	2.1	63.0	15	75 0
MW-91	Fluvial	Performance	Biennial	280474.97	802014.43	289.30	2.7	55.0	15	67 0
MW-128	Fluvial	Background	Biennial	282712.19	803376.38	284.77	-0.6	54.8	20	75.3
MW-132	Fluvial	Performance	Annual	281006.28	802129.10	301.05	-0.3	73 5	15	88.5
MW-144	Fluvial	Performance	Annual	281138.63	801528.84	291.89	-0.3	56.8	20	76 5
MW-145	Fluvial	Performance	Annual	280967.63	800823.18	284.86	-0.1	80.1	20	96.8
MW-147	Fluvial	Performance	Semiannual	281501.06	801674.04	289.97	-0 2	60.2	20	78.0
MW-153	Fluvial	Performance	Biennial	282119 38	800952 34	279.26	-0.1	76.1	20	96.1
MW-169	Transition	Sentinel	Biennial	282491.23	800956 58	262.17	-0.3	68.1	20	88.1
MW-170	Fluvial	Sentinel	Biennial	282443.17	801260.46	273 98	-0.2	59.8	20	79.9
MW-171	Fluvial	Sentinel	Biennial	282315.35	801057 83	271.02	-0.3	53.3	15	68.4
MW-172	Fluvial	Background	Annual	280213.31	802221.98	300.94	-0.7	68.0	10	78.0
MW-174	Fluvial	Performance	Annual	280352.00	802092.07	296.83	-0.3	67.0	10	77.0
MW-175	Fluvial	Performance	Annual	280618.49	802175.36	291.93	-0.3	67.5	10	77.5
MW-176	Fluvial	Performance	Annual	280823.77	802032.08	299.92	-0.2	76.0	10	86.0

TABLE 2
LTM WELLS
OFF DEPOT GROUNDWATER MONITORING WORK PLAN
Dunn Field - Defense Depot Memphis, Tennessee

Well	Aquifer	Well Classification	Sample Frequency	Northing (feet)	Easting (feet)	Ground Elevation (feet, msl)	Stick Up (feet)	Riser Length (feet)	Screen Length (feet)	Total Well Depth (feet, btoc)
MW-178	Fluvial	Background	Annual	280982.81	802227 34	300.57	-0.3	76 0	10	86 0
MW-179	Fluvial	Performance	Annual	281075.70	802158 65	301.32	-0.2	77.0	10	87.0
MW-180	Fluvial	Performance	Annual	281476.43	802131 85	296.39	-0.3	72.0	10	82.0
MW-182	Fluvial	Sentinel	Biennial	280524 22	800623.13	272 98	2.4	62.0	10	72.0
MW-184	Fluvial	Performance	Biennial	280903.16	801442.29	283 34	-0.2	58 0	10	68.0
MW-185	Fluvial	Sentinel	Biennial	282673.47	800985.92	256.98	-0 3	85.0	10	95.0
MW-186	Fluvial	Sentinel	Biennial	282691.30	800988.07	256 69	-0 4	148.0	10	158.0
MW-187	Fluvial	Background	Annual	280563.18	802348.09	303.21	-0.5	76.0	10	86.0
MW-190	Fluvial	Performance	Annual	281138.88	801595.73	297.58	-0.3	78.0	10	88.0
MW-221	Fluvial	Performance	Annual	281399.71	802100.05	298 37	3.2	73.1	15	88 1
MW-222	Fluvial	Performance	Annual	280986.04	802145 54	301.06	2.8	74 2	15	89 2
MW-223	Fluvial	Performance	Annual	280913.53	802104 29	300.41	2 6	73.9	15	88.9
MW-224	Fluvial	Performance	Annual	281017.74	802181.62	301.18	3.0	73.7	15	88.7
MW-225	Fluvial	Performance	Annual	280947.12	802070 50	301.30	3.2	75.0	15	90.0
MW-226	Fluvial	Performance	Annual	280931 94	802147.21	300.56	2.6	74.2	15	89.2
MW-227	Fluvial	Performance	Annual	280257 91	802081.00	296.64	3.1	63.6	15	78.6
MW-228	Fluvial	Performance	Annual	280251 88	802157.40	298.59	3.1	64 1	15	79 1
MW-231	Intermediate	Sentinel	Biennial	280944 20	801628.65	289.43	-0 3	167.8	26	193 3
MW-234	Intermediate	Sentinel	Biennial	281005 44	801630.89	291.71	-0 2	166.6	10	176 8
MW-235	Fluvial	Sentinel	Biennial	280727.57	800447.83	264.21	-0 2	50.6	10	60.8
MW-237	Intermediate	Sentinel	Biennial	281356.02	800963.99	289 53	-0 4	166.5	10	176 7
MW-239	Intermediate	Sentinel	Biennial	281334.02	801009.58	288.77	-0 3	165 5	10	175 7
MW-240	Intermediate	Sentinel	Biennial	282897.03	800869 30	259.51	-0 2	86.6	10	96.8

TABLE 3
LTM WELLS - WATER LEVELS ONLY
OFF DEPOT GROUNDWATER MONITORING WORK PLAN
Dunn Field - Defense Depot Memphis, Tennessee

Well	Aquifer	Well Classification	Northing (feet)	Easting	Ground Elevation (feet,msl)	Stick Up (feet)	Riser Length (feet)	Screen Length (feet)	Total Well Depth (feet, btoc)
MW-03	Fluvial	Performance	281596.25	802100 69	290.40	2.0	65.5	10	75.5
MW-07	Fluvial	Performance	281839.88	802481 70	293.10	2.0	67.0	10	77.0
MW-08	Fluvial	Background	282001.04	802727.91	292.74	-0.2	56.5	10	68 9
MW-10	Fluvial	Performance	281662 55	802201 26	289.20	-0.4	58.6	10	71.0
MW-28	Fluvial	Background	281568 58	803154 48	294.89	-0.1	54.3	15	69 4
MW-42	Fluvial	Background	281883 92	800182.40	275.10	-0 3	49.0	10	59.0
MW-43	Intermediate	Sentinel	280284.33	800111.73	284.99	0.0	161 5	10	173 0
MW-45	Fluvial	Background	280728 08	804125.99	293.30	-0.1	58.0	10	68 0
MW-67	Memphis	Sentinel	280473.05	800933 94	275.53	2.7	260.0	15	275 0
MW-68	Fluvial	Performance	281500.76	802040.04	291.60	0 1	72.5	10	82 5
MW-80	Fluvial	Background	281417.56	800199 07	274.00	-0.2	53 0	20	73 0
MW-126	Fluvial	Background	282390 01	800491.67	252.49	-0.3	16 0	10	26 0
MW-127	Fluvial	Background	280738 40	799810 30	268.86	-0.2	60 0	10	70 0
MW-129	Fluvial	Background	282271.08	803128.53	293.33	-0.3	65.0	15	80.5
MW-130	Fluvial	Background	282116 23	803242.02	293.69	-0.5	59 5	20	80 0
MW-134	Fluvial	Performance	281012.74	802102.58	301.05	-0.2	75.0	15	90.0
MW-154	Fluvial	Background	280501.53	800919.48	274.07	-0.3	53 3	10	63.3
MW-167	Fluvial	Background	281394.03	800618.54	285.21	-0.4	70.5	15	82 6
MW-220	Fluvial	Performance	281617.49	802166.87	290.31	3.0	64.9	15	79.7
MW-230	Fluvial	Background	281842.54	802800.22	286 92	-0.4	59.3	15	74 5

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TABLE 4
PERFORMANCE MONITORING SCHEDULE
OFF DEPOT GROUNDWATER MONITORING WORK PLAN
Dunn Field - Defense Depot Memphis, Tennessee

		Year 1 - Quarterly				Year 2 - Semiannual	
Well	Aquifer	Oct 2009	Mar 2010	Jun 2010	Sep 2010	Mar 2011	Sep 2011
MW-54	Fluvial	S	P	P	P	P	P
MW-70	Fluvial	S	P	P	P	P	P
MW-76	Fluvial	S	P	P	P	P	P
MW-77	Fluvial	S	P	P	P	P	P
MW-79	Fluvial	S	P	P	P	P	P
MW-148	Fluvial	S	P	P	P	P	P
MW-149	Fluvial	S	P	P	P	P	P
MW-150	Fluvial	S	P	P	P	P	P
MW-151	Fluvial	S	P	P	P	P	P
MW-152	Fluvial	S	P	P	P	P	P
MW-155	Fluvial	S	P	P	P	P	P
MW-157	Fluvial	S	P	P	P	P	P
MW-158	Fluvial	S	P	P	P	P	P
MW-158A	Fluvial	S	P	P	P	P	P
MW-159	Fluvial	S	P	P	P	P	P
MW-160	Fluvial	S	P	P	P	P	P
MW-161	Fluvial	S	P	P	P	P	P
MW-162	Fluvial	S	P	P	P	P	P
MW-163	Fluvial	LF	P	P	P	P	P
MW-164	Fluvial	S	P	P	P	P	P
MW-165	Fluvial	S	P	P	P	P	P
MW-165A	Fluvial	S	P	P	P	P	P
MW-166	Fluvial	S	P	P	P	P	P
MW-166A	Fluvial	S	P	P	P	P	P
MW-232	Intermediate	S	P	P	P	P	P
MW-241	Fluvial	S	P	P	P	P	P
MW-242	Fluvial	S	P	P	P	P	P
MW-243	Fluvial	S	P	P	P	P	P
MW-244	Fluvial	S	P	P	P	P	P
MW-245	Fluvial	S	P	P	P	P	P
MW-246	Fluvial	S	P	P	P	P	P
MW-247	Fluvial	S	P	P	P	P	P
MW-248	Fluvial	S	P	P	P	P	P
MW-249	Fluvial	S	P	P	P	P	P
MW-250	Intermediate	S	P	P	P	P	P
MW-251	Intermediate	S	P	P	P	P	P

Notes

P Sample planned.

LF Sample collected using low-flow purging methods.

S PDB sample collected at mid-point of saturated screened interval.

TABLE 5
LTM SCHEDULE
OFF DEPOT GROUNDWATER MONITORING WORK PLAN
Dunn Field - Defense Depot Memphis, Tennessee

Well ID	Sample Frequency	Annual Mar 2010	Semiannual Sep 2010	Biennial Mar 2011	Semiannual Sep 2011
MW-04	Biennial	-	-	P	-
MW-05	Biennial	-	-	P	-
MW-06	Annual	P	-	P	-
MW-13	Biennial	-	-	P	-
MW-14	Biennial	-	-	P	-
MW-15	Annual	P	-	P	-
MW-31	Annual	P	-	P	-
MW-32	Annual	P	-	P	-
MW-33	Biennial	-	-	P	-
MW-37	Biennial	-	-	P	-
MW-44	Annual	P	-	P	-
MW-51	Biennial	-	-	P	-
MW-57	Annual	P	-	P	-
MW-58	Biennial	-	-	P	-
MW-65	Biennial	-	-	P	-
MW-69	Annual	P	-	P	-
MW-71	Annual	P	-	P	-
MW-74	Annual	P	-	P	-
MW-75	Annual	P	-	P	-
MW-78	Biennial	P	-	P	-
MW-87	Annual	P	-	P	-
MW-91	Biennial	-	-	P	-
MW-128	Biennial	-	-	P	-
MW-132	Annual	P	-	P	-
MW-144	Annual	P	-	P	-
MW-145	Annual	P	-	P	-
MW-147	Semiannual	P	P	P	P
MW-153	Biennial	-	-	P	-
MW-169	Biennial	-	-	P	-
MW-170	Biennial	-	-	P	-
MW-171	Biennial	-	-	P	-
MW-172	Annual	P	-	P	-
MW-174	Annual	P	-	P	-
MW-175	Annual	P	-	P	-
MW-176	Annual	P	-	P	-
MW-178	Annual	P	-	P	-
MW-179	Annual	P	-	P	-
MW-180	Annual	P	-	P	-
MW-182	Biennial	-	-	P	-
MW-184	Biennial	-	-	P	-
MW-185	Biennial	-	-	P	-
MW-186	Biennial	-	-	P	-
MW-187	Annual	P	-	P	-
MW-190	Annual	P	-	P	-
MW-221	Annual	P	-	P	-
MW-222	Annual	P	-	P	-

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TABLE 5
LTM SCHEDULE
OFF DEPOT GROUNDWATER MONITORING WORK PLAN
Dunn Field - Defense Depot Memphis, Tennessee

Well ID	Sample Frequency	Annual Mar 2010	Semiannual Sep 2010	Biennial Mar 2011	Semiannual Sep 2011
MW-223	Annual	P	-	P	-
MW-224	Annual	P	-	P	-
MW-225	Annual	P	-	P	-
MW-226	Annual	P	-	P	-
MW-227	Annual	P	-	P	-
MW-228	Annual	P	-	P	-
MW-231	Biennial	-	-	P	-
MW-234	Biennial	-	-	P	-
MW-235	Biennial	-	-	P	-
MW-237	Biennial	-	-	P	-
MW-239	Biennial	-	-	P	-
MW-240	Biennial	-	-	P	-

Notes:

P Sample planned

\- Sample not planned

TABLE 6
QUALITY CONTROL SAMPLES
OFF DEPOT GROUNDWATER MONITORING WORK PLAN
Dunn Field - Defense Depot Memphis, Tennessee

Event	Date	Field Samples	Field Duplicates	Matrix Spike	Matrix Spike Duplicate	Trip Blanks	Equipment Blanks	Total	Analyses
Quarterly Performance Monitoring	Mar-10	36	4	2	2	2	1	47	VOCs
Annual LTM	Mar-10	33	4	2	2	2	1	44	VOCs
Quarterly Performance Monitoring	Jun-10	36	4	2	2	2	1	47	VOCs
Quarterly Performance Monitoring	Sep-10	36	4	2	2	2	1	47	VOCs
Semiannual LTM	Sep-10	1	1	1	1	1	1	6	VOCs
Semiannual Performance Monitoring	Mar-11	36	4	2	2	2	1	47	VOCs
Biennial LTM	Mar-11	58	6	3	3	5	2	77	VOCs
Semiannual Performance Monitoring	Sep-11	36	4	2	2	2	1	47	VOCs
Semiannual LTM	Sep-11	1	1	1	1	1	1	6	VOCs

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FIGURES

1028 16

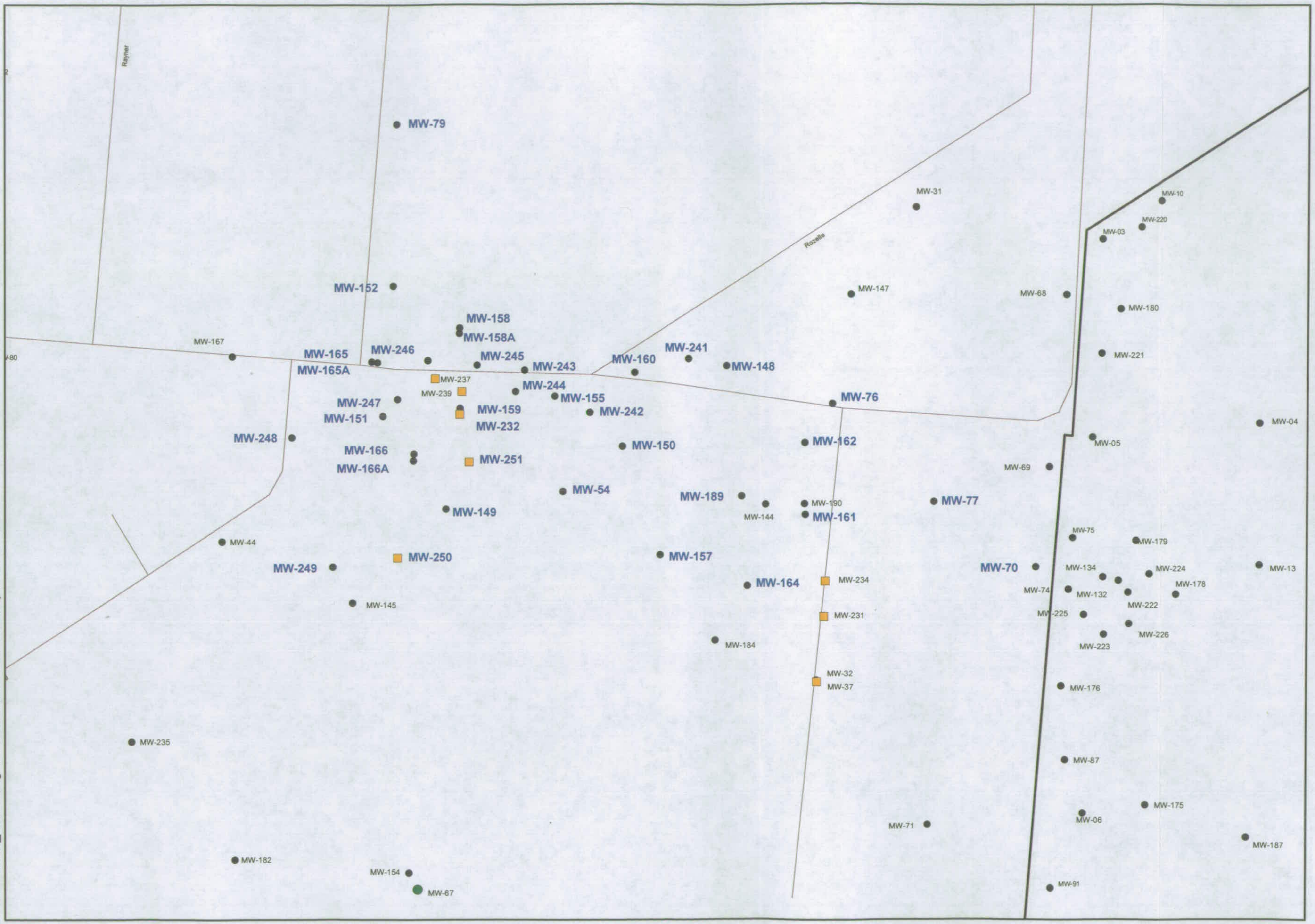

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Figure 1

PERFORMANCE WELL LOCATION MAP

OFF DEPOT GROUNDWATER SAMPLING WORK PLAN

DUNN FIELD
DEFENSE DEPOT
MEMPHIS, TENNESSEE

Legend

- Monitoring Well Screened in the Fluvial Aquifer
- Monitoring Well Screened in the Intermediate Aquifer
- Monitoring Well Screened in the Transition Zone
- Monitoring Well Screened in the Memphis Aquifer

- MW-241 Performance Monitoring Well

— Dunn Field Boundary

0 50 100 150 200
Feet

Installation Location
Memphis, Tennessee

Date: February 2010
Edition: Rev 0

HDR | eM

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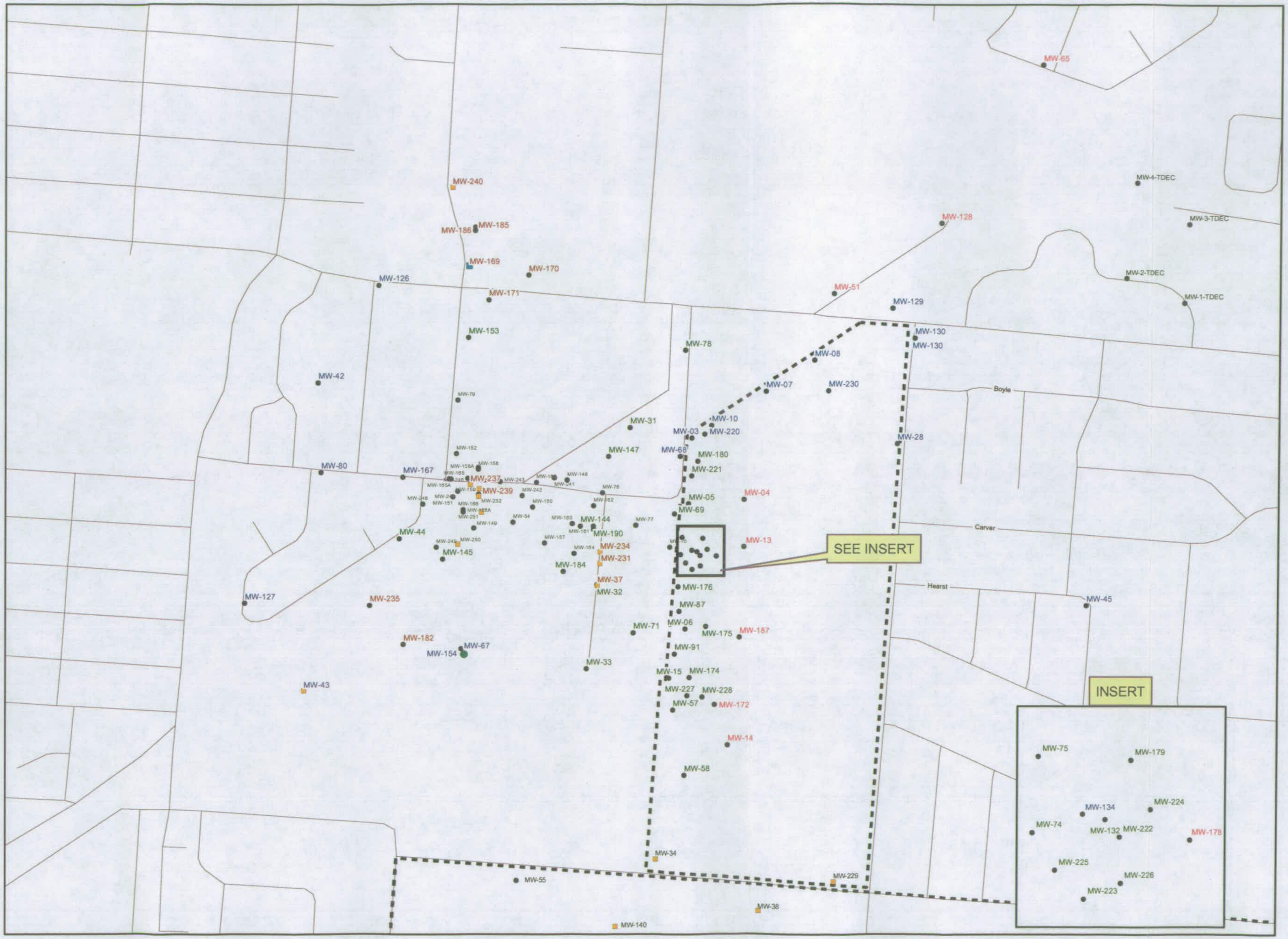

Figure 2

LTM WELL LOCATION MAP

OFF DEPOT GROUNDWATER SAMPLING WORK PLAN

DUNN FIELD
DEFENSE DEPOT
MEMPHIS, TENNESSEE

Legend

- Monitoring Well Screened in the Fluvial Aquifer
- Monitoring Well Screened in the Intermediate Aquifer
- Monitoring Well Screened in the Transition Zone
- Monitoring Well Screened in the Memphis Aquifer

Off Depot Well Classification

- MW-04 Background
- MW-05 Sentinel
- MW-06 Performance
- MW-03 Water Level Only
- Dunn Field Boundary

0 200 400 600 800
Feet

Installation Location
Memphis, Tennessee

MEMPHIS INT

Date: March 2009
Edition: Rev 0

HDR | eM

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Appendix A

Selected Work and Test Procedures from RA SAP

- WTP 1 General Procedures for Field Personnel
- WTP 4 Groundwater Sampling
- WTP 6 Investigation Derived Waste Disposal
- WTP 7 Sample Control and Documentation
- WTP 8 Sample Containers and Preservation
- WTP 9 Sample Packing and Shipping
- WTP 10 Sampling Equipment Decontamination
- WTP 13 Health and Safety Monitoring

WORK AND TEST PROCEDURE 1
GENERAL PROCEDURES FOR FIELD PERSONNEL

1.0 PURPOSE

The purpose of this Work and Test Procedure (WTP) is to provide guidance for the general field practices to be followed by MACTEC personnel while in the field at DDMT. A review of this WTP is mandatory prior to any field activities.

2.0 DISCUSSION

This WTP provides general guidance for field operations. The project-specific work plan will be referred to in order to determine the exact requirements for a specific project.

Each individual assigned to field work must participate in the MACTEC Medical Monitoring Program, must have taken the OSHA 40-Hour course (updated with the 8-Hour OSHA Refresher, when necessary), and must be certified as able to wear respiratory protection, and to participate in field activities through the MACTEC Medical Monitoring Program.

Minimum required personal protective equipment (PPE) for all employees involved in field work are steel-toed work boots. Additional PPE will be discussed in project specific work plans and in the site Health and Safety plan. A general checklist of personal supplies and equipment is presented as Attachment 1.1.

3.0 PROCEDURES

The following WTPs should be considered in conjunction with this WTP:

NUMBER	NAME
1	General Procedures for Field Personnel
2	Drilling Operations
3	Well Installation, Development, and Abandonment
4	Groundwater Sampling
5	Hydraulic Conductivity Testing
6	Investigation Derived Waste Disposal
7	Sample Control and Documentation

NUMBER	NAME
8	Sample Containers and Preservation
9	Sample Packing and Shipping
10	Sampling Equipment Decontamination
11	Soil Sampling
12	Personnel Protective Equipment Decontamination
13	Health and Safety Monitoring

3.1 PREPARATION

This section discusses the procedures to be used prior to beginning the field activities at each site.

3.1.1 Office

Prior to leaving the office for field work, personnel will perform the following actions:

1. The Project/Task Manager will assign a Field Team Leader to direct field activities and coordinate with project/task managers, and personnel. Task specific responsibilities of the Field Team Leader will be addressed in the appropriate WTP; general responsibilities include;

    - Reviewing project-specific work plan, Health and Safety Plan (HSP), and Quality Assurance Project Plan (QAPP).
    - Notifying site personnel to arrange site access and coordinate schedules; contacts include DRC, affected tenants, and/or offsite property owners.
    - Coordinating field efforts with the project chemist and analytical laboratory
    - Generating appropriate paperwork for each event. Shipping appropriate paperwork and field books to the site.
    - Ordering appropriate supplies and equipment for delivery prior to the start of each event.
    - If any work is to be subcontracted, a review of the subcontractor contract, work plan, and Health and Safety plan.
    - Ensure that all employees traveling to the site have Driver's License (or other picture identification) and an OSHA Certification Card in their possession prior to leaving the office.

3.1.2 Field

After arrival on site, but prior to commencement of operations, the following procedures will be employed:

- Verify that all required paperwork and equipment for field activities is on site. Inventory all rental equipment.
- Conduct site set up activities to include posting of signage (if applicable), delineation of work zones as specified by the SHSO or the Field Team Leader.
- Calibrate monitoring equipment (as needed).
- Conduct team safety meetings as required by the HASP.
- Conduct team review of the WTP and procedures to be followed.

3.2 FIELD OPERATIONS

Prior to commencement of operations at each of the sites, a site reconnaissance will be performed to determine requirements for site preparation and clearance, such as clearing of brush and other identifying obstructions. Proposed drilling and sampling locations will be clearly marked. Clearance for utilities at drilling locations will then be conducted by utility operators or locating services such as Tennessee One-Call. No intrusive activities will be conducted until utility clearance has been completed. The MACTEC Field Team Leader will also select appropriate locations for the decontamination area, emergency equipment, and a drum staging area through consultation with DRC and site tenants as necessary.

The responsibilities incumbent on field personnel at DDMT are project and task specific. At a minimum, the field personnel are required to

1. Maintaining a logbook that describes field activities, and other information. In the logbook or on various forms that may be required, the following information must be recorded for each activity:

    - Location
    - Date and time
    - Identity of persons performing the activity
    - Weather conditions

For field measurements, the following additional information will be required:

- The numerical value and units of each measurement
- The identity of and calibration results for each field instrument

For sampling activities, the following additional information will be required:

- Sampling type and method
- The identity of each sample and the depth(s) from which it was obtained
- The amount of each sample
- Sample description (e.g., color, odor, clarity)
- Identification of sampling devices
- Identification of conditions that might reflect representativeness of a sample (e.g., refueling operations, damaged casings)

2. Completing any required data collection/sample control forms (e.g., Chain-of-Custody, Field Sampling Report, etc.)..
3. Communication with the MACTEC project/task manager regarding site conditions and out of scope work to be performed.
4. Before leaving the site daily, the following procedures will be performed by on-site personnel:

   - Decontaminate field equipment.
   - Field Team Leader is responsible for checking that all personnel have completed logbooks and field forms daily
   - Properly dispose of soiled PPE.
   - Ensure that any drums containing investigation-derived waste or PPE are sealed nightly and clearly labeled with the contents, date, and site/location name.
   - Make arrangements for shipment of samples (if applicable). Check daily with the analytical laboratory to ensure samples arrived in good condition.

3.3 POST-OPERATION

This section discusses the procedures to be followed after field activities have been completed.

3.3.1 Field

Upon the completion of field activities, the MACTEC Field Team Leader will visit each site to verify that the area has been cleared and restored as closely as possible to its prior condition. Trash will be removed from the site, and surface damage, such as wheel ruts caused by the drilling and support equipment, will be repaired.

- Ensure that equipment and associated supplies have been shipped back to the office.

3.3.2 Office

Upon return to the office, field personnel will perform the following:

- Submit logbook and original forms to Project/Task Manager for review.
- Check equipment and supplies shipped back to the office.
- Arrange for proper disposal of investigation-derived waste.
- Contact the analytical laboratory to ensure that the samples arrived in good condition (e.g., temperature is within acceptable ranges).

4.0 REFERENCES

USACE, 2001. Engineering and Design Requirements for the Preparation of Sampling and Analysis Plans, Department of the Army, Washington D.C. February 1, 2001.

USEPA, 2001. Environmental Investigations Standard Operating Procedures and Quality Assurance Manual, Environmental Compliance Branch, Athens, Georgia, November, 2001.

5.0 ATTACHMENTS

Attachment 1.1 - Personal Field Equipment and Supplies Checklist

ATTACHMENT 1.1

PERSONAL FIELD EQUIPMENT AND SUPPLIES GENERAL CHECKLIST

Steel Toe Workboots ____________

Full Face Respirator (with appropriate cartridges) ____________

Safety glasses ____________

Logbook ____________

Pens ____________

Data Collection Forms ____________

Respirator Cartridges ____________

OSHA Certification Card ____________

Tape Measure ____________

Hard Hat ____________

Hammer ____________

First Aid Kit and Emergency Eyewash Station ____________

Overshoes ____________

Sun Screen ____________

Work Gloves ____________

Disposable Gloves ____________

WORK AND TEST PROCEDURE 4
GROUNDWATER SAMPLING

1.0 PURPOSE

The purpose of this Work and Test Procedure (WTP) is to provide guidance for collection of groundwater samples for field or laboratory analysis.

2.0 DISCUSSION

This WTP specifies details and procedures for collecting groundwater samples for chemical analysis. Groundwater samples will be collected from monitoring wells using either a disposable Teflon bailer or a stainless steel bladder pump. The groundwater samples will be analyzed to identify chemical constituents and their concentrations.

3.0 PROCEDURES

3.1 ASSOCIATED PROCEDURES

The following WTPs should be considered for review in conjunction with this WTP:

NUMBER	NAME
1	General Instructions for Field Personnel
3	Well Installation and Development
7	Sample Control and Documentation
8	Sample Containers and Preservation
9	Sample Packing and Shipping
10	Sampling Equipment Decontamination
12	Personnel Protective Equipment Decontamination
13	Health and Safety Monitoring

3.2 PREPARATION

3.2.1 Office

Prior to leaving the office for field work, the field team leader is responsible for activities listed in WTP 1, as well as the following actions:

- Working with the project chemist to generate a sampling plan detail listing the wells and constituents to be sampled
- Coordinating with the analytical laboratory to ensure that the sample containers, and preservatives are shipped to the site and arrive prior to the start of sampling event
- Generating appropriate paperwork for each event including; sample labels, request for analysis forms, field sampling reports, purge forms. Shipping appropriate paperwork and field books to the site prior to the start of sampling.
- Ordering appropriate supplies and equipment for delivery prior to the start of sampling. A generalized list of sampling equipment and supplies is provided as Attachment 4.2
- Confirm the shipping receipts and schedule with lab and equipment suppliers

3.2.2 Field

After arrival on site, but prior to commencement of operations, the following procedures will be employed:

- Check that required sampling equipment has arrived on site.
- Conduct site set up activities; posting of signage and establishment of a decontamination area, and organization and inventory of supplies in the field storage area.
- Check that monitoring equipment is functioning properly, and calibrated as needed.
- Ensure that sufficient drums are on site to containerize any excess sample material collected.
- Assign task to field teams according to the project work plans

3.3 FIELD OPERATIONS

Prior to sampling, a field station will be established. The station will contain equipment, supplies, safety gear, and instrumentation necessary for the collection of samples. Field instruments will be calibrated, files containing sample information will be processed, and sample bottles will be sorted for each sample location according to analyses.

Environmental conditions will also be noted. Each sampling site will be characterized by the following factors:

- Location of work
- Weather conditions
- Rainfall amounts
- Temperature – minimum and maximum
- Wind direction
- Ongoing activities that may influence or disrupt sampling efforts
- Accessibility to the sampling locations (e.g., rough terrain, fallen trees, flooding, etc.)

These conditions will be recorded in the field sampling books and used to assess sampling procedures in relation to the sample data. A Site Manager – Daily Quick Reminder List for use in guiding field activities is included as Attachment 4.6.

3.3.1 Sampling Equipment Calibration

Field measurements of groundwater physical parameters are used for groundwater sampling and for independent measurements during remedial actions. Before, during, and after use, the water-quality measurement equipment will be properly calibrated per manufacturer's instructions and following EPA Guidance (EISOPQAM 2001). After sampling, before leaving the site, a calibration check will be made as described in the following sections.

Field measurements will be made with a YSI 6920 or similar multi-probe device with flow-through cell. The flow cell allows a water sample to be pumped from a source, such as a groundwater monitoring well, to a sonde. Flow cells add efficiency to low flow purging and field sampling applications, when it is impossible or undesirable to place a sonde down-hole in situ in a well. Calibration procedures for the YSI 6920 are given as Attachment 4.1.

3.3.2 Sample Collection Procedures

Groundwater samples may be collected from monitoring and injection wells, or piezometers. In most cases, non-dedicated bladder pumps or disposable bailers will be used to sample the wells. Passive Diffusion Bags may also be used for groundwater sampling. Decontamination of pumps at water level indicators are required prior to and after each sampling event. A general supply list for groundwater sampling is given as Attachment 4.2.

Sampling will be performed no less then 24 hours after well development is completed. Observations made during sample collection will be recorded in a field notebook and on a monitoring well purge and sampling form. The following intitial steps will be followed before collecting groundwater samples in the field.

1. Locate the well to be sampled and record the condition of the well including any damage or evidence of tampering.
2. Lay out plastic sheeting around the wellhead and place the monitoring, purging, and sampling equipment on the sheeting to prevent contamination of the surface soils and the equipment.
3. Determine concentration of organic vapors every time a casing cap is removed to measure a water level or to collect a sample.
4. Water levels will be measured before purging, during purging, and after sampling. For wells with dedicated pumps, water levels will be measured ONLY if the water is above the top of the pump. DO NOT pull the pump to measure the water level. The water level probe should be carefully lowered down the well to minimize disturbance.

   Caution shall be used when opening each well to avoid fumes which may have accumulated and to prevent foreign materials from entering the well. All ground-water levels shall be measured to the nearest 0.01 foot (from the well datum reference point) using an electronic water level indicator. Each well will be marked with an easily identifiable permanent reference point that will be located on the top of the well casing. The depth to ground water will be measured from this reference point to the ground-water surface in the well. The depth to ground water data will be recorded in either a project field notebook or on a ground-water level measurement sheet. The depth to the ground water is subtracted from the surveyed elevation of the reference point to determine the ground-water elevation.

   The water-level indicator and tape will be decontaminated prior to each use. The decontamination procedure for the water level indicator is:

   A. Hand wash the calibrated tape and probe with a solution of Alconox (or equivalent).

   B. Rinse with deionized (Reagent Grade II) water.
5. Measure the water level from the measuring point to the nearest 0.01 foot, as specified in ASTM D4750.
6. DO NOT measure the total depth of the well prior to sampling. Well depth should be obtained from well logs. Measuring to the bottom of the well casing may cause re-suspension of settled solids.
7. If the turbidity cannot be reduced to below 20 NTUs after purging for approximately two hours (and other field parameters are stable as indicated in the following sections), then the field team leader shall be contacted for approval to sample the well. If the turbidity is below 50 NTU, then the well may be sampled without using

filtration techniques. If the turbidity is 50 NTU or higher, then both dissolved and total metals and dissolved and total organic carbon samples should be collected (samples for organic compound analysis should not be filtered). The dissolved metals and organic carbon samples should be collected by filtration with a disposable 0.45 μm in-line filter. Approximately 500 mL of the groundwater should be pumped through the filter and disposed prior to sample collection.

3.3.2.1 Sampling using a Disposable Bailer

The sampling protocol will be as follows for the collection of groundwater samples using a disposable Teflon bailer:

1. Well sampling equipment will be decontaminated as specified in WTP 11 – Sampling Equipment Decontamination, and protected from recontamination until use. Purging and sampling will be conducted in a manner that minimizes the agitation of sediments in the well and formation. Equipment will not be allowed to free fall into a well.

2. Measure the static water level prior to purging using a decontaminated electronic water level indicator. The probe of the water level indicator will be lowered into the well bore and the water level will be recorded.

3. Attach the Teflon coated stainless steel leader rope to the bailer and polypropylene (or nylon) rope to the Teflon coated rope. Lower the bailer into the well, until it contacts the water surface. Allow the bailer to sink and fill with a minimum of water surface disturbance. Slowly withdraw the bailer from the well, preventing the bailer and bailing line from touching the ground.

4. The well should be purged until a minimum of three well volumes is removed from the well, and the water quality indicators of pH, specific conductivity, and turbidity stabilize. Readings will be taken every 5 to 10 minutes and recorded on the well purge form (Attachment 4.4). Stabilization is achieved after three successive readings are within ± 0.1 for pH, ± 3% for specific conductance, and <20 NTU for turbidity. Temperature will also be measured and recorded, but will not be used as a stabilization parameter. Sampling may begin once the well has stabilized. If stabilization does not occur or turbidity cannot be reduced below 20 NTU, the field team leader should be contacted for further guidance. If the well is purged dry, a sample will be collected as soon as sufficient recharge has occurred within 24 hours. Temperature, specific conductance, turbidity and pH will also be measured and recorded; however, stabilization of these parameters is not required.

5. After purging the well and allowing for sufficient recharge, collect samples by pouring the water from the bailer into the appropriate sample containers. This process will be repeated as necessary to fill each container.

6. Collect the samples to be analyzed for volatile organics first, filling the bottle, leaving zero headspace. Proceed with the collection of samples for the remaining

analyses, collecting the more volatile parameters first. (Refer to sampling order presented in the low-flow section).

7. Wells should be sampled in order of increasing contamination (i.e. - samples that are expected to be least contaminated will be collected before those that are more highly contaminated) and as specified in the project specific work plan and WTP-8 - Sample Control and Documentation, and WTP-9 - Sample Containers and Preservation.

8. Add preservatives if necessary to samples as indicated in the QAPP and WTP-9 - Sample Containers and Preservation, label the sample containers as specified in the QAPP and WTP-8 - Sample Control and Documentation, and WTP-9-Sample Containers and Preservation. Required sample containers and holding times are presented in the project work plan, QAPP, and WTP-9 - Sample Containers and Preservation.

9. After samples have been collected, replace the well cap and lock the security casing.

10. Place samples into the cooler with ice and fill out required Chain-of-Custody documents in accordance with the procedures specified in the QAPP.

11. Record field conditions, any problems encountered during sampling, and sample appearance in the field logbook and transfer the information to the Field Sampling Report (Attachment 4.2). In addition to the information required in any field sampling investigation (WTP 1 - General Instructions for Field Personnel), the following information will also be recorded in the logbook each time a well is purged and sampled.

    - Depth to water before and after purging
    - Total depth of the well (measure after sample collected)
    - Condition of each well, including visual (mirror) survey
    - The thickness of any floating hydrocarbon layer
    - Field parameters such as pH, conductance, temperature, and turbidity

3.3.2.2 Sampling Using a Bladder Pump

The sampling protocol will be as follows for the collection of groundwater samples using a stainless steel/Teflon bladder pump:

1. Slowly and carefully lower the pump inlet to, or slightly above, the screened interval where representative groundwater flow is expected. In cases where the entire screen is not saturated, place the pump inlet at or slightly above the middle of the saturated zone, keeping in mind the limitations stated below.

2. DO NOT place pump inlet less than 2 feet above the bottom of the well, as this may cause the mobilization of bottom sediments. If saturated screen length is 2 feet or less, place pump inlet to, or slightly above, the middle of the screened interval.

3. Allow at least 1 foot of water above the inlet so there is little risk of entrainment or air in the sample.

4. After the water level in the well has equilibrated, begin purging at a rate of 200 to 500 mL/minute. All purge water will be containerized as IDW. The appropriate and final purge rate will be determined by monitoring groundwater drawdown. Drawdown should not exceed 4 inches.

5. The discharge during purging and sampling must flow with minimal turbulence or agitation.

6. The water level should stabilize and the pump rate should allow water to recharge the well so that little or no water level drawdown is observed.

7. Record groundwater level frequently until stabilization occurs. Adjust discharge rate appropriately to make sure that excessive drawdown does not occur. After stabilization, measure water levels at regular intervals.

8. If drawdown is greater than 4 inches, decrease the discharge rate of the pump and repeat discharge and water level measurements. Repeat until the water level stabilizes to closely match the recharge rate. Record pumping rate and any adjustments and depths to water on the purging and sampling log sheet.

9. An in-line multi-probe flow-through cell will be used to monitor the indicator parameters so as not to expose the sample to the atmosphere prior to measurement of the parameters. During purging, water quality indicator parameters [pH, redox potential (ORP), turbidity, specific conductivity, and dissolved oxygen (DO)] will be measured every 5-10 minutes until the parameters have stabilized. Measurement should be recorded on the well purge form (Attachment 4.4) A minimum of 5 sets of water quality indicator parameters should be recorded.

10. Stabilization is achieved after three successive readings are within ± 0.1 for pH, ± 10 mV for ORP, ± 3% for specific conductance, ± 10% for DO, and <20 NTU for turbidity. Temperature will also be measured and recorded, but will not be used as a stabilization parameter. Sampling may begin once the well has stabilized.

11. Specific conductance and DO usually take the longest to stabilize. Fifteen minutes to 1.5 hours of purging at the recommended purge rate may be required to reach stabilization. Stabilized purge indicator trends are generally obvious and follow either an exponential or asymptotic change to stable parameter values during purging. The above stabilization guidelines are provided as estimates and will not be appropriate for use in all circumstances.

12. The pump will not be turned off between the purging and sampling processes.

13. If stabilization does not occur or turbidity is >20 NTU after two hours of purging, the field team leader should be contacted for further guidance.

Wells installed in very low permeability formations (<0.1 L/minute recharge rate) will require alternative purging and sampling methods. Use of the usual low-flow techniques is impractical in this type of environment, because devices to pump at such low flow rates are not readily available. Under these conditions, the wells will be pumped at the lowest practical rate, and an attempt will be made to stabilize all parameters except drawdown. Sampling will commence early enough to ensure that the screened interval is not exposed to atmospheric conditions by the time the last sample is taken. In the event the added limitation of an insufficient volume of water in the well is encountered, the well will be sampled using a disposable Teflon bailer. The well will be bailed to dryness and sampled when it has recharged to the static water level.

Groundwater samples will be collected by gently filling the sample bottles with minimum turbulence once equilibrium is established. Lower the flow rate to 100 mL/minute and collect the parameters in the following order:

- VOCs (no headspace)
- Methane, Ethane, Ethene (no headspace)
- Carbon Dioxide (no headspace)
- TOC (no headspace)
- Sulfide (no headspace)
- Anions
- Alkalinity
- Metals (total and dissolved)
- Field Parameters (ferrous iron and carbon dioxide)

3.3.2.3 Sampling Using a Passive Diffusion Bag Sampler

Select groundwater samples will be collected for VOC analyses using passive diffusion bag (PDB) sampling. A typical PDB sampler consists of a low-density polyethylene tube closed at both ends and filled with deionized water. It is positioned in the well at the desired target depth by attaching it to weighted line, or a fixed object. The water within the bag is then allowed to equilibrate with the ambient groundwater (at least two weeks) before being retrieved. The sampler water is then decanted into 40 mL volatile organic analysis (VOA) vials and sent to the lab for analysis. Detailed procedures for using PDB samplers in wells can be found in "User's Guide for Polyethylene-Based Passive Diffusion Bag Samplers to Obtain Volatile Organic Compound Concentrations in Wells" (USGS, 2001). The following is a generalized summary of PDB sampling:

1. The top and bottom of the PDB sampler will be attached to 3/16" polyester or similar non-buoyant rope strong enough to support the weight of the sampler and subject to minimal stretch. The PDB will be suspended within the well screen at various depths

based on the measured total depth and knowledge of the location of the screen in the well. Weights will be attached to the bottom of the sampler to keep it in place in the hole. The sampler can also be configured to rest on the bottom of the well. The sampler will be allowed to equilibrate before being carefully retrieved with the attached line and the contents analyzed.

2. For wells with dedicated in-well pumps, the PDB sampler will be tied to the pump just below the inlet using plastic cable ties or stainless rings. Total well depth will be measured after pump removal and compared to current records to ensure that the PDB will not rest in sediment settled in the bottom of the well. A stainless steel weight will be attached to the bottom of the PDB to counterbalance the buoyancy of the sampler and keep it in position. The pump/PDB apparatus will then be very carefully lowered back down the hole and secured in position.

3. After the equilibration period, the bags will carefully be withdrawn from the hole and the bag removed from the pump and inspected. Any evidence of algae or other coatings on the bag or tears in the membrane will be noted in the field book. If there are tears, the sample will be rejected.

4. The contents of the intact bag will then be transferred to pre-preserved VOA vials causing as little agitation of the sample as possible. The samples will then be shipped to the laboratory for analysis.

3.4 POST-OPERATION

3.4.1 Field

Before leaving the site, the following procedures will be performed by on-site personnel:

- Decontaminate equipment.
- Complete logbook, making notations as to site conditions, anomalous readings, etc.
- Ensure that equipment and associated supplies have been shipped back to the office.
- Ensure that the site has been cleaned to its pre-sampling state (i.e., ensure that all trash generated as a result of sampling activities is disposed of).
- Ensure that all drums containing any IDW are properly labeled with the date and drum contents. If IDW samples are to be taken, follow the procedures outlined in WTP 7 – Waste Sampling.

3.4.2 Office

Upon return to the office, field personnel will perform the following:

- Submit logbook and any original forms to Project Manager for review.

- Inventory equipment and supplies shipped back to the office.
- Make provisions for proper disposal of IDW upon receipt and review of the laboratory data concerning the contents.

4.0 REFERENCES

ASTM, 1984. Annual Book of ASTM Standards, American Society of Testing and Materials, 1986.

Barcelona, et. al., 1983. A Guide to the Selection of Materials for Monitoring Well Construction and Groundwater Sampling. Urbana, IL: Illinois State Water Survey, ISWS Contract Report 327.

USACE, 2001. Requirements for the Preparation of Sampling and Analysis Plans, United States Army Corps of Engineers, EM 200-1-3, February, 2001.

USEPA, 1986. RCRA Groundwater Monitoring Technical Enforcement Guidance Document. OSWER-9950.1. United States Environmental Protection Agency, September 1986.

USEPA, 1991. Environmental Investigations Standard Operating Procedures and Quality Assurance Manual, Environmental Compliance Branch, Athens, Georgia, February 1, 1991.

USEPA, 1992. RCRA Groundwater Monitoring: Draft Technical Guidance, Office of Solid Waste, Washington, D.C., November 1992.

USEPA, 1996. Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures, Office of Solid Waste, Washington, D.C., April 1996.

5.0 ATTACHMENTS

Attachment 4.1 – Sample Equipment Calibration
    Attachment 4.1a - YSI Calibration Sheet
Attachment 4.2 - General Field Supply Checklist-Sampling Activities
Attachment 4.3 - Field Sampling Report Form
Attachment 4.4 – Purge Form
Attachment 4.5 - Daily Quality Control Report Form
Attachment 4.6 – Site Manager - Daily Quick Reminder List

ATTACHMENT 4.1

YSI 6920 Calibration Procedures

The YSI 6920 will be calibrated for the following parameters; pH, temperature, specific conductivity meter, turbidimeter, dissolved oxygen, and redox potential. The following sections describe the procedures for calibrating each of these parameters. Date, time, and any problems encountered during calibration and check should be noted in the site field book, and complete records of each calibration recorded on YSI calibration sheet (Attachment 5.1a)

Conductivity

The following steps will be followed to calibrate the conductivity probe on the YSI 6290.

1. Prior to calibration, put the sonde into the **Run** mode and let the sensors make readings in air. The conductivity reading should be less than 3 uS/cm. If the readings are much higher (>10 uS/cm), follow the probe cleaning procedures before calibrating the sonde
2. Pour enough standard into the calibration/transport cup to fully immerse the conductivity cell and thermistor. The calibration standard used should be within the same range as the water to be sampled. However, standards with less than 1 mS/cm (1000 uS/cm) are NOT recommended.

   <u>Recommended Calibration Standards:</u>

Freshwater:	1 mS/cm standard
Brackish water:	10 mS/cm standard
Seawater:	50 mS/cm standard

3. Place the probe into the standard and make sure that the probe is completely immersed past the vent hole. Gently tap the side of the calibration cup to dislodge any air bubbles trapped inside the cell
4. Allow at least 1 minute for temperature equilibrium to occur before proceeding.
5. From the **Calibrate** menu, select Conductivity and then **SpCond** to calibrate for Specific Conductance (or temperature-compensated conductivity). Enter the value of the standard in mS/cm at 25°C and press Enter
   <u>NOTE:</u> The value entered MUST be in mS/cm. Multiply the value in uS/cm by 1000 to convert to mS/cm
6. Observe the conductivity readings until they stabilize and do not significantly change for approximately 30 seconds and then press Enter. The screen will indicate that calibration

has been accepted and will prompt you to press Enter again to return to the **Calibrate** menu.

7. Escape out of the **Calibrate** menu back to the **Main** menu. Select **Advanced** and then **Cal Constant**. Record the **Cond** cell constant which should range between 4.55 and 5.45

8. Rinse the sensors and calibration cup in DI water and then proceed to calibrate pH.

Conductivity Calibration Tips:

- Calibrate conductivity first to avoid carry-over from other standards. NOTE: pH buffers are highly conductive!
- Never calibrate with standards that are less than 1.0 mS/cm. These standards are easily interfered with by outside electrical noise (RF, etc.)
- Pre-rinse the sensor with a small amount of standard to eliminate contamination.
- Ensure that the conductivity probe is completely immersed in standard. The hole in the side of the probe MUST be under the surface of the solution and NOT have any trapped bubbles in the openings.
- If the meter reports **"Out Of Range,"** investigate the cause. **NEVER** override a calibration error without fully understanding the cause. The most typical cause is an incorrect entry of the standard value such as 1000 (uS/cm) rather than 1.0 (mS/cm). Other common errors are (1) not using enough standard to fill the cell and vent hole and (2) air bubbles trapped in the cell.
- When the calibration has been accepted, check the conductivity cell constant found in the **Advanced** menu under **Cal Constants**. The **Cond** cell constant should be 4.55 to 5.45. Values out of this range usually indicate a problem with the calibration process or calibration standard.

pH

The following procedure describes a 3 point to calibration of the pH probe on the YSI 6290.

1. Place enough pH 7 buffer into the calibration cup to immerse the pH probe, reference junction, and thermistor. Allow at least 1 minute for temperature equilibration before reading.

2. From the **Calibrate** menu, select **ISE1 pH** and then choose **2-Point** or **3-Point** depending on the calibration procedure required. For example, if the water to be monitored has a pH of 7.5, then there is no need to calibrate the probe with a pH 4 buffer – a 2 point calibration will be sufficient.

3. Enter **7.0** when prompted for the first pH value. ALWAYS begin with pH 7. Observe the pH reading and record the pH mV reading. The pH mV should range between –50 to +50.

When the values show no significant change for approximately 30 seconds, press Enter. The display will indicate that the calibration has been accepted and will prompt you to enter a second pH value.
NOTE: While calibrating pH, it is recommended that the pH mV readings are recorded. To enable pH mV, select **Report** from the **Main** menu. Highlight pH mV and press Enter to enable this value.

4. After the pH 7 calibration is accepted, press Enter again to continue. Rinse the sensors DI before rinsing them in the second buffer.

5. Place enough buffer (pH 4 or 10) into the calibration cup to immerse the pH probe, reference junction, and thermistor. Allow at least 1 minute for temperature equilibration before reading. Observe the pH reading and record the pH mV reading. The pH mV should range between 130 to 230 in pH 4 buffer and –130 to –230 in pH 10. Press enter when the pH reading shows no significant change for approximately 30 seconds. Press enter again to return to the **Calibrate** menu or to proceed to the third pH calibration buffer.
NOTE: Subtract the pH 7 mV from the pH 4 or 10 mV. This difference must be greater than 165 mV. While the pH probe may continue to calibrate with less than 165 mV, this indicates that the pH probe will soon need replacement.

6. If a 3-Point calibration is being performed, follow the directions above.

7. Rinse the sensors and calibration cup in DI water

Dissolved Oxygen

The following steps will be followed to calibrate the dissolved oxygen (DO) probe on the YSI 6290;

1. Place approximately 1/8 inch of water in the bottom of the calibration cup. Engage only 1 thread of the calibration cup onto the sonde to ensure that the DO probe is readily vented to the atmosphere. Ensure that the DO probe and the thermistor are NOT in contact with the water. Wait at least 10 minutes for the air in the calibration cup to become water saturated and for the temperature to equilibrate.

2. Observe the **DO charge** reading (DO ch) and ensure that the reading ranges between 25 and 75.

3. Observe the temperature and DO readings and when they show no significant change for approximately 30 seconds, the press Enter. The screen will indicate that the calibration has been accepted and prompt you to press Enter again to return to the **Calibrate** menu.
NOTE: If you are using YSI model 600XLM, 6920, 6000, or 6600, you will need to make sure the auto-sleep functions are disabled. To disable the auto-sleep functions, go to the **Advanced** menu and select **Setup**. Choose **Auto-sleep RS232** and press Enter to disable. Then select **Auto-sleep SDI12** and press Enter.

4. Escape out of the **Calibrate** menu back to the **Main** menu. Select **Advanced** and then **Cal Constant**. Record the **DO Gain** which should range between -0.7 and 1.5.

5. Rinse the sensors and calibration cup in DI water

DO Calibration Tips:

- Inspect the DO probe anodes (silver rectangles), recondition using the 6035 reconditioning kit if they are darkened or gray in color.
- The KCl solution and membrane should be changed prior to each long-term deployment and at least once every 90 days. In addition, the KCl and membrane should be replaced if (1) bubbles are visible under the membrane; (2) deposits of dried KCl appear on the membrane or o-ring; (3) the readings are unstable; (4) the DO charge reading is out of range (<25 or >75).
- If needed install a new membrane, making sure that it is tightly stretched and wrinkle free. CAUTION: If you remove the DO probe from the sonde, be sure to inspect the probe port for moisture. Remove any moisture from the connector area. Also verify that the probe is clean and dry and apply a small amount of silicone grease to the o-ring before re-installing the probe. NOTE: DO membranes will be slightly unstable during the first 3 to 6 hours after they are installed. It is suggested that a calibration check be made after this time period.

DO Calibration Check:

1. From the **Report** menu, enable the **DO Charge**. Then go to the **Run** menu and start the sonde in the **Discrete Run** mode at a 4 second rate and allow the sonde to run (burn-in) for at least 10 minutes. Record the **DO Charge** (DO ch) after 5 minutes which should be 25 to 75.
2. After the burn-in is complete, go to the **Advanced** menu, then **Setup** and confirm that the **Auto-sleep RS232** and **Auto-sleep SDI12** functions are enabled. NOTE: Wait at least 60 seconds before proceeding to the next step.
3. Start the sonde in the **Discrete Run** mode at a 4 second rate and record the first 10 DO% numbers in your log book. These numbers must start high and gradually decrease. For example: 110, 105, 102, 101.5, 101.1, etc. It does not matter if the numbers do not reach 100%, it is only important that they have the same high to low trend. If you have a probe that starts with a low number and steadily climbs upward, then the sensor has a problem and the calibration must be rejected. NOTE: The initial power up can corrupt the first 2 DO% samples; disregard any low numbers that appear in this position.
4. The probe is now ready to be calibrated.

Oxidation Reduction Potential (ORP)

The following steps will be followed to calibrate the oxidation reduction potential (ORP) probe on the YSI 6290;

1. Place enough ORP (gold) calibration solution into the calibration cup to immerse the ORP probe, reference junction, and thermistor. Allow at least 1 minute for temperature equilibration before reading.
2. From the **Calibrate** menu, select **ISE2 ORP**
3. Enter 240.0 when prompted for it. When the values show no significant change for approximately 30 seconds, press Enter. The display will indicate that the calibration has been accepted.
4. Rinse the sensors and calibration cup in DI water

Turbidity

The following steps will be followed for a two point calibration of the turbidity probe on the YSI 6290;

1. Place enough 0 NTU solution into the calibration cup to immerse the turbidity probe, reference junction, and thermistor. Allow at least 1 minute for temperature equilibration before reading.
2. From the **Calibrate** menu, select **Optic T-Turbidity-6026** (or Turbidity 6136) and then choose **2-Point**.
3. Enter 0.0 at the prompt, and press Enter
4. When the values show no significant change for approximately 30 seconds, press Enter. The display will indicate that the calibration has been accepted and will prompt you to enter a second turbidity value. If needed activate the wiper 1-2 times by pressing 3-Clean Optics as shown on the screen, to remove any bubbles.
5. Rinse the sensors and calibration cup in DI water
6. Place enough 100 or 200 NTU solution into the calibration cup to immerse the turbidity probe, reference junction, and thermistor. Allow at least 1 minute for temperature equilibration before reading.
7. Enter 100.0 or 200.0 depending on the solution you are using. When the values show no significant change for approximately 30 seconds, press Enter. The display will indicate that the calibration has been accepted and will prompt you to enter.

Calibration Check

At the completion of sampling activities, and before leaving the site each night a calibration check of the YSI will be made including; DO, conductivity, pH, turbidity, and ORP. Calibration will be checked by placing the probe in the solution for each parameter, allowing at least one minute for temperature equilibration before reading the value and recording on the YSI calibration sheet (Attachment 5.1a). The sensors and calibration cup should be rinsed with DI water between each solution. If a significant difference (±5%) between the initial calibration and calibration check is observed, the Field Team Leader should be notified, the change should be noted in the field book, and on all purge forms, and field sampling reports used during that period.

References

Water Monitoring Solution, Inc. YSI Calibration Procedures Profiling and Logging, available online; http://www.water-monitor.com. July 2004.

YSI Incorporated. Environmental Monitoring Systems, Operations Manual. Available online; July 2004.

ATTACHMENT 4.1a
YSI CALIBRATION PRIOR TO SAMPLING

DATE ____/_____/___ TIME___:___:___
SONDE ID___________________ HANDSET ID____________________
BATTERY VOLTAGE_________________

DISSOLVED OXYGEN
CHANGED DO MEMBRANE? YES NO If yes, when? ____/_____/___ ___:___:___
Note: If membrane is changed, wait 6 to 8 hours before completing DO test and final calibration
DO % VALUE BEFORE CALIBRATION ____________%; AFTER CALIBRATION_________%

DO CHARGE ______________(range 25 to 75) DO GAIN ________________(range -0.7 to1.5)

CONDUCTIVITY
Note: Calibrate first to avoid carry-over from other standards (i.e. pH buffers are highly conductive)
CALIBRATION STANDARD USED________________µS/cm, TEMP_________°C
READING BEFORE CALIBRATION__________µS/cm, AFTER CALIBRATION_________µS/cm

CONDUCTIVITY CELL CONSTANT____________________µS/cm (Range 5 0 ± 0.5)

pH
pH 7 VALUES BEFORE CALIBRATION: _________ (pH) AFTER CALIBRATION_________ (pH)

pH 7 MILLI-VOLT READINGS: __________mV Range -50 to +50 mV

ph 10 VALUES BEFORE CALIBRATION: ________ (pH) AFTER CALIBRATION_________ (pH)

pH 10 MILLI-VOLT READINGS: __________mV Range -130 to -230 mV

pH 4 VALUES BEFORE CALIBRATION: _________ (pH) AFTER CALIBRATION_________ (pH)

pH 4 MILLI-VOLT READINGS: __________mV Range 130 to 230 mV
Note: Span between pH 4 and 7, 7 and 10 mV numbers should be ~165-180 mV

REDOX POTENTIAL (ORP)
CALIBRATION STANDARD USED________________mV, CAL TEMP_________°C

READING BEFORE CALIBRATION___________mV, AFTER CALIBRATION__________mV

TURBIDITY
Wiper Parked ~180° from optics? Y N Note: Change wiper if probe is not parked correctly
TURBIDITY STANDARD __________________ (NTUs)

VALUES BEFORE CALIBRATION: _________ (NTUs) AFTER CALIBRATION________ (NTUs)

TURBIDITY STANDARD __________________ (NTUs)

VALUES BEFORE CALIBRATION: _________ (NTUs) AFTER CALIBRATION________ (NTUs)

CALIBRATION SUCCESSFUL? YES NO INITIAL___________

DESCRIBE ANY PROBLEMS ENCOUNTERED ____
____
____

PREPARED BY/DATE: JP 07/13/04
CHECKED BY/DATE: AC 07/13/04

ATTACHMENT 4.1a-continued
YSI CALIBRATION CHECK AFTER SAMPLING

DATE ____/_____/___ TIME___:___:___
SONDE ID____________________ HANDSET ID_____________________
BATTERY VOLTAGE___________

NOTE: CALIBRATION IS SUCCESSFUL WHEN THERE IS NO SIGNIFICANT DIFFERENCES (± 5 %) BETWEEN INITIAL CALIBRATION AND CALIBRATION CHECK

DISSOLVED OXYGEN
CHANGED DO MEMBRANE? YES NO If yes, when? ____/_____/___ ___:___:___
Note: If membrane is changed, wait 6 to 8 hours before completing DO test and final calibration
DO % VALUE BEFORE CALIBRATION___________%, AFTER CALIBRATION________%
DO CHARGE ________________ DO GAIN _________________
CALIBRATION SUCCESSFUL? YES NO INITIAL____________

CONDUCTIVITY
Note :Calibrate first to avoid carry-over from other standards (i.e. pH buffers are highly conductive)
CALIBRATION STANDARD USED__________________μS/cm, CAL TEMP_________°C
VALUE____________μS/cm
CONDUCTIVITY CELL CONSTANT_____________________μS/cm (Range 5.0 ± 0.5)
CALIBRATION SUCCESSFUL? YES NO INITIAL____________

pH
pH 7 VALUE _________ (pH)
pH 7 MILLI-VOLT READINGS: __________mV Range -50 to +50 mV
ph 10 VALUE _________ (pH)
pH 10 MILLI-VOLT READINGS: __________mV Range -130 to -230 mV
pH 4 VALUE _________ (pH)
pH 4 MILLI-VOLT READINGS: __________mV Range 130 to 230 mV
Note: Span between pH 4 and 7, 7 and 10 mV numbers should be ~165-180 mV
CALIBRATION SUCCESSFUL? YES NO INITIAL____________

REDOX POTENTIAL (ORP)
CALIBRATION STANDARD USED__________________mV, CAL TEMP_________°C
VALUE__________mV
CALIBRATION SUCCESSFUL? YES NO INITIAL____________

TURBIDITY
Wiper Parked ~180° from optics? Y N Note: Change wiper if probe is not parked correctly
TURBIDITY STANDARD 1 ___________________ (NTUs)
VALUE__________ (NTUs)
TURBIDITY STANDARD 2 ___________________ (NTUs)
VALUE __________ (NTUs)
CALIBRATION SUCCESSFUL? YES NO INITIAL____________

PREPARED BY/DATE: JP 07/13/04
CHECKED BY/DATE: AC 07/13/04

ATTACHMENT 4.2

General Field Supply Checklist-Sampling Activities

Steel Toe Workboots ____________

Full Face Respirator (with appropriate cartridges) ____________

Safety Glasses ____________

Logbook ____________

Pens ____________

Data Collection Forms ____________

OSHA Certification Card ____________

Tape Measure ____________

Hard Hat ____________

Hammer ____________

First Aid Kit and Emergency Eyewash Station ____________

Overshoes ____________

Sun Screen ____________

Work Gloves ____________

Disposable Gloves ____________

Stainless Steel Bladder Pump (with extra bladders and grab plates) ____________

Disposable Teflon Bailers ____________

Air Compressor and Controller ____________

Water Level Indicator ____________

YSI (or similar meter with flow through cell) with calibration solution ____________

Plastic Sheeting ____________

Teflon Lined Plastic Tubing ____________

Safety Line ____________

DI Water, Methanol, and Liquinox for Decon ____________

ATTACHMENT 4.3

FIELD SAMPLING REPORT

JOB No. 6301-04-0002
JOB NAME DDMT
DATE ___________ TIME _____
SAMPLING POINT:
DEPTH ___________

SAMPLE INFORMATION

SAMPLE I.D. NO.: EB-1

MATERIAL. ☐ WATER ☐ SOIL ☐ SLUDGE ☐ OTHER (LIST) ___________

TYPE: ☐ GRAB ☐ COMPOSITE ☐ OTHER (LIST) ___________

HAZARDOUS ☐ YES ☐ NO ☐ UNKNOWN

CONTAINER		NUMBER	PRESERVATIVE/ PREPARATION	COMMENTS
TYPE	VOLUME			

COMMENTS: (WELL PURGING VOLUME: SAMPLE APPEARANCE; ODOR; COLOR, ETC.)

____

____

GENERAL INFORMATION

WEATHER ___________ AIR TEMPERATURE

SAMPLES SHIPPED TO: ___________

SPECIAL HANDLING: ___________

MODE OF SHIPMENT: ☐ CAR/TRUCK ☐ BUS ☐ PLANE ☐ COMMERCIAL VEHICLE

QA/QC

SAMPLE COLLECTED BY: ___________ SAMPLING OBSERVED BY: ___________

DISCREPANCIES ___________

Attachment 4.4

WELL PURGING - FIELD WATER QUALITY MEASUREMENTS FORM

Location DDMT - ______________________
Site Name

Identify Measuring Point (MP) ______________
(e g Top of Casing)

page ___ of ___

Well ID: ______________________

Field Sampling Personnel ______________________

Depth to Screen below MP. ________ of screen (Top) ________ of screen (Bottom)

Pump Intake at (ft. below MP): ______________

Purging Device (Pump Type) ______________
(e g Dedicated pump, peristaltic pump, bailer, bladder pump etc.)

Date	Time 24 hr	Depth to Water Below MP ft	Purge Rate mL/min	pH pH units	Spec Cond mS/cm	Turbidity NTUs	DO Flow cell mg/L	Temp °C	Redox Potential mV	Cum Volume Purged gallons	CHEMetrics DO mg/L (low)	Hach Ferrous Iron mg/L	Comments

Notes:
Note when "Stabilization" has occurred. Stabilization Criteria (achieved after a minimum of three successive readings):
- ±0.1 for pH
- ±10 mV for redox
- ±3% for specific cond.
- ±10% for DO
- <20 NTUs for turbidity
- NA for temperature

If stabilization does not occur within 2 hours, contact Site Manager for action.
If well goes dry prior to stabilization, stop, allow well to recharge, and collect sample.

050006 01

1028 45

1028 46

ATTACHMENT 4.5

DAILY QUALITY CONTROL REPORT

Report No. ___ **Contract No.** ____________ **Date:** _________

Location of Work: **Defense Depot, Memphis, Tennessee**

Description of Work: ____________________________________

Weather:______________ **Rainfall (inches) Avg.**_____ **Temp:**_____

Activities Performed:

Field Team Leader:

Team # 1:

Team # 2:

Team # 3:

Team # 4:

Collected samples are listed below:

Samples Collected:

Team 1	Team 2	Team 3	Team 4

Personnel On-Site:

Difficulties:

Visitors:

Field Team Leader: __________________

ATTACHMENT 4.6

SITE MANAGER – DAILY QUICK REMINDER LIST

Arrival at Site

- ☐ Pick up sampling supplies – compare inventory packing list with shipment
- ☐ Call lab daily to check status of samples. No sample bottle breakage, COC matches what is in cooler and samples received at correct temperature.

Instrument Calibration

- ☐ Supervise calibration of instruments and review calibration forms
- ☐ Call in for barometric pressure, used to calibrate DO for YSI meter
- ☐ Make sure each team conducts the mid-day calibration check on the YSI and fills out daily form

Health and Safety

- ☐ Make sure each team has appropriate PPE, first aid kit and fire extinguisher in each vehicle, map to nearest hospital, and knowledge of emergency phone nos.
- ☐ Make sure members are aware of any team member with medical emergency issues (i.e. allergic reactions to bees, etc.) and has necessary equipment to handle the incidence
- ☐ Make sure each team is aware of "Stop work" PID action levels

Vehicle Load Out

- ☐ Prepare coolers for samplers and assign locations to field teams. Emphasize QC locations.
- ☐ Make sure each team has field test kit supplies for ferrous iron and carbon dioxide.
- ☐ Distribute sample folders to team members each day

Purging and Sampling

- ☐ Remind team members to call in field measurements and verify reasonableness. Review field measurements for reasonableness (real time) and trouble shoot if required. Sign off on purge forms at end of day.
- ☐ Make team member aware of IDW disposal/storage procedures. Methanol must be containerized separately from wash water and rinse water.
- ☐ Oversee sample packing and shipping procedures. Verify that metals and sulfide pH has been checked and adjusted if necessary. Make sure coolers with VOCs have a trip blank. Verify that each cooler has a COC, RFAs, temperature blank, double bagged ice, trip blank (if required), and custody seals. Complete shipping checklist.
- ☐ Remind teams to leave no equipment or valuables in vehicles parked at the hotel (due to recent theft)

End of Day Activities

- ☐ Check field books, FSRs, and Purge forms for completeness daily
- ☐ Remind teams to leave no equipment or valuables in vehicles parked at the hotel (due to recent theft)
- ☐ Remind teams to charge equipment overnight
- ☐ Fax daily reports and purge forms to Paul Brafford/John Quinn daily – COCs to Judy Hartness
- ☐ Check schedule daily and update as needed

End of Shift Activities

- ☐ Call in work hours on Friday by 10:00AM EST for field team.
- ☐ Conduct supply inventory
- ☐ Pack and return all rental supplies to vendors
- ☐ Make sure all equipment has been decontaminated and wrapped in aluminum foil and stored neatly
- ☐ Make sure IDW has been sampled and labeled properly

Site Manager: ______________________________ Date: ____________________

WORK AND TEST PROCEDURE 6

INVESTIGATION DERIVED WASTE SAMPLING AND DISPOSAL

1.0 PURPOSE

The purpose of this Work and Test Procedure (WTP) is to provide guidance for collection of samples of investigation derived waste (IDW) to be analyzed for use in the proper disposal of IDW material.

2.0 DISCUSSION

This WTP specifies details and procedures for collecting IDW samples. The project-specific workplan will be referred to in order to determine the exact requirements. The sampling objectives will be to allow for efficient and proper disposal of the IDW.

3.0 PROCEDURES

3.1 ASSOCIATED PROCEDURES

The following WTPs should be considered in conjunction with this WTP:

NUMBER	NAME
1	General Instructions for Field Personnel
7	Sample Control and Documentation
8	Sample Containers and Preservation
9	Sample Packing and Shipment
10	Sample Equipment Decontamination
12	Personnel Protective Equipment Decontamination
13	Health and Safety Monitoring

3.2 PREPARATION

3.2.1 Office

Prior to leaving the office for field work, the field team leader is responsible for activities listed in WTP 1, as well as the following actions:

- Determine appropriate sampling methods and ensure that sufficient supplies are shipped to the site;

- Ensure that sufficient preprinted sample and container storage labels are shipped to the site;
- Review the existing data to determine the probable identity of various compounds that may be present in the waste.

3.2.2 Field

After arrival on site, but prior to commencement of operations, the following procedures will be employed:

- Check that required sampling equipment has arrived on site in operating order;
- Check that monitoring equipment is functioning properly, calibrated as needed and that respective manuals are present.

3.3 FIELD OPERATIONS

Four categories of IDW are anticipated to be generated during the RA field activities:

- Soil cuttings from borings drilled for monitoring well installation
- Development and purge water from monitoring well development and groundwater sampling activities
- Decontamination fluids resulting from cleaning of heavy equipment and from decontamination of sampling equipment
- Miscellaneous waste, consisting of disposable supply containers and used personal protective equipment (PPE) (i.e., Tyvek coveralls, boot covers, gloves and respirator cartridges)

Disposal options for the DDMT IDW are based primarily on contaminant concentrations of the waste Non-hazardous wastes may be disposed of at the investigation site or off-site at a RCRA Subtitle D facility. Hazardous wastes must be containerized and disposed off-site in accordance with RCRA Subtitle C requirements. Attachment 6.1 illustrates the factors that will be considered in deciding how the IDW will be managed.

IDW will be containerized at each site in 55-gallon drums or alternative storage containers which meet the requirements of 40 Code of Federal Regulation (CFR) Subpart I – Use and Management of Containers, including:

- Keeping the container in good condition
- Using containers made of material that is compatible with the waste
- Keeping the container closed during storage

A label will be placed on each drum identifying the site where the waste was generated, the matrix of the waste in the drum, and the date that accumulation of the waste began. Drum labels will be kept simple and easy to read. Attachment 6.2 provides an example of a typical label. Further, drums containing hazardous waste will be labeled in accordance with applicable DOT regulations, including 49 CFR Parts 172, 173, 178 and 179.

At DDMT, purge water from purging wells prior to sampling, developing wells, and equipment decontamination will be transported from the well in drill rig support trucks or sealed 5-gallon buckets to a Baker tank at Dunn Field or 55-gallon drums in the decontamination area. At the completion of activities, the waste water will sampled from the midpoint of the Baker tank or the drums using disposable Teflon bailers. If the concentrations are below those listed in the City of Memphis Industrial Wastewater Discharge Requirements under Permit No. S-NN3-097, the water is pumped directly from the tank into the City of Memphis Sewer system via the Dunn Field treatment system. Waste methanol generated during decontamination procedures will be stored separately and treated as a hazardous waste.

Soil from borings and material from well abandonment will be placed into 20-cubic-yard roll-off boxes. Material in the boxes will be sampled at approximately four locations in each box using a pre-cleaned stainless steel spoon or hand auger. The material to be analyzed for TCLP VOCs for final disposal purposes will be deposited directly into the appropriate labeled laboratory supplied containers. If TCLP analyses other than VOCs are required, the material collected from the different locations in the box will be composited into one sample in a pre-cleaned stainless steel bowl. It will then be placed in the appropriate labeled laboratory supplied containers and analyzed for the additional analyses as needed. Upon receipt of the results of the laboratory analyses, the material will be disposed of in accordance with the analytical results. If the results are less than the TCLP regulatory levels, the soil will be disposed of as non-hazardous Investigation Derived Waste at a landfill approved to accept CERCLA off-site waste. If the results exceed TCLP regulatory levels, the material will be disposed of in accordance with hazardous waste requirements.

3.4 POST-OPERATION

3.4.1 Field

Before leaving the site, the following procedures will be performed by on-site personnel:

- Decontaminate or dispose of sampling equipment;
- Complete logbook, making notations as to site conditions, anomalous readings, etc.;
- Ensure that drums or containers containing investigative-derived waste are properly labeled with the date and drum contents.

3.4.2 Office

Upon return to the office, field personnel will perform the following:

- Submit logbook and any original forms to Task/Project Manager for review;
- Inventory all equipment and supplies shipped back to the office;
- Make provisions for proper disposal of investigative derived waste.

4.0 REFERENCES

ASTM, 1984. Annual Book of ASTM Standards, American Society of Testing and Materials, 1986.

CH2M Hill, 2004. Main Installation Pre-Final Remedial Design. Prepared for the U.S. Army Engineering and Support Center, Huntsville. February 2004.

USACE, 2001. Engineering and Design Requirements for Preparation of Sampling and Analysis Plans, Department of the Army, Washington D.C. February 1, 2001.

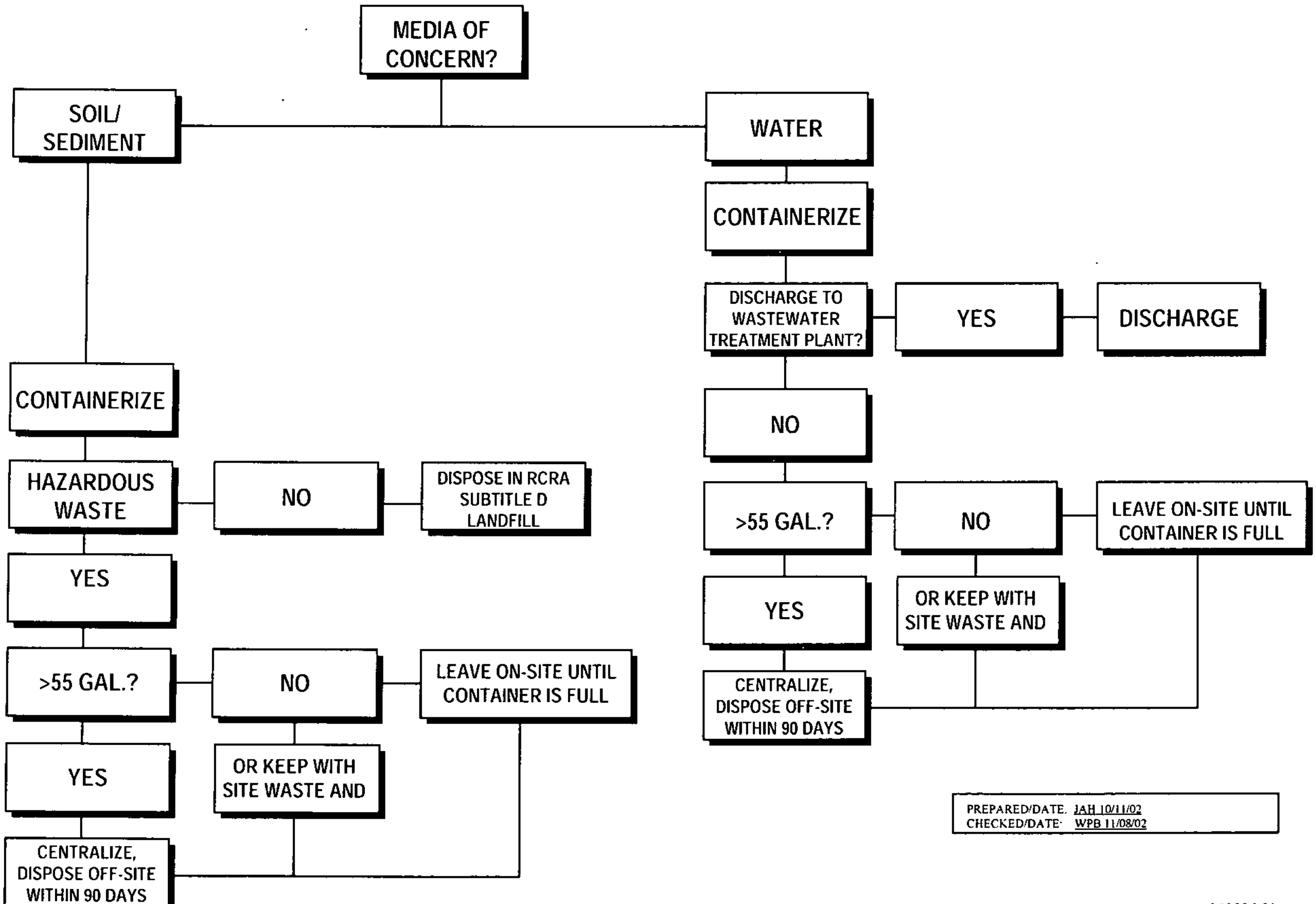
USEPA, 2001. Environmental Investigations Standard Operating Procedures and Quality Assurance Manual, Environmental Compliance Branch, Athens, Georgia, November, 2001.

5.0 ATTACHMENTS

Attachment 6.1 - IDW Decision Tree
Attachment 6.1 - Example Drum Label

Attachment 6-1

IDW DECISION TREE



PREPARED/DATE. JAH 10/11/02
CHECKED/DATE: WPB 11/08/02

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Attachment 6.2

INVESTIGATION DERIVED WASTE LABEL

Drilling and Sampling Waste

These materials may be hazardous or special waste, pending laboratory analysis, and/or other evaluation.

The contents should not be disposed or removed without consent of the generator listed below.

CONTENTS:
____ Drill Cuttings
____ Purge and/or Development Water
____ Other ______________________

Date Placed
in Container: ______________

Drum No. ____________
Source I.D. ____________
(Boring #, Well #, etc.)

Generator Name: ______________________
Contact: ______________________
Phone: ______________________

WORK AND TEST PROCEDURE 7
SAMPLE CONTROL AND DOCUMENTATION

1.0 PURPOSE

The purpose of this Work and Test Procedure (WTP) is to provide guidance for sample control and identification, data recording, and the proper completion of Chain-of-Custody (C-C) forms.

2.0 DISCUSSION

This WTP specifies details and procedures for sample control and documentation. The project-specific work plan will be referred to in order to determine exact requirements for the sampling activities. Sample control and documentation are required to support the legal defensibility of data generated from sampling activities. Required documents include the sampling logbooks, sample labels and seals, analytical reports, C-C forms, and daily field sampling reports.

Relevant information will be recorded in the project logbook. This information will include weather conditions, sample description, and whether any unusual odors were noticed upon sample collection.

3.0 PROCEDURES

3.1 ASSOCIATED PROCEDURES

The following WTPs should be considered for review in conjunction with this WTP:

NUMBER	NAME
1	General Instructions for Field Personnel
4	Groundwater Sampling
8	Sample Containers and Preservation
9	Sample Packing and Shipping
10	Sample Equipment Decontamination

3.2 PREPARATION

3.2.1 Office

Prior to leaving the office for field work, the field team leader is responsible for activities listed in WTP 1, as well as the following actions:

- Work in conjunction with the project chemist to create a sampling plan detail
- Create a sample tracking sheet (Attachment 7.1)
- Coordinating with the analytical laboratory to ensure that proper documentation including chain of custody forms and custody seals are shipped to the site.

3.2.2 Field

After arrival on site, but prior to commencement of operations, the following procedures will be employed:

- Check that required supplies are on-site;
- Record relevant data in the logbook (including ambient air temperatures, weather conditions, sample appearance, odor, etc.).

3.3 FIELD OPERATIONS

3.3.1 Sample Location and Identification

This section details sample nomenclature procedures to be used in general field investigations.

3.3.1.1 Sample Identification

Individual samples will be identified by a unique alphanumeric code (also referred to as a sample ID number or field number) which will be written on the sample label and recorded on the C-C form. Additional information to be written on the label includes location ID, time and date of sample, sampler's initials, and the analytical methods to be performed (Attachment 7.2).

During sampling events during the field effort, nomenclature will be used to distinguish between categories of sampling events, sample locations, and, where appropriate, depth of sample collection.

The extenders will consist of a two-digit matrix code (sample type, if other than ground water), alphanumeric depth codes (if necessary), and quality QA/QC codes where applicable. Field split samples will be labeled the same as the parent sample, with a QA extender added to the end of the name.

TB	Trip Blank
FB	Field Blank
EB	Equipment Blank
MS	Matrix spike
MSD	Matrix spike duplicate
MW	Monitoring well (groundwater)
SW	Surface water
SB	Soil boring (0-2', 2-4', 4 –6', etc.)
SS	Surface Soil (0-6")

The identity of the trip blanks, field blanks, and equipment blanks will consist of the prefix TB, FB, or EB, respectively, followed by the date without punctuation. When two or more trip, field, or equipment blanks are collected in a day, the date will be followed by a sequential number. QA/QC split sample trip blanks and equipment blanks will be identified by adding the suffix "QA" to the end of the sample ID. If groundwater samples are collected from PDBs, each sample number must reflect the top and bottom depth of the diffusion bag in the well.

The identity of field duplicate samples will be concealed from the laboratory by using a consecutively numbered generic name indicating the area from which the duplicate was collected. For example, the first duplicate sample collected from target treatment area 1 will be named TTA1DUP-1. The true identity of duplicates/replicates will be recorded on the sampling plan detail (SPD) and field notebook. The SPDs will be maintained in the project file and copies will be kept at the on-site field office. Copies of these forms will be provided to the QA Coordinator and the data validation team as needed for their reviews. An example SPD is presented in Attachment 7.3.

3.3.2 Completing the Log Book

The logbook is a written record of sampling activities that is completed in the field during sampling. The purpose of the log book is to record and document field conditions or procedural exceptions that may aid in the analysis of data generated from sampling activities.

Information pertaining to environmental conditions at the site during the field investigation will be noted in the field log book each day. Information will be recorded in indelible ink in a log book with sequentially numbered pages. The recorder will sign and date each page. The following information will be recorded for each activity:

1. Location
2. Date and time
3. Identity of people performing the activity
4. Weather conditions

For field measurements, the following information will be recorded:

1. The numerical value and units of each measurement
2. The identity of and calibration results for each field measurement

For field sampling activities, the following information will be recorded:

1. Sample type and sampling method
2. The identity of each sample and the depth(s) from which it was collected
3. The amount of each sample
4. Sample description (e.g., color, odor, clarity)
5. Identification of sampling devices used
6. Identification of sampling conditions that might affect the representativeness of a sample (i.e., refueling operations, damaged casings)

These criteria will be recorded in the field sampling book and used to assess sampling procedures in relation to the sample data. Information that is contained elsewhere (such as in the Field Sampling Report or the Purge Log) should be repeated in the logbook.

3.3.3 Daily Quality Control Reports (DQCRs)

Each day the Field Team Leader will prepare a DQCR (Attachment 7.7). The DQCR will include weather information at the time of sampling, ID of samples collected, data from field instruments and calibrations, and will reflect any problems that occurred in the field. In addition, the DQCR documents personnel and visitors at the site during field activities. Modifications to field procedures will be requested by a Field Adjustment Form (Attachment 7.8).

3.3.4 Photographs

Photographs taken for the purpose of project documentation must be recorded in the field logbook. When movies, slides, or photographs are taken of a site location, they are numbered to correspond to logbook entries. The name of the photographer, date, time, site location, site description, sequential number of the photograph and the roll number, orientation of photograph and weather conditions are entered in the logbook as the photographs are taken. A series entry may be used for rapid-sequence photographs. The photographer is not required to record the aperture settings and shutter speeds for photographs taken within the normal automatic exposure range. However, special lenses, films, filters, and other image enhancement techniques will be avoided, since they can adversely affect the admissibility of evidence. Adequate logbook notations and receipts will be used to account for routine file processing. Once processed, the slides or photographic prints will be serially numbered and labeled according to the logbook descriptions. For instant photographs , the required information will be entered on the back of each photograph as soon as it is taken.

3.3.5 Completing Sample Labels/Tags

Sample labels will be filled out for each sample with an indelible pen. Where necessary, the label will be protected from water and solvents with clear label protection tape. Any change in the pre-prepared label information will be initialed by the sampler. Each label will contain the following information:

- Name or initials of collector
- Date, place, and time of collection
- Job name and number
- Sample number and/or boring number and depth
- Preservative (if required)
- Analysis requested

3.3.6 Collecting Samples

Proper sampling procedures are vital to the data acquisition process. Once collected, it is also important to maintain the integrity of the samples. Detailed sampling and decontamination protocols are described in WTP 4 - Groundwater Sampling, WTP 7 - Waste Sampling, and WTP 11 - Sampling Equipment Decontamination. A summary of the planned sample containers, sample volumes, preservation and maximum allowable holding times from the time of collection to analysis are presented in WTP 9 - Sample Containers and Preservation.

3.3.7 Sample Custody

Sample custody is a part of a quality field or laboratory operation. Custody of a sample is defined as:

1. Having physical possession
2. Being in view, after being in possession
3. Having possession, then being placed in a secure area
4. Being maintained in a secure area by the person who had possession last

These custody practices will be observed in the field and during the laboratory operations. They will be performed according to the procedures described in the following subsections.

3.3.7.1 C-C Record

C-C records will be provided in each sample cooler. The custody record will be fully completed, in triplicate, by the field technician designated by the Field Team Leader as responsible for sample shipment to the laboratory. The information specified on the C-C record will contain the same level of detail found in the site log book, with the exception that on-site measurement data will not be recorded. The custody record will include, among other things, the following information:

- Name of person collecting the samples
- Date samples were collected
- Type of sampling conducted (composite/grab)
- Location of sampling station (including the site location)
- Number and type of containers used
- Signature of the MACTEC person relinquishing samples to a non-MACTEC person (such as a Federal Express agent), with the date and time of transfer noted, and the cooler designation.
- Airbill Number

In addition, if samples are known to require rapid turnaround in the laboratory because of project time constraints or analytical concerns such as extraction time or sample retention period limitations, the person completing the C-C record (Attachment 7.4) should note these constraints in the remarks section of the custody record and the Request for Analysis Form (Attachment 7.5). The same C-C form will be adapted for each subcontract laboratory unless a form is provided by the subcontract laboratory.

If it is not practicable to seal the sample shippers at a Federal Express office, they will be sealed beforehand. The duplicate custody record will, therefore, have the signature of the relinquishing field technician and a statement of intent (for example, to Federal Express P.M. June 30, 2001).

The duplicate custody record will then be placed in a plastic bag, taped to the underside of the cooler lid, and the cooler closed. The container will be tightly bound with filament tape. Finally, seals (see section 3.3.6.2 below) will be signed by the individual relinquishing custody and affixed in such a way that the cooler cannot be opened without breaking the seals.

The original and duplicate custody records and the airway bill or delivery note together constitute a complete record, and it is the responsibility of the Project Manager to ensure that all records are consistent and that they are made part of the permanent job file.

At the laboratory, the Sample Control Coordinator will open the package, retrieve the original record, and complete the "Received at Laboratory by box" by affixing his/her signature. The Sample Control Coordinator will record the condition of samples received on the Cooler Receipt Form (Attachment 7.6).

Custody Seals: Custody seals will be preprinted, adhesive-backed seals designed to break if disturbed. Sample shipping containers (coolers, cardboard boxes, etc., as appropriate) will be sealed in as many places as necessary to ensure security. Seals will be signed and dated before use. Upon receipt by the laboratory, the custodian will check and certify, by completing logbook entries, that the seals on boxes and bottles are intact.

Sample Handling: The sample custodian will receive the samples for the laboratory. He/she will perform the following actions upon sample receipt:

- Document whether the individual samples, boxes, or ice chests were sealed upon receipt and document any damaged condition of custody seals in the appropriate section of the cooler receipt form (Attachment 7.6).
- Check cooler temperature and record on the cooler receipt form.
- Sign C-C records, and identify the date and time of sample receipt.
- Check the pH of all samples except VOC samples. Notify project chemist of discrepancies.
- Log samples into the Receipt Logbook and computer file.
- Place sample numbers (from Receipt Logbook) on sample containers and secure the samples in appropriate refrigeration unit.
- Complete the cooler receipt form.

- The laboratories will submit sample receipt confirmation electronically daily to MACTEC to check for discrepancies.

Sample Log-In: Incoming samples will be accompanied by a MACTEC Request for Analysis Form (Attachment 7.5). In the event that this form does not accompany the incoming samples, it will be completed by the Sample Custodian who logs in the samples, or faxed by MACTEC upon immediate notification of the MACTEC Project Chemist. The custodians will enter the laboratory and test setup information into the computer. The laboratory custodian will have the Request for Analysis Form checked and initialed by a supervisor, and will issue copies to the applicable labs, normally on the day samples are received.

The Internal C-C for the Laboratory: Once a sample is within the custody of the laboratory, the transfer of the sample, its aliquot or extract will be documented in the internal C-C record. Every time a sample is transferred from one person to another, whether it is for distribution, storage, sample preparation, analysis or disposal, it will be relinquished by the person who has custody to the person who will then take new custody of the sample. Date and time of the exchange will be recorded. The sample will be shown and this person is tasked with ensuring secure and appropriate handling of the sample. There will be no lapses in sample accountability. The internal C-C form will be fully signed by each person who had contact with the sample.

3.4 POST-OPERATION

3.4.1 Field

Before leaving the site daily, the following procedures will be performed by on-site personnel:

- Check that sampling bottles assigned to the specific sampling location have been filled with the prescribed amount of sample and that sample labels contain required and relevant information (date, time, sampler's identification).
- Maintain custody of samples, maintaining them as specified for the analyses to be performed.
- Prepare samples for shipment to the laboratory.
- Complete the C-C forms.

- Contact the laboratory to inform them that samples will be shipped and also remind them of any unusual analytical requirements for the samples to be analyzed (i.e., holding times for hexavalent chromium).
- Verify completion of logbook, ensuring that required information has been recorded.

Upon completion of the field effort, ensure that associated supplies have been shipped back to the office, rental company, or laboratory as needed.

3.4.2 Office

Upon return to the office, field personnel will perform the following:

- Submit logbook and any original forms to Project Manager for review.
- Inventory equipment and supplies shipped back to the office.
- Contact the laboratory to verify that samples were received in good condition and that requested analyses are understood.

4.0 REFERENCES

CH2M Hill, 2004. Long-Term Groundwater Monitoring Plan. Prepared for the U.S. Army Engineering and Support Center, Huntsville. July 2002.

EIM, 1991a. Installation Restoration Program Information Management Systems Data Loading Handbook. EIM, Brooks Air Force Base, Texas.

EIM, 1991b. Installation Restoration Program Information Management Systems Contractor Data Loading Tool Users Manual. EIM, Brooks Air Force Base, Texas.

USACE, 2001. Engineering and Design Requirements for the Preparation of Sampling and Analysis Plans, Department of the Army, Washington D.C. February 1, 2001.

USEPA, 2001. Environmental Investigations Standard Operating Procedures and Quality Assurance Manual, Environmental Compliance Branch, Athens, Georgia, November, 2001.

5.0 ATTACHMENTS

Attachment 7.1 – Sample Tracking Sheet
Attachment 7.2 - Example Sample Label
Attachment 7.3 – Sampling Plan Detail
Attachment 7.4 –C-C Form
Attachment 7.5 - Request for Analysis Form
Attachment 7.6 - Cooler Receipt Form
Attachment 7.7 – Daily Quality Control Report
Attachment 7.8 – Field Adjustment Form

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ATTACHMENT 7.1
SAMPLE TRACKING SHEET

Sample ID	Comment	Date Sample Collected	Time Collected	Matrix	Number of Containers Collected	Requested Analysis	Type of Pump	Date Sample Shipped	Shipment Tracking Number	Preliminary Data Due	Preliminary Data Received	Laboratory Lot #	EDD Due date	EDD Received	STL SDG Received	Initial DQE Completed	DQE Senior Reviewed	Data Flags Entered	Final Table Checked
MW-31					3	VOCs (SW 8260 B)													
MW-32					3	VOCs (SW 8260 B)													
MW-44					3	VOCs (SW 8260 B)													
MW-54					3	VOCs (SW 8260 B)													
MW-70					3	VOCs (SW 8260 B)													
MW-76					3	VOCs (SW 8260 B)													
MW-77					3	VOCs (SW 8260 B)													
MW-79					3	VOCs (SW 8260 B)													
MW-80	Collect MS/MSD				9	VOCs (SW 8260 B)													
MW-144	Collect DUP				3	VOCs (SW 8260 B)													
MW-145					3	VOCs (SW 8260 B)													
MW-147					3	VOCs (SW 8260 B)													
MW-148					3	VOCs (SW 8260 B)													
MW-149					3	VOCs (SW 8260 B)													
MW-150					3	VOCs (SW 8260 B)													
DUNNDUP-1	Dup of MW-144				3	VOCs (SW 8260 B)													
MW-151					3	VOCs (SW 8260 B)													
MW-152					3	VOCs (SW 8260 B)													
MW-153					3	VOCs (SW 8260 B)													
MW-154					3	VOCs (SW 8260 B)													
MW-155					3	VOCs (SW 8260 B)													
MW-156					3	VOCs (SW 8260 B)													
MW-157	Collect DUP				3	VOCs (SW 8260 B)													
DUNNDUP-2	Dup of MW-157				3	VOCs (SW 8260 B)													
TTA-2-EQB-1	Rinsate				3	VOCs (SW 8260 B)													
TTA-2-EQB-2	Rinsate				3	VOCs (SW 8260 B)													
TTA-2-EQB-3	Rinsate				3	VOCs (SW 8260 B)													
TB-	Trip Blank				2	VOCs (SW 8260 B)													
TB-	Trip Blank				2	VOCs (SW 8260 B)													
TB-	Trip Blank				2	VOCs (SW 8260 B)													
TB-	Trip Blank				2	VOCs (SW 8260 B)													
TB-	Trip Blank				2	VOCs (SW 8260 B)													
TB-	Trip Blank				2	VOCs (SW 8260 B)													

ATTACHMENT 7.1
SAMPLE TRACKING SHEET

Sample ID	Comment	Date Sample Collected	Time Collected	Matrix	Number of Containers	Requested Analysis	Type of Pump	Date Sample Shipped	Shipment Tracking Number
MW-31					3	VOCs (SW 8260 B)			
MW-32					3	VOCs (SW 8260 B)			
MW-44					3	VOCs (SW 8260 B)			
MW-54					3	VOCs (SW 8260 B)			
MW-70					3	VOCs (SW 8260 B)			
MW-76					3	VOCs (SW 8260 B)			
MW-77					3	VOCs (SW 8260 B)			
MW-79					3	VOCs (SW 8260 B)			
MW-80	Collect MS/MSD				9	VOCs (SW 8260 B)			
MW-144	Collect DUP				3	VOCs (SW 8260 B)			
MW-145					3	VOCs (SW 8260 B)			
MW-147					3	VOCs (SW 8260 B)			
MW-148					3	VOCs (SW 8260 B)			
MW-149					3	VOCs (SW 8260 B)			
MW-150					3	VOCs (SW 8260 B)			
DUNNDUP-1	Dup of MW-144				3	VOCs (SW 8260 B)			
MW-151					3	VOCs (SW 8260 B)			
MW-152					3	VOCs (SW 8260 B)			
MW-153					3	VOCs (SW 8260 B)			
MW-154					3	VOCs (SW 8260 B)			
MW-155					3	VOCs (SW 8260 B)			
MW-156					3	VOCs (SW 8260 B)			
MW-157	Collect DUP				3	VOCs (SW 8260 B)			
DUNNDUP-2	Dup of MW-157				3	VOCs (SW 8260 B)			
TTA-2-EQB-1	Rinsate				3	VOCs (SW 8260 B)			
TTA-2-EQB-2	Rinsate				3	VOCs (SW 8260 B)			
TTA-2-EQB-3	Rinsate				3	VOCs (SW 8260 B)			
TB-____	Trip Blank				2	VOCs (SW 8260 B)			
TB-____	Trip Blank				2	VOCs (SW 8260 B)			
TB-____	Trip Blank				2	VOCs (SW 8260 B)			
TB-____	Trip Blank				2	VOCs (SW 8260 B)			
TB-____	Trip Blank				2	VOCs (SW 8260 B)			
TB-____	Trip Blank				2	VOCs (SW 8260 B)			

ATTACHMENT 7.2
EXAMPLE LABEL

SampleID#: ______________________
Matrix: __________________________
Analysis: ________________________
Container: _______________________
Preservative: ____________________
Project#: ______________________
Location: ______________________
Date: ____________ Time:_____________
Initials: _________________
MACTEC , Inc.

			Parameter:	VOCs		Anions (Nitrate & Sulfate)	
			Method.	SW8260B		E 300 0	
			Container	40 mL VOA vial		250 mL Plastic	
			Preservative	HCl to pH<2, Cool to 4°C		No Preservative Cool to 4°C	
Sample ID	Comment	Date	Time	STL	CEMRD	STL	CEMRD
1 PX-1D	Deep Well			3		0	
2 PX-2				3		0	
3 PX-4				3		0	
4 PX-6				3		0	
5 PX-8				3		0	
6 PX-9*				3		1	
7 PX-10*				3		1	
8 PX-11*				3		1	
9 PX-12*				3		1	
10 PX-14*				3		1	
11 PX-15*	Collect Dup/Split			3		1	
12 PX-16*				3		1	
13 PX-17*				3		1	
14 PX-18*	Collect MS/MSD			9		3	
15 PX-19*	Collect Dup/Split			3		1	
16 PX-20				3		0	
17 PX-21				3		0	
18 PX-24*				3		1	
19 PX-25*				3		1	
20 PX-26*				3		1	
21 PX-35*				3		1	
22 PXDup1*	Dup of PX-19			3		1	
23 PXDup2*	Dup of PX-15			3		1	
24 PX-19QA*	Split of PX-19				3		1
25 PX-15QA*	Split of PX-15				3		1
			TOTAL	75	6	18	2
26 PXEQB-1	***			3		1	
			TOTAL	3		1	
27 TB-_______	Trip Blank (a)			2			
28 TB-_______	Trip Blank (a)			2			
29 TB-_______	Trip Blank (a)			2			
30 TB-_______	Trip Blank (a)			2			
31 TB-_______	Trip Blank (a)			2			
32 TB-_______	QA Trip Blank (a)				2		
33 TB-_______	QA Trip Blank (a)				2		
34 TB-_______	QA Trip Blank (a)				2		
			TOTAL	10	6		

* Wells to be additionally sampled for nitrate, sulfate, methane, and alkalinity
** The laboratory does not perform MS/MSD on Methane
- Do not collect extra vials for MS/MSD.
***Equipment blanks will not be collected on dedicated equipment However, if for any reason the dedicated equipment cannot be used, an equipment blank will be collected for each analytical method
(a) Actual number of trip blanks based on number of shuttles to be shipped

Chain of Custody Record

ATTACHMENT 7.4

SEVERN TRENT **STL**
Severn Trent Laboratories, Inc.

STL-4124 (0901)

Client	Project Manager	Date	Chain of Custody Number 150570
Address	Telephone Number (Area Code)/Fax Number	Lab Number	Page ____ of ____
City / State / Zip Code	Site Contact / Lab Contact	Analysis (Attach list if more space is needed)	
Project Name and Location (State)	Carrier/Waybill Number		Special Instructions/ Conditions of Receipt
Contract/Purchase Order/Quote No			

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Air	Aqueous	Sed.	Soil		Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH		Analysis												Special Instructions/ Conditions of Receipt

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal
☐ Return To Client ☐ Disposal By Lab ☐ Archive For ____ Months (A fee may be assessed if samples are retained longer than 1 month)

Turn Around Time Required
☐ 24 Hours ☐ 48 Hours ☐ 7 Days ☐ 14 Days ☐ 21 Days ☐ Other ____

QC Requirements (Specify)

	Date	Time		Date	Time
1 Relinquished By			1 Received By		
2 Relinquished By			2 Received By		
3 Relinquished By			3 Received By		

Comments

DISTRIBUTION: WHITE - Returned to Client with Report; CANARY - Stays with the Sample; PINK - Field Copy

050006.01

1028 69

Attachment 7.5

Mactec
3200 Town Point Dr, Suite 100
Kennesaw, GA 30144

REQUEST FOR ANALYSIS

Project Manager: Tom Holmes
Project Chemist. Jessica Vickers
Project: DDMT

Matrix: Groundwater
Sample ID. MW-47

Container	No.	Preservation	Parameter	Method	Prep
40 mL VOA w/septum	3	HCL to pH<2 Cool to 4 C	VOCs	SW8260B	SW5030B
500 mL Plastic	1	No Preservative Cool to 4 C	Anions/Sulfate/Bromide/Alk	E310.1/E300 0	
40 mL VOA w/septum	2	HCL to pH<2 Cool to 4 C	Total Organic Carbon	SW9060	
40 mL VOA w/septum	2	HNO3 to pH <2/Cool to 4C Field Filter	Dissolved Organic Carbon	E415.1	
500 mL Plastic	1	ZnAc & NaOH to pH>9 Cool to 4 C	Sulfide	E376.1	
1 L Poly	1	HNO3 to pH <2 Cool to 4 C	Total Metals (As, Mn, Se)	SW6010B	
40 mL VOA w/septum	2	HCL to pH<2 Cool to 4 C	Methane/Ethane/Ethene	RSK 175	
40 mL Amber VOA w/septum	3	No Preservative Cool to 4 C	Metabolic Fatty Acids		

Comments:____

Prepared By:________________________ Checked By:________________________

ATTACHMENT 7.6

COOLER RECEIPT FORM

Contractor Cooler________

LIMS#_________

QA Lab Cooler #_________

Number of Coolers_________

PROJECT:______________________________________

Date received:___________

USE BOTTOM OF PAGE 2 OF THIS FORM TO NOTE DETAILS CONCERNING CHECK-IN PROBLEMS.

A. PRELIMINARY EXAMINATION PHASE: Date cooler was opened: ________________
by (print)_________________________ (sign)_________________________

1. Did cooler come with a shipping slip (air bill, etc.)? .... YES NO
   If YES, enter carrier name & air bill number here: ________________________

2. Were custody seals on outside of cooler? .... YES NO
   How many & where ____________, seal date: ____________ seal name:__________

3. Were custody seals unbroken and intact at the date and time of arrival? .... YES NO

4. Did you screen samples for radioactivity using the Geiger counter? .... YES NO

5. Were custody papers in a plastic bag & taped inside to the lid? .... YES NO

6. Were custody papers filled out properly (ink, signed, etc.)? .... YES NO

7. Did you sign custody papers in the appropriate place? .... YES NO

8. Was the project identifiable from custody papers? If YES, enter project name at the top of this form .... YES NO

9. Were temperature blanks used? .... YES NO
   Cooler Temperature_______________(°C) Thermometer ID No.______________

10. Have designated person initial here to acknowledge receipt of cooler: _______________________ (date) _______________________

B. LOG-IN PHASE: Date samples were logged in: _________________________
by (print) _________________________ (sign) _________________________

11. Describe type of packing in cooler: _________________________________

12. Were all bottles sealed in separate plastic bags? .... YES NO

13. Did all bottles arrive unbroken with labels in good condition? .... YES NO

14. Were all bottle labels complete (ID, date, time, signature, preservative, etc.)? .... YES NO

15. Did all bottle labels agree with custody papers? .... YES NO

16. Were correct containers used for the tests indicated? .... YES NO

17. Were samples preserved to correct pH, if applicable? .... YES NO

18. Was a sufficient amount of sample sent for tests indicated? .... YES NO

19. Were bubbles absent in volatile organic analysis (VOA) samples? If NO, list VOA samples below .... YES NO

20. Was the project manager called and status discussed? If YES, give details on the bottom of this form .... YES NO

20. Who was called? ____________ By whom? ____________ (date)____________

PREPARED BY/DATE: JAH 10/11/02
CHECKED BY/DATE: WPB 11/08/02

ATTACHMENT 7.7

DAILY QUALITY CONTROL REPORT

Report No. ___ **Contract No.** ____________ **Date:** _________

Location of Work: **Defense Depot, Memphis, Tennessee**

Description of Work: ____________________________________

Weather:______________ **Rainfall (inches) Avg.**_____ **Temp:**_____

Activities Performed:

Field Team Leader:

Team # 1:

Team # 2:

Team # 3:

Team # 4:

Collected samples are listed below:

Samples Collected:

Team 1	Team 2	Team 3	Team 4

Personnel On-Site:

Difficulties:

Visitors:

Field Team Leader: _________

ATTACHMENT 7.8

MACTEC

FIELD ADJUSTMENT FORM

Date: ______________________________

Project: Defense Depot Memphis Tennessee

Project Number: ______________________________

Field Effort: ______________________________________

Description of field adjustment and rationale:

____

____

____

____

____

____

Prepared by/Title: ______________________________

I have read the above description and rationale and concur with the adjustment

requested: ______________________________________
Signature Date

WORK AND TEST PROCEDURE 8
SAMPLE CONTAINERS AND PRESERVATION

1.0 PURPOSE

The purpose of this Work and Test Procedure (WTP) is to provide guidance for the selection of sample containers, required cleaning for the specified containers, required sample volumes for various analyses, preservation requirements, and required holding times.

2.0 DISCUSSION

This WTP specifies details and procedures for selection and preparation of sample containers and for preservation of the samples once they have been collected. The project-specific work plan will be used to determine the exact sampling requirements.

The selection of suitable containers will prevent contamination of sample from container materials. Adequate preservation of the samples by prescribed methods will ensure that no biological or chemically mediated changes in sample integrity/concentration occurred while the sample was in transit. Both the selection of suitable containers and the proper preservation will support the legal defensibility of data generated as a component of investigative activities. Container type and preservation methods are analytical method-specific.

3.0 PROCEDURES

3.1 ASSOCIATED PROCEDURES

The following WTPs should be considered for review in conjunction with this WTP:

NUMBER	NAME
1	General Instructions for Field Personnel
4	Groundwater Sampling
7	Sample Control and Documentation
9	Sample Packing and Shipping
10	Sample Equipment Decontamination

3.2 PREPARATION

3.2.1 Office

Prior to leaving the office for field work, the field team leader is responsible for activities listed in WTP 1, as well as the following actions:

- Work with the project chemist to generate a sampling plan detail listing the wells and constituents to be sampled
- Coordinate with the analytical laboratory to ensure that the sample containers, and preservatives are shipped to the site and arrive prior to the start of sampling event

3.2.2 Field

After arrival on site, but prior to commencement of operations, the following procedures will be employed:

- Check that sufficient sample containers, preservatives and coolers are present on site for storage and shipment.

3.3 FIELD OPERATIONS

3.3.1 Sample Container Selection/Preparation

The sample container to be selected is matrix and method specific. Sample containers are specified and selected to ensure that little, if any chemicals are transferred from the sample containers to the sample itself, thereby skewing the results. The sample containers will be pre-cleaned and provided to MACTEC by the laboratory. Cleaning procedures will be performed according to USEPA guidelines. A summary of recommended sample containers is provided by method in Attachment 8.1.

3.3.2 Sample Preservation

Samples are generally collected into containers containing preservative in the field prior to shipping to the laboratory to minimize any chemical or physical changes to the sample contents during shipment. Sample preservation and temperature will be checked immediately upon receipt of samples at the laboratory. The results of these checks will be recorded on the cooler receipt form. A summary of recommended preservation techniques by matrix by method is summarized in Attachment 8.1.

It should be noted that the USEPA (1992) do not recommend filtration of samples. However, where required by the scope of work, samples for dissolved metals will be collected and filtered with an in-line 0.45 micron filter at each well location, then preserved with appropriate preservatives.

3.3.3 Holding Times

Project samples will be preserved and analyzed within the time intervals specified for each method and matrix listed in Attachment 8.1. For samples analyzed by gas chromatography, first column analysis and second column confirmations will be completed within the maximum holding times specified in Attachment 8.1.

With regard to holding time requirements and definitions presented in Attachment 8.1, extraction is defined as completion of the sample preparation process as described in the applicable method. Analysis completion is defined as completion of analytical runs, including dilutions, second column confirmations, and any required reanalyzes.

3.4 POST OPERATION

3.4.1 Field

Before leaving the site daily, the following procedures will be performed by on-site personnel:

- Check that sampling bottles assigned to the specific sampling location have been filled with the prescribed amount of sample, contain the proper type and amount of preservative and that all sample labels contain relevant information (date, time, sampler's identification, and whether the sample has been preserved).
- Maintain custody of samples, maintaining them as specified for the analyses to be performed.
- Prepare samples for shipment to the laboratory.
- Complete the C-C forms and other relevant information.
- Contact the laboratory to verify that samples are received in good condition and that request for analyses are understood.

Upon completion of the field effort ensure that associated supplies have been properly stored, disposed of or shipped back to the office as appropriate.

3.4.2 Office

Upon return to the office, field personnel will perform the following:

- Submit logbook and any original forms to Task/Project Manager for review.
- Inventory equipment and supplies shipped back to the office.
- Contact the laboratory to verify that samples were received in good condition and that requested analyses are understood.

4.0 REFERENCES

USACE, 2001. Engineering and Design Requirements for the Preparation of Sampling and Analysis Plans, Department of the Army, Washington D.C. February 1, 2001.

USEPA, 2001. Environmental Investigations Standard Operating Procedures and Quality Assurance Manual, Environmental Compliance Branch, Athens, Georgia, November, 2001.

5.0 ATTACHMENTS

Attachment 8.1 - Requirements for Containers, Preservation Techniques, and Holding Times for Groundwater Samples

Attachment 8.2 - Requirements for Containers, Preservation Techniques, and Holding Times for Soil Samples

ATTACHMENT 8.1

CONTAINERS, PRESERVATIVES, AND HOLDING TIMES
MATRIX: GROUNDWATER SAMPLES

Parameter	Units	Method	Container	Minimum Recommended Quantity (mL)	Preservative	Holding Time
Groundwater						
Volatile Organics	µg/L	SW 5030B/8260B	VOA w/ Teflon®-lined septum	3 X 40 (no headspace)	4°C; HCl to pH<2	14 days/7 days if unpreserved
Dissolved Gases: Methane, Ethane, Ethene	µg/L	STL SOP COI-GC-005 (EPA RSK SOP-175M)	VOA w/ Teflon®-lined septum	3 X 40 (no headspace)	4°C: HCl to pH<2	14 days
Carbon Dioxide	mg/L	STL SOP COI-GC-005 (EPA RSK SOP-175M)	VOA w/ Teflon®-lined septum	2 X 40 (no headspace)	4°C	7 days
Semi-Volatile Organics	µg/L	SW 3520C/8270C	G-TLC (amber)	1000	4° C	7 d Extraction/ 40 d Analysis
Pesticides	µg/L	SW 3520C/8081A	G-TLC (amber)	1000	4°C	7 d Extraction/ 40 d Analysis
PCBs	µg/L	SW 3520C/8082	G-TLC (amber)	1000	4°C	7 d Extraction/ 40 d Analysis
Herbicides	µg/L	SW 3520C/8151A	G-TLC (amber)	1000	4°C	7 d Extraction/ 40 d Analysis
Metals ICP	mg/L	SW 3005A/6010B Trace	P	1000	HNO_3 to pH<2 (dissolved – filter on site)	6 months
Mercury	mg/L	SW 7470A	P	500	HNO_3 to pH<2 (dissolved – filter on site)	28 days
Anions: Bromide, Chloride, Nitrate, Nitrite, and Sulfate	mg/L	EPA 300.0/SW 9056	P, G	250	4°C	28 days (Br, Cl, SO_4) 48 hours (NO_2, NO_3)

ATTACHMENT 8.1

CONTAINERS, PRESERVATIVES, AND HOLDING TIMES
MATRIX: GROUNDWATER SAMPLES

Parameter	Units	Method	Container	Minimum Recommended Quantity (mL)	Preservative	Holding Time
Alkalinity	mg/L	EPA 310.1	P	250 (no headspace)	4°C	48 hours
Sulfide	mg/L	EPA 376.1	P	500 (no headspace)	4°C; Zinc Acetate & NaOH to pH>10	7 days
TOC	mg/L	SW 9060/EPA 415.1	P, G	2 X 40 (no headspace)	4°C; H_2SO_4 to pH<2	28 days
Dissolved Organic Carbon	mg/L	EPA 415.1	P, G	2 X 40 (no headspace) (dissolved – filter on site)	4°C; H_2SO_4 to pH<2	28 days
Volatile Fatty Acids	mg/L	ASTM D 1552	VOA w/ Teflon® lined septum	1x40 (no headspace)	4°C;	28 days
CONTAINER AND SAMPLE HANDLING GUIDE MATRIX: FIELD TESTS FOR GROUNDWATER						
pH	units	EPA 150.1	P, G	50	N/A	ASAP
Specific Conductance	mS/cm	EPA 120.1	P, G	250	4°C	24 hours
Temperature	°C	EPA 170.1	P, G	50	N/A	ASAP
Turbidity	NTUs	EPA 180.1	P, G	250	N/A	ASAP

ATTACHMENT 8.1

CONTAINERS, PRESERVATIVES, AND HOLDING TIMES
MATRIX: GROUNDWATER SAMPLES

Parameter	Units	Method	Container	Minimum Recommended Quantity (mL)	Preservative	Holding Time
Redox Potential	mV	SM 2580	P, G	50	N/A	ASAP
Dissolved Oxygen	mg/L	MCAWW 360.1	P, G	50	N/A	ASAP
Ferrous Iron	mg/L	HANNA Kits 38039/38041	P, G	50	N/A	ASAP
Carbon Dioxide	mg/L	HANNA Kit 3818	P	50	N/A	ASAP

Acronym Definitions:

P = Polyethylene
G = Glass
G-TLS = Glass with Teflon®-lined septum
G-TLC = Glass with Teflon®-lined cap
PTFE = Fluoropolymer Resin/Teflon®

PREPARED BY:	
CHECKED BY:	

ATTACHMENT 8.2

CONTAINER AND SAMPLE HANDLING GUIDE
MATRIX: SOIL

Parameter	Units	Method	Container	Minimum Recommended Quantity	Preservative	Holding Time
Volatile Organics Compounds – Encores*	µg/kg	SW 5035/8260B	G-TLC/ Encores ™	4 X 5 gram Encores ™	4°C	48 hrs for preservation/ 14 days Analysis
Semi-Volatile Organics	µg/kg	SW 3550B/8270C	G-TLS	8 oz.	4°C	14 day Extraction/ 40 day Analysis
Pesticides	µg/kg	SW 3550B/8081A	G-TLS	8 oz.	4°C	14 day Extraction/ 40 day Analysis
PCBs	µg/kg	SW3540/8082	G-TLS	8 oz.	4°C	14 day Extraction/ 40 day Analysis
Herbicides	µg/kg	SW 8151A	G-TLC	8 oz.	4°C	14 day Extraction/ 40 day Analysis
Metals ICP	mg/kg	SW 3050A/SW 6010B	P, G	8 oz.	4°C	6 months
Mercury	mg/kg	SW 7471A	P, G	8 oz.	4°C	28 days
TOC	mg/kg	Walkley Black	G	8 oz.	4°C	28 days
TCLP	mg/L	SW 1311	G-TLS/ Encore™	Extractables, metals-16 oz. VOCs-25g Encore™ or 4 oz.	4°C	VOCs-14 days Ext/NA/14 days Analysis, Extractables-14 days Ext/7 days Prep/40 days Analysis, Metals-6 months Ext/NA/6 months Analysis, Mercury-28 days Ext/NA/28 days Analysis

* If collecting for volatile organic compounds only, an additional aliquot of soil must be obtained in a one 4-oz wide mouth jar for moisture content determination.

Acronym Definitions:

P = Polyethylene
G = Glass
G-TLS = Glass with Teflon®-lined septum
G-TLC = Glass with Teflon®-lined cap
PTFE = Fluoropolymer Resin/Teflon®

PREPARED BY:	
CHECKED BY:	

WORK AND TEST PROCEDURE 9

SAMPLE PACKING AND SHIPPING

1.0 PURPOSE

The purpose of this WTP is to provide guidance for packing and shipping environmental samples to the laboratory for analysis. A Sample Handling, Packing and Shipping Instructions Checklist is included as Attachment 9.1.

2.0 DISCUSSION

This WTP specifies details and procedures for packing and shipment of samples to the laboratory for analysis. The project-specific work plan will be used to identify the exact shipping requirements for a specific project.

The goals for sample packing and shipping are that: 1) the integrity of the sample is maintained, and 2) no personnel exposure to the sample container contents occurs during transit. These goals should be met regardless of the method by which the samples were shipped.

Samples will usually be shipped as either environmental samples or as hazardous materials based on the expected contaminant concentrations. While the concentration of constituents in the sample is not generally known prior to shipment of the sample, inferences can be made based on the site location and knowledge of past activities, observations during collection, and past sample results. Hazardous materials are generally considered to be samples of highly contaminated media collected at or near an observed release and can consist of pure product or a mixture. Environmental samples are generally media with low-level contamination.

Relevant regulations include Department of Transportation (DOT) regulations for ground transportation (49 CFR) and the International Air Transport Association (IATA) regulations for air transportation. Common carriers (e.g., Federal Express, UPS, DHL, etc.) must abide by these regulations. This WTP provides specific guidance on how to package and ship samples to achieve the stated objectives and remain in compliance with shipping regulations. If field personnel are unsure regarding shipping regulations, they will immediately contact the carrier of choice (e.g., Federal Express, UPS, DHL, etc.) for shipping guidance.

3.0 PROCEDURES

3.1 ASSOCIATED PROCEDURES

The following WTPs will be reviewed in conjunction with this field effort:

NUMBER	NAME
1	General Instructions for Field Personnel
4	Groundwater Sampling
6	Investigation Derived Waste Disposal
7	Sample Control and Documentation
8	Sample Containers and Preservation
10	Sample Equipment Decontamination
11	Soil Sampling

3.2 PREPARATION

3.2.1 Office

Prior to leaving the office for field work, the field team leader is responsible for activities listed in WTP 1, as well as the following actions:

- Work with the project chemist to ensure that a sufficient amount of sample containers, sample transportation containers, and sample packing material have been shipped to the site based on the total number of samples and average number of samples to be collected per day.
- Develop guidelines on the number/type of samples, per shipper based on type of samples being collected and analytical results from past sampling events at the site(i.e. VOCs in one cooler to limit the number of trip blanks needed, samples from high concentration wells packed in separate cooler to prevent cross contamination)

3.2.2 Field

After arrival on site, but prior to commencement of operations, the following procedures will be employed:

- Check that required sample containers, sample transport containers, and packing material are on-site.

3.3 FIELD OPERATIONS

On specific projects, protocols for sample shipment will be specified in the work plan. This WTP provides general guidelines for sample shipment.

- The samples will be shipped to the laboratory by an overnight courier service.
- Samples will not remain on site for more than 24 hours after collection, unless samples were collected on a weekend. These samples will be stored on ice at 4°C until the first possible courier shipment.
- Glass sample containers will be placed inside sealed plastic bubble wrap bags or wrapped in bubble wrap and placed in sealable plastic bags as a precaution against cross-contamination due to leakage or breakage.
- All sample bottles will be placed in coolers supplied by the laboratory in such a manner as to eliminate the chance of breakage and/or leakage during shipment.
- Sufficient ice in plastic bags (double-bagged) will be placed in the coolers to keep the samples at 4°C throughout shipment.
- Special arrangements will be made with the laboratory's point-of-contact for samples that are to be delivered to a laboratory on a Saturday so that hold times and/or sample preservations are not compromised.

In order to demonstrate that the samples and coolers have not been tampered with during shipment, custody seals will be used. Custody seals are adhesive labels that are placed across the cooler lids in such a manner that they will be visibly disturbed upon opening of the sample container or cooler. The seals will be initialed and dated upon placement. Upon receipt at the laboratory, the sample custodian will note the condition of custody seals and will also check the sample temperature, recording these items on the laboratory cooler receipt form.

In no instance will a highly contaminated sample (such as waste or pure product) be shipped in the same container as a low level contaminated sample (such as environmental soil and groundwater samples). This procedure is to minimize the possibility of cross-contamination.

3.4 POST-OPERATION

3.4.1 Field

Before leaving the site daily, the following procedures will be performed by on-site personnel:

- Ensure that the sample transport containers are properly packed and are in compliance with DOT and IATA regulations.

- Confirm receipt of samples at laboratory.

- Fill out sample tracking form noting sample shipment

3.4.2 Office

Upon return to the office, field personnel will perform the following:

- Submit logbook and any original forms to Project Manager for review.
- Inventory all equipment and supplies shipped back to the office.

4.0 REFERENCES

Code of Federal Regulations, Part 49, Sections 100-199.

USACE, 2001. Engineering and Design Requirements for the Preparation of Sampling and Analysis Plans, Department of the Army, Washington D.C. February 1, 2001.

USEPA, 2001. Environmental Investigations Standard Operating Procedures and Quality Assurance Manual, Environmental Compliance Branch, Athens, Georgia, November, 2001.

5.0 ATTACHMENTS

Attachment 9.1 – Sampling Handling, Packing & Shipping Instructions Checklist

ATTACHMENT 9.1

SAMPLE HANDLING, PACKING & SHIPPING INSTRUCTIONS CHECKLIST

When packing samples for shipment to the laboratory, review this list to ensure that all project samples, documents, and materials are included in the sample shipper.

PROJECT SAMPLES

- ☐ All samples, duplicates, MS/MSDs, equipment blanks, ambient blanks, and trip blanks should be included in the cooler that are listed on the COC.
- ☐ Verify that the proper number of bottles with appropriate preservative(s) were collected for each sample
- ☐ Verify that samples were checked for pH (except volatile samples)

DOCUMENTS

- ☐ **Chain-of-Custody (COC)** generated for *each* cooler
- ☐ Review the COC for completeness, including appropriate signature(s) and date(s), and include the **courier tracking/shipping number** on the COC
- ☐ **Request for Analysis (RFA)** form for every sample included in the cooler
- ☐ The **COC and RFAs** should be placed in a Ziploc bag and taped to the underside of the cooler lid
- ☐ **Custody seals** should be placed on the front and back of each cooler

PACKING MATERIALS

- ☐ Verify that ice is "double-bagged" and is sufficient to maintain a temperature of 4°C
- ☐ Glass bottles should be placed in a bubble bag to prevent breakage and leakage
- ☐ Place highly contaminated samples (if known) together
- ☐ Place a **trip blank** in each cooler that contains samples for VOC analyses at beginning of day
- ☐ To minimize the number of trip blanks, place all VOC samples in the same cooler
- ☐ Each cooler contain a **temperature blank**
- ☐ All sample coolers insured by shipper ($1000.00)

Comments:____

____

____

Checklist Completed By:____________________ Date:__________

Note: This Checklist should be included in the project file with the field documents.

WORK AND TEST PROCEDURE 10
FIELD EQUIPMENT DECONTAMINATION

1.0 PURPOSE

The purpose of this Work and Test Procedure (WTP) is to provide guidance for the proper decontamination of field equipment. This WTP also provides guidance for collection of equipment rinsates that will measure the quality of the decontamination procedure.

2.0 DISCUSSION

This WTP specifies details and procedures for decontamination of field equipment that may become contaminated as a result of field sampling activities. The decontamination of sampling equipment will help prevent cross-contamination of samples collected at one location with residual contamination from samples collected at another location; will help prevent exposure of individuals to residual contamination present on the equipment; and will help prevent the spread of contamination via sampling equipment. Proper decontamination procedures will also support the legal defensibility of data generated as a component of investigative activities.

Decontamination procedures will be evaluated by the collection of equipment rinsates. These samples consist of reagent water collected from final rinse of sampling equipment after the decontamination procedure has been performed. The samples are analyzed with the environmental sample to assess the adequacy of the decontamination performed.

3.0 PROCEDURES

3.1 ASSOCIATED PROCEDURES

The following WTPs should be reviewed in conjunction with this WTP:

NUMBER	NAME
1	General Instructions for Field Personnel
2	Drilling
3	Well Installation, Development, and Abandonment
4	Groundwater Sampling
5	Hydraulic Conductivity Testing

NUMBER	NAME
6	Investigative Derived Waste Disposal
7	Sample Control and Documentation
8	Sample Containers and Preservation
9	Sample Packing and Shipping
11	Soil Sampling

3.2 PREPARATION

3.2.1 Office

Prior to leaving the office for field work, the field team leader is responsible for activities listed in WTP 1, as well as the following actions:

- Ensure that sufficient quantities of decontamination supplies and materials have been shipped to the site based on expected number of samples and days at site.

3.2.2 Field

After arrival on site, but prior to commencement of operations, the following procedures will be employed:

- Verify that decontamination supplies and equipment have arrived on site.
- Set up decontamination area(s).

3.3 FIELD OPERATIONS

3.3.1 Decontamination Area

The location of the decontamination area, used primarily for larger pieces of equipment, will be determined in consultation with DRC personnel. The decontamination pad will consist of a sump lined with 6-mil polyethylene sheeting. The sump will be constructed by either excavating a small area to create a depression to collect the decontaminated water or by elevating the edges of the sheeting to create a pool-like structure to collect the decontaminated water.

3.3.2 Decontamination Water Source

Tap water from the municipal water treatment system will be used as a rinse in the decontamination procedure. The Field Team Leader will be responsible for coordinating with DRC personnel to secure an adequate supply of tap water for decontamination procedures. One sample of each water source used will be analyzed for the full range of parameters as the field samples to be collected. If water supply is a portable water tank, a sample must be collected from each tank used.

3.3.3 Decontamination Procedures

The required decontamination procedure for large pieces of equipment such as drill rigs, auger flights, and drilling and well casing, is:

1. Wash the external surface of equipment or materials with high pressure hot water and Alconox or equivalent, and scrub with brushes if necessary until all visible dirt, grime, grease, oil, loose paint, rust flakes, etc., have been rinsed from the equipment into a collection structure.
2. Air dry.
3. Decontamination solutions will be stored in tanks or drums and maintained at the site until analyses have been completed.

The required decontamination procedure for sampling equipment except the water level indicator probe is:

1. Wash and scrub with Alconox or equivalent detergent.
2. Double tap water rinse.
3. Rinse with American Society for Testing and Materials (ASTM) Type II Reagent - Grade Water
4. A pesticide grade methanol spray rinse (all solvents must be pesticide grade or better) in a stainless steel bowl. The methanol waste will be containerized separate from purge water and disposed of as a hazardous waste.
5. Rinse with ASTM Type II Reagent - grade water.
6. Wrap in oil free aluminum foil for transport.

The decontamination procedure for the water level indicator and the oil/water interface probe is:

1. Hand wash the calibrated tape and probe with a solution of Alconox (or equivalent).
2. Rinse with deionized (Reagent Grade II) water.

3.3.4 Equipment Rinsate Collection

When field cleaning equipment is required during a sampling investigation, a piece of the field-cleaned equipment is selected for collection of a equipment rinsate. At least one equipment rinsate will be collected for each sampling protocol (i.e. soil sampling, pumps used for groundwater sampling) during each week of sampling operations. Equipment rinsates will be conducted in a manner which allows proper representation of field decontamination procedures.

Sampling Equipment: Equipment rinsates will be obtained from decontaminated bladder pumps, bailers, HydroPunch sampler, stainless steel split-spoons, hand augers, sludge samplers, Ponar dredges, stainless steel bowls, and beakers with ASTM Type II water or better.

The equipment rinsate protocol will be as follows:

a. Label Sample Container - Label the sample container as outlined in WTP 7

b. Collect Sample - Equipment rinsates will be collected on all equipment types used to collect samples. The collection procedure is described below:

   After sample collection equipment has been decontaminated as described above, an equipment rinsate will be collected. ASTM Type II water (or better) will be poured over and through sampling equipment (i.e., split-spoon, bailer, stainless steel beaker) into a cleaned stainless steel bowl (preferably the equipment and bowl to be used on a specifically identifiable sample location). Water collected will then be poured into the appropriate sample container. Repeat the process as necessary to fill each container to the required volume. Vials for volatile analysis and bottles for total organic carbon (TOC) analysis will be completely filled, leaving no air space above the liquid portion (to minimize volatilization). Check that the Teflon on the Teflon- lined silicone septum is toward the sample in the caps and secure the cap tightly. If semi-volatile compounds are to be sampled for, collect these samples next. Proceed to the collection of samples for the remaining analyses. Be careful of all pre-preserved bottles. If acids are present, open the bottle downwind and away from the body.

c. Custody, Handling and Shipping - Complete the procedures as outlined in WTPs 8 - Sample Control and Documentation and 10 - Sample Packing and Shipping.

3.4 POST OPERATION

3.4.1 Field

Before leaving the site, the following procedures will be performed by on-site personnel:

- Decontaminate all equipment.
- Properly store decontamination derived waste (i.e., decontamination water).
- Ensure that sampling equipment and associated decontamination supplies have been shipped back to the office.

3.4.2 Office

Upon return to the office, field personnel will perform the following:

- Submit logbook and any original forms to Task/Project Manager for review.
- Inventory equipment and supplies shipped back to the office.
- Arrange for proper disposal of the decontamination derived waste after determination of its contents.

4.0 REFERENCES

USEPA, 2001. Environmental Investigations Standard Operating Procedures and Quality Assurance Manual, Environmental Compliance Branch, Athens, Georgia, November, 2001.

USACE, 2001. Engineering and Design Requirements for the Preparation of Sampling and Analysis Plans, Department of the Army, Washington D.C. February 1, 2001.

5.0 ATTACHMENTS

None

WORK AND TEST PROCEDURE 13
HEALTH AND SAFETY MONITORING

1.0 PURPOSE

The purpose of this Work and Test Procedure (WTP) is to provide guidance for monitoring levels of combustible gas and organic vapors. This monitoring is performed to minimize the risks to field personnel associated with combustible gases and to minimize on-site worker exposure to organic vapors through a preliminary identification of the concentration of organic compounds detectable with a photoionization detector (PID) or Flame Ionization Detector (FID).

2.0 DISCUSSION

Specific monitoring requirements will be provided in the work plan or HSP. Information gathered from air monitoring will be used to determine appropriate protective measures to be taken and assess off-site migration of contaminants released during construction activities or subsequent operation of remedial systems so that appropriate contingency plans and/or control measures can be implemented.

2.1 COMBUSTIBLE GAS

A combination combustible gas/oxygen/hydrogen sulfide indicator (EXOTOX 40) will be used to monitor combustible gas levels. The EXOTOX 40 has the capability to monitor for oxygen, explosive gases, and a "toxic" gas (carbon monoxide <u>or</u> hydrogen sulfide) simultaneously. Only one toxic gas can be fitted to the EXOTOX and is chosen at the time of order. The monitor does not have the capability to detect specific explosive gases, but quantitatively detects % lower explosive limit (LEL) by comparison with a known calibration gas (usually methane). The oxygen sensor calibration is affected by humidity, so calibration of this sensor should take place in conditions similar to the working environment.

The LEL refers to the lowest concentration of a combustible gas in air that will explode or support combustion. The upper explosive limit (UEL) is the highest concentration of a combustible gas in air that will support combustion or detonation. Generally, the combustibility of an atmosphere is defined in terms of a proportion of the LEL or UEL. Most combustible gas meters are calibrated to provide this information.

2.2 PHOTOIONIZATION DETECTOR

A commonly used air monitoring instrument is the PID. The instrument operates under the principle of photoionization, i.e., the absorption of light by a gas molecule resulting in the molecule's ionization. The sensor of the instrument consists of a sealed ultraviolet light source that emits photons at an energy level high enough to ionize most organic compounds, but not high enough to ionize the major components of air (i.e., O_2, N_2, CO, CO_2, or H_2O).

Most PIDs are designed for use with interchangeable probes with lamps of different energies (9.5 eV, 10.2 eV, and 11.7 eV). Lamps are selected based on the ionization potential (IP) of suspected contaminants on-site; the lamp energy must be equal to or greater than the IP of a compound for the compound to be detected. IPs for contaminants expected on-site can be found in the Health and Safety Plan. The PID is sensitive to many organic and inorganic vapors/gases and therefore, cannot be used as a qualitative instrument in unknown situations. It is strictly qualitative except when the nature of the contamination is known, and the instrument has been calibrated to that specific contaminant. High humidity decreases the sensitivity of the PID. Atmospheres with concentrations of gases above the detection limits of the instrument will cause inconsistent behavior.

2.3 FLAME IONIZATION DETECTOR

Another commonly used air monitoring instrument is the flame ionization detector (FID). The instrument operates by drawing in an aliquot of the gas or vapor under consideration into the instrument ionization chamber. The extracted gas is then ionized in a flame. A current is produced that is proportional to the number of carbon atoms present and this information is relayed to a meter or strip chart recorder. In many FID monitoring instruments, the instrument can be operated under two modes: survey mode and gas chromatography (GC) mode. In the survey mode, all organic compounds are detected at the same time; in the GC mode, volatile species are separated, thus enabling tentative identification and measurement of various compounds.

A limitation to the use of this instrument is that it does not detect any inorganic gases or vapors nor some synthetic gases. The instrument should not be used at temperatures less than 40° Fahrenheit. High concentrations of contaminants or oxygen-depleted environments will affect results and will require system modification. In the survey mode, readings reported are relative to the calibration standard used. Specific analyte identification requires calibration with the analyte of interest.

2.4 CHEMICAL-SPECIFIC DRAEGER TUBES

Chemical-specific detector tubes will be used in conjunction with the FID and PID to detect and quantify specific organic vapor levels at the sites. Detector tubes indicate the presence of a specific chemical by a color change in the tubes' packing material. A prespecified sample volume is drawn through the detector tube at a constant flow rate. If the sample contains the vapor or gas in question, it will react with the chemical on the packing material, resulting in a color change. The concentration of the vapor is directly proportional to the length of the stain. Detector tubes are pre-calibrated prior to being shipped from the manufacturer. The pump used in sampling must be checked regularly to verify flow rate and sample volume per pump stroke.

Problems contributing to poor accuracy of the detector tubes include the following: leaking pump, insufficient contact (analysis) time, high humidity and/or temperature, difficulty in reading the scale, interferences from other compounds, improperly stored tubes, outdated tubes, and operator error

3.0 PROCEDURES

3.1 ASSOCIATED PROCEDURES

The following WTPs should be reviewed in conjunction with this WTP:

NUMBER	NAME
1	General Instructions for Field Personnel

3.2 PREPARATION

3.2.1 Office

Prior to leaving the office for field work, the field team leader is responsible for activities listed in WTP 1, as well as the following actions:.

- Determine monitoring requirements by review of HSP
- Identify site contaminants to target or monitor
- Ship necessary equipment and calibration supplies

3.2.2 Field

After arrival on site, but prior to commencement of operations, the following procedures should be employed:

- Confirm all necessary equipment has arrived at the site
- Calibrate equipment as specified by the manufacturer

3.3 FIELD OPERATIONS

3.3.1 Field Operations

3.3.1.1 Combustible Gases

Combustible gas monitoring will be performed at selected locations during intrusive site activities where vapor accumulation is considered likely, using a calibrated EXOTOX 40 portable multi-gas monitor. Action levels based on Lower Explosive Limit (LEL) readings monitored at the source are as follows:

LEL Level	Action
<10% LEL	None; proceed with work and continue monitoring
10 - 25% LEL	Potential explosion hazard; proceed with caution and monitor LEL levels closely, notify SSO
>25% LEL	Explosion hazard exists; stop work; evacuate site and ventilate area until levels of combustible gases fall below 25% LEL

3.3.1.2 FID/PID

Monitoring for organic vapors will be performed in the breathing zone and/or at the source (as appropriate) to determine appropriate levels of PPE to be used during work. A PID or FID will be used in conjunction with chemical-specific detector tubes to detect and quantify organic vapor levels.

Ambient air in the breathing zone will be monitored for organic vapors at least once every 15 minutes during site operations and with every change in task or work location. Continuous monitoring will be conducted at locations where vapor buildup is a potential hazard. Since the PID/FID only provides non-specific quantitative readings, chemical-specific detector tubes (Draeger tubes) will also be used, as dictated by action levels, during field investigations to monitor for the presence of specific organic vapors. Action levels for organic vapors and chemical detector tubes are project specific and are presented in the site-specific Health and Safety Plan.

Atmospheric monitoring measurements obtained are compared with 50% of the OSHA Permissible Exposure Limits (PELs) and/or 50% of the ACGIH Threshold Limit Values, whichever standard is lower. Site-specific action criteria based on the results of vapor monitoring are specified in the site-specific Health and Safety Plan.

3.3.1.3 Calibration

All atmospheric monitoring equipment will be calibrated a minimum of two times daily in accordance with the manufacturer's instructions: before work begins; and in the afternoon of the work shift. Calibration procedures for each instrument can be found in the manufacturer's instruction manuals. An example of the calibration record form that will be used to record daily calibration is shown in Attachment 13.1.

The EXOTOX is factory-calibrated, but may be recalibrated by following manufacturer's instructions. H_2S gas (or carbon monoxide), ambient fresh air, and methane gas are used in the calibration procedure.

The PID is factory-calibrated to a benzene gas standard. Calibration will be checked prior to and after each usage following procedures described in manufacturer's instruction manual. Isobutylene is used as a check gas for the on-site instrument calibration.

The FID is factory-calibrated to a Methane gas standard. Calibration will be checked prior to and after each usage following procedures described in manufacturer's instruction manual. Methane is used as a check gas for the on-site instrument calibration.

3.4 POST-OPERATION

3.4.1 Field

Before leaving the site daily, the following procedures should be performed by on-site personnel:

- Decontaminate any contaminated monitoring equipment.

- Complete logbook and required monitoring forms, making notations as to site conditions, anomalous readings, etc.
- Ensure that the site is cleaned to the condition that it was in prior to monitoring operations (i.e., all trash related to monitoring operations must be disposed of prior to departure from the site).

3.4.2 Office

Upon return to the office, field personnel should perform the following:

- Submit logbook and any original forms to Task/Project Manager for review.
- Inventory all equipment and supplies shipped back to the office.

4.0 REFERENCES

NIOSH/OSHA/USCG/EPA, 1985. Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities. USDHHS.

5.0 ATTACHMENTS

Attachment 13.1 - Daily Instrument Calibration Form

ATTACHMENT 13.1

DAILY INSTRUMENT CALIBRATION FORM

SITE LOCATION: ______________________________ DATE: ____________________

CALIBRATION PERFORMED BY: ______________________________________

CALIBRATION STANDARD: ____________________ CONCENTRATION: ___________

INSTRUMENT CALIBRATED (specify model)/serial no.	DATE/ TIME	INSTRUMENT READING	INITIALS	COMMENTS

FINAL PAGE

ADMINISTRATIVE RECORD

FINAL PAGE