REPORT

Post Remediation Monitoring Plan

Remedial Action Implementation for Oneida (141 Cedar Street) Former Manufactured Gas Plant Site Oneida, New York

nationalgrid

Syracuse, New York

August 2006

BBL®

an ARCADIS company

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1. Introduction

1.1 Purpose

This document presents a *Post-Remediation Monitoring Plan* (PRMP) for monitoring and maintenance activities to provide a mechanism to evaluate the effectiveness of the remedial measures at the Oneida (141 Cedar Street) Former Manufactured Gas Plant (MGP) Site located in Oneida, New York. This document has been prepared to fulfill the monitoring and maintenance requirements as stipulated in the New York State Department of Environmental Conservation (NYSDEC)-approved final *Remedial Design Work Plan* for the Site (Blasland, Bouck & Lee, Inc. [BBL], 2002). This PRMP is a component of the *Construction Certification Report* for remedial activities at the Site.

1.2 Records Management

All official documents generated throughout the duration of the project (including monitoring and maintenance activities) shall be maintained by National Grid for a minimum period of 5 years following final site closeout. Specific recordkeeping and reporting requirements are presented in detail under each monitoring and maintenance activity included within this PRMP.

1.2.1 Monitoring and Maintenance Needs Summary

Upon completion of remedial activities at the Oneida (141 Cedar Street) Former MGP Site, monitoring and maintenance activities must be initiated for select remedial components. The following remedial components and associated monitoring and maintenance activities are presented in detail within Sections 2 and 3 of this PRMP:

- Monitoring of groundwater at the Oneida (141 Cedar Street) Former MGP Site; and
- Monitoring and maintenance of a 2-foot soil cover.

1.3 Site Description

The Site is located at 141 Cedar Street in the City of Oneida, Madison County, New York. Prior to the performance of remedial construction activities, the site consisted of approximately 0.25 acre of paved,

unoccupied land situated along the southeast side of Cedar Street. The Site was generally level and was supported by retaining walls of generally poor structural condition along the northeast, southeast, and southwest boundaries. These retaining walls supported fill material that was used to provide level grade from Cedar Street to the southeastern Site boundary. These structures and fill material were removed during the remedial construction efforts resulting in the matching of the general grade to adjoining land owned by the City of Oneida.

Additional details regarding Site history and remedial construction activities are presented in the *Construction Certification Report* (BBL, 2004).

2. Groundwater Monitoring

This section describes the groundwater monitoring activities that will be initiated at the Oneida (141 Cedar Street) Former MGP Site within 18 months of the completion of remedial construction. The purpose of the groundwater monitoring activities is to provide a mechanism to evaluate the effectiveness of the remedial measures completed at the Site.

2.1 Groundwater Sampling and Analysis

The groundwater monitoring program will consist of groundwater sampling and analysis. It is anticipated that the first groundwater sampling event will occur in June 2005, and a second groundwater sampling event will be performed in November 2005. The results of the two sampling events will be compared to New York State Ambient Water Quality Standards for groundwater as presented in TOGS 1.1.1. If the groundwater sample analytical results for the first two sample events show that MGP-related constituents meet TOGS 1.1.1 standards, indicating that clean site closure has been achieved as a result of the site remediation efforts and supplemental remediation efforts, then National Grid will propose to discontinue post-remediation groundwater monitoring. If the first two sampling events indicate the presence of MGP-related constituents greater than site background or TOGS 1.1.1 standards, then additional post-remediation groundwater sampling will be continued with subsequent groundwater sampling events being performed on an annual basis (one sampling event per year) following the completion of the 2005 sampling events. If groundwater sampling is continued, annual groundwater sampling will be performed during the late spring for a total period of 5 years (2005 to 2009), at which time an evaluation will be performed resulting in the recommendation to continue or discontinue groundwater monitoring activities.

Groundwater sampling activities will include the collection of groundwater samples from one existing upgradient groundwater monitoring well (141-MW-1) and one existing downgradient groundwater monitoring well (MW-4).

Each monitoring well will be purged and sampled using low-flow groundwater sampling techniques. Field measurements of specific conductance, pH, dissolved oxygen (DO), oxidation reduction potential (ORP), turbidity, and temperature will be obtained using a flow-through cell/multiparameter probe unit (i.e., YSI) for each sample. Additionally, the wells will be checked with clear bailer for the presence of LNAPL and DNAPL, as described in Attachment A. Groundwater elevations will also be measured at each monitoring well location.

More information on the groundwater sampling and analysis activities to be performed for the Site are described below.

2.1.1 Groundwater Sampling Activities

Groundwater elevations will be obtained using a water-level meter and will be conducted using the procedures presented in Attachment A. Groundwater sampling will be performed using low-flow groundwater sampling techniques as described in Attachment B. A representative groundwater sample from each groundwater monitoring well will be collected in the field and measured for the following:

- DO;
- ORP;
- Turbidity;
- Temperature;
- Specific conductance; and
- pH.

Specific field procedures for measurement of these water quality parameters are described in Attachment E.

2.1.2 Groundwater Analysis

Groundwater samples collected from monitoring wells 141-MW-1 and MW-4 will be analyzed by a NYSDEC/New York State Department of Health (NYSDOH)-certified laboratory for PAHs using the NYSDEC 1991 Analytical Services Protocol (ASP) and United States Environmental Protection Agency (USEPA) Method 8270 and for benzene, toluene, ethylbenzene, and xylene (BTEX) using USEPA Method 8260.

All groundwater samples will be identified, packaged, and shipped using chain of custody procedures set forth in Attachment F. Equipment decontamination will be performed in accordance with the procedures in Attachment C.

2.2 Quality Assurance/Quality Control Procedures

This subsection presents the field and laboratory quality assurance/quality control (QA/QC) procedures to be implemented as part of the PRMP.

2.2.1 Field QC Checks

To verify the quality of data collected using field instrumentation, duplicate measurements will be obtained and reported for all field measurements. A duplicate will involve obtaining measurements a second time at the same sampling location.

As part of the monitoring program, one field duplicate groundwater sample will be collected during each sample event and analyzed to check reproducibility of the sampling methods. Trip blanks will be used to assess whether samples have been exposed to non-Site-related volatile constituents during sample storage and transport. One trip blank will accompany the groundwater samples to be analyzed for PAH and BTEX for each sample event. A trip blank will consist of a container filled with analyte-free water (supplied by the laboratory), which will remain unopened with field samples throughout the sampling event. The trip blanks will only be analyzed for PAH and BTEX.

2.2.2 Laboratory QC Checks

Internal laboratory QC checks will be used to monitor data integrity. These checks will include method blanks, matrix spikes (and matrix spike duplicates), spike blanks, internal standards, surrogate samples, calibration standards, and reference standards.

Matrix spikes and matrix spike duplicates will be used to measure the accuracy of organic analyte recovery from the sample matrices. All matrix spikes and matrix spike duplicates will be Site-specific. For organic constituents, matrix spike/matrix spike duplicate pairs will be analyzed for each sampling event.

As part of the monitoring program, one matrix spike and one matrix spike duplicate groundwater sample will be collected in the field for laboratory analysis. The matrix spike/matrix spike duplicate results will be examined in conjunction with a spike blank (for each analytical method) and surrogate spike data to assess the accuracy of the analytical methods. When matrix spike recoveries are outside QC limits associated with the analytical methods, associated spike blank and surrogate recoveries will be evaluated to attempt to verify the reason(s) for the variance(s) and determine the effect on the reported sample results. The QC limits will be those available QC limits for SW-846 Method 8270 for PAH constituents and Method 8260 for BTEX constituents as presented in NYSDEC 1991 ASP (with updates).

2.3 Analytical Data Interpretation and Reporting Requirements

The following subsections describe data interpretation activities to be performed as part of the PRMP and reporting requirements to be met following receipt and evaluation of laboratory and analytical results.

2.3.1 Data Validation Activities

Data validation will consist of a review of QA/QC data and the raw data to verify that the laboratory was operating within required limits, analytical results were correctly transcribed from the instrument readouts, and that samples are related to any out-of-control QC samples, if any. The objective of data validation is to identify any questionable or invalid laboratory measurements.

QA/QC review of laboratory data packages will include an assessment of compliance with method guidelines and project-specific requirements. This assessment will evaluate holding times, calibration requirements (initial and continuing), blank contamination, surrogate spikes (where applicable), matrix spikes and duplicates (where applicable), and compound identification. The data validator will use as USEPA guidance, where appropriate, and the most recent versions of the NYSDEC 1991 ASP documents available at the time of project initiation. Data validation will consist of data editing, screening, checking, auditing, reviewing, and data interpretation to determine if the data quality is sufficient to meet the data quality objectives (DQOs).

The data validator will verify that reduction of laboratory measurements and laboratory reporting of analytical parameters is in accordance with the procedures specified for each analytical method (i.e., perform laboratory calculations in accordance with the method-specific procedure). Any deviations from the analytical method will be delineated on chain of custody forms. Any special reporting requirements apart from this PRMP will also be detailed on chain of custody forms. The data quality will be evaluated by application of the relevant guidelines, procedures, and criteria modified as necessary to address project-specific and method-specific criteria, control limits, and procedures.

Upon receipt of the laboratory data, the following reduction, validation, and reporting scheme reviews will be implemented by the data validator:

- Evaluate completeness of data package.

- Verify that field chain of custody forms were completed and that samples were handled properly.

- Verify that holding times were met for each parameter. Holding time exceedances, should they occur, will be documented. Data for all samples exceeding holding time requirements will be flagged as either estimated or rejected. The decision as to which qualifier is more appropriate will be made on a case-by-case basis.

- Verify that parameters were analyzed according to the methods specified.

- Review QA/QC data (i.e., make sure duplicates, blanks, and spikes were analyzed on the required number of samples, as specified in the method; verify that duplicate and matrix spike recoveries are acceptable).

- Investigate anomalies identified during review. When anomalies are identified, they will be discussed with the project manager and/or laboratory manager, as appropriate.

- If data appear suspect, the specific datum of concern will be investigated. Calculations will be traced back to raw data; if calculations do not agree, the cause will be determined and corrected.

It should be noted that the existence of qualified results does not automatically invalidate data. The goal to produce the best possible data does not necessarily mean producing data without QC qualifiers. Qualified data can provide useful information.

Upon completion of the validation of each sample delivery group/parameter, a data validation report will be prepared.

Data validation/usability reports will be included as an appendix to the annual *Post-Remediation Monitoring Report,* if appropriate, and kept in the project file at the National Grid office in Syracuse, New York.

2.3.2 Data Interpretation Activities

Following completion of the data validation activities, the data will be reviewed and compared with previously collected data to monitor the effectiveness of the remedial action.

If the results of the first two sampling events indicate constituent concentrations in monitoring wells are less than the NYSDEC TOGS 1.1.1 criteria or at or below background concentrations, a recommendation will be made to the NYSDEC for a termination of the PRMP activities at the Site.

If the monitoring program is required beyond the first year of monitoring, it will be evaluated on an annual basis to determine if revisions to this PRMP are warranted based on the results of the sampling events.

2.4 Groundwater Monitoring Reporting Requirements

Following receipt and evaluation of the validated analytical data, a groundwater monitoring activities summary will be prepared and included in a *Post-Remediation Monitoring Report* that will be submitted annually to the NYSDEC to document the results of the groundwater sampling and analysis activities. It is anticipated that the report will be completed within 12 weeks of the conclusion of sample collection, unless sampling or analytical problems arise that prohibit completion of the report within this time frame.

The groundwater monitoring activities summary component of the *Post-Remediation Monitoring Report* will compare groundwater laboratory analytical results with TOGS 1.1.1 standards or will be compared to background data as appropriate.

3. Site Monitoring and Maintenance

Site monitoring and maintenance activities will be conducted at the Oneida (141 Cedar Street) Former MGP Site at the same frequency and time as the groundwater monitoring program.

Site monitoring and maintenance activities will include the visual inspection of the 2-foot soil cover. The condition at the time of inspection will be noted in a field log book. Documentation will include the date, time, and personnel performing the visual inspection. Inspection of the 2-foot soil cover within the 141 Cedar Street parcel will include identification of signs of settlement that may allow the ponding of surface water, signs of stressed vegetation, and signs of erosion that could result in the reduction of the soil cover thickness being less than 2 foot. Additionally, a well vegetated cover must be in place for the soil cover to be deemed acceptable. If damage of the soil cover is observed, the location and a description of the damage will be documented. Photographic documentation will be collected for any identified damage that will require repair. Photographic documentation of the site remediation area will also be obtained to document the overall condition of the soil cover. Photographic documentation will be attached to each annual *Post-Remediation Monitoring Report.* Any identified damage that is observed during visual inspection activities that warrants repair will be scheduled for maintenance/repair.

Annual inspection and maintenance/repair (if necessary) activities performed in relation to the 2-foot soil cover will be documented and detailed within the following annual *Post-Remediation Monitoring Report.*

4. Reporting Requirements

4.1 Annual Reports

A *Post-Remediation Monitoring Report* will be prepared and submitted to the NYSDEC after the completion of the first year of sampling. The *Post-Remediation Monitoring Report* will be developed to provide a comprehensive summary of groundwater monitoring and soil cover inspection activities for the entire 1-year monitoring period. The *Post-Remediation Monitoring Report* will be prepared in accordance with specific reporting requirements as detailed within Sections 2 and 3 of this PRMP. If post-remediation monitoring is required beyond the first year, subsequent monitoring reports will be prepared and submitted to the NYSDEC annually.

4.2 Five-Year Report

If post-remediation monitoring is required beyond the first year, at the conclusion of 5 years of the performance of groundwater sampling and soil cover inspection activities, a 5-year *Post Remediation Monitoring Report* will be developed for submittal to the NYSDEC. This 5-year report will be developed to provide a compilation of data obtained during the post remediation monitoring activities performed throughout the 5-year period. This data will be evaluated with respect to groundwater criteria (i.e., TOGS 1.1.1 or background) to determine the effectiveness of the remedial activities in achieving remedial goals. This effectiveness evaluation will be performed to determine if continued groundwater monitoring and soil cover monitoring is necessary or if remediation goals have been achieved resulting in the recommendation for the discontinuation of monitoring and maintenance activities.

5. Health and Safety Plan

Activities associated with the performance of post remediation monitoring activities will be performed in accordance with the NYSDEC-approved *Health and Safety Plan, Oneida (141 Cedar Street) Former Manufactured Gas Plant Site, Oneida, New York* (BBL, 2003) and in accordance with National Grid's Environmental Health and Safety (EHS) Guidelines administered by National Grid's EHS Department.

6. References

BBL. 2004. *Construction Certification Report, Remedial Action Implementation for Oneida (141 Cedar Street) Former Manufactured Gas Plant Site, Oneida, New York* (December 2004).

BBL. 2003. *Health and Safety Plan, Oneida (141 Cedar Street) Former Manufactured Gas Plant Site, Oneida, New York* (October 2003).

BBL. 2002. *Final Remedial Design Work Plan, Oneida (141 Cedar Street) Former Manufactured Gas Plant Site, Oneida, New York* (November 2002).

Attachments

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Attachment A

Water and LNAPL Level Measurement Procedures

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Attachment A

Water and NAPL Level Measurement Procedures

I. Introduction

To avoid the influence of natural fluctuations in the potentiometric surface, measurements will be made during a 24-hour period which has no major storm event. The water levels will be obtained using an electric water level probe or a weighted steel tape.

II. Materials

The following materials, as required, shall be available during water level measurement activities:

- Personal protective equipment (as required by the Site Health and Safety Plan)
- Flame ionization detector (FID) or Photoionization detector (PID) to measure headspace vapors
- Cleaning equipment (including non-phosphate soap and distilled/deionized water)
- Appropriate forms and field notebook
- Keys for wells
- Water level probe (Slope Indicator Co. or equivalent)
- Disposable clear bailers
- Waterproof marker
- Hacksaw
- Measuring tape (Engineer's 6-foot rule)
- Weighted steel tape

III. Procedures

1. Record the site and well number on the Water Level Record (Attachment A-1) or field notebook along with other appropriate information collected during the water level measurement.

2. Don personal protective equipment (as required by the Health and Safety Plan).

3. Clean the water level probe and cable with a soapy water wash and a distilled/deionized water rinse in accordance with the cleaning procedures in Attachment C.

4. Unlock and open the well cover while standing upwind of the well. Remove the well cap. Measure headspace vapors using a FID or PID using the procedures outlined in Attachment D.

5. Locate the measuring reference point on the well casing. If one is not found, initiate a reference point by notching the inner and outer casings with a hacksaw or by using a waterproof marker. If a well has both inner and outer casings, use the top of the inner casing as the reference point. All downhole measurements will be taken from the reference points.

6. Measure and record, to the nearest hundredth of a foot, the distance from the reference point to ground level.

7. Measure and record, to the nearest hundredth of a foot, the inside diameter of the casings.

8. Lower the water level probe until it reaches the water surface. Measuring to the nearest hundredth of a foot, record the depth to water from the reference point.

9. Lower the water level probe or weighted steel tape to the bottom of well. Measure and record the depth of the well from the reference point to the nearest hundredth of a foot. Again, record the reference point used. If weights are suspended from the water level probe, adjust the recorded depth for the length of the weight.

10. Remove weighted steel tape or water level probe from the well.

11. Clean the water level probe and cable in accordance with the cleaning procedures in Attachment C.

12. Lower the clear bailer into the well. If detected, measure and record the depth of LNAPL from the reference point to the nearest hundredth of a foot. Continue lowering the bailer to measure and record the depth of any DNAPL.

13. Remove the clear bailer from the well.

14. Decontaminate the clear bailer in accordance with the cleaning procedures in Attachment C.

15. Compare depth of well to previous records.

16. Lock the well when all activities are completed.

Attachment A-1

Water Level Record

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ATTACHMENT A-1

WATER LEVEL RECORD

Sheet _____ of _____

Site: ______________________________ **Job Title:** ______________________________

Job No.: ______________________________

Date	Well No.	FID/PID Reading	Stickup Inner/Outer	Well Depth	Water Depth	Time	Comments	Initials

Attachment B

Low-Flow Groundwater Sampling Procedures for Monitoring Wells

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Attachment B

Low-Flow Groundwater Sampling Procedures for Monitoring Wells

I. Introduction

This protocol describes the procedures to be used to collect groundwater samples. No wells will be sampled until well development has been performed. During precipitation events, groundwater sampling will be discontinued until precipitation ceases. When a round of water levels is taken for the purpose of generating water elevation data, water levels will be taken consecutively at one time prior to sampling or other activities.

II. Materials

The following materials, as required, shall be available during groundwater sampling:

- Power source (i.e., generator);
- Appropriate health and safety equipment, as specified in the site Health and Safety Plan (HASP);
- Plastic sheeting (for each sampling location);
- Dedicated or disposable bailers;
- New disposable polypropylene rope;
- Buckets to measure purge water;
- Water level probe;
- 6' rule with gradation in hundredths of a foot;
- Flow-through cell/multi-parameter probe unit (i.e., YSI) to measure conductance, temperature, pH, dissolved oxygen, oxidation reduction potential;
- Turbidity meter;
- Appropriate water sample containers;
- Appropriate blanks (trip blank supplied by the laboratory);
- Appropriate transport containers (coolers) with ice and appropriate labeling, packing, and shipping materials;
- Groundwater sampling logs or bound field notebook;
- Chain-of-custody forms;
- Indelible ink pens;
- Site map with well locations;
- Peristaltic, Rediflow, bladder, or equivalent pump and dedicated tubing; and
- Keys to wells.

III. Procedures

A. The procedures to sample monitoring wells will be as follows:

1. Review materials checklist (Part II) to ensure the appropriate equipment has been acquired.

2. Identify site and well sampled on sampling logs or in bound field notebook, along with date, arrival time, and weather conditions. Identify the personnel and equipment utilized and other pertinent data requested on the Groundwater Sampling Log (Attachment B-1).

3. Label all sample containers using the label in Attachment B-2 (or the equivalent).

4. Don safety equipment, as required in the HASP.

5. Place plastic sheeting adjacent to well to use as a clean work area.

6. Remove lock from well and if rusted or broken replace with a new brass keyed-alike lock.

7. Unlock and open the well cover while standing upwind of the well. Remove well cap and place on the plastic sheeting.

8. Set the dedicated or disposable sampling device and meters on plastic sheeting.

9. Prior to sampling, groundwater elevations will be measured at each monitoring well. Obtain a water level depth and bottom of well depth using an electric well probe and record on sampling logs or bound field notebook. Clean the well probe after each use with a soapy (Alconox) water wash and a tap water rinse. [Note: water levels will be measured at all wells prior to initiating a sampling event].

10. After groundwater elevations are measured, groundwater will be purged from the wells using low-flow sampling techniques. Purge water will be collected.

11. Pump, safety cable, tubing, and electrical lines will be lowered slowly into the well to a depth near the bottom of the well where contamination, if any, is present. The pump intake must be kept at least 2 feet above the bottom of the well to prevent mobilization of any sediment present in the bottom of the well.

12. Measure the water level again with the pump in well before starting the pump. Start pumping the well at 200 to 500 milliliters per minute (ml/min.). Ideally, the pump rate should cause little or no water level drawdown in the well (less than 0.3 feet and the water level should stabilize). The water level should be monitored every 3 to 5 minutes (or as appropriate) during pumping. Care should be taken not to cause pump suction to be broken or entrainment of air in the sample. Record pumping rate adjustments and depths to water. Pumping rates should, if needed, be reduced to the minimum capabilities of the pump to avoid pumping the well dry and/or to ensure stabilization of indicator parameters.

13. During purging of the well, monitor the field indicator parameters (turbidity, temperature, specific conductance, pH, DO, ORP, etc.) every 3 to 5 minutes (or as appropriate). The well is considered stabilized and ready for sample collection once the following field parameters have stabilized:

    - +10% on DO;
    - turbidity is less than 50 NTU;
    - +3% ORP;
    - +3% on specific conductivity; and
    - +0.1 pH.

    If total drawdown of less than 0.3 feet and constant or increasing water levels are achieved during the indicator parameter stabilization, sample collection should be performed at the same or lesser pumping rate used during parameter stabilization.

If a total drawdown of less than 0.3 feet cannot be achieved during purging, sample collection may still proceed if a stabilized water elevation is achieved during purging. A stabilized water elevation is defined here as the condition where the water elevation stabilizes at a constant or increasing level during purging of the well, even if total drawdown exceeds 0.3 feet. After the establishment of a stabilized water elevation and indicator parameter stabilization, samples should be collected at a pumping rate equal to or less than the flow rate used during parameter stabilization.

If total drawdown during purging and sampling exceeds 0.3 feet and a stabilized water elevation cannot be achieved during purging, one of the following procedures will be followed depending upon the recharge characteristics of the well:

Three to five well volumes should be purged or purging should continue for up to 4 hours. If the indicator parameters stabilize within 4 hours of purging or within three to five well volumes, collect samples at or below the pumping rate used in the purging. If the indicator parameters do not stabilize within three to five well volumes or 4 hours of purging, the following options may be considered: a) stop purging and do not collect any samples; b) stop purging and collect the samples; c) stop purging and secure the well; purging and sampling may continue the next day; d) continue purging until stabilization is achieved; e) the pumping rate will be increased, the well pumped dry, and samples collected after recharge (see below). The steps followed will be documented in the appropriate field notebook and/or sampling logs.

If the well runs dry before three well volumes are removed, purging should be stopped before the water level in the well falls below the top of the pump and samples should be collected after the well has recovered. At least one set of water quality parameters should be recorded and the samples collected. If the sample analyses are turbidity sensitive, the well may be allowed to sit for a sufficient time for the turbidity to decrease to original, pre-pumping levels before resampling. Upon recharge, samples may be collected at the midpoint of the purge water removal as determined by the initial pumping of the well. This will minimize the effects of sediment from the well bottom and volatilization from exposure to air at the water/air interface in the well. Indicator parameters should be recorded every 5 minutes or less in both purges of the well. Determination of the most representative water quality parameters will be made based on observation of the individual well field data.

14. If the parameters have stabilized but the turbidity is not in the range of the 50 NTU goal, the pump flow rate should be decreased to no more than 100 ml/min. Measurement of the indicator parameters should continue every 3 to 5 minutes. Field indicator parameters will be measured in a flow-through cell/ multi-parameter probe unit (i.e., YSI). If the NTU requirement of less than 50 NTU for turbidity cannot be achieved, allow the well to rest for at least 1 hour. Carefully withdraw a sample and measure turbidity.

15. Fill in the sample label according to procedures in Attachment B-2 and cover the label with clear packing tape to secure the label onto the container.

16. After the appropriate purge volume of groundwater has been removed from the well, obtain the groundwater sample needed for analysis directly from the sampling device in the appropriate container and tightly screw on the caps.

17. Secure with packing material and store at 4°C on wet ice in an insulated transport container provided by the laboratory.

18. After all sampling containers have been filled, remove an additional volume of groundwater. Measure and record on the sampling logs or bound field notebook the physical appearance, pH, temperature, turbidity, and conductivity.

19. If using a dedicated bailer, replace dedicated bailer in the well and replace the well cap and lock well.

20. Record the time sampling procedures were completed on the sampling logs or bound field notebook.

Attachment B-1

Groundwater Sampling Field Log

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ATTACHMENT B-1

GROUNDWATER SAMPLING LOG

WELL DATA

Well ID	_____	PID Reading (ppm)	_____
Date	_____	Depth to Water (ft BTOC)	_____
Sampler(s)	_____	Total Depth of Well (ft BTOC)	_____
Purge/Sample Method	_____	Pump, Controller Setting (if applicable)	_____
Field Fe II	_____	Field Alkalinity	_____
		Height of Purge Column	_____

Other Observations (weather conditions, well deterioration/damage, evidence of tampering, odor, etc.):

Samples Collected	Volume Collected (ml)
Nitroaromatics	_____
Nitrate/Nitrate	_____
Methane	_____

PURGE DATA

Time	Pump Flow Rate (ml/min)	Water Quality Parameters						Depth to GW (ft BTOC)
		Temperature (°C)	pH	Specific Conductance (mmhos/cm)	Dissolved Oxygen (mg/L)	ORP (mV)	Turbidity (NTU)	
Initial Stabilization Criteria	Stable Water Level	±0.5°C	±0.1	±3%	±10% or 0.1	±10mV	<50	-----

Final (post sample) depth to groundwater prior to pump shutoff (ft BTOC):

Total volume purged (L):

Sample ID(s):

Sample Time:

Attachment B-2

Sample Label

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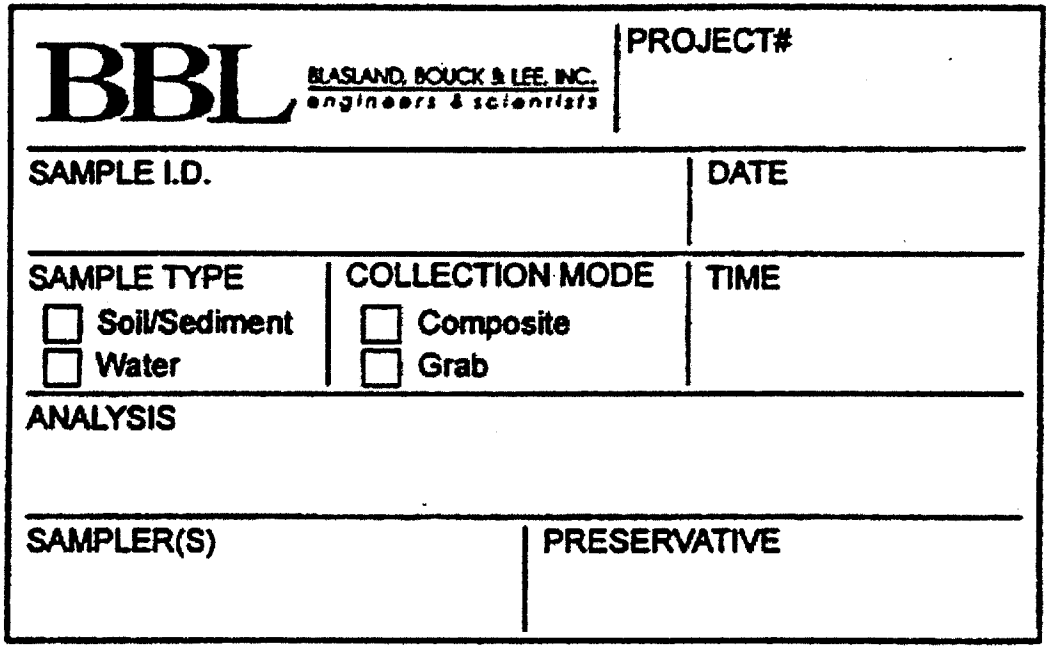

Sample Label

Attachment C

Equipment Decontamination Procedures

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Attachment C

Equipment Decontamination Procedures

I. Introduction

Decontamination areas for smaller equipment to be washed by hand will generally be set up adjacent to the individual work areas, as described in the site Health and Safety Plan (HASP). The equipment decontamination procedures include pre-field, in the field, and post-field cleaning of sampling equipment. The sampling equipment includes all non-disposable equipment potentially coming in contact with contaminated materials. The non-disposable equipment will be decontaminated after completion of each sampling event. All rinse water will be contained and appropriately disposed of.

II. Typical Equipment Decontamination Materials List

- Distilled/deionized water;
- Non-phosphate soap;
- Tap water;
- Appropriate cleaning solvent (e.g., hexane, methanol);
- Nitric acid;
- Wash basins;
- Brushes;
- Plastic sheeting;
- Aluminum foil;
- Large heavy-duty garbage bags;
- Spray bottles;
- Ziploc®-type bags;
- Handiwipes; and
- Disposable gloves.

III. Storage of Equipment

All sampling equipment will be stored in a clean environment and, where appropriate, the equipment will be covered in aluminum foil after cleaning prior to use.

IV. Safety Procedures During Equipment Decontamination

1. Personnel will wear the following safety equipment when cleaning smaller sampling equipment (e.g., split-spoons, trowels);

   - Safety glasses, goggles, and/or a splash shield;
   - Coveralls;
   - Waterproof cover boots; and
   - PVC or nitrile outer gloves.

   Additional personal protective equipment (PPE) may be required based on the results of field screening, as described in the HASP.

2. Personnel will wear the following additional safety equipment when cleaning larger equipment with a high-pressure water/stream cleaning unit (i.e., drilling rig backhoe):

   - Laminated-type Tyvek™ disposable coveralls (e.g., Saranex™); and
   - Chemical-resistant overboots.

3. All solvent rinsing will be conducted in an adequately ventilated area.

4. All solvent transported into the field will be stored and packed in appropriate containers with care taken to avoid extreme heat.

5. Handling of solvents will be conducted in accordance with the manufacturer's Material Safety Data Sheets (MSDS).

V. Field Decontamination Procedures

A. Decontamination Station

All equipment will receive an initial decontamination prior to use at the site. The frequency of subsequent decontamination while on site will depend on how the equipment is actually used in relation to taking environmental samples. All fluids produced from the decontamination procedures will be collected and stored on-site and handled in accordance with Section VI of this procedure.

B. Decontamination of Sampling Equipment

The first step, a soap and water wash, is completed to remove all visible particulate matter and residual oils and grease. When analyzing for organic constituents, this step will be followed by a tap water rinse to remove the detergent and a rinse sequence of solvent (e.g., hexane, methanol) and distilled/deionized water. When analyzing for inorganic constituents, the soap and water wash will be followed by a nitric acid rinse, a tap water rinse, and a distilled/deionized water rinse.

The field sampling equipment decontamination procedures when analyzing for organic constituents are as follows:

1. Non-phosphate detergent and water wash;
2. Tap water rinse;
3. Solvent rinse (e.g., hexane, methanol);
4. Distilled water rinse;
5. Wrap equipment completely with aluminum foil to prevent contact with other materials during storage and/or transport to the field, as appropriate.

C. Decontamination of Heavy Equipment

Other equipment and materials associated with sampling tasks will be decontaminated prior to use. Items such as drill rigs and auger flights present potential sources of cross-contamination of environmental samples. These items may come into contact with the materials adjacent to the matrix being sampled or may be attached to sampling equipment which has been decontaminated in accordance with procedures set forth above. Heavy equipment may potentially retain contaminants from other sources such as roadways or

storage areas or have soil material from previous job sites that has not been removed. For these reasons, it is most important that these items be decontaminated prior to their use at the site.

Two options are available to accomplish decontamination of heavy equipment: steam cleaning and manual scrubbing. The use of steam cleaning can remove visible debris and has several advantages. Steam cleaners provide high pressure which is very effective for residuals removal. They are also efficient in terms of ease of handling and generate low volumes of wash solutions.

Steam cleaning is the preferred method for decontamination of heavy equipment and will be used to decontaminate drill rigs and other heavy equipment whenever possible. Manual scrubbing of equipment will only be used if steam cleaning fails to remove visible materials.

The drilling equipment will be thoroughly decontaminated by steam cleaning or manual scrubbing upon initial arrival on-site and between drilling locations. Drill rig items, such as auger flights, drill rods, and drill bits, will be decontaminated between borings.

D. Decontamination of Other Equipment

The water level probe used for water level measurements will be cleaned between each well with a soapy water wash and a distilled/deionized water rinse. The transducer and cable used during the in-situ hydraulic conductivity testing and the gamma ray logging instrument probe used during the borehole logging will be cleaned in the same manner.

Well development equipment will be cleaned with a soapy water wash, followed by a tap water rinse, a solvent rinse, and a distilled/deionized water rinse.

VI. Disposal Methods

All fluids generated during decontamination procedures will be collected and contained on-site in a temporary storage tank or in 55-gallon drums for subsequent disposal at the permanent groundwater treatment system. Solids (e.g., disposable gloves, disposable clothing, and other disposable equipment) resulting from personal decontamination procedures will be placed in plastic bags and appropriately disposed of in 55-gallon drums or a covered roll-off.

Attachment D

Flame Ionization Detector (FID) and Photoionization Detector (PID) Air Monitoring and Field Screening Procedures

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Attachment D

Flame Ionization Detector (FID) and Photoionization Detector (PID)
Air Monitoring and Field Screening Procedures

Flame Ionization Detector (FID)

I. Introduction

Field screening with a photoionization detector (PID), such as an HNu, is a procedure to measure relative concentrations of volatile organic compounds (VOCs) and other compounds. The characteristics of the PID are presented in Attachment D-1 and the compounds which it can detect are presented in Attachment D-2. Field screening will be conducted on the work area air to assess exposure to on-site workers of air contaminants via the air pathway.

II. Materials

The following materials, as required, shall be available while performing PID field screening:

- Personal protective equipment (PPE), as required by the site Health and Safety Plan (HASP);
- PID and operating manual;
- Calibration canisters for PID; and
- Field notebook.

III. PID Calibration

PID field instruments will be calibrated and operated to yield "total organic vapor" in ppm (v/v) as benzene. Operation, maintenance, and calibration shall be performed in accordance with the manufacturer's instructions and entered on the PID Calibration and Maintenance Log (Attachment D-3).

1. Don PPE (as required by the HASP).
2. Turn the FUNCTION switch to the BATTERY CHECK position. Check that the indicator is within or beyond the green battery arc. If indicator is below the arc or the red LED is lit, the battery must be charged.
3. Turn the FUNCTION switch to the STANDBY position and rotate the ZERO POTENTIOMETER until the meter reads zero. Wait 15 to 20 seconds to confirm the adjustment. If unstable, readjust.
4. Check to see that the SPAN POTENTIOMETER is adjusted for the probe being used (e.g., 9.8 for 10.2 eV).
5. Set the FUNCTION switch to the desired ppm range (0-20, 0-200, or 0-2,000). A violet glow from the UV source should be visible at the sample inlet of the probe/sensor unit.
6. Listen for the fan operation to verify fan function.

7. Connect one end of the sampling hose to the calibration canister regulator outlet and the other end to the sampling probe of the PID. Crack the regulator valve and take a reading after 5 to 10 seconds. Adjust the span potentiometer to produce the concentration listed on the span gas cylinder. Record appropriate information on the PID Calibration and Maintenance Log (Attachment D-3 or equivalent).

8. If so equipped, set the alarm at desired level.

IV. Work Area Air Monitoring Procedure

1. Measure and record the background PID reading.

2. Measure and record breathing space reading.

V. Equipment Cleaning

After each use, the readout unit should be wiped down with a clean cloth or paper towel. The UV light source window and ionization chamber should be cleaned in the following manner once a month:

1. With the PID off, disconnect the sensor/probe from the unit.

2. Remove the exhaust screw, grasp the end cap in one hand and the probe shell in the other, and pull apart.

3. Loosen the screws on the top of the end cap and separate the end cap and ion chamber from the lamp and lamp housing.

4. Tilt the lamp housing with one hand over the opening so that the lamp slides out into your hand.

5. Clean the lamp with lens paper and HNu cleaning compound (except 11.7 eV). For the 11.7 eV lamp, use a chlorinated organic solvent.

6. Clean the ion chamber using methanol on a Q-tip® and then dry gently at 50°C to 60°C for 30 minutes.

7. Following cleaning, reassemble by first sliding the lamp back into the lamp housing. Place ion chamber on top of the housing, making sure the contacts are properly aligned.

8. Place the end cap on top of the ion chamber and replace the two screws; tighten the screws only enough to seal the o-ring.

9. Line up the pins on the base of the lamp housing with pins inside the probe shell and slide the housing assembly into the shell.

Attachment D-1

Characteristics of the PID

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Attachment D-1

Characteristics of the Photoionization Detector (PID)

I. Introduction

Photoionization detectors (PIDs) are used in the field to detect a variety of compounds in air. PIDs can be used to detect leaks of volatile substances in drums and tanks, determine the presence of volatile compounds in soil and water, and make ambient air surveys. If personnel are thoroughly trained to operate the instrument and interpret the data, these PID instruments can be a valuable tool. Its use can help decide the level of protection to be worn, assist in determining the implementation of other safety procedures, and in determining subsequent monitoring or sampling locations.

Portable PIDs detect the concentration of organic gases as well as a few inorganic gases. The basis for detection is the ionization of gaseous species. The incoming gas molecules are subjected to ultraviolet (UV) radiation, which ionizes molecules that have an ionization potential (IP) less than or equal to that rated for the UV source. Every molecule has a characteristic IP, which is the energy required to remove an electron from the molecule, yielding a positively charged ion and the free electron. These ions are attracted to an oppositely charged electrode, causing a current and an electric signal to the LED display. Compounds are measured on a parts per million (ppm) volume basis.

II. HNu PI-101

The HNu portable photoionizer detects the concentration of organic gases as well as a few inorganic gases. The basis for detection is the ionization of gaseous species. The incoming gas molecules are subjected to UV radiation, which is energetic enough to ionize many gaseous compounds. Each molecule is transformed into charged ion pairs, creating a current between two electrodes. Every molecule has a characteristic IP, which is the energy required to remove an electron from the molecule, yielding a positively charged ion and the free electron.

Three probes, each containing a different UV light source, are available for use with the HNu. Energies are 9.5, 10.2, and 11.7 electron volts (eV), respectively. All three probes detect many aromatic and large-molecule hydrocarbons. The 10.2 eV and 11.7 eV probes, in addition, detect some smaller organic molecules and some halogenated hydrocarbons. The 10.2 eV probe is the most useful for environmental response work, as it is more durable that the 11.7 eV probe and detects more compounds than the 9.5 eV probe. The 10.2 eV probe will be used for all PID screenings related to field activities at the site. A listing of molecules and compounds that the HNu can detect is presented in Attachment D-2.

The primary HNu calibration gas is either benzene or isobutylene. The span potentiometer knob is turned to 0.8 for benzene calibration. A knob setting of zero increases the sensitivity to benzene approximately 10-fold. Its lower detection limit is in the low ppm range. Additionally, response time is rapid; the dot matrix liquid crystal displays 90% of the indicated concentration in 3 seconds.

III. Limitations

The PID instrument can monitor several vapors and gases in the air. Many non-volatile liquids, toxic solids, particulates, and other toxic gases and vapors, however, cannot be detected with PIDs. Since PIDs cannot detect

all chemicals that may be present at a sample location, a zero reading on either instrument does not necessarily signify the absence of air contaminants.

The PID instrument is generally not specific and its response to different compounds is relative to the calibration gases. Instrument readings may be higher or lower than the true concentration. This effect can be observed when monitoring total contaminant concentrations if several different compounds are being detected at once. In addition, the response of these instruments is not linear over the entire detection range. Therefore, care must be taken when interpreting the data. Concentrations should be reported in terms of the calibration gas and span potentiometer or gas-select-knob setting.

PIDs are small, portable instruments and may not yield results as accurate as laboratory instruments. PIDs were originally designed for specific industrial applications. They are relatively easy to use and interpret when detecting total concentrations of known contaminants in air, but interpretation becomes more difficult when trying to identify the individual components of a mixture. Neither instrument can be used as an indicator for combustible gases or oxygen deficiency.

The plan intends for the PIDs to be used only as a guide for work area air monitoring to establish action levels (as defined in the Health and Safety Plan).

Attachment D-2

Molecules and Compounds Detected by a Photoionization Detector

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ATTACHMENT D-2

MOLECULES AND COMPOUNDS DETECTED BY A PHOTOIONIZATION DETECTOR (PID)

Some Atoms and Simple Molecules

IP(eV)		IP(eV)
H	13.595	I_2 9.28
C	11.264	HF 15.77
N	14.54	HCl 12.74
O	13.614	HBr 11.62
Si	8.149	HI 10.38
S	10.357	SO_2 12.34
F	17.42	CO_2 13.79
Cl	13.01	COS 11.18
Br	11.84	CS_2 10.08
I	10.48	N_2O 12.90
H_2	15.426	NO_2 9.78
N_2	15.580	O_3 12.80
O_2	12.075	H_2O 12.59
CO	14.01	H_2S 10.46
CN	15.13	H_2Se 9.88
NO	9.25	H_2Te 9.14
CH	11.1	HCN 3.91
OH	13.18	C_2N_2 13.8
F_2	15.7	NH_3 10.15
Cl_2	11.48	CH_3 9.840
Br_2	10.55	CH_4 12.98

Paraffins and Cycloparaffins

Molecule	IP(eV)
methane	12.98
ethane	11.65
propane	11.07
n-butane	10.63
i-butane	10.57
n-pentane	10.35
i-pentane	10.32
2,2-dimethylpropane	10.35
n-hexane	10.18
2-methlypentane	10.12
3-methlypentane	10.08
2,2-dimethlybutane	10.06
2,3-dimethlybutane	10.02
n-heptane	10.08
2,2,4-trimethlypentane	9.86
cyclopropane	10.06
cyclopentane	10.53
cyclohexane	9.88
methlycyclohexane	9.85

Alkyl Halides

Molecule	IP(eV)
HCl	12.74
Cl_2	11.48
CH_4	12.98
methyl chloride	11.28
dichloroemethane	11.35
trichloromethane	11.42
tetrachloromethane	11.47
ethyl chloride	10.98
1,2-dichloroethane	11.12
1-chloropropane	10.82
2-chloropropane	10.78
1,2-dichloropropane	10.87
1,3-dichloropropane	10.85
1-chlorobutane	10.67
2-chlorobutane	10.65
1-chloro-2-methylpropane	10.66
2-chloro-2-methylpropane	10.61
Hbr	11.62
Br_2	10.55
methyl bromide	10.53
dibromomethane	10.49
tribromomethane	10.51
CH_2BrCl	10.77
$CHBr_2Cl$	10.59
ethyl bromide	10.29
1,1-dibromoethane	10.19
1-bromo-2-chloroethane	10.63
1-bromopropane	10.18
2-bromopropane	10.075
1,3-dibromopropane	10.07
1-bromobutane	10.13
2-bromobutane	9.98
1-bromo-2-methylpropane	10.09
2-bromo-2-methylpropane	9.89
1-bromopentane	10.10
Hl	10.38
I_2	9.28

Alkyl Halides

Molecule	IP(eV)
methyl iodide	9.54
diiodomethane	9.34
ethyl iodide	9.33
1-iodopropane	9.26
2-iodopropane	9.17
1-iodobutane	9.21
2-iodobutane	9.09
1-iodo-2-methylpropane	9.18
2-iodo-2-methylpropane	9.02
1-iodopentane	9.19
F_2	15.7
HF	15.77
$CFCl_3$ (Freon 11)	11.77
CF_2Cl_2 (Freon 12)	12.31
CF_3Cl (Freon 13)	12.91
$CHClF_2$ (Freon 22)	12.45
$CFBR_3$	10.67
CF_2Br_2	11.07
CH_3CF_2Cl (Genetron 101)	11.98
$CFCl_2CF_2Cl$	11.99
CF_3CCl_3 (Freon 113)	11.78
$CFHBrCH_2Cr$	10.75
CF_2BrCH_2Br	10.83
CF_3CH_2I	10.00
$n\text{-}C_3F_7I$	10.36
$n\text{-}C_3F_7CH_2Cl$	11.84
$n\text{-}C_3F_7CH_2I$	9.96

Aliphatic Alcohol, Ether, Thiol, and Sulfides

Molecule	IP(eV)
H_2O	12.59
methyl alcohol	10.85
ethyl alcohol	10.48
n-propyl alcohol	10.20
I-propyl alcohol	10.16
n-butyl alcohol	10.04
dimethyl ether	10.00
diethyl ether	9.53
n-propyl ether	9.27
I-propyl ether	9.20
H_2S	10.46
methanethiol	9.440
ethanethiol	9.285
1-propanethiol	9.195
1-butanethiol	9.14
dimethyl sulfide	8.685
ethyl methyl sulfide	8.55
diethyl sulfide	8.430
di-n-propyl sulfide	8.30

Aliphatic Aldehydes and Ketones

Molecule	IP(eV)
CO_2	13.79
formaldehyde	10.87
acetaldehyde	10.21
propionaldehyde	9.98
n-butyraldehyde	9.86
isobutyraldehyde	9.74
n-valeraldehyde	9.82
isovaleraldehyde	9.71
acrolein	10.10
crotonaldehyde	9.73
benzaldehyde	9.53
acetone	9.69
methyl ethyl ketone	9.53
methyl n-propyl ketone	9.39
methyl i-propyl ketone	9.32
diethyl ketone	9.32
methyl n-butyl ketone	9.34
methyl i-butyl ketone	9.30
3,3-dimethyl butanone	9.17
2-heptanone	9.33
cyclopentanone	9.26
cyclohexanone	9.14
2,3-butanedione	9.23
2,4-pentanedione	8.87

Aliphatic Acids and Esters

Molecule	IP(eV)
CO_2	13.79
formic acid	11.05
acetic acid	10.37
propionic acid	10.24
n-butyric acid	10.16
isobutyric acid	10.02
n-valeric acid	10.12
methyl formate	10.815
ethyl formate	10.61
n-propyl formate	10.54
n-butyl formate	10.50
isobutyl formate	10.46
methyl acetate	10.27
ethyl acetate	10.11
n-propyl acetate	10.04
isopropyl acetate	9.99
n-butyl acetate	10.01
isobutyl acetate	9.97
sec-butyl acetate	9.91
methyl propionate	10.15
ethyl propionate	10.00
methyl n-butyrate	10.07
methyl isobutyrate	9.98

ATTACHMENT D-2

Aliphatic Amines and Amides

Molecule	IP(eV)
NH_3	10.15
methyl amine	8.97
ethyl amine	8.86
n-propyl amine	8.78
i-propyl amine	8.72
n-butyl amine	8.71
i-butyl amine	8.70
s-butyl amine	8.70
t-butyl amine	8.64
dimethyl amine	8.24
diethyl amine	8.01
di-n-propyl amine	7.84
di-i-propyl amine	7.73
di-n-butyl amine	7.69
trimethyl amine	7.82
triethyl amine	7.50
tri-n-propyl amine	7.23
formamide	10.25
acetamide	9.77
N-methyl acetamide	8.90
N,N-dimethyl formamide	9.12
N,N-dimethyl acetamide	8.81
N,N-diethyl formamide	8.89
N,N-diethyl acetamide	8.60

Other Aliphatic Molecules with N Atom

Molecule	IP(eV)
nitromethane	11.08
nitroethane	10.88
1-nitropropane	10.81
2-nitropropane	10.71
HCN	13.91
acetonitrile	12.22
propionitrile	11.84
n-butyronitrile	11.67
acrylonitrile	10.91
3-butene-nitrile	10.39
ethyl nitrate	11.22
n-propyl nitrate	
methyl thiocyanate	10.065
ethyl thiocyanate	9.89
methyl isothiocyanate	9.25
ethyl isothiocyanate	9.14

Olefins, Cyclo-ofefins, Acetylenes

Molecule	IP(eV)
ethylene	10.515
propylene	9.73
1-butene	9.58
2-methylpropene	9.23
trans-2-butene	9.13
cis-2-butene	9.13
1-pentene	9.50
2-methyl-1-butene	9.12
3-methyl-1-butene	9.51
3-methyl-2-butene	8.67
1-hexene	9.46
1,3-butadiene	9.07
isoprene	8.845
cyclopentene	9.01
cyclohexene	8.945
4-methylcyclohexene	8.91
4-cinylcylohexene	8.93
cyclo-octatetraene	7.99
acetylene	11.41
propyne	10.36
1-butyne	10.18

Some Derivatives of Olefins

Molecule	IP(eV)
vinyl chloride	9.995
cis-dichloroethylene	9.65
trans-dichloroethylene	9.66
trichloroethylene	9.45
tetrachloroethylene	9.32
vinyl bromide	9.80
1,2-dibromoethylene	9.45
tribromoethylene	9.27
3-chloropropene	10.04
2,3-dichloropropene	9.82
1-bromopropene	9.30
3-bromopropene	9.7
$CF_3CCl=CClCF_3$	10.36
$n\text{-}C_5F_{11}CF=CF_2$	10.48
acrolein	10.10
crotonaldehyde	9.73
mesityl oxide	9.08
vinyl methyl ether	8.93
allyl alcohol	9.67
vinyl acetate	9.19

Aromatic Compounds

Molecule	IP(eV)
benzene	9.245
toluene	8.82
ethyl benzene	8.76
n-propyl benzene	8.72
i-propyl benzene	8.69
n-butyl benzene	8.69
s-butyl benzene	8.68
t-butyl benzene	8.68
o-xylene	8.56
m-xylene	8.56
p-xylene	8.445
mesitylene	8.40
durene	8.025
styrene	8.47
alpha-methyl styrene	8.35
ethynylbenzene	8.815
napthalene	8.12
1-methylnapthalene	7.69
2-methylnapthalene	7.955
biphenyl	8.27
phenol	8.50
anisole	8.22
phenetole	8.13
benzaldehyde	9.53
acetophenone	9.27
benzenethiol	8.33
phenyl isocyanate	8.77

Aromatic Compounds

Molecule	IP(eV)
phenyl isothiocyanate	8.520
benzonitrile	9.705
nitrobenzene	9.92
aniline	7.70
fluoro-benzene	9.195
chloro-benzene	9.07
bromo-benzene	8.98
iodo-benzene	8.73
o-dichlorobenzene	9.07
m-dichlorobenzene	9.12
p-dichlorobenzene	8.94
1-chloro-2-fluorobenzene	9.155
1-chloro-3-fluorobenzene	9.21
1-chloro-4-fluorobenzene	8.99
o-fluorotoluene	8.915
m-fluorotoluene	8.915
p-fluorotoluene	8.785
o-chlorotoluene	8.83
m-chlorotoluene	8.83
p-chlorotoluene	8.70
o-bromotoluene	8.79
m-bromotoluene	8.81
p-bromotoluene	8.67
o-iodotoluene	8.62
m-iodotoluene	8.61
p-iodotoluene	8.50
benzotrifluoride	9.68
o-fluorophenol	8.66

ATTACHMENT D-2

Heterocyclic Molecules

Molecule	IP(eV)
furan	8.89
2-methyl furan	8.39
2-furaldehyde	9.21
tetrahydrofuran	9.54
dihydropyran	8.34
tetrahydropyran	9.26
thiophene	8.860
2-chlorothiophene	8.68
2-bromothiophene	8.63
pyrrole	8.20
pyridine	9.32
2-picoline	9.02
3-picoline	9.04
4-picoline	9.04
2,3-lutidine	8.85
2,4-lutidine	8.85
2,6-lutidine	8.85

Miscellaneous Molecules

Molecule	IP(eV)
ethylene oxide	10.565
propylene oxide	10.22
p-dioxane	9.13
dimethoxymethane	10.00
diethoxymethane	9.70
1,1-dimethoxyethane	9.65
propiolactone	9.70
methyl disulfide	8.46
ethyl disulfide	8.27
diethyl sulfite	9.68
thiolacetic acid	10.00
acetyl chloride	11.02
acetyl bromide	10.55
cyclo-$C_6H_{11}CF_3$	10.46
$(n\text{-}C_3F_7)(CH_3)C{=}O$	10.58
trichlorovinylsilane	10.79
$(C_2F_5)_3N$	11.7
isoprene	9.08
phosgene	11.77

Notes:

Reference: HNu Systems, Inc., 1985
IP = Ionization Potential

Attachment D-3

Photoionization Detector Calibration and Maintenance Log

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ATTACHMENT D-3

PHOTOIONIZATION DETECTOR CALIBRATION AND MAINTENANCE LOG

Instrument Manufacturer: ______________________________

Instrument Model: ______________________________

Identification Nuumber: ______________________________

Lamp (Circle One): 9.5eV 10.2eV 11.7eV

			Calibration Standard				
Date/Time	Initials	Battery Check	Source	Type	Concentration	Span Potentiometer Setting	Comments

Attachment E

Field Procedures for Water Quality Measurements

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Attachment E

Field Procedures for Water Quality Measurements

I. Introduction

Water quality parameters, such as dissolved oxygen (DO), specific conductance, pH, turbidity, and temperature, of natural waters are usually measured in the field. The pH and conductivity will be recorded using a portable meter with temperature-compensating pH and conductivity electrodes. Dissolved oxygen will be measured with a DO meter. The temperature will be measured with a glass, digital, bimetal thermometer, or combination temperature/pH/conductivity meter. In the case of sampling groundwater, hydrochemical parameters should be recorded initially, during purging, and after sampling. Attachments E-1 and E-2 contain the appropriate calibration and maintenance logs for the above-referenced meters.

II. Materials

The following materials, as required, shall be available during field measurement of water quality:

- Personal protective equipment (PPE), as specified in the site Health and Safety Plan (HASP);
- Sodium chloride standard solution, 1,000 mg/L;
- pH buffers, 10.00, 7.00, and 4.00;
- Spare Teflon® membranes;
- Cleaning equipment;
- Fine screwdriver (for meter calibration adjustments);
- Extra batteries for the meters;
- Distilled/deionized water;
- Appropriate forms and field notebook;
- Barometer;
- Flow-through cell;
- ORP standard solution (Zohell solution);
- Standard turbidity solution;
- Range of standard conductivity solutions; and
- A zero DO solution to be used as a check solution.

III. Procedures for Measuring pH

Calibration Procedure

The pH meter will be calibrated daily.

1. Switch on instrument.
2. Connect electrode to meter via the BNC connector and remove protective cap from electrode.
3. Rinse end of electrode in distilled/deionized water.
4. Measure and record temperature of buffer solutions.
5. Immerse pH electrode in pH buffer 7.00, set the temperature adjust dial to that of the buffer 7.00 and allow sufficient time for the electrode to stabilize. Adjust the calibration dial for the correct readout.
6. Remove electrode from buffer and rinse with distilled/deionized water.
7. Immerse pH electrode in buffer 4.00, set the temperature control to that of the buffer 4.00 and allow sufficient time for the electrode to stabilize. Adjust the Slope Control for the correct readout.
8. Rinse electrode with distilled/deionized water. The meter is calibrated and ready for use.

Operation Procedure

1. Calibrate pH meter.
2. Rinse probe in distilled/deionized water.
3. Fill two 100-milliliter plastic, disposable beakers with water from the sample.
4. Measure and record temperature of sample. Adjust temperature dial for ambient water temperature.
5. Insert probe into one sample beaker and obtain a reading. The meter will read between 0 and 14, in 0.01 increments.
6. Rinse probe off with distilled/deionized water.
7. Repeat Steps 4, and 5, and 6 in other beaker.
8. Log results in field notebook and the average will be the actual result.
9. Rinse probe off with distilled/deionized water.

Maintenance Procedures

1. Replace batteries on a regular basis.
2. Store electrode in protective casing when not in use.

3. Keep records of usage, maintenance, calibration, problems, and repairs.

4. After use, the meter will be inspected and the inspection recorded in the field notebook.

5. A replacement meter will be available on-site or ready for overnight shipment.

6. pH meter will be sent back to manufacturer for service when needed.

IV. Procedures for Measuring Conductivity

Conductivity is the ability of a solution to pass an electric current. This current is carried by inorganic dissolved solids. The measurement of conductivity is useful to relate the chemical purity of the water and the amount of dissolved solids in a solution.

Calibration Procedure

The conductivity meter will be calibrated daily.

1. Be sure the probe is clean.

2. Soak the probe in distilled/deionized water for at least 30 minutes.

3. Remove the probe from the water and fling out drops clinging inside.

4. Immerse the probe to or beyond the vent holes in a beaker containing a 1,000 mg/L sodium chloride standard solution. Agitate vertically to remove entrapped air.

5. Repeat Steps 3 and 4 at least once more.

6. Press the Power key and CND key. Verify that the LO BAT indication does not appear.

7. Press the 2 milliSiemens per centimeter (mS/cm) range key.

8. Check the reading on the display. It should be 1.990 mS/cm. If adjustment is needed, use a small screwdriver to adjust the CAL control next to the display. Counterclockwise adjustment increases the reading.

Operation Procedure

1. Calibrate the conductivity meter.

2. Rinse probe in distilled/deionized water.

3. Fill two 100-milliliter plastic, disposable beakers with water from the sample.

4. Turn meter on to the 2 mS/cm scale.

5. Insert probe into sample beaker and obtain a reading. The meter will read between 0 and 2.0 mS/cm in 0.001 increments.

6. Repeat Step 5 with other beaker.

7. Record both results in the field notebook and average.

8. Rinse probe in distilled/deionized water.

9. If the electrodes become coated with foreign compounds, the probe should be cleaned with a detergent solution and then rinsed with distilled/deionized water.

Maintenance Procedures

1. Replace batteries on a regular basis.

2. Store electrode in protective casing when not in use.

3. Keep records of usage, maintenance, calibration, problems, and repairs.

4. After use, the meter will be inspected and the inspection recorded in the field notebook.

5. A replacement meter will be available on-site or ready for overnight shipment.

6. Conductivity meter will be sent back to manufacturer for service when needed.

V. Procedures for Measuring Temperature

Temperature readings will be taken at each water sampling location to assist in pH and conductivity measurement. It will also assist in chemical and biological interpretations. A thermometer may be part of a pH/conductivity meter or separate.

Operation Procedure

1. Rinse thermometer in distilled/deionized water.

2. Immerse thermometer in the water sample and read it to the nearest degree Celsius (°C).

3. Record reading in the field notebook or relevant log.

Preventative Maintenance

1. Use of a Teflon®-coated thermometer lends extra strength and shock-resistance to guard against accidental breakage.

2. Store in protective casing when not in use.

VI. Procedures for Measuring Dissolved Oxygen (DO)

The DO test is an important analysis in determining the quality of natural waters. The effects of wastes on rivers/streams, the suitability of water for fish and other organisms, and the progress of self-purification can be measured or estimated from the DO content.

Calibration Procedure

The DO meter will be calibrated daily using the air calibration method.

1. Prepare the probe with a thin Teflon® membrane stretched over the sensor.
2. Perform a battery check and obtain a barometric pressure reading from a daily weather report.
3. With the unit off, adjust the meter pointer to ZERO with the screw in the center of the meter panel.
4. Switch dial to ZERO and adjust pointer using the ZERO knob.
5. Switch dial to FULL SCALE and adjust pointer using the FULL SCALE knob. Check batteries if pointer cannot reach full scale.
6. Attach probe to unit and tighten.
7. Turn unit on.
8. Allow 15 minutes for optimum probe stabilization and polarization.
9. Switch dial to CALIB O2.
10. Hold probe in the air for 10 minutes or until reading is stable.
11. Using the CALIB knob, set the pointer to the mark associated with the local barometric pressure and ambient air temperature. If barometric pressure is unknown, a correction value of 97% should be used.

Operation Procedure

1. Calibrate the DO meter.
2. Perform the battery check.
3. Set mode switch to operate and the operation switch to the desired range.
4. Place probe into water sample.
5. Take a water temperature measurement and adjust temperature dial.
6. Switch to DO content measurement and allow reading to stabilize.
7. Record water temperature and DO on appropriate form or in the field notebook.

Maintenance Procedures

1. Replace batteries on a regular basis (at a suggested interval of every 6 months or every 1,000 hours of operation).

2. Store electrode in protective casing when not in use.

3. Keep records of usage, maintenance, calibration, problems, and repairs.

4. A replacement DO meter will be ready for overnight shipment.

5. DO meter will be sent back to manufacturer for service when needed.

VII. Procedures for Measuring Turbidity

The measurement of turbidity is useful in that it expresses the amount of suspended particles in the water samples.

Standardization Procedure

Standardization will be performed before each set of tests to ensure consistently accurate results.

1. Turn the instrument off and check the mechanical zero setting. Adjust to a zero NTU reading if necessary.

2. Turn power switch on and perform a battery check.

3. Place the focusing template into the cell holder. This will block all light from reaching the detector and allow the instrument to be zeroed electronically in Steps 4 and 5.

4. Press the 1.0 range switch and adjust the Zero Control for a reading of zero NTU.

5. Press the 10.0 range switch to verify that the meter still indicates zero NTU. Readjust the Zero Control if necessary.

6. Remove the focusing template and place the appropriate Gelex secondary standard for the turbidity range to be used into the cell holder. Use the index mark on the standard to orient the vial in the same position each time, thereby eliminating variation due to rotation.

7. Place the light shield over the turbidity standard and allow the meter to stabilize.

8. Adjust the SPAN control for a meter reading equal to the value of the Gelex standard in the cell holder. Remove the light shield and turbidity standard. The instrument is now ready for use.

Calibration Procedures

Each range is calibrated at the factory, but should be checked from time to time against fresh Formazin turbidity standard dilutions. Three trimmer potentiometers on the amplifier circuit board provide an adjustment for each range. Check each range as described in the following procedure and make the appropriate adjustments, when necessary, using the procedures described in Range Calibration.

1. With the instrument turned off, check the mechanical zero adjustment on the meter face. Adjust for a zero reading if necessary.

2. Turn the instrument on and perform a battery check. Change battery if needed.

3. Place the focusing template into the cell holder, press the 1.0 range switch, and adjust the Zero Control to obtain a zero NTU reading.

4. Remove the focusing template and insert a 0.75 NTU turbidity standard. Adjust the SPAN control for a corrected 0.75 NTU reading.

5. Remove the 0.75 NTU standard and replace it with a 10 NTU standard. Press the 10.0 range switch. The meter should indicate 10 (+0.2) NTU. If it does not, the 10.0 range potentiometer needs adjustment as described in the Range Calibration procedure. Adjust the SPAN control for a reading of exactly 10 NTU.

6. Remove the 10 NTU standard and replace it with the cell riser and 100 NTU standard. Press the 100 range switch. The meter should indicate 100 (+2) NTU. If it does not, the 100 range potentiometer needs adjustment as described in the Range Calibration procedure.

7. Remove the 100 NTU standard and cell riser and insert the 10 NTU standard. Press the 10.0 NTU range switch. Adjust the SPAN control for a reading of exactly 10 NTU.

8. Remove the 10 NTU standard and replace it with a 0.75 NTU standard. Press the 1.0 range switch. The meter should indicate the corrected value for the 0.75 NTU standard (+0.02). If it does not, the 1.0 range potentiometer needs adjustment as described in the Range Calibration procedure.

Range Calibration Procedures

In the event the range adjustment potentiometers on the amplifier circuit board require adjustment, remove the instrument from its case and proceed as follows:

1. With the instrument turned off, check the meter's mechanical zero adjustment. Adjust for a zero reading if necessary.

2. Turn on power and perform a battery check.

3. Place the focusing template into the cell holder, press the 1.0 range switch, and adjust the SPAN control fully counterclockwise.

4. Adjust the Zero Control clockwise to obtain a 0.05 NTU reading on the 1.0 scale.

5. Adjust the SPAN control clockwise to obtain a reading of 0.15 NTU on the 1.0 scale. Do not alter the SPAN control setting for the remainder of this procedure.

6. Press the 100 range switch and adjust the Zero Control for a zero reading.

7. Remove the focusing template and insert the cell riser and 100 NTU Formazin turbidity standard. Cover the standard with the light shield and allow the meter to stabilize. Adjust the 100 range adjustment potentiometer to obtain a full-scale reading.

8. Remove the 100 NTU standard and cell riser and insert the focusing template into the cell holder.

9. Press the 10.0 range switch and adjust the Zero Control for a zero reading.

10. Remove the focusing template and substitute the 10 NTU Formazin standard. Cover with the light shield and allow the meter to stabilize. Adjust the 10.0 range adjustment potentiometer to obtain a full-scale reading.

11. Remove the 10 NTU standard and insert the focusing template.

12. Press the 1.0 range switch and adjust the Zero Control for a zero reading.

13. Remove the focusing template and insert the 0.75 NTU Formazin turbidity standard. Cover with the light shield and allow the meter to stabilize. Adjust the 1.0 range adjustment potentiometer to obtain a reading equal to the corrected NTU value determined when adding the turbidity of the dilution water to the nominal value of the standard.

Measurement Procedures

1. Turn power switch on and perform a battery check.

2. Press the appropriate range switch: 0-1, 0-10, or 0-100 NTU.

3. Place the focusing template into the cell holder and adjust the Zero Control for a reading of zero NTU. Remove focusing template.

4. Fill a clean sample cell to the white line with the sample to be measured and place it into the cell holder. Use the white dot on the sample cell to orient the cell in the same position each time. Cover sample with light shield and allow meter to stabilize.

5. Read and record the turbidity of the sample.

6. Perform a duplicate sample every 10 or set of samples, whichever is more frequent.

Maintenance Procedure

1. Recharge battery on a regular basis.

2. Store in protective casing when not in use.

3. Keep records of usage, maintenance, calibration, problems, and repairs.

4. After use, the meter will be inspected and the inspection recorded in the field notebook.

5. A replacement meter will be ready for overnight shipment.

6. Keep nephelometric sample tubes clean both inside and out. Replace them when they become scratched or etched. Do not handle the tubes in the region where the light beam enters them.

7. Clean lens periodically.

8. Nephelometer will be sent back to the manufacturer for service when needed.

VIII. Procedures for Measuring ORP

The measurement of ORP is useful in determining the reducing conditions of the groundwater.

Attachment E-1

Temperature/pH/Conductivity/ORP/Meter Calibration and Maintenance Log

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ATTACHMENT E-1

TEMPERATURE/pH/CONDUCTIVITY/ORP METER CALIBRATION AND MAINTENANCE LOG

Instrument Manufacturer ______________________________
Instrument Model ______________________________
Identification Number ______________________________

Date/Time	Initials	Temperature	pH Standard Used/Expiration	Conductivity Standard Used/Expiration	Battery Check	Comments

Attachment E-2

Dissolved Oxygen Meter Calibration and Maintenance Log

BBL®

an ARCADIS company

ATTACHMENT E-2

DISSOLVED OXYGEN METER CALIBRATION AND MAINTENANCE LOG

Instrument Manufacturer ______________________

Instrument Model ______________________

Identification Number ______________________

Date/Time	Initials	Water Temperature	Actual DO	Measured DO	Battery Check	Membrane Checked/ Replaced	Comments

Attachment F

Sample Handling and Delivery Procedures

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Attachment F

Sample Handling and Delivery Procedures

I. Sample Handling

After collecting a sample, the following procedures are followed:

1. Record the following information on the daily field logs or in the field notebook, as appropriate:

    a. Project name and number;
    b. Sample number and depth;
    c. Sampling method;
    d. Date;
    e. Name of sampler(s);
    f. Sample collection time (military);
    g. Location (project reference);
    h. Analyses to be completed;
    i. Preservative;
    j. Organic vapor reading; and
    k. Any comments.

2. Fill in sample label with:

    a. Project number;
    b. Sample number;
    c. Sample interval (if applicable);
    d. Sample type (composite or grab);
    e. Sample matrix (soil/sediment or water);
    f. Date;
    g. Sample collection time (military);
    h. Analyses required;
    i. Initials of the sampling personnel; and
    j. Preservative added, if applicable.

3. Ensure that all sample containers have the sample labels securely affixed to the container with clear packing tape.

4. Check the caps on the sample containers to ensure that they are tightly sealed.

5. Complete the chain-of-custody form (Attachment F-1) with the required sampling information and ensure that the recorded information matches the sample labels. Initial the chain-of-custody after sampling or prior to sample packing. Note: If the designated sampling person relinquishes the samples to other sampling or field personnel for packing or other purposes, the samplers will complete the chain-of-custody prior to this transfer. The appropriate personnel will sign and date the chain-of-custody form to document the sample custody transfer.

II. Sample Containers and Preservation

In general, the sampling and preservation procedures for the samples to be analyzed by the contracted laboratory will follow those specified in USEPA's document *Test Methods for Evaluating Solid Waste* (USEPA SW-846). The materials and methods used in sample handling (methods used to obtain and preserve the samples) are designed to:

- Retard biological action;
- Reduce chemical interactions;
- Reduce volatilization of the compounds; and
- Reduce alteration of the sample (by the selection of appropriate sample container materials).

Sample preservation methods include the addition of parameter-specific chemical preservatives and/or refrigeration. The contracted analytical laboratory will supply the appropriate precleaned sample containers along with sample labels and preservative(s). Where appropriate, samples will be field preserved. The field personnel will be responsible for properly collecting, labeling, and preserving the samples (as appropriate). The samples are then packed and shipped with the chain-of-custody forms.

III. Packing

1. Using duct tape, secure the outside and inside of the drain plug at the bottom of the cooler to be used for sample transport.

2. Wrap bottles in bubblewrap or other cushioning material.

3. Place 1 or 2 inches of cushioning material at the bottom of the cooler.

4. Place the sealed sample containers in the cooler.

5. Repackage ice in sealed plastic bags and place loosely in the cooler.

6. Fill the remaining space in the cooler with cushioning material.

7. Place chain-of-custody forms in a sealed plastic bag and tape the forms to the inside of the cooler lid.

8. Close the lid of the cooler and fasten with duct tape.

9. Wrap strapping tape around both ends of the cooler at least twice.

10. Mark the cooler on the outside with the following information: shipping address and return address. Cover the labels with clear plastic tape. Place a signed custody seal label over cooler lid (Attachment F-2).

IV. Shipping

1. All samples will be hand-delivered or delivered by an express carrier within 48 hours from the date of sample collection.

2. The following chain-of custody procedures will apply to sample shipping:

a. Relinquish the sample containers to the laboratory via express carrier. The signed and dated chain-of-custody form(s) should be included in the cooler. Place the form(s) in a plastic bag, and tape the bag to the inside lid of the cooler. The express carrier will not be required to sign the chain-of-custody forms. The sampler should retain the express carrier receipt of bill of lading.

b. When the samples are received by the laboratory, the laboratory personnel shall complete the chain-of-custody forms by recording receipt of samples and compare the sample identification numbers on the containers with the chain-of-custody forms.

Attachment F-1

Chain of Custody Form

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BLASLAND, BOUCK & LEE, INC.
engineers & scientists

6723 Towpath Road, P.O. Box 66
Syracuse, New York 13214-0066
TEL: (315) 446-9120

CHAIN OF CUSTODY RECORD

PROJ. NO.	PROJECT NAME
SAMPLERS: *(Signature)*	

STA. NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	Number of Containers							REMARKS

Relinquished by: *(Signature)*	DATE	TIME	Received by: *(Signature)*	Relinquished by: *(Signature)*	DATE	TIME	Relinquished by: *(Signature)*
Relinquished by: *(Signature)*	DATE	TIME	Received by: *(Signature)*	Relinquished by: *(Signature)*	DATE	TIME	Relinquished by: *(Signature)*
Relinquished by: *(Signature)*	DATE	TIME	Received for Laboratory by: *(Signature)*	DATE	TIME	Remarks:	

10/23/95
5951168L.CDR

Distribution: Original Accompanies Shipment; Copy to Coordinator Field Files

Attachment F-2

Custody Seal

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I-CHEM

Chemists In The Container Business™

CUSTODY SEAL

Date _____

Signature _____