TECHNICAL MEMORANDUM NO. 2

FOR

REMEDIAL INVESTIGATION/FEASIBILITY STUDY
CITY DISPOSAL CORPORATION LANDFILL
(DUNN LANDFILL)

PELA Reference Number 495201

Prepared for

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1.0 INTRODUCTION

Work performed at the City Disposal Corporation Landfill, Dunn, Wisconsin, is pursuant to an Administrative Order by Consent entered into by the United States Environmental Protection Agency (EPA), the Wisconsin Department of Natural Resources (WDNR), and Waste Management of Wisconsin, Inc. The Administrative Order was executed on August 25, 1987.

To comply with the Administrative Order, a Remedial Investigation/Feasibility Study (RI/FS) scope of work was submitted to EPA and WDNR. Field work for Task 3.0 (Site Investigation) was initiated November 14, 1988. Participating in the field work were representatives from P. E. LaMoreaux & Associates, Inc. (PELA) and PELA subcontractors Warzyn Engineering, Inc. and Exploration Technology, Inc. Field work for Subtasks 3.1 - 3.9 was started November 15, 1988, and completed October 12, 1989.

Technical Memorandum No. 2 has been prepared to document field activities performed to complete Subtask 3.1, Soil Sampling; Subtask 3.2, Surface-Water Monitoring; Subtask 3.3, Geophysical Survey; Subtask 3.4, Existing Monitoring Wells; Subtask 3.5, Installation of Leachate Wells; Subtask 3.6, Installation of Piezometers, Nested Wells, and Water Table Wells; Subtask 3.7, Downhole Geophysics; Subtask 3.8, Monitoring and Analysis; and Subtask 3.9, Air Monitoring; of the Technical Scope of Work (TSOW) for a Remedial Investigation and Feasibility Study (RI/FS) at the City
Disposal Corporation Landfill (Dunn Landfill) in Dane County, Wisconsin. The Work Plan developed pursuant to the TSOW provides a description of the activities to be accomplished during execution of the RI/FS. The procedures for execution of work are described in the Sampling and Analysis Plan, the Quality Assurance Project Plan, and the Health and Safety Plan. This memorandum, as specified in the Plans, provides: 1) A map showing locations of traverses for the EM conductivity survey borings for the cover-survey, and locations for collection of soil samples; 2) Map showing location of monitoring wells and surface water monitoring sites; 3) A tabulation of water level measurements; 4) Results of analyses of soil samples; 5) Borehole logs; 6) Summaries of well construction and well development; and 7) Geophysical logs.

Locations for the installation of piezometers, nested wells, and water-table wells were revised, with regulatory concurrence as recommended in Technical Memorandum No. 1, based on: a review of data from the conductivity survey (Plate 1), a review of results of air monitoring, a field reconnaissance, and a review of topographic features. The area northeast of the landfill consists of landforms produced by glaciation. Locations for proposed well nests and piezometers were revised to provide data on the lithology, water-bearing characteristics and direction(s) of ground-water flow. Wells were installed at the recommended locations upon concurrence with EPA and WDNR. The location for well nest P-3A, 3B, and 3C was revised to provide data on lithologies beneath the topographic high, and to reduce the possibility of damage to the well nest by agricultural practices. The locations for shallow wells P-6A and P-9A were revised to provide data from beneath the topographic lows. The location for shallow well P-8A
was revised to prevent damage to the well by agricultural practices. The location of shallow well P-10A was revised to provide data downgradient of anomalous conductivity and PID readings. Locations for piezometers PZ-1, PZ-2, PZ-3, PZ-7, and PZ-8 were revised to minimize the potential for damage to the piezometers by agricultural practices. Surveyed locations of wells and piezometers are shown in Plate 2.
2.0 SUBTASK 3.1 - SOIL SAMPLING

A. Soil Cover Survey

Soil samples were collected (November 15, 1988 through November 30, 1988) in accordance with the following protocol which was provided in the Technical Scope of Work (Volume 1):

1. A 100-foot grid system established on the landfill surface. Horizontal or vertical controls were surveyed by a registered, licensed surveyor - The Landmark Survey Group, Inc. (Plate 1).

2. A boring was completed, by hand auger, at each node on the 100-foot grid and thickness and lithology of the soil cover was described. Borings were completed at 177 grid locations. The cuttings were described by a PELA geologist utilizing standard rock color and grain-size charts and standard descriptive procedures. The descriptions were provided in Appendix B of Technical Memorandum No. 1 (March 6, 1989).

3. Composite samples were collected from boreholes at each of 38 locations (approximately 20 percent (20%) of the borings) for analysis of grain-size distribution (including hydrometer) and classification using ASTM-D2487-83, "Test Method for Classification of Soils for Engineering Purposes." The sample sites were selected by random generation of numbers (1 of 5). Analysis were provided in Appendix D of Technical Memorandum No. 1.
4. Bulk samples (50-pound composite samples) were collected from five (5) of the 38 borings and analyzed for permeability and proctor density. Results of analysis were provided in Appendix E of Technical Memorandum No. 1.

5. Samples were collected from the borings (as in item 3 above) and analyzed for moisture content. Analysis were provided in Technical Memorandum No. 1 (Appendix D).

6. Field density measurements were completed at the same locations as selected as described in 3 above. The field density tests were performed using a Troxler Nuclear Density Gauge. The measurements were made by Warzyn Engineering, Inc. and were included in Technical Memorandum No. 1 as Appendix C.

B. Soil Sampling for Chemical Analysis

Soil sampling was performed on September 22, 1989 (Plate 1) to assess chemical contamination of the soils. The sample collection sites were selected on the basis of landfill topography, surface drainage patterns, known locations of buried industrial waste, and provisions for a control sample. Soil sampling was accomplished by use of a push tube, at seven locations. To prohibit infiltration through the cover material and/or to eliminate ponding, all boreholes are backfilled with the cuttings and tamped. The cuttings were described by a PELA geologist using standard rock-color and grain-size charts, and standard descriptive procedures. The samples were
properly containerized and labeled, and chain-of-custody forms were completed in accordance with the Sampling and Analysis Plan. The samples were delivered to ETC, Inc., in Edison, New Jersey, for analysis of parameters on the U.S. EPA Target Compound List (TCL). Lithologic descriptions of samples are provided in Appendix A. Chemical analyses of samples are in progress.
3.0 SUBTASK 3.2 - WATER-LEVEL MONITORING

Water-level measurements are fundamental to hydrogeologic studies. Some of the major uses of water-level data are to indicate the direction of ground-water flow and areas of recharge and discharge, to evaluate the effects of stresses on the ground-water system, to define hydraulic characteristics of the aquifers, and to evaluate surface-water/ground-water relationships.

Water-level data was obtained from wells, piezometers, and from surface-water bodies. Water levels in wells and at staff gages were determined to the nearest 0.01 foot. The measurements/readings were taken in accordance with the prescribed monitoring schedule and were recorded, along with the time of measurement, method, and name of the person who performed the measurements. Measurements were taken from November 15 to December 7, 1988, and April 5 to October 12, 1989. Data are provided in Appendices B and C.

Permanent monitoring stations were established at locations on Badfish Creek and Grass Lake to assess the hydraulic relationship between the surface water and ground-water systems. Locations were surveyed by a registered, licensed surveyor (Plate 2). Staff gage readings were conducted at a minimum frequency of twice per week from November 15 to December 7, 1988, and April 5 to October 12, 1989. Data are provided in Appendix B.
Water levels in monitoring wells installed previously and wells installed as required by the TSCW were also monitored from November 15, 1988, through October 12, 1989. Data are provided in Appendix C.

On September 21, 1989, transducer probes were placed in Badfish Creek 15 feet downstream of SG-2 in 20 inches of water and well B-17 for a period of 26 hours. Readings were taken every 15 minutes to measure water level fluctuations in Badfish Creek and well B-17. Results are shown in Figure 1.

The discharge of Badfish Creek was measured, 40 feet upstream from SG-4, on four (4) separate occasions, concurrent with staff gage readings. Measurement were taken using a current meter at spaced intervals across the creek. Precise measurements were difficult to obtain, because floating grass fouled instruments, and rapid variations in stream stage, due to fluctuations in effluent discharge upstream from the gaging activities. Results of stream flow measurements are provided in Table 1.
FIGURE 1. STAGE OF BADFISH CREEK AND GROUNDWATER LEVEL FLUCTUATIONS.
Table 1. Measurement of Stream Flow, Badfish Creek

<table>
<thead>
<tr>
<th>Date</th>
<th>Start Time</th>
<th>Completion Time</th>
<th>Discharge (Cubic Feet Per Second)</th>
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<td>August, 29, 1989</td>
<td>10:13</td>
<td>12:06</td>
<td>102</td>
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<td>August 31, 1989</td>
<td>09:22</td>
<td>11:20</td>
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<tr>
<td>September 20, 1989</td>
<td>10:33</td>
<td>13:40</td>
<td>68.4</td>
</tr>
<tr>
<td>October 7, 1989</td>
<td>10:46</td>
<td>12:03</td>
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A Belforte recording rain-gage was installed on site and precipitation was monitored during field investigations. Figure 2 shows precipitation recorded during the field activities.

A microbarograph (Belforte) was installed on site to record fluctuations of barometric pressure. Copies of the charts are provided in Appendix D.
FIGURE 2. PRECIPITATION AT CITY DISPOSAL CORPORATION LANDFILL.

RAINFALL IN INCHES

MAY 22nd – OCTOBER 12th 1989
4.0 SUBTASK 3.3 - GEOPHYSICAL SURVEY

In accordance with plans for Task 3.0, an electromagnetic survey was completed, as specified in the TSOW and SAP, to obtain information on subsurface and near surface conditions (Plate 1). A Geonics model EM 34-3 XL conductivity meter was used to perform the geophysical survey. The geophysical survey field work was initiated November 15, 1988, and completed on December 7, 1988. Initially a 40-meter coil spacing was utilized along the 100-foot grid system. Horizontal and vertical dipole modes were read and recorded. In addition to data collected at nodes of the grid system, an EM survey was performed around the periphery of the landfill. Subsequent to the completion of the 40-meter coil spacing surveys, EM data were collected at each node using 20- and 10- meter coil spacings in both the horizontal and vertical dipole modes. Data recorded from the surveys and six (6) contour maps of conductivity values were provided in Appendix F and Appendix G of the Technical Memorandum No. 1.

Results of the geophysical survey, in conjunction with other information, were used during final selection of locations of leachate wells and monitoring wells.
5.0  SUBTASK 3.5 - INSTALLATION OF LEACHATE WELLS

In accordance with the TSOW and Technical Memorandum No. 1, four leachate wells (LW-1 through LW-4) were installed. The wells were drilled and constructed from July 12 to July 14, 1989. The locations of leachate wells are shown on Plate 2. Level B personal protective equipment was used during the drilling of all four (4) leachate wells until the top of the refuse was penetrated and air monitoring in the work zone indicated PID levels less than 5 ppm. The leachate wells were constructed so as not to penetrate the bottom of the fill or refuse materials. Specifics on drilling and well construction for each leachate well is provided in Table 2 and Appendix G. Sampling was accomplished using a split-spoon sampler. Descriptions of samples are provided in Appendix E.

In accordance with the TSOW and the Sampling and Analysis Plan (SAP), laboratory analyses for parameters on the target compound list were completed on selected samples. Sample selection was based on field screening with a calibrated photoionization detector (PID) (See Appendix I) of samples as retrieved. Only one soil sample, collected from the interval 27 to 29 feet below land surface at LW-4, had an elevated PID reading. The results of laboratory analysis are provided in Appendix F.
6.0 SUBTASK 3.6 - INSTALLATION OF PIEZOMETERS, NESTED WELLS, AND WATER TABLE WELLS

Wells were installed from April 6 to August 10, 1989, to determine the thickness of glacial deposits, hydrology of deep water-bearing zones in the glacial deposits, the relationships between ground-water, surface-water, glacial deposits, and bedrock, and to provide means for sampling ground water. Refer to Appendices A and E for lithologic descriptions, Appendix C for water-level measurements, and Appendix G for details on well construction. Information obtained from deep borings and installation of shallow piezometers was used to establish locations for additional wells, intervals to be screened, number of wells required for each well nest, and appropriate drilling techniques. Rationale and recommendations for the replacement of all the existing wells was provided in Technical Memorandum No. 1. Ten new wells were installed (B-6RR, B-7RR, B-9AR, B-9RR, B-12RR, B-14RR, B-16RR, B-17RR, B-18RR, and B-19RR).

Shallow piezometers (PZ-1 through PZ-9) and water table monitoring wells (P-5A through P-10A) were installed during the initial phase of the well installation program (Plate 2). Initial locations for wells were based on a triangular grid to provide a geometric network for computing ground-water gradient and flow direction.

The second phase of the well installation program consisted of drilling and installation of monitoring wells in bedrock. Evaluation of data obtained from drilling each bedrock well was used to determine the number of wells in each well nest and the interval to be screened in each well. Four well nests were installed. Each nest
consists of a bedrock well, a water table well and a well installed at an intermediate depth in a more permeable zone in the glacial material. Locations for well nests are shown on Plate 2.

An experienced geologist was present during drilling to supervise drilling operations, collect samples, and to prepare field descriptions of the samples and documentation of activities during drilling. Drilling equipment was cleaned using a steam-cleaner and non-phosphate detergent before each well was drilled.

**Piezometer (Water-Level Observation Well) Installations**

After completion of each boring, 2-inch, schedule 40 PVC casing and screen was installed. The casing was sealed with bentonite and grouted to land surface. The well points were set so the screened interval intercepts the water table. The well screen length was a minimum of 15 feet. Construction details are provided in Table 2.

**Well Installations**

Selection of the drilling method was based on several factors:

1. Hydrogeologic environment:
   a. Type(s) of lithologic material,
   b. Depth of drilling,
   c. Depth of desired screen setting below water table.

2. Purpose of study.

3. Location of drilling site.
4. Required design of monitoring wells.

5. Availability of drilling equipment.

The drilling method used for installation of the monitoring wells and leachate wells was the hollow-stem continuous-flight auger method with split-spoon samples. Mud rotary and rock core-drilling methods were used at depth and for bedrock wells.

The hollow-stem auger method provides numerous advantages to other drilling methods:

1. Auger drilling rigs are generally fast, mobile, and relatively inexpensive to operate in unconsolidated materials.

2. Drilling fluid is not required, therefore introduction of additional fluids can be minimized.

3. The problem of hole caving in saturated, unconsolidated material, is overcome by placing the casing and screen inside the hollow stem before the augers are removed.

4. Undisturbed samples are collected via split spoons, Shelby tubes or continuous samplers.

5. Natural gamma-ray logging can be performed inside the hollow stem which permits definition of the lithology and thickness of subsurface units.

6. Sand pack is installed in the annulus between the well screens and auger.

7. Grout is placed above the sand pack in the annulus between the casing and hollow stem and the augers are pulled out. Grout is continuously injected until augers are removed.
The split-spoon sampler is advanced with blows from a 140-pound hammer falling 30 inches (automatic or manual systems). By recording the blows and exact distance advanced, the resistance of the material can be determined.

Following retrieval of drilling samples, the material was placed in an appropriate container and sealed to prevent loss of moisture. Descriptive information was entered in the on-site geologist's field log forms. Final logs are provided in Appendix E.

In accordance with the TSOW and the SAP, laboratory analyses for parameters on the target compound list were completed on selected samples. Sample selection was based on field screening with a PID. No soil samples recovered during the construction of piezometers, water-table wells, or nested wells had elevated PID readings.

During construction of well P-2A, PID readings greater than 5 ppm were recorded in the open borehole when the total depth of the borehole reached 36 feet below land surface. A composite sample was collected over the interval 32 to 36 feet below land surface. Results of analysis are provided in Appendix F.

**Rock Coring**

Bedrock wells required drilling and sampling of consolidated rock material. Borings to refusal were completed as described above. Bedrock coring was then initiated. Coring was performed through a surface (temporary) casing. An HQ (2-7/8 inches) wireline system was used for coring. When drilling fluids were used the type and quantity of fluids were properly documented. The drilling mud additive used during
mud rotary drilling was Quik-Gel, a finely ground sodium bentonite manufactured by Baroid. Chemical analyses provided by the manufacturer indicate the additive is comprised of 55.44 percent S:O₉, 20.14 percent A1₂O₃, 3.67 percent Fe₂O₃, 0.49 percent CaO, 2.49 percent MgO, 2.76 percent Na₂O, 0.60 percent K₂O, 5.50 percent bound water, and 8.00 percent moisture at 220°F. Quik-Gel also contains a small amount of non-toxic organic polymer.

Packer tests were executed at 5-foot intervals in bedrock. Packer tests were performed by setting an H packer in the 3 7/8-inch corehole above the interval to be tested. A Brainard-Kilman 1.7-inch piston displacement pump was then used to withdraw water from the test interval, and the pump was removed from the well. Water-level measurements were taken as the water level recovered (Appendix J).

Drill cuttings and samples (regardless of drilling and sampling method) were described on site by a PELA geologist/hydrogeologist. Information was recorded on logging forms and/or in bound field books, and includes the following:

* Description of the material recovered in each run;
* Project identification, boring number, location, date boring began, date boring completed, driller’s name, and geologist’s name;
* Elevation of the ground surface;
* Elevation of or depth to ground water and changes in water level, including the dates and the times measured;
* Size, type, and design of sampler used;
* Size, type, and set of core bit and reaming shell used;
* Size, type, and length of all casing used;
* Length of each core run and the length or percentage, or both, of the core recovered;
* Standard penetration resistance (N);
* Any change in the character of the drilling fluid or drilling fluid return if fluids used with rock coring;
* Drilling time in minutes per foot;
* Boring number and location;
* Sample number;
* Sample interval/length of sample;
* Date and time;
* Any special feature.

**Well Construction**

Details of well construction are provided in Table 2 and in monitoring well construction summaries (Appendix G).

Well screens, including the bottom plug, were decontaminated immediately prior to assembly. Precautions were taken to assure that grease, oil, or other contaminants did not contact the well screen.

Flush threaded, 2-inch PVC casing and screen was used for well construction. Wells completed in bedrock were constructed using schedule 80 PVC. All other monitoring wells were constructed with schedule 40 PVC. The casing was certified by
the National Sanitation Foundation. The threaded part of each PVC joint was wrapped with Teflon tape.

The screen and casing were lowered to the predetermined level and held in position by suspending the string of riser pipe or, if the string tended to float, by manipulating the hydraulic ram. The length of well screens and slot sizes were determined on the basis of conditions encountered during drilling, lithologic characteristics, and interpretation of geophysical logs. On deep holes where the weight of the string of riser pipe was significantly more than the flotation force, care was taken to keep the riser pipe plumb. The riser was trimmed to the proper length after the grout was in place.

A sand pack consisting of .85 - .95 graded silica sand was emplaced above the uppermost row of slots in the well screen. For specifics on each well see Appendix G. The volume of sand pack required to fill the annular space between the well screen and the borehole was computed and measured.

The interval to be screened in each water table monitoring well was selected based on interpretation of the lithologic and geophysical logs for each well. The top of the screened interval was placed above the water table. Initially, the monitoring wells were constructed such that the top of the screen is below the water table in order to minimize the possibility of contamination of the groundwater samples by soil gases. Upon numerous discussions and concurrence with EPA, these wells (P-1C, P-2C, P-3C, P-4C, B-6RR, and B-7RR) were replaced with wells in which the screen extends above the water table. Wells B-14RR and B-17RR were constructed with screens
approximately 0.7 to 0.9 feet below the water table due to the proximity of the water table to land surface in the area of these wells. In each of these wells the sand pack extends above the water table.

The well screen was centered in the borehole by centralizers attached to the screen. The sand pack was placed in increments, as required to assure that no voids were left in the gravel pack. The level of each layer of sand pack and seal was verified and recorded.

While holding the riser pipe with the drill rig, the hollow stem augers were carefully withdrawn to the top of the gravel pack and a volume of bentonite to create a seal three to five feet in thickness was measured and carefully poured into the annular space.

The volume of grout required to completely fill the annular space between the seal and the ground surface was prepared in the proportions specified below. Portland Cement Type I (ASTM C 150) was mixed with water in the proportions of six to eight gallons of water per sack of cement. Between two and four pounds of bentonite powder was added to the mix for each sack of cement used. These proportions produced a cement-bentonite grout that could easily be pumped using the drilling rig pump. Grout was injected via a tremie pipe the opening for which was temporarily set immediately above the bentonite seal. The grout was pumped through the tremie pipe continuously until it flowed at the surface. The tremie pipe was equipped with a side discharge to prevent high pressure erosion of the bentonite seal.
The hollow-stem augers were removed before the grout began to set. Grout was pumped into the annular space so as to maintain a continuous column of grout up to the ground surface.

The riser pipe was not disturbed until 48 hours after grouting was completed, except to take water level measurements. The riser pipe was trimmed while the grout was plastic or at least 48 hours after the hole was grouted. Precautions were taken to prevent pipe cuttings from entering the riser. A vented cap was installed on the top of the riser pipe.

A well protector of 4 1/2-inch diameter anodized aluminum was set in the wet grout. Each well protector was positioned and maintained in a plumb position. Grout which overflowed the borehole was removed to prevent the formation of horizontal projections (mushrooming) which may be subject to frost heave. A 1/4-inch diameter hole was drilled in the well protector 6 inches above the ground surface to permit water to drain from the annular space. Sand was placed in the annular space up to 6 inches above the hole to prevent insects from entering through the drilled hole. The well numbers are clearly marked on the outside of the protective casing and on the underside of the protective locking cap.
7.0  SUBTASK 3.7 - GEOPHYSICAL LOGGING

Downhole geophysical logging (natural gamma ray) was performed on boreholes and wells from April 9 to July 15, 1989. All logs were run using a truck-mounted MLS 3500 Series Portable Logging System.

A natural gamma log measures the natural radiation of gamma rays from the materials present in the subsurface. Certain lithologies, such as clays and shales, exhibit high gamma ray counts. Clean quartz sands and carbonates typically exhibit low gamma ray counts. Gamma ray logs are used primarily to define lithologic intervals.

Geophysical logging was used in this investigation to aid in selection of screen settings for wells installed and for use in correlation of lithologies penetrated in drilling. Copies of gamma ray logs run on 28 boreholes/wells are provided in Appendix H.
8.0 SUBTASK 3.8 - MONITORING AND ANALYSIS

The importance of proper sampling techniques can not be over-emphasized. Precautions were taken to insure samples were representative of groundwater in the aquifer(s) and to insure samples were neither altered nor contaminated by sampling and handling procedures. Water samples are being analyzed for volatile organics, extractibles (BNA), metals, and other parameters as described in Section 5.0 (Sample Analysis and Handling) and Section 5.1.3 (Laboratory Analysis - Water) of the SAP. Quality assurance samples included: field duplicate samples - one per group of 10 or fewer investigative samples, field blank samples - one per group of 10 or fewer, and matrix spike/matrix spike duplicate - one per group of 20 or fewer.

Ground-Water Samples

Ground water sampling was accomplished from September 25 to October 12, 1989. Sampling began with on-site wells considered to have the least possibility of being contaminated and proceeded to well considered to have the greatest possibility of being contaminated. The composition of the water within the well casing and in close proximity to the well is generally not representative of the overall ground-water quality at the sampling site. This is due to the potential for drilling contaminants near the well and possible lateral variation in oxidation reduction potential. For these reasons, the well is pumped until it is thoroughly flushed of standing water. The sample is representative of water contained in the aquifer.
All on-site wells were equipped with dedicated positive displacement pumps (Well Wizards). A description of well wizards was provided in the SAP. Procedures outlining the sample collection process are provided below.

The depth to water in the well was measured with an electrical probe. Based on the water-level measurements and the depth of the well, the volume of standing water in the well was calculated. The well was purged using the dedicated pump. The standard procedure was to pump until a minimum of four well volumes had been removed from the well.

The standard order of sampling was as follows: volatiles, extractibles, metals, cyanide, pH/specific conductance, fluoride, chloride, total organic carbon, phenols, nitrate/nitrite, bicarbonate/carbonate/total dissolved solids/sulfate, and ammonia/total Kjeldahl nitrogen.

The water sample was carefully poured from the discharge line directly into sample containers. Care was taken to minimize agitation during transfer of the sample. All sample containers for analysis for volatile organics were filled completely, sealed, and closely inspected to ensure that no trapped air remained within the vial, which may affect the subsequent analysis. If recharge of the well was slow, the samples for volatile organic compounds were collected as soon as recharge was sufficient to obtain the appropriate sample volume. The remainder of the samples were collected when the well fully recovered.
No ground-water was detected or measured in leachate wells LW-1, LW-2, LW-3, and LW-4 during RI field investigations, therefore, no ground-water samples were collected from these wells.

Field measurements of pH, specific conductance, and temperature were performed using procedures recommended by the manufacturers of the meters, and procedures provided in The SAP and Quality Assurance Program Plan (QAPP). Specific conductance measurements were performed prior to pH measurements. Logging of instrument calibration is provided in Appendix I.

Samples for analysis of metals from on-site monitoring wells were filtered at the well head by use of an end-line filter on the pump discharge line. After sampling the filter was cut open to describe any filter cake.

**Surface-Water Samples**

No surface water runoff was evident during RI field investigations, therefore, no surface water samples were collected.

**Private Water Supply Samples**

Ground-water samples were collected from four (4) domestic wells in the vicinity of the landfill on October 6 and 10, 1989. The wells were sampled from a tap or access at a point closest to the well and prior to any treatment, filtration and/or storage. The system of water withdrawal and piping at each well was photo-documented and notes entered in log books. Samples were collected directly into the sample bottles after
sample bottles after running the water sufficient time to empty the pipe system and, if possible, storage tanks.

Samples were containerized in appropriate bottles, packed in shuttles and transported to the laboratory with properly executed documentation in accordance with procedures described in the QAPP. Sample analysis is in progress.
9.0 SUBTASK 3.9 - AIR MONITORING

Air monitoring was performed during site activities as a part of the Health and Safety Plan. Air monitoring was performed from November 15 to December 7, 1988; April 6 to August 10, 1989; and August 22 to October 12, 1989. The information was used to assess the need for personal protection and to provide qualitative screening of soil samples. Air monitoring was performed during the cover survey, soil sampling, installation of nested wells, and water sampling. The monitoring was performed with an HNU photoionizer meter, or photoionization detector (PID). The instruments were calibrated (Appendix I) and operated in accordance with manufacturers guidelines and standard procedures. Air monitoring records are in bound field log books of documentation during field activities.
10.0 DOCUMENTATION

To assure uniformity and completeness, standard forms were used for sample description, drilling, and well construction details. The field logs have been submitted along with monthly progress reports. Final logs and summaries of well construction forms are included in Appendices of this report. Each form has a serial number to aid in document control and data management. Table 3 provides a correlation chart of the forms and serial numbers.
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