Roy F. Weston, Inc.
Suite 500
750 East Bunker Court
Vernon Hills, IL 60061-1450
847-918-4000 • Fax 847-918-4055
www.rfweston.com

30 June 2000

Mr. Russell D. Hart
Remedial Project Manager (HSRW-6J)
United States Environmental Protection Agency
Region 5
77 West Jackson Boulevard
Chicago, Illinois 60604

RFW Work Order No. 02687.007.003
KMC Work Order No. 40-50-01-AKW-A

Re: Revised QAPP Addendum for Groundwater Remedy Performance Monitoring
Moss-American Site, Milwaukee, Wisconsin

Dear Mr. Hart:

Roy F. Weston, Inc. (WESTON), on behalf of Kerr-McGee Chemical LLC (KMC), is submitting the attached revised Quality Assurance Project Plan (QAPP) addendum which addresses the agency's comments. In accordance with EPA QAPP guidance, only new or revised subsections/ appendices are included in the addendum.

If you have any questions or require additional information, please do not hesitate to contact me at (847) 918-4142, or Keith Watson at (405) 270-3747.

Very truly yours,

ROY F. WESTON, INC.

Thomas P. Graan

Thomas P. Graan, Ph.D.
Principal Project Manager

TPG:sk

Attachments

cc: K. Watson, KMC
G. Edelstein, WDNR

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Response to 14 June 2000 Comments
Installation of Groundwater Remedial System
Moss-American Site
Milwaukee, Wisconsin

RESPONSE TO U.S. EPA COMMENTS

U.S. EPA Comment 1: *The dates of QAPP approval for which this Addendum 1 is applicable should be provided in the text or on the signature page. The reviewer should be able to compare QAPP and QAPP Addendum for consistency.*

KMC Response: A paragraph has been included at the beginning of the QAPP Addendum that states the original QAPP name and approval date.

U.S. EPA Comment 2: *It should be clearly identified in Section 3.4 that the same lab (Lancaster) is doing the analysis for treatment as previously approved for monitoring.*

KMC Response: Section 3.4 has been modified to more clearly identify that the laboratory (Lancaster Laboratory) identified and approved for use in the original QAPP is doing all of the analytical work with the exception of microbial enumeration.

U.S. EPA Comment 3: *The definition of containment samples should be included in this Addendum for the better understanding the project by the reviewer.*

KMC Response: Containment wells are six wells (MW30S, MW31S, MW32S, MW33S, MW36S, and MW37S) that are located between the edges of the funnel and gate system (see Figure 2-2). These wells were installed and are being sampled to ensure that the funnel-and-gate system is containing and directing the contaminant plume toward the treatment gates. These wells will be analyzed on a quarterly basis, for BTEX and PAHs.

U.S. EPA Comment 4: *Section 2.7 of the QAPP referenced Table 2-1A of the FSP for the analytical parameters to be tested for treatment and containment performance. Last sentence of Section 2.7 identified that analytical parameters for containment performance wells will be similar to the groundwater monitoring. In the monitoring data package I did not see any reported results for most parameters listed in Table 2-1.A, except BTEX and PAHs.*

KMC Response: The last sentence of section 2.7 has been deleted to prevent confusion. Table 2-1a has also been modified to more effectively show the monitoring program.

U.S. EPA Comment 5: *Section 8.1. It is not clear why the treatment sample collections done in two stages: monthly for some analytes and quarterly for others. The rational for this should be provided. How often the monitoring sampling is done?*

KMC Response: Section 8.1 has been modified to clarify the difference between monthly and quarterly samples. The monthly samples are field and operating parameters that will be used for optimizing the nutrient and dissolved oxygen levels in the water. The quarterly samples will help to measure the treatment being accomplished by the treatment system.

U.S. EPA Comment 6: *Section 10.2.2. The information of the data validation/review is performed for the nitrate/nitrite nitrogen; BOD, COD, TOC, and microbial sampling should be provided.*

KMC Response: The groundwater nutrients and microbial enumeration sampling data will be reviewed against the corresponding analytical SOPs and the procedures listed in this QAPP.

U.S. EPA Comment 7: *Tables 4-1a and 8-1a are identical. Is it necessary to have two tables providing the same information in the QAPP?*

KMC Response: Table 8-1a is being deleted from the QAPP addendum. The reference in section 8.1 to Table 8-1a has been changed to Table 4-1a.

U.S. EPA Comment 8: *Section 2.1.4 of FSP, page 2 of 12. Provide more details about the treatment and collecting the data before, during and after the treatment. How long the treatment will continue month, two months, quarter, etc. See comment 5 of the memo.*

KMC Response: The sampling strategy was more clearly defined under comment 5 and section 8.1 of the QAPP addendum. The pilot treatment operation is anticipated to last for 18 to 24 months.

U.S. EPA Comment 9: *If the samples will be collected quarterly, does it provide sufficient data to reevaluate the sampling strategy after first six months (Section 2.1.4, page2).*

KMC Response: Years of groundwater sampling has provided known baseline conditions. Two quarterly rounds of sampling data during the pilot operation are anticipated to show enough information to re-evaluate the system.

U.S. EPA Comment 10: *Section 3.2.1 of FSP. Explain why field duplicate samples will not be collected for water quality parameters which will be collected once a month. We strongly recommend collecting field duplicate samples.*

KMC Response: The monthly sampling parameters are the pilot study field and operating parameters that will be used to optimize the nutrient and dissolved oxygen levels in the groundwater. These parameters are not cleanup quality parameters and have no impact on cleanup standards. Duplicate samples will not be collected for the monthly monitoring parameters.

U.S. EPA Comment 11: *The attached Lancaster Laboratory Quality Assurance Plan was not reviewed, because it provides a lot information not applicable to the project.*

KMC Response: The Lancaster Laboratory Quality Assurance Plan is an all inclusive QAPP for all phases of work that Lancaster Laboratory is providing at the Moss American site. The pages that were included with the QAPP addendum were pages that were changed so that the laboratory QAPP covered the changes of this addendum.

1.0 INTRODUCTION

This QAPP addendum prepared by Roy F. Weston, Inc. (WESTON), on behalf of Kerr-McGee Chemical, LLC (KMC), addresses the groundwater sampling and analysis associated with the groundwater treatment and containment performance monitoring program. The original QAPP for the Installation of the Groundwater Remedial system was dated October 1999 and approved by U.S. EPA in November 1999.

2.5.2 Project Objectives

The groundwater sampling and analysis program for groundwater treatment and containment performance monitoring is designed to provide groundwater elevation and analytical data necessary to monitor the performance of the treatment gates and to ensure that contaminants do not migrate laterally around the edges of the funnel-and-gate system.

2.7 PARAMETERS TO BE TESTED AND FREQUENCY

Table 2-1a of the Field Sampling Plan (FSP) (Appendix A) presents the groundwater analytical parameters and frequencies of sample collection for treatment and containment performance wells.

3.2.2 Validation of Analytical Data

For both groundwater treatment and containment performance monitoring sampling, only the groundwater samples collected quarterly and analyzed for benzene, toluene, ethylbenzene, and xylenes (BTEX collectively) and polynuclear aromatic hydrocarbons (PAHs) will undergo complete validation. Validation will be in accordance with specifications outlined in Section 9 of the QAPP.

3.4 LABORATORY OPERATIONS

All analyses will be conducted by Lancaster Laboratories with the exception of microbial enumeration. Lancaster Laboratories of Lancaster Laboratories was identified as the laboratory in the initial QAPP and has performed the laboratory analysis for all phases of work. BioRenewal Technologies, Inc., (BioRenewal) of Madison, Wisconsin is anticipated to perform the microbial enumeration analysis. Figure 3-2 presents an overview of the BioRenewal organization chart. Appendix F contains the BioRenewal Standard Operating Procedure (SOP) detailing the microbial enumeration procedures.

BioRenewal Technologies, Inc., Project Manager

Mr. Dave Hitchins will serve as the project manager for BioRenewal.

BioRenewal Technologies, Inc., Quality Assurance/Quality Control (QA/QC)

Ms. Joanne Simanic will serve as the project QA/QC manager for BioRenewal.

4.2 ACCURACY, PRECISION, AND SENSITIVITY OF ANALYSIS

Table 4-1a presents the project analytical limits, project detection limits, and laboratory method detection limits for analysis of the groundwater performance monitoring samples.

7.1 FIELD INSTRUMENTS/EQUIPMENT

Field instruments to be used during sampling of the Moss-American treatment performance monitoring wells will include the following:

- Combination pH, temperature, and specific conductance meter.
- Redox potential meter.

- Dissolved oxygen meter.
- Water level indicator.

The calibration, checkout, and maintenance programs for each instrument are outlined in the respective SOP's presented in Appendix E, along with the procedures for field measurements.

8.1 OFF-SITE LABORATORY ANALYTICAL SERVICES

Groundwater samples collected from the treatment performance monitoring wells will be analyzed on a monthly and quarterly basis. The monthly samples are field and operating parameters used to optimize the nutrient and dissolved oxygen levels in the water. The quarterly samples will help to measure the treatment being accomplished by the treatment system. Typically, bioremediation don't produce immediate results. Therefore, quarterly sampling is sufficient to gage the efficiency of performance. The frequency and parameters for the treatment performance monitoring wells are as indicated below:

- Monthly, groundwater samples will be collected and measured for temperature, pH, specific conductance, dissolved oxygen concentration, and redox potential using field instrumentation; and laboratory-analyzed for microbial enumeration, nitrate-nitrogen, Kjeldahl nitrogen, ammonia nitrogen, total phosphate-phosphorous, and orthophosphate-phosphorous.

- Quarterly, groundwater samples will be collected and analyzed for five-day biochemical oxygen demand (BOD_5), chemical oxygen demand (COD), total organic carbon (TOC), BTEX, and PAHs.

The frequency and parameters for the containment performance monitoring wells (MW30S, MW31S, MW32S, MW33S, MW 36S, and MW37S) are as indicated below:

- To ensure that the funnel-and-gate system is containing and directing the contaminant plume toward the treatment gates, quarterly groundwater samples will be collected from the six containment performance monitoring wells and analyzed for BTEX and PAHs.

Please note that the parameters, frequency, and schedule associated with sampling of the containment performance monitoring wells will be similar to the site-wide groundwater monitoring program.

Table 4-1a identifies the analytical method and laboratory detection limit for each groundwater parameter. Table 2-1a in the FSP (Appendix A) identifies the laboratory parameters for each medium to be sampled and the corresponding QC samples.

The sampling strategy will be reevaluated after the first 6 months of pilot operation.

10.1 FIELD MEASUREMENTS AND SAMPLE COLLECTION

Raw data from groundwater field measurements (pH, temperature, specific conductance, redox potential, and dissolved oxygen) will be appropriately recorded in the field logbook. If the data are used in the project reports, the data will be reduced or summarized, and the method of reduction will be documented in the report.

10.2.2 Data Validation

Data validation will occur for the quarterly groundwater sampling (BTEX and PAHs) only. Data validation for the groundwater samples collected for analysis of BTEX and PAHs will be in accordance with the applicable methods, SOPs, and U.S. EPA Functional Guidelines (as applicable). A complete data review will not be conducted for the groundwater nutrients, nitrite-nitrogen, nitrate-nitrogen, BOD_5, COD, TOC, or microbial enumeration sampling. The groundwater nutrients and microbial enumeration sampling data will be reviewed against the corresponding analytical SOPs and the procedures listed in this QAPP.

12.1 FIELD EQUIPMENT/INSTRUMENTS

The field equipment for the performance groundwater sampling includes a combination temperature/pH/conductivity meter, a redox potential meter, a dissolved oxygen meter, and a water level indicator. Specific preventative maintenance procedures for this equipment are discussed in the SOPs in Appendix E, and will be conducted in accordance with the manufacturers specifications.

13.1 FIELD MEASUREMENTS

Field data will be checked for compliance with the established QC criteria that are specified in the QAPP and FSP. Data from field measurements of pH, specific conductance, temperature, redox potential, and dissolved oxygen will be assessed by thorough review of QC data (e.g., calibrations, standards, blanks, and replicates), documentation that analytical procedures were followed, and reports from system audits.

FIELD SAMPLING PLAN

2.1 SAMPLING DESIGN AND RATIONALE

The groundwater sampling program is designed to monitor the effectiveness of the funnel-and-gate groundwater treatment system during the pilot operation period of approximately 18 months. Two categories of groundwater monitoring wells (treatment performance monitoring wells and containment performance monitoring wells) will be installed as part of the treatment system performance monitoring plan. The monitoring, maintenance, and sampling protocols were previously described in the Final (100 Percent) Design for Groundwater Remedial System Report (March 1998). Table 2-1a summarizes the anticipated sampling effort. Details of the sampling program are discussed in the following subsections.

2.1.4 Treatment Performance Monitoring Wells

The treatment performance monitoring system consists of a total of 18 groundwater monitoring wells. Three treatment performance monitoring wells will be installed at each of the six treatment gates (TG1 – TG6). The specific locations of these wells and their designations are:

- One well will be installed approximately 10 feet upgradient of each treatment gate and will be designated as well number one (1) for each respective gate (i.e., TG1-1, TG2-1, TG3-1, TG4-1, TG5-1, and TG6-1).
- One well will be installed at the center of each treatment gate and will be designated as well number two (2) for each respective gate (i.e., TG1-2, TG2-2, TG3-2, TG4-2, TG5-2, and TG6-2).
- One well will be installed approximately 10 feet downgradient of each treatment gate and will be designated as well number three (3) for each respective gate (i.e., TG1-3, TG2-3, TG3-3, TG4-3, TG5-3, and TG6-3).

Figure 2-2 presents the location of the treatment performance monitoring wells.

The purpose of the wells is to provide groundwater elevation and analytical data necessary to monitor the performance of the treatment gates. Specifically, groundwater elevation data will be

used to measure the horizontal hydraulic gradient induced within each gate. The hydraulic gradient will then be used to evaluate groundwater flow velocities and residence times through the treatment gates. These data will be collected every quarter.

During the pilot operating period, the treatment performance monitoring wells will be sampled and analyzed according to the following schedule:

- Monthly, groundwater samples will be collected and measured for temperature, pH, specific conductance, dissolved oxygen concentration, and redox potential using field instrumentation; and laboratory-analyzed for microbial enumeration, nitrate-nitrogen, Kjeldahl nitrogen, ammonia nitrogen, total phosphate-phosphorous, and orthophosphate-phosphorous.

- Quarterly, groundwater samples will be collected and analyzed for five-day biochemical oxygen demand (BOD_5), chemical oxygen demand (COD), total organic carbon (TOC), benzene, toluene, ethylbenzene, xylene (BTEX collectively), and polynuclear aromatic hydrocarbons (PAHs).

Analytical data obtained from these wells will provide an indication of the groundwater chemistry before, during and after treatment at each treatment gate. The pilot treatment operation is anticipated to last 18 to 24 months. After the first six months of monthly sampling and two quarters of quarterly sampling, the sampling strategy will be reevaluated. If no dynamic changes (contaminant flux) occurs during the first two quarters, the sampling frequency is likely to be decreased. If dynamic changes occur, the sampling frequency is likely to be increased.

2.1.5 Containment Performance Monitoring Wells

The containment performance monitoring wells will consist of a total of six new monitoring wells (MW-30S, MW-31S, MW-32S, MW-33S, MW-36S, and MW-37S) installed to supplement the 17 existing monitoring wells. Figure 2-2 presents the location of the containment performance monitoring wells. The purpose of these wells is to provide groundwater elevation and analytical data necessary to ensure that contaminants do not migrate laterally around the

edges of the funnel-and-gate system. Parameters, frequency, and schedule associated with the sampling of the containment performance monitoring wells will be similar to groundwater sampling program of existing monitoring wells.

Groundwater elevation data will be collected from the six new monitoring wells on a quarterly basis. These measurements will be used to determine the hydraulic properties (i.e. hydraulic gradient, groundwater flow volume, groundwater flow velocity, etc.) occurring throughout the site.

To ensure that the funnel and gate system is containing the contaminant plume and directing the plume toward the treatment gates, the six new monitoring wells will be sampled quarterly and analyzed for BTEX and PAHs.

3.1.4 Monitoring Well Installation

All groundwater monitoring wells will be installed in accordance with Wisconsin NR 141 regulations. The well construction specifications are as follows:

- All well casings and screens will be 2 inches in diameter. Well screens will be 5 or 10 feet in length (depending on the depth and thickness of the groundwater-bearing zone) and will have slot openings that are 0.010 inches wide.
- A filter pack consisting of clean, well-graded No. 30 silica sand will be installed around the well screen and extend to a point that is a minimum of 2 feet above the top of the well screen. If the well is constructed in an area where the water level is less than 5 feet below ground surface, the filter pack may be installed to a point that is not less than 6 inches above the top of the well screen.
- A filter pack seal consisting of clean fine sand will be installed on top of the filter pack and will extend to a point that is feet above the top of the filter pack. If the well is constructed in an area where the water level is less than 5 feet below ground surface, the filter pack seal may be installed to a point that is not less than 6 inches above the top of the filter pack.

- An annular space seal consisting of hydrated bentonite pellets or chips will be installed on top of the filter pack seal to a point that is 2 feet above the top of the filter pack seal.

- A ground surface seal consisting of bentonite chips will be installed on top of the annular space seal to a point that is 12 inches below ground surface. The remaining 12 inches of annular space will be filled with topsoil. Because of the potential for frost heave at the site, concrete will not be used as a ground surface seal.

- A protective steel cover with a minimum diameter of 4 inches will be installed around the well casing. The protective cover will extend from the bottom of the ground surface seal to a minimum of 24 inches above the ground surface. The protective cover will have a locking cover and a lock will be installed. Figure 3-1 presents a well construction diagram.

After installation of all monitoring wells, each well will be developed using the following procedure:

- All equipment to be introduced into the well will be decontaminated in accordance with procedures outlined in Section 3.3.

- The depth to the water level in the well and the total depth of the well will be measured with an electrical sounding device. The depth to the water and time of measurement will be recorded. The reference point for these depths will be the top of casing. The volume of standing water in the well will be calculated. Volume of water in a 2-inch-diameter well (gallons) = water column height (feet) × 0.163 (gallons/foot). The volume of water in the well (well volume) will be recorded.

- Each well will be developed by alternatively surging and purging for a minimum of 30 minutes. The surge and purge cycle will consist of several minutes of surging followed by several minutes of purging to remove the material collecting in the bottom of the well. The surging will be accomplished by rapidly moving a weighted bailer or surge block in the screened interval. This action will displace and suspend any silt or fine sand buildup in the filter pack. Purging the well using a bailer or pump to remove the groundwater and suspended sediment will follow surging.

- A positive displacement pump (peristaltic or equivalent), or disposable bailer will be used for monitoring well development. Equipment will be decontaminated before being used in the well. A minimum of three well volumes will be purged from the well. After purging the third well volume, measurements of groundwater pH, temperature, and specific conductance will be recorded. Well development will continue until the groundwater pH, temperature and specific conductance is stable for two consecutive well volumes ($\pm$ 0.25 units for pH, $\pm$ 1 degree C for temperature, and $\pm$ 10 % for specific conductance). A maximum of five well volumes will be purged during the well development.

- If the well can be purged dry, the well will be developed in a manner that limits agitation by slowly purging the well dry. Wells that can be purged dry may not be surged and no water will be added to the well.

Well development water will be containerized in 55-gallon drums and stored onsite for future treatment and/or disposal.

3.1.5 Treatment and Containment Performance Monitoring Well Sampling Protocol

Treatment and containment performance monitoring wells will be sampled using the following procedures:

- Upon removing the protective cap to the monitoring well riser, the headspace will be screened for the presence of volatile organic vapors. The purpose of this screening is strictly for health and safety monitoring and not for characterization. The measured values will be recorded in the field log book.

- The depth to water will be measured with an electrical sounding device with a precision of $\pm$ 0.01 feet. The measuring point will be a marked and surveyed point on the top of the inner well casing. The depth to water will be recorded in the field logbook.

- The volume of standing water in the well (well volume) will be calculated and recorded in the field logbook.

- A pre-cleaned, disposable bailer or a submersible pump (peristaltic or equivalent) will be used to purge each well. A minimum of three well volumes and a maximum of five well volumes will be removed from each well prior to sample collection.

- After removal of each well volume, field measurements of groundwater pH, specific conductance, and temperature will be taken. Purging of the wells will continue until the groundwater pH, temperature, and specific conductance stabilize ($\pm$ 0.25 units for pH, $\pm$ 0.5 degrees C for temperature, and $\pm$ 10 % for specific conductance), or until five well volumes have been purged. The pH, temperature and specific conductance measurements will be recorded in the field logbook or on standardized sampling forms.

- After stabilization of the groundwater pH, temperature, and specific conductance and prior to sample collection, the groundwater redox potential and dissolved oxygen concentration will be measured.

- In the event that a monitoring well goes dry before three well volumes have been purged, the well will be allowed to recharge for 15 minutes and will then be purged dry again before the groundwater sample is collected.

- Groundwater samples will be directly poured into the sample container from the bailer or pump tubing after the well purging has been completed. The groundwater samples will be collected in decreasing order of sensitivity of volatizing organic compounds. Sample bottles will be filled at an angle in order to limit splashing and bubbling. VOA sample bottles will be preserved with hydrochloric acid prior to the addition of the sample. The VOA sample bottles will be filled such that no air space is present in the bottle after it is capped. If bubbles appear, a new VOA vial will be used.

- All samples will be placed in a cooler on ice, immediately following sample collection.

Alternatively, a dedicated bladder pump may be installed in each well for well purging and collection of groundwater samples.

3.2.1 Field Duplicate Samples

Field duplicate samples will be collected at a frequency of one duplicate sample per ten groundwater samples for all groundwater (treatment performance monitoring well and containment performance monitoring well samples) samples. Field duplicate samples will only be collected for analysis of BTEX and PAH parameters.

3.2.2 Field Blank Samples

Field blanks will be collected at a frequency of one field blank sample per ten groundwater samples. Field blank samples will only be collected for analysis of BTEX and PAH parameters.

3.2.3 Matrix Spike/Matrix Spike Duplicate Samples

Matrix spike/matrix spike duplicate samples will be collected at a frequency of one MS/MSD per 20 groundwater samples collected. A MS/MSD will only be collected for analysis of BTEX and PAH parameters.

3.2.4 Trip Blanks

One trip blank will be enclosed in each shipment container in which aqueous samples to undergo BTEX analysis are included.

3.3 DECONTAMINATION PROCEDURES

The standard decontamination protocol for drilling equipment is presented in Table 3-2.

4.1 PROJECT SAMPLE NUMBERING SYSTEM

- Sample type and location. Treatment performance monitoring wells will have the designation TG (see section 2.1.3 for all treatment well designations). Containment performance monitoring wells will have the designation MW (see section 2.1.4 for the six containment well designations).

Groundwater Samples Collected from the Treatment Performance Monitoring Wells

- MA3-TG1-1 –020700-01 reads as:
  - Moss-American Site, phase 3.
  - Treatment Performance Monitoring Well, upgradient sample located at gate 1.
  - Collected on 2 July 2000.
  - First sample of the day collected from this location.

Groundwater Samples Collected from the Containment Performance Monitoring Wells

- MA3-MW31S –020700-01 reads as:
  - Moss-American Site, phase 3.
  - Containment Performance Monitoring Well, shallow well number 31
  - Collected on 2 July 2000.
  - First sample of the day collected from this location.

5.1 SAMPLE CONTAINERS AND SAMPLE PRESERVATION

Table 5-1a lists the required sample containers, sample volumes, sample preservation requirements, and holding times associated with all parameters and media applicable to the Moss-American Site groundwater sampling activities during the groundwater performance monitoring associated with the funnel-and-gate treatment system.

Table 2-1a
Summary of Sampling Effort for Groundwater Treatment System Performance Monitoring during Pilot Operation Period
Moss-American Site
Milwaukee, Wisconsin

Sample Matrix	Laboratory Parameters[1]	Characterization Samples			Field Duplicate Samples			Field Blank Samples			Matrix Spike/Matrix Spike Duplicate Samples			Matrix Total[2]
		No.	Freq.	Total	No.	Freq.	Total	No.	Freq.	Total	No.	Freq.	Total	
Treatment Performance Monitoring Wells	Kjeldahl Nitrogen*	324	1	324	--	--	--	--	--	--	--	--	--	324
	Ammonia Nitrogen*	324	1	324	--	--	--	--	--	--	--	--	--	324
	Total phosphate Phosphorous*	324	1	324	--	--	--	--	--	--	--	--	--	324
	Orthophosphate* Phosphorous	324	1	324	--	--	--	--	--	--	--	--	--	324
	Microbial* Enumeration	324	1	324	--	--	--	--	--	--	--	--	--	324
	Nitrate Nitrogen*	324	1	324	--	--	--	--	--	--	--	--	--	324
	BOD_5[3]**	144	1	144	--	--	--	--	--	--	--	--	--	144
	COD[4]**	144	1	144	--	--	--	--	--	--	--	--	--	144
	TOC[5]**	144	1	144	--	--	--	--	--	--	--	--	--	144
	BTEX[6]**	144	1	144	12	1	12	12	1	12	6	1	6	168
	PAHs[7]**	144	1	144	12	1	12	12	1	12	6	1	6	168
Containment Performance Monitoring Wells	BTEX**	36	1	36	6	1	6	6	1	6	6	1	6	48
	PAH**	36	1	36	6	1	6	6	1	6	6	1	6	48

Note: Trip blank samples will be included in each shipment of aqueous BTEX samples. MS/MSD samples are not additional samples, MS/MSD samples are characterization samples that are to undergo a MS/MSD analysis.

1 – Groundwater parameters to be measured in the field on a bi-weekly basis of samples collected from the 18 treatment performance monitoring wells include temperature, pH, specific conductivity, dissolved oxygen concentration, and redox potential.

2 – Matrix Total figures include characterization samples, field duplicates samples, and field blank samples. Matrix Total figures do not include trip blank or matrix spike/matrix spike duplicate (MS/MSD) samples. Figures are based on a 18-month pilot operation period.

3 – Five-day Biochemical Oxygen Demand.

4 – Chemical Oxygen Demand.

5 – Total Organic Carbon.

6 – Benzene, Toluene, Ethylbenzene, Total Xylenes.

7 – Polynuclear Aromatic Hydrocarbons.

* - Monthly analysis

** - Quarterly analysis