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M.D.

THE MEMPHIS DEPOT
TENNESSEE

ADMINISTRATIVE RECORD
COVER SHEET

AR File Number 1039

HDR | e2M

Memorandum

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

From: Kevin Sedlak
Tom Holmes

Date: 13 May 2010

Re: **Work Plan for IRA System Removal**
Dunn Field - Defense Depot Memphis, Tennessee

HDR|e^{2}M has prepared this work plan to describe removal of the Interim Remedial Action (IRA) groundwater recovery system on Dunn Field 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.

INTERIM REMEDIAL ACTION SYSTEM

The following information is taken from the *Source Areas Interim Remedial Action Completion Report, Rev.1* (HDR|e^{2}M, 2009).

System Construction

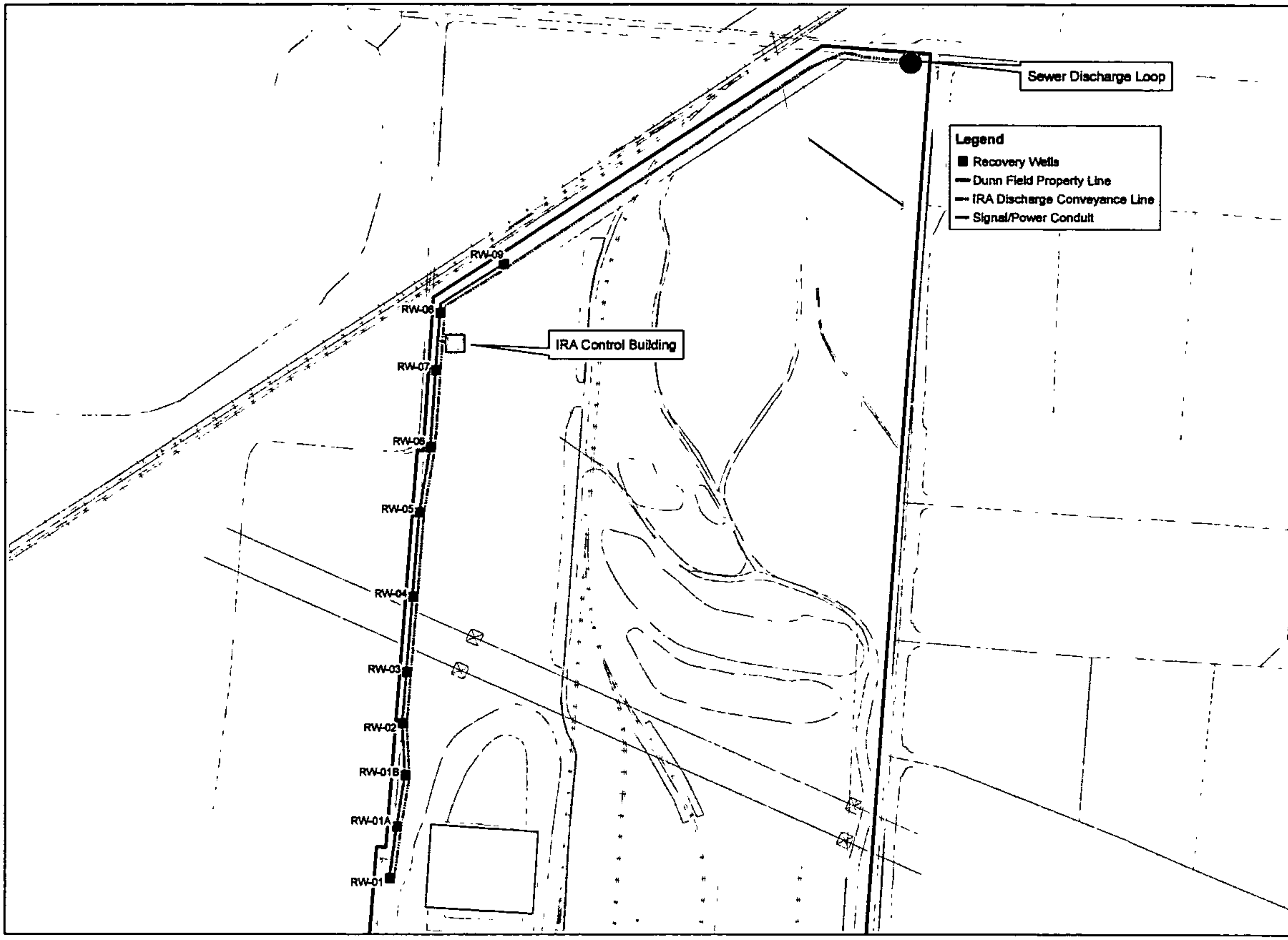
The IRA Record of Decision (ROD) at Dunn Field was signed in April 1996 with the objective of hydraulic containment to: (1) prevent further contaminant plume migration; and (2) reduce contaminant mass in groundwater. The final design for Phase 1 of the groundwater extraction system was completed in August 1997 and included the installation of seven groundwater extraction wells (recovery well [RW]-3 through RW-9), one pre-cast concrete building, an underground conveyance system, and flow measurement and control systems. The system was constructed from January to October 1998 and began operation in November 1998.

The Phase II design was completed in January 2000 and included four additional extraction wells with associated conveyance piping and instrumentation/controls. The Phase II system update was developed due to the detection of additional groundwater contamination in the southern portion of Dunn Field. Installation of new RWs (RW-1, RW-1A, RW-1B and RW-2) south of RW RW-03 and construction of other components was completed by March 2001. The expanded system was in full operation in June 2001.

The groundwater is discharged to the city sewer system without treatment under Industrial Wastewater Discharge Agreement Permit # S-NN3-092 with the City of Memphis.

Five Year Reviews

The *Five Year Review for Dunn Field* (CH2M HILL, 2003) concluded that over 300 pounds of volatile organic compounds (VOCs) had been removed by the IRA from 1998



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N W E S

Figure 1

IRA SYSTEM LAYOUT

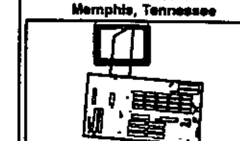
IRA SYSTEM REMOVAL
WORK PLAN

DUNN FIELD
DEFENSE DEPOT
MEMPHIS, TENNESSEE

Projection: NAD 1927 StatePlane Tennessee
Datum : WGS 84
Units: Feet

0 50100 200
Feet

Installation Location
Memphis, Tennessee



Date: May 2010
Edition: Rev 0

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to 2002. However, the extraction system did not adequately control groundwater flow and plume migration in the fluvial aquifer. Potentiometric surface maps indicated that groundwater was captured in the immediate vicinity of each RW, but the capture zones were not connected between wells, and portions of the groundwater plume were able to pass through the voids in the extraction well capture zones. An increase in chlorinated volatile organic compound (CVOC) concentrations was observed in monitoring wells (MWs) west of Dunn Field.

The IRA was found to be protective in the short term, because there was no current or planned use of the fluvial aquifer as a drinking water supply and local ordinances restrict installation of private wells. The Five Year Review stated that monitoring data from the IRA and the remedial investigation suggested that aquifer restoration could be accomplished effectively by other technologies rather than expanding the groundwater extraction system. Fully protective remedies for all media were selected in the *Dunn Field ROD* (CH2M HILL, 2004). The *Second Five Year Review* (e²M, 2008) completed in January 2008 did not alter the findings relative to the protectiveness of the IRA.

System Monitoring

Groundwater samples have been collected regularly since 1999 to evaluate system effectiveness in restricting plume migration. Samples were collected quarterly in 1999 and 2000 and were collected semiannually since 2002; limited sampling was performed in 2001. Sample analyses were generally limited to VOCs. Groundwater samples from MWs were collected using both passive diffusion bags and low-flow sampling methods.

The *Annual Operations Report – 2008, Dunn Field Groundwater IRA – Year Ten* (HDR|e²M, 2009) described the system operations and maintenance activities for 2008 and presented the semiannual groundwater monitoring results. The report included historical groundwater results for the primary CVOCs detected in groundwater for all wells in the monitoring program.

Effluent samples from the IRA discharge were collected quarterly to monitor contaminant mass reduction. As of 31 December 2008, the IRA system had discharged 312,015,593 gallons of groundwater to the sewer system and had removed approximately 918 pounds of total VOCs, including 369 pounds of trichloroethene. The VOC concentrations in the system effluent decreased significantly after the fluvial soil vapor extraction component of the Source Areas remedial action began operation in July 2007.

Current Status

All RWs are currently offline. Groundwater sample results from the April and October 2008 IRA semiannual monitoring events demonstrated that the Source Areas RA was having a significant impact in reducing CVOC concentrations in groundwater. CVOC concentrations in most monitoring wells on Dunn Field did not exceed 50 micrograms per liter (µg/L) for any single CVOC; this concentration limit is the objective for the Source Areas groundwater remedy, with further reduction to maximum contaminant levels to be achieved by the Off Depot remedy.

RW-5 through RW-9 were shutdown on 9 June 2008 and RW-1 through RW-4 were shutdown on 23 January 2009. Following review of analytical results for the semiannual samples collected in April 2009, the BRAC Cleanup Team approved removal of the IRA system with proper abandonment of the RWs.

SYSTEM REMOVAL PROCEDURES

General Work and Test Procedures (WTPs) to be followed during system removal are included in the *Remedial Action Sampling and Analysis Plan, Rev. 1* (RA SAP) (MACTEC, 2005). The specific WTPs are included in Appendix A and listed below:

- WTP 1 General Procedures for Field Personnel
- WTP 3 Well Installation, Development and Abandonment
- WTP 13 Health and Safety Monitoring

System removal will include the RWs, control building, and the connection to the sanitary sewer. Underground piping for the groundwater discharge line and electrical conduit for power/system controls and underground junction boxes will be left in place. Electrical power is provided through a utility connection and transformer located in the northwest corner of Dunn Field. The power line then goes to the IRA control building located between RW-7 and RW-8; wiring for electrical power and pump controls are routed from the control building to each RW. Each RW has two stainless steel enclosures: the control enclosure contains a control panel, motor starter box, main breaker, control breaker and transducer box with desiccant; and the pump house contains the steel-cased RW with submersible pump and polyvinyl chloride (PVC) discharge line, water level transducer, water meter, pressure gauge, exhaust fan and space heater. The PVC discharge line from each RW connects to the main discharge line which runs to the connection in the northeast corner of Dunn Field. The sanitary sewer connection includes an aboveground, 6-inch diameter steel sewer inlet loop with insulation and heat trace wiring. The IRA system components are shown on Figure 1 and photographs are provided in Appendix B.

IRA system removal will include site preparation, demolition of structures, well abandonment and site restoration. Site preparation will be performed by HDR|e^{2}M; the other tasks will be performed by subcontractors with supervision by HDR|e^{2}M.

Site Preparation

Site preparation activities consist of shutting off electrical power, removing pumps and water level meters from the RWs and placing temporary caps over the well casing to prevent material falling into the well during demolition of well pads and enclosures. Memphis Light Gas and Water has disconnected the power supply and the pumps and transducers have been removed where possible. Pumps became wedged in wells RW-2 and RW-5 during removal and will be pulled after the well enclosure is removed and access is improved.

Demolition of Structures

Structure demolition will be performed by HEPACO and will include removal of electrical components and other recyclable materials from the well enclosures and control building; pulling electrical wiring from underground conduit where practical; demolition of 22 stainless steel well enclosures, 11 RW pads and the control building pad; and removal of the sewer connection

The IRA system is considered consumable property that was 100% consumed and is not included on the government property inventory for DDMT. Materials will be recycled where possible and the remaining debris will be disposed as solid waste/debris.

A new connection will be installed on the west end of the existing piping for discharge of condensate and other waste water in accordance with the industrial discharge permit. The connection will consist of a flange with a 2-inch male cam lock with a shut off valve and locking cap.

Site restoration will consist of grading and placing grass seed and straw over all areas disturbed during demolition activities. Depressions resulting from removal of concrete pads at RWs and the control building be leveled or filled with on-site soil prior to re-seeding. No fill material will be brought on-site.

HEPACO will maintain a daily log of activities including work performed, personnel and hours on site, problems encountered from site conditions or mechanical breakdown, and other information as appropriate.

Recovery Well Abandonment

Well abandonment will be performed by M&W Drilling. The 11 RWs will be properly abandoned by a licensed Tennessee Well driller in accordance with Memphis Shelby County Health Department (MSCHD) Regulations. The well locations are shown on Figure 1 and the well construction data are shown on Table 1.

The total depth of each well will be measured to confirm that obstructions will not interfere with abandonment. One-half gallon of bleach will be poured into each well in accordance with MSCHD regulations. Bentonite chips will be placed into the well to seal the screened section and absorb existing water in each well. The wells will then be filled with grout from the bentonite up until undiluted grout is visible at the surface. The grout will be tremied into the casing, keeping the side-discharge tremie pipe approximately 1 foot below the grout surface. Water displaced by the grout will be contained for proper disposal. After allowing at least two days for grout settlement, the grout will be topped off with concrete. The well casing will be cut down to 6-inches below ground surface. The area around each well will be restored to match surrounding area.

M&W Drilling will maintain a daily log of well abandonment activities including work performed, personnel and hours on site, problems encountered from site conditions or mechanical breakdown, and other information as appropriate. All downhole equipment will be decontaminated prior to use, according to procedures in the *Environmental Investigations Standard Operating Procedures Quality Assurance Manual* (EPA, 2001).

IDW Management

The waste generated during IRA system removal will be classified as either non-investigative waste or investigative derived waste (IDW). Non-investigative waste, such as packaging materials, personal protective equipment and other inert refuse, will be 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 collected during well abandonment. The waste water will be collected for testing and discharge in accordance with the City of Memphis discharge permit.

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).

REPORTING

A brief memorandum will be prepared to document system removal and abandonment of the RWs. The report will include description and chronology of removal activities, and documentation of material recycling and disposal. Photographs of site activities and any deviations from this plan will be provided. This information will also be included in the final annual operations report for the IRA, to be prepared upon completion of system removal.

TABLES

TABLE 1
RECOVERY WELL SUMMARY
IRA SYSTEM REMOVAL WORK PLAN
Dunn Field Defense Depot Memphis, Tennessee

Well	Northing	Easting	Date Installed	Aquifer	Ground Elevation (feet msl)	Well Diameter (inches)	Top of Screen Depth (feet, btoc)	Screen Length (feet)
RW-01	280267.14	801973.88	Oct-99	Fluvial	294.1	4	67	5
RW-01A	280386.26	801990.08	Oct-99	Fluvial	293.9	4	68	5
RW-01B	280504.87	802009.37	Oct-99	Fluvial	287.9	4	63	5
RW-02	280624.56	802003.32	Oct-99	Fluvial	288.5	4	65	5
RW-03	280743.76	802012.69	Feb-98	Fluvial	297.7	6	68	10
RW-04	280918.07	802027.11	Feb-98	Fluvial	303.7	6	75	10
RW-05	281113.38	802041.97	Mar-98	Fluvial	305.8	6	82	10
RW-06	281264.22	802067.17	Jan-98	Fluvial	303.2	6	77	10
RW-07	281442.21	802079.19	Jan-98	Fluvial	296.1	6	70	10
RW-08	281574.72	802088.53	Jan-98	Fluvial	291.6	6	71	10
RW-09	281688.06	802232.41	Jan-98	Fluvial	289.3	6	65	10

FIGURES

Appendix A

Selected Work and Test Procedures from RA SAP

WTP 1 General Procedures for Field Personnel

WTP 3 Well Installation, Development and Abandonment

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 3

WELL INSTALLATION, DEVELOPMENT, AND ABANDONMENT

1.0 PURPOSE

The purpose of this Work and Test Procedure (WTP) is to provide guidance for the installation and development of monitoring wells suitable to generate data for determination of the extent of groundwater contamination and of site hydrogeological conditions. Procedures for well abandonment are also included.

2.0 DISCUSSION

This WTP specifies details and procedures for the design, construction, installation, and development of monitoring and injection wells at DDMT.

Monitoring wells allow for direct measurement of both groundwater contamination and flow parameters beneath the site. Monitoring wells will be designed and installation supervised by qualified environmental professionals according to project specifications, and in accordance with USEPA guidelines.

Well installation will be performed by the drilling subcontractor under the direction of a MACTEC geologist/engineer. General requirements for the drilling subcontractor and oversight are provided in WTP 2, Drilling Operations.

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
2	Drilling Operations
12	Personnel Protective Equipment Decontamination
13	Health and Safety Monitoring

3.2 PREPARATION

Well installation will occur immediately after drilling. Therefore preparation for well installation should be made prior to beginning drilling operations, these preparations are given in WTP 1 and 2.

3.3 WELL CONSTRUCTION

Included in this section is the rationale for selection of well construction materials. A qualified geologist/engineer will oversee well installation activities.

3.3.1 Well Construction Materials

Well risers will consist of material durable enough to retain their long-term stability and structural integrity and be relatively inert to minimize alteration of groundwater samples. Selection of PVC or stainless steel for the monitoring wells is based on the primary purpose of the well, which is the detection of potential contaminants. PVC has demonstrated very good chemical resistance except to high concentrations of low molecular-weight ketones, aldehydes, and chlorinated solvents. Stainless steel has demonstrated very good chemical resistance, including resistance to high concentrations of low molecular-weight ketones, aldehydes, and chlorinated solvents. Low concentrations of these same chemicals with long term exposure to PVC have not had documented effects (Barcelona et al., 1983; NWWA, 1989).

Stainless steel resistance to corrosion, in most corrosive environments, particularly under oxidizing conditions, has been shown to be very effective. Stainless steel requires exposure to oxygen in order to attain its highest corrosion resistance. Oxygen combines with part of the stainless steel alloy to form an invisible protective film on the surface of the metal. As long as the film remains intact, the corrosion resistance of the stainless steel remains high. According to Barcelona et al. (1983), in cases where long-term exposures in very corrosive conditions are eminent, corrosion may occur with the subsequent release of chromium or nickel as contaminants in ground water samples.

Well materials will consist of new, threaded, flush joint polyvinyl chloride (PVC) or stainless steel pipe, with a minimum inside diameter of 2 inches. If PVC is used, the riser pipe will conform to ASTM D 1785, Standards for Schedule 40 Pipe. Materials will be new and unused and will be decontaminated prior to installation. Casing will only be joined with compatible welds or couplings that do not interfere with the primary purpose of the well. Use of solvent or glue will not be permitted.

Well screens will consist of new, commercially fabricated, threaded, flush joint, minimum 2-inch inside (ID) diameter, factory slotted or continuous wrap PVC, or, in the case where known or expected chlorinated solvents are present in the groundwater, stainless steel screen. Screen slot size will be based on previous available soil information, but will be generally sized to prevent 90 percent of the filter pack from entering the well. The screen slot size will be adjusted if site geologic conditions significantly differ from the expected conditions. Previous well installation at DDMT have generally used factory-slotted or wire-wrapped screens with 0.010-inch openings, no less than 10-feet in length, and no greater than 20-feet in length.

Silt traps will not be used in monitoring wells. Silt traps usage fosters a stagnant, turbid environment, which could influence analytical results for trace concentrations. A notch will be cut in the top of the casing to be used as a measuring point for water levels.

3.3.2 Well Design

Monitoring wells will be designed and installed in a manner to accomplish the following objectives: to collect representative groundwater samples; to prevent contamination of the aquifer by the drilling equipment; to prevent vertical seepage of surface water or inter-aquifer contamination.

This section describes well installation and construction procedures including the placement of the screen, installation of the filter pack, bentonite seal, and grout seal. The Field Team Leader and the Project/Task Manager will collectively make decisions on well depths, locations, screened intervals, etc. Boring at DDMT are generally drilled 10-feet into the clay unit at the base of aquifers to confirm the local presence of the lower confining unity. Well screens are generally set above the clay at the base of the aquifer; the deeper portion of the boring is filled with bentonite.

3.3.2.1 Screen Location

The screened intervals will be selected for each proposed well based on specific DQOS. There are several water bearing units of interest present at DDMT (fluvial, intermediate, and Memphis aquifer). Both the fluvial and intermediate aquifers can be found in unconfined conditions, with significant saturated thickness (>50 feet). In most areas, the saturated thickness of the fluvial aquifer is 20 feet or less. For most wells at DDMT the screen will start from the top of clay upward, for a maximum of 20 feet of screen per well. If the saturated thickness is substantially greater than 20 feet, a cluster well may be installed so that the entire saturated interval is screened.

3.3.2.2 Filter Pack

A filter pack will be installed in the annular space between the boring and the well screen. The filter pack will consist of silica sand. The filter pack will be clean, inert, well rounded and contain less than 2 percent flat particles. The filter pack will be certified as free of contaminants by the supplier and have a grain size distribution compatible with the formation materials and the screen.

A filter pack size of (20-40) will be used based on wells previously installed at DDMT. This sand size was determined from grain-size analysis of the screened intervals by previous consultants at the site. If the site conditions show significant change (i.e. more gravelly, or much more clayey) from those previously encountered a grain-size analysis will be completed and filter pack design based on those results.

The filter pack will be placed from the bottom of the hole to a minimum of 4 feet above the top of the well screen. The filter pack will not extend across more than one water-bearing unit. When sonic drilling methods are used, the filter pack will be emplaced through the nominal 6-inch diameter steel casing using the gravity method. The procedure for gravity installation of the filter pack will be as follows:

Prior to installation of the well casing, the inside of the 6-inch steel casing will be thoroughly cleared of sediment and cuttings by reaming with the 4-inch sampling barrel and flushing with potable water. The sand filter pack will be gravity-placed through the 6-inch steel casing in lifts of no more than approximately 1 foot. Care will be taken to prevent bridging by frequently measuring the thickness of the filter pack as it is placed. As the steel casing is slowly withdrawn between lifts, it will be vibrated with the sonic drilling head to compact the sand filter pack.

3.3.2.3 Bentonite Seal

A minimum 5-foot thick bentonite seal will be installed above the filter pack in the annular space of the well. Only 100 percent sodium bentonite (pellets or chips) will be used and care will be taken to prevent bridging by frequently measuring the thickness of the bentonite as it is gravity placed. When the seal is installed above the water table, the bentonite will be hydrated with water from an approved water source as described in WTP 2 - Drilling Operations. At least 5 gallons of water will be added after each 24 to 30 inches of bentonite is placed. The bentonite seal will be allowed to hydrate for a minimum of 4 hours prior to placement of the grout collar around the wells (USACE, 1998).

3.3.2.4 Annular Space

As described above, the annular space between the well riser and the borehole wall will be filled with a filter pack, a bentonite seal, and a grout seal. In the case of deeper, Type III wells, the upper section of the borehole will be cased with solid PVC or iron pipe and grouted in place.

3.3.2.5 Plumbness and Alignment

The well pipe assembly will be hung in the borehole, prior to placement of the filter pack, and not allowed to rest on the bottom of the hole to keep the well assembly straight and plumb. Centralizers will be installed at 50-foot intervals in wells greater than 20 feet in depth. The centralizers will not be attached in the length containing the well screen or bentonite seal. In addition the centralizers should not restrict the passage of the tremie pipe used for filter pack and grout placement (USACE, 1998).

3.3.2.6 Grout Seal

A nonshrinking cement-bentonite grout mixture will be placed in the annular space from the top of the bentonite seal to approximately 6-inches below the ground surface. Concrete will be added in the remaining annular space during installation of the protective casing and concrete pad.

The cement-bentonite mixture will consist of the following compounds in proportion to each other: 94 pounds of neat Type I Portland or American Petroleum Institute (API) Class A Cement, not more than four pounds of 100 percent sodium bentonite powder, and not more than 8 gallons potable water. A side discharge tremie pipe will be used to place the grout mixture into the annular space. The tremie pipe will be located a maximum of 10 feet from the top of the bentonite seal in deep wells to ensure even placement of grout in the annular space. Pumping will continue until undiluted grout is visible at the surface.

3.3.2.7 Well Completion Details

Type II and Type III Monitoring Wells will be completed as shown in the project Well Installation Diagrams (Attachment 3.1 and 3.2 respectively).

Based on well location and future area use, the Project/Task Manager will determine surface completion (flush or projected above ground surface) requirements for all permanent monitoring well installations. Temporary monitoring well installations will be clearly marked by the use of wooden stakes placed around the well and cordoned off with silt fencing and/or barrier tape. For permanent monitoring well installations, if a well stick up is not appropriate, surface completions will be flush with the land surface. The casing will be cut approximately 3 inches below land surface and will be secured with a water tight casing cap to prevent surface water from entering the well. A water-proof valve box with locking cover will be placed over the well casing. The valve box lid will be centered in a 3-foot by 3-foot by 4-inch thick concrete pad that slopes away from the box.

If an aboveground surface completion is used, the well casing will be extended 2 or 3 feet above land surface. A casing cap will be provided for each well. A vent hole will be placed in the protecting casing and a ventilated well cap will be used. A steel sleeve will be placed over the casing to shield the extended casing and cap. The steel sleeve will be seated in a minimum 3-foot by 3-foot by 4-inch concrete surface pad. The diameter of the sleeve will be a minimum of 4 inches greater than the diameter of the casing. A weep hole will be drilled in the steel sleeve about 1 inch above the top of the well pad. The pad will be sloped away from the well sleeve and a lockable cap or lid will also be installed. Three 3-inch diameter concrete-filled steel guard posts will be installed around each well unless the well is located in an area receiving vehicular traffic. These guard posts will be 5 feet in total length and installed radially from the well head. The guard posts will be installed approximately 2 feet into the ground and set in concrete; these posts will not be installed in the concrete pad placed at the well base. The protective sleeve and guard posts will be painted orange using a brush (USACE, 1998). Installation of the well will be completed prior sampling the well.

Wells will be secured immediately after well completion. Corrosion-resistant locks will be provided for both flush and aboveground surface completions. A brass survey marker will be installed in the concrete pad. The information required by the TDEC (i.e., well identification number, registration number, etc.) should be inscribed, stamped or otherwise permanently marked on monitoring well identification tags.

3.3.3 Well Installation

Well installation will be supervised by a qualified geologist. When installing wells through more than one water bearing zone or aquifer, measures will be taken to prevent cross-connection or cross-contamination of the zones during the drilling and well installation.

3.3.3.1 Procedures

Borings for monitoring wells will be advanced using sonic drilling. The following protocols will be used to install the well casing and screen:

1. Remove the PVC or stainless steel screen and riser from packaging and steam clean to remove manufacturing residues.
2. Fill deepest part of boring that has intersected the clay layer with bentonite.
3. Install a 10 to 20-foot section of minimum 2-inch (I.D.), threaded, flush jointed, pre-manufactured PVC or stainless steel screen inside the steel drill casing.
4. Install solid riser to ground surface, plus 24-to 36-inch stick-up (if required).
5. Install the filter pack using the gravity method through the annular opening between drill casing and well screen, as the drill casing is removed, to distribute the filter pack around the screen in a uniform height and density. Take care to prevent bridging by measuring the thickness of the filter pack as it is placed.
6. Continue removing drill casing and installing filter pack until at least 4 feet above the top of the well screen. Use the sonic drilling head to vibrate the steel casing as it is slowly withdrawn in order to compact the filter pack and prevent bridging.
7. Install a minimum 5-foot bentonite seal. The bentonite seal will be hydrated with potable water. Allow the bentonite seal a minimum of 4 hours of hydration time before grouting the annulus. Deeper wells below the water table can utilize bentonite slurry for the bentonite seal if the potential exist for the bentonite to bridge during installation through water or drilling mud; bentonite slurry, if used, will be placed with a side-discharge tremie pipe.
8. Remove remaining drill casing and grout boring annulus to ground surface with grout/bentonite mixture.
9. Develop well (after waiting no less than 24 hours after installation).

3.3.3.2 Well Installation Diagrams

The field supervisor will maintain suitable logs detailing drilling and well construction practices. Well dimensions, amount, type and manufacture of materials used to construct each well will be recorded on the Monitoring Well Installation Diagrams (Attachment 3.1 and 3.2). Only Type II wells are currently planned for installation at DDMT. Additional information to be recorded on the monitoring well installation diagram will include:

- Well identification
- Drilling method
- Installation date(s)
- Elevations of ground surface and the measuring point notch
- Total boring depth
- Lengths and descriptions of the screen and rising
- Thickness and descriptions of filter pack, bentonite seal, casing grout, and any backfilled material
- Record quantities of all materials
- Summary of material penetrated by the boring

Each installation diagram will be completed in the field, reviewed in the office and submitted in an appendix of the Technical Report.

3.3.4 Well Development

The purpose of well development is to create good hydraulic contact between the well and the aquifer and to remove accumulated sediments from the well. Each newly installed monitoring well will be developed. Drilling fluids used during well construction will be removed during development. The following sections describe the procedures for well development.

3.3.4.1 Well Development Procedures

Each monitoring well will be developed no sooner than 24 hours after installation to allow for adequate grout curing time. Wells will be developed using pumps equipped with surge rings or bailers. Any other techniques must be approved by the Project/Task Manager. The monitoring well development protocol is as follows:

1. Measure the static water level and the depth to the top of sediment in the well.
2. Record the total depth of the well (from the Well Installation Diagram).
3. Calculate the volume of water in the well and saturated annulus.
4. Begin developing the well using a combination of surging and pumping. Continue pumping and periodically surging until each the following criteria have been met:
   a. Fluids lost to the formation during well installation have been removed (this is a minimum requirement where conditions permit).
   b. The well water is clear to the unaided eye and the turbidity of the water removed.
   c. pH, temperature, turbidity, and specific conductance have stabilized. In general, field parameters are stable when nephelometric turbidity units (NTUs) are less than 10, pH is within 0.1 on consecutive readings, and temperature and specific conductance are within 10 percent of previous readings. It should be noted that natural turbidity levels in ground water may exceed 10 NTU.
   d. If feasible, monitor the static water level (SWL) during purging. Adjust the purge rate to keep the SWL from dropping more than 0.3 meter from the initial SWL.
   e. No sediment remains in the bottom of the well. However, it can be accepted if the sediment thickness remaining within the well is less than 1 percent of the screen length or less than 0.1 ft for screen equal or less than 10 feet long.
5. In the event that the above criteria have not been met after six hours of pumping, surging, and bailing (including recharge time for poorly recharging wells), development activities will be temporarily discontinued at that well. The MACTEC field staff will advise the MACTEC Project/Task Manager who will decide whether or not to continue development of the well.
6. In the event of slowly recharging wells that will not sustain pumping or bailing, the MACTEC field staff will advise the Project/Task Manager as soon as a determination of estimated recharge time has been made.
7. Physical characteristics of the water (suspended sediment, turbidity, temperature, pH, EC, purge rate, odor, etc.) will be recorded throughout the development operation. At a minimum, they will be recorded initially and after each well volume has been removed, or every 30 minutes, whichever comes first.
8. The total quantity of water removed and final depth to the top of sediment (total depth of well) will be recorded.
9. The static water level in the well (after at least 24 hours) will also be recorded once the water level in the well has completely recovered.

No detergents, soaps, acids, bleaches, or other additives will be used to develop a well. Well development equipment will be decontaminated as specified in WTP 11 -Sampling Equipment Decontamination.

3.3.4.2 Well Development Records

Well development data will be recorded on Well Development Data Sheets. An example of this sheet is shown as Attachment 3.3.

3.3.4.3 Well Development Water

Development water will be drummed or stored in bulk containers. The containers will be clearly labeled with site name, well name, date, and contents. The development water will be properly disposed in accordance with IDW procedures set forth in the FSP.

3.3.5 Well Abandonment

After it has been determined that a monitoring well is no longer needed it will be abandoned. According to the LTM Plan (CH2M Hill, 2004), wells are recommended for abandonment for the following reasons:

- The test objectives have been achieved and the well is no longer needed.
- The well is improperly constructed, i.e.:
  - Well installed with improper installation of the outer casing and position of the sand pack
  - Wells with elevated pH readings (due to improper construction)
- The wells that have improperly placed screens or long screens.
- The monitoring wells where dense non-aqueous phase liquid has been potentially indicated.
- The well has been vandalized or damaged.

To properly abandon a well, the surface completion (concrete pad and protective casing) should be removed and the well filled with a cement/bentonite grout from the bottom. An alternative method is to completely remove the well casing and screen from the borehole. This may be accomplished by over-drilling the well casing down to the bottom of the borehole, thereby removing the grout and filter pack materials from the hole. The well casing should then be removed from the hole with the drill rig.

The borehole can then be backfilled with the appropriate grout material. The grout should be placed into the borehole from the bottom to the top by pressure grouting with the positive displacement method (tremie method). The top 2 feet of the borehole should be poured with concrete to insure a secure surface seal (plug). The concrete surface plug can also be recessed below ground surface if the potential for construction activities exists.

3.3.6 Survey of Well Locations

Upon completion of the wells, a Tennessee licensed professional surveyor will locate each new monitoring well by standard surveying methods. A vertical survey will be conducted to establish the elevation of each monitoring well casing and brass disk. Vertical control will be to the National Geodetic Vertical Datum. The horizontal grid coordinates within 0.1 foot, the ground elevation to within 0.01 foot, and the elevation of the top of casing (notch) within 0.01 foot will be recorded. The survey will be referenced to the State Plane coordinate system.

3.4 POST-OPERATION

3.4.1 Field

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

- Decontaminate all field equipment.
- Ensure that installed/developed wells are secured.
- Complete logbook, making notations as to site conditions, anomalous readings, etc.
- Complete monitoring well development records and well installation diagram.
- Ensure that related equipment and associated supplies have been shipped back to the office.
- Ensure that all IDW containers are sealed and labeled clearly with the date, name, and contents.
- Ensure that the site is returned to its condition prior to well installation to the extent feasible (i.e., all trash related to well installation and development must be disposed of prior to departure from the site).

3.4.2 Office

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

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

4.0 REFERENCES

USACE, 1998. Monitoring Well Design, Installation, and Documentation at Hazardous Toxic, and Radioactive Waste Sites. November 1998.

USEPA, 1991. Guidance on Oversight of Potentially Responsible Party Remedial Investigations and Feasibility Studies. Final, OSWER Directive 9835.1 Document 070191-1, July 1991.

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.

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

NWWA, 1989. Handbook of Suggested Practices for the Design and Installation of Groundwater Monitoring Wells. Dublin, OH: National Water Well Association.

USEPA, 1992. RCRA Groundwater Monitoring: Draft Technical Guidance. EPA530-R-93-001. United States Environmental Protection Agency. November 1992.

USEPA, 1986. RCRA Groundwater Monitoring Technical Enforcement Guidance Document. OSWER-9950-1. United States Environmental Protection Agency, September 1986.

5.0 ATTACHMENTS

Attachment 3.1- Type II Monitoring Well Stickup Installation Diagram
Attachment 3.2- Type II Monitoring Well Flush Mount Installation Diagram
Attachment 3.3 - Well Development Record

ATTACHMENT 3.1

TYPE II MONITORING WELL INSTALLATION DIAGRAM (STICK-UP COMPLETION)

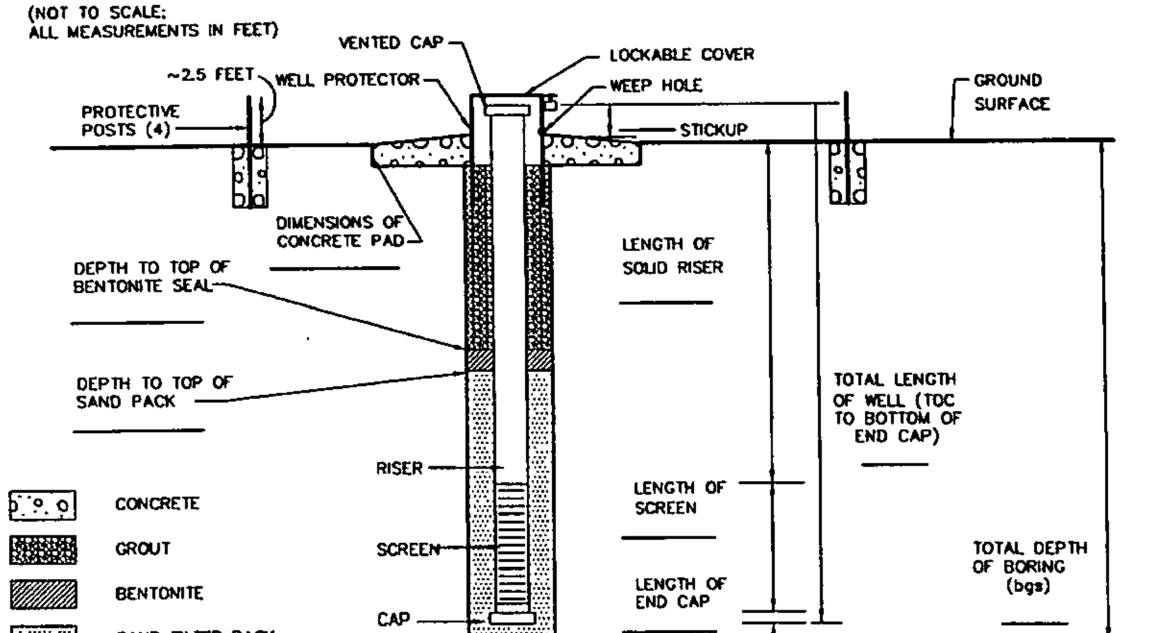
PROJECT NAME ____________ PROJECT NO. ____________
WELL NO. ____________ WELL LOCATION ____________
DATE ____________ TIME ____________

GROUND SURFACE ELEVATION ____________
TOP OF SCREEN ELEVATION ____________
REFERENCE POINT ELEVATION ____________
TYPE FILTER PACK ________ GRADATION ________
FILTER PACK MANUFACTURER ____________
SCREEN MATERIAL ____________
MANUFACTURER ____________
SCREEN DIAMETER ________ SLOT SIZE ________
RISER MATERIAL ____________
MANUFACTURER ____________
RISER DIAMETER ____________
DRILLING TECHNIQUE ____________
AUGER/BIT SIZE AND TYPE ____________

BENTONITE TYPE ____________
MANUFACTURER ____________
CEMENT TYPE ____________
MANUFACTURER ____________
BOREHOLE DIAMETER ____________
MACTEC FIELD REPRESENTATIVE ____________
DRILLING CONTRACTOR ____________
AMOUNT BENTONITE USED (SEAL) ____________
AMOUNT BENTONITE USED (GROUT) ____________
AMOUNT CEMENT USED (GROUT) ____________
AMOUNT SAND USED ____________
STATIC WATER LEVEL (>24 hrs after dev)
MEASURED ON (Date/Time) ____________

REMARKS ____________

(NOT TO SCALE;
ALL MEASUREMENTS IN FEET)



QA / QC — DRILLER: ____________ INSPECTOR: ____________
DISCREPANCIES: ____________ CHECKED BY: ________ DATE: ____________

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PREPARED BY/DATE: JAH 12/23/02
CHECKED BY/DATE: DMW 12/23/02

ATTACHMENT 3.2

TYPE III MONITORING WELL INSTALLATION DIAGRAM (FLUSH MOUNT COMPLETION)

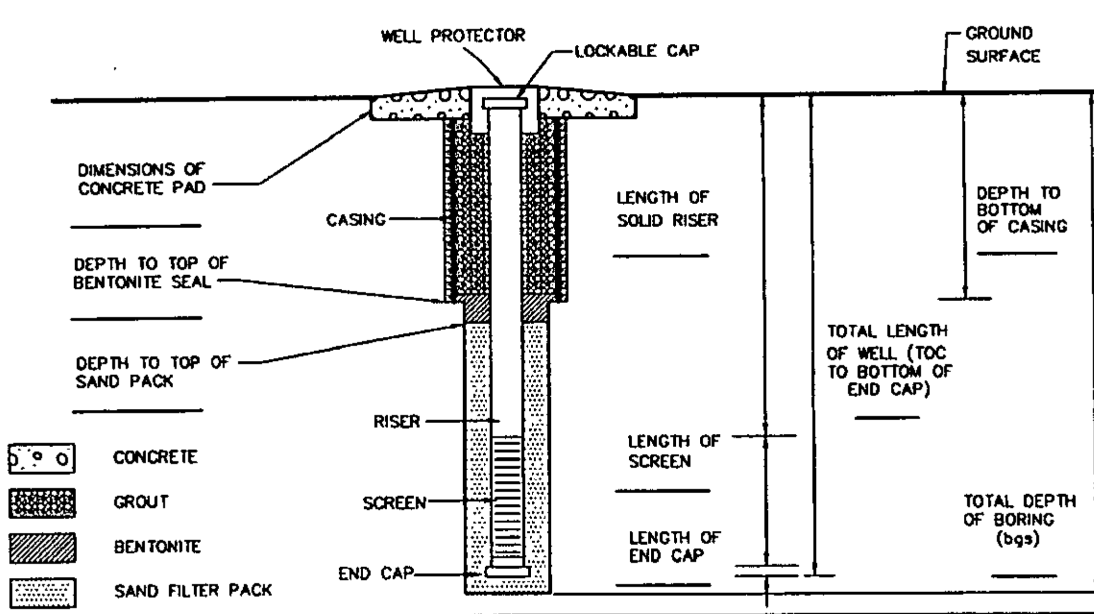
PROJECT NAME ______ PROJECT NO. ______
WELL NO. ______ WELL LOCATION ______
DATE ______ TIME ______

GROUND SURFACE ELEVATION ______
TOP OF SCREEN ELEVATION ______
REFERENCE POINT ELEVATION ______
TYPE FILTER PACK ______ GRADATION ______
FILTER PACK MANUFACTURER ______
SCREEN MATERIAL ______
MANUFACTURER ______
SCREEN DIAMETER ______ SLOT SIZE ______
RISER MATERIAL ______
MANUFACTURER ______
RISER DIAMETER ______
DRILLING TECHNIQUE ______
AUGER/BIT SIZE AND TYPE ______

BENTONITE TYPE ______
MANUFACTURER ______
CEMENT TYPE ______
MANUFACTURER ______
BOREHOLE DIAMETER ______
MACTEC FIELD REPRESENTATIVE ______
DRILLING CONTRACTOR ______
AMOUNT BENTONITE USED (SEAL) ______
AMOUNT BENTONITE USED (GROUT) ______
AMOUNT CEMENT USED (GROUT) ______
AMOUNT SAND USED ______
STATIC WATER LEVEL (>24 hrs after dev)
MEASURED ON (Date/Time) ______

REMARKS ______

(NOT TO SCALE:
ALL MEASUREMENTS IN FEET)



QA / QC	DRILLER: ______	INSPECTOR: ______	
	DISCREPANCIES: ______	CHECKED BY: ______	DATE: ______

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PREPARED BY/DATE: JAH 12/23/02
CHECKED BY/DATE: DMW 12/23/02

ATTACHMENT 3.3

WELL DEVELOPMENT DATA

PROJECT NAME ______________________ PROJECT No. ______________

DEVELOPED BY ____________ CHECKED BY ____________ SHEET 1 OF ______

1. Well No.: ______________ Site Location: ______________________
2. Date of Installation: ______________
3. Date of Development: ______________
4. Static Water Level: Before Development ________ ft.; 24 hrs. After ________ ft.; Date/Time ________
5. Organic Vapor: Before Development ____________ ppm; After Development ____________ ppm
6. Quantity of Water Loss During Drilling, If Used: ______________ gal.
7. Quantity of Standing Water in Well and Annulus Before Development: ______________ gal.
8. Depth From Top of Well Casing to Bottom of Well: ______________ ft. (from Well Installation Diagram)
9. Well Diameter: __________ in.
10. Screen Length: __________ ft.
11. Minimum Quantity of Water to be Removed: ______________ gal.
12. Depth to Top of Sediment: Before Development __________ ft.; After Development __________ ft.
13. Physical Character of Water (Before/After Development): ______________________

    ____

14. Type and Size of Well Development Equipment: ______________________

    ____

15. Description of Surge Technique, If Used: ______________________

    ____

    ____

16. Height of Well Casing Above Ground Surface: ______________ ft. (from Well Installation Diagram)
17. Quantity of Water Removed: ______________ gal. Time for Removal: ______________ hr. / min.
18. 1-Liter Water Sample Collected: ______________ (Time) Photographed? Y / N
19. Final Turbidity in Nephelometric Units: ______________ NTUs
20. Final Imhoff Cone Measurements < 0.75 mL/L, If Applicable: ______________

HF — Rev. 4/94

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

ATTACHMENT 3.3
(continued)

WELL DEVELOPMENT DATA
(Continued)

PROJECT NAME ______________________ PROJECT No. ______________

DEVELOPED BY ____________ CHECKED BY ____________ SHEET ______ OF ______

Well No.: ______________ Site Location: ______________________

Date/ Time	Hrs. Dev./ Cum. Hrs. Dev.	Gals. Purged/ Cum. Gals. Purged	pH	Temp.	Cond.	NTUs	Remarks

HF — Rev. 4/94

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

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 or 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

Appendix B

Site Photographs

Photograph 1 – IRA Control Building

Photograph 2 – IRA Control Building Interior, Control Panel

Photograph 3 – Recovery Well (RW) Enclosures

Photograph 4 – RW Control Enclosure

Photograph 5 – RW Pump House

Photograph 6 – Sanitary Sewer Discharge Loop

FINAL PAGE

ADMINISTRATIVE RECORD

FINAL PAGE