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BATTELLE
WORK/QUALITY ASSURANCE PROJECT PLAN

GENERAL PROJECT INFORMATION

Project Title:	Ashland MGP
Project Number:	TBD
Client:	Jamie Dunn, Ph.D. Wisconsin Department of Natural Resources Northern Region Headquarters 810 West Maple Street Spooner, WI 54801 Phone: (715) 635-4049 Fax: (715) 635-4106
QAPP Effective Date:	June 1, 2001
Version Number:	1.0
Project Manager:	Stephen Emsbo-Mattingly
Prepared By:	Stephen Emsbo-Mattingly **Date:** June 1, 2001
Reviewed By:	Allen Uhler **Date:** June 1, 2001
Deliverable Due Date:	4 Weeks from verified time of sample receipt (VTSR)

1.0 SCOPE OF WORK

Background

The Ashland MGP operated from the late 1800's to the 1940's as a carbureted water gas plant. Coal, coke and petroleum were presumably delivered to the facility via railroad. Down gradient from the site, a lumber mill operated on the shore of Lake Superior. This facility generated a considerable quantity of wood scrap that was distributed throughout the local coastline area. Approximately 100 feet of shoreline immediately down gradient from the Ashland MGP was filled since the MGP began operating. Recent site investigation efforts have revealed a pipeline that connected the MGP plant with the former shoreline of Lake Superior. This pipeline contains non-aqueous phase liquid (NAPL) at various locations.

Today, the subsurface soils, groundwater and sediments down gradient from the Ashland MGP are contaminated with polycyclic aromatic hydrocarbons (PAH), dense non-aqueous phase liquids (DNAPL), and light non-aqueous phase liquid (LNAPL) sheens. Currently, it is not known if the PAH detected around the Lake Superior shoreline is from one or more sources.

Objectives

The purpose of this project is to characterize the nature of the PAH contamination in the NAPL, soil, sediment and water collected from the site. NAPL and/or PAH arising from tar sources will be identified. A planning phase is recommended in order to ensure that an adequate number of samples are collected to represent all known or suspected sources and to support the technical requirements of the forensic investigation. A work plan will be required to describe the phased analytical approach for determining the source of PAH in the various environmental media. The limited analytical sensitivity and analyte

specificity of traditional EPA methods necessitates the use of more robust forensic methods, tailored to identify and differentiate among hydrocarbon products, as described below.

An estimated 30 NAPL, sediment, soil and water samples will be received for analysis. Herein, the laboratory will analyze soil/sediment and product samples for a suite of parameters, including:

Total Petroleum Hydrocarbons
High-resolution GC/FID fingerprints
PAH and selected heteroatomic compounds by GC/MS/SIM
Biomarkers by GC/MS/SIM – quantitative
Selected GC/MS Fingerprints - qualitative

This QAPP contains a detailed description of the laboratory components of the study, applicable quality assurance/quality control (QA/QC) activities, data reduction and reporting procedures, and schedule for this work.

1.1 Technical Approach

1.1.1 Sample Collection

Battelle will supply bottles, coolers, blue ice, packing material and chains-of-custody to the sample collection team.

The general sample requirements are matrix-specific. The analyses of NAPL samples will require only a few milliliters of sample. We recommend that if at all possible more NAPL be collected. Our recommendation is to collect duplicate 40 ml VOA bottles of any NAPL to be submitted for analysis. Filling them to the top should minimize the headspace in the sample vials. The analysis of any solid or particulate samples will require about 8 ounces of sample. These can be collected in 8-oz wide mouth glass jars certified for low level organic chemical analysis. Water samples will be re-sampled with one-liter amber bottles at locations where sheen samples were previously collected and analyzed. The purpose of this analysis is an evaluation of the chemical similarities and differences between DNAPL samples and the sheens that form from them. Consequently, water samples must be collected in such a way that the maximum amount of sheen material enters the bottle.

The sample collection team will arrange for the shipment of the samples to Battelle. Samples must be packaged securely in coolers, chilled to 4°C ± 2°C, and shipped overnight to Battelle. Blue ice is recommended. If frozen water is used to cool the samples during shipment, the ice must be double-bagged in multiple zip-lock bags. Individual bottles should be safely wrapped in order to minimize the risk of breakage. A properly completed chain-of-custody and custody seals should accompany the samples. Saturday delivery of coolers should be avoided if possible or arranged with the laboratory manager. Our address is Battelle, 397 Washington St., Duxbury, MA 02332. Attn: Mr. Robert Lizotte.

1.1.2 Receipt, Storage, and Handling

For estimating purposes only, we have assumed that the following samples will be received for analysis in a single shipment: 9 NAPL, 7 sediment, 6 soil and 1 water. The extraction holding time is measured from the time of sample collection as follows: 7 days for water samples and 14 days for soil and sediment samples. NAPL samples are not constrained by a sample preparation holding time. All extracts and

dilutions must be analyzed within 40 days of sample preparation. Samples should be held at 4°C until analysis.

Table 1: Sample Storage and Holding Times

Sample Type	Preservation	Storage	Holding Times
Products	Ice	Refrigerated at 4 °C	Preparation: not applicable Analysis: 40 days from preparation
Soils	Ice	Refrigerated at 4 °C	Preparation: 14 days from collection Analysis: 40 days from preparation

Unexpended water sample will be discarded after their holding times have expired. Product samples will be permanently archived (in a labeled box) with the tar library standards. The electronic data generated by the instruments and all hard-copy data will be archived for a period of at least three years.

The chain of custody forms and a listing of samples will be distributed as the samples arrive. The sample custodian will notify the project manager by telephone immediately upon receipt of samples for inspection.

1.1.3 Sample Preparation

Sediment, soil and water samples will be solvent extracted. A Procedural Blank (PB), Laboratory Control Sample (LCS), Matrix Spike (MS) and Sample Duplicate (Dup) will accompany each batch of 20 or fewer soil, water and sediment samples. NAPL samples will be diluted with solvent. An PB, LCS and Dup will accompany each batch of 20 of fewer NAPL samples. The batch QC are summarized below:

Table 2. Quality Control Samples

QC sample Type	*Required (check)*	*Comments*
Blank	√	Extracted and Diluted Samples
LCS	√	Extracted and Diluted Samples
LCSDUP		
MS	√	Extracted Samples
MSD		
SRM		
Field Sample Duplicates	√	Extracted and Diluted Samples
Field Sample Triplicates		
Independent Check (IC)	√	Extraction Surrogates and Internal Standard
Other:	√	North Slope Crude ~10 mg/ml (XQ50NSC-D or equivalent), Diesel ~10 mg/ml (XP92-D or equivalent), and Coal Tar ~1 mg/ml (SRM 1597 or equivalent). Quantitate for internal use only, no control charts

1.1.3.1 Preparation and Analysis – semi-volatile analysis

Product – TPH, GC/FID fingerprints, PAH characterization, biomarkers. Product samples will be extracted for TPH, fingerprints, PAH and biomarkers as described in Battelle SOP 5-203, *Extraction of Sediment/Soil Samples for Petroleum Analysis*. Samples will be spiked as per Tables 3 and 4. Sample will be split **BEFORE RIS** spiking.

- Spike SIS after the dilution
- Dilution weight: 100 mg in 10 ml DCM
- PIV: 1.0 ml
- No dilution for biomarker analysis: 1000 µL extract
- Dilute for the PAH and TPH analysis: 100 µL extract + 900 µL DCM
- Cleanup: None
- Fractionation: None

NAPL – whole oil fingerprints. NAPL samples will be prepared for a full scan, C5-C40 chromatographic fingerprint. 1 ml of whole product will be measured into a GC vial (using a 1 ml syringe) for analysis. These 1 ml whole oil samples will not be spiked with any surrogates or internal standards.

- Sample volume: 1 ml

Soils and Sediments – TPH, GC/FID fingerprints, PAH characterization, biomarkers. Soil samples will be extracted for TPH, fingerprints, PAH and biomarkers as described in Battelle SOP 5-203, *Extraction of Sediment/Soil Samples for Petroleum Analysis*. Samples will be spiked as per Tables 3 and 4. Sample will be split **AFTER RIS** spiking.

- Extraction weight: 30 g – use 2-10 g for highly contaminated samples.
- PIV: 1.0 ml
- Cleanup: as per soil and sediment procedures in the method. The sample preparation chemist must match the matrix and cleanup column packing material appropriately.
- Pre-and post-column gravimetric determination of total extractable hydrocarbons (TEH).
- Determine the percent extractable according to the SOP.
- Determine the percent of material recovered from the column.
- Dilutions: by analyst judgment, but discuss with project manager.

Water – GC/FID fingerprints/PAH characterization. Water samples will be extracted for fingerprints and PAH by separatory funnel techniques as described in Battelle SOP 5-200, *Water Extraction for Trace Level Semi-Volatile Organic Contaminant Analysis*. Samples will be spiked as per Tables 3 and 4. Sample will be split **AFTER RIS** spiking.

- Extraction volume: 1-l
- Rinse bottle with portion of first solvent aliquot.
- PIV: 0.5 ml
- Cleanup: None anticipated (if samples warrant)
- Gravimetric determination of TEH if samples warrant

Table 3: SIS and LCS/MS Spiking Levels

Standard Type	Standard Contents	Standard ID	Spike Volume	Spike Amount
SIS	Naphthalene-d8 Phenanthrene-d10 Chrysene-d12 OTP	FJ40 (10xSample) FJ39 (1xQC) or equivalent	200 µl soils and QC	~24µg PAH_{Sample} ~400µg OTP_{Sample} ~2.4 µg PAH QC ~40.0 µg OTP QC
Matrix Spike	PAH and SHC Target compounds	TBD	TBD	~24 µg PAH_{Sample}
PAH (LCS)	PAH and SHC Target compounds	FJ38 or equivalent	100 µl LCS	~0.5 µg PAH ~ 5.0 µg SHC

Table 4: RIS Spiking Levels

Standard Type	Standard Contents	Standard ID	Spike Volume	Spike Amount
RIS	Acenaphthene-d10 Fluorene-d10 Benzo[a]pyrene-d12 5α-Androstane	FJ66 or equivalent	100 µl all samples	~ 1.0 µg PAH ~ 20 µg 5α-Androstane

1.1.3.2 Instrumental Analysis, Calibration, and Maintenance

Organics -- GC/FID Analysis. Samples will be analyzed by GC/FID for total petroleum hydrocarbons (soils and product only) and chromatographic fingerprints. Instrumental methods, maintenance, and QC procedures for the GC/FID analysis of samples will be performed according to Battelle SOP No. 5-202, a modification of EPA Method 8015. Analytical instruments will be calibrated before sample analysis with a 5-point calibration (minimum).

- Mass discrimination <20% (1-(C36/C22)*100)
- The calibration solution will be composed of selected aliphatic hydrocarbons within the C8 through C36 carbon range, with RFs of similar alkanes being applied to target compounds not contained in the initial calibration solution. TPH will be calculated based on the mass integrated from C8 to C36.
- Generation of a detailed chromatographic fingerprint.
- Check standards will bracket the analytical run of authentic and quality control samples.

Organics -- GC/MS Analysis for PAH, heteroatoms and biomarkers. Samples will be quantified based on recovery internal standards. Surrogate recoveries will be quantified and reported for each sample. Instrumental methods, maintenance, and QC procedures for the GC/MS analysis of samples for PAH will

be performed according to Battelle SOP No. 5-157. Analytical instruments will be calibrated before sample analysis with a 5-point calibration (minimum), using the 0.01 ug/ml low standard concentration. In the absence of dilutions, the reporting limit of 0.5 ug/kg will be used for all soil/sediment samples and 5 mg/kg for products.

- Mass discrimination <25% (1-(Qt Ion Area [Benzo(ghi)perylene/Phenanthrene])*100). Review with project manager before analysis.

- The instrument will be operated in the Select Ion Mode (SIM). Make sure the following ions are acquired for the entire run: 83 and 85.

- Quantification will be performed using the RIS compounds for PAH, heteroatoms and biomarkers (Attachment 1).

- Two extracts will be produced for every NAPL sample: PAH and biomarkers will be quantitated on the 1:10 dilution. All target analytes not detected within the instrument calibration range may be quantitated using the 1:1 dilution after consultation with the PM.

- Check standards at least every 12 hr. GC/MS run time. Bracket the analytical run with calibration standards.

Organics -- GC/MS Analysis for full scan fingerprint. Whole oil samples will be run for a chromatographic picture only. Instrumental methods, maintenance, and QC procedures for the GC/MS qualitative analysis of oil samples for this analysis will be performed according to Battelle SOP No. 5-157. An alkane standard (from the STOCK GC/FID CALIBRATION SOLUTION) and North Slope Crude will be run prior to any samples to demonstrate good chromatography with low mass discrimination. Use a narrow bore GC liner packed with glass wool (see Andy Cram for details). GC conditions should be similar to the VOC analysis until C8, then similar to the GC/FID analysis through C40. The exact GC conditions will be determined and added to the project files for this analysis.

- If the NAPL is too viscous, dilute with a few drops of DCM.

- Produce a detailed TIC report that identifies the largest 50 peaks.

1.2 Deliverables

Deliverables for this project will include:

- Tabulated results of PAH/biomarker analysis.
  - mg/kg dry weight for solid samples.
  - mg/kg oil weight for tar/residue.
- Histograms of PAH/biomarker distributions for each sample.
- Results of Quality Control Analysis on a sample delivery group basis.
- Results of analysis in Microsoft Excel spreadsheet.

The final data report package will include hard copy and electronic copy summary Excel tables for all field and QC data, a QC narrative, and copies of the chain of custody forms. Copies of all acquisition and reduced data files for all Calibrations, QC and samples should be placed in the appropriate subdirectory, Production 'NS-DUX-NSF':\\emsbo-mattingly\WDNR Ashland MGP.

The data will be qualified as described in Attachment 3.

The following header information should be used, listed in this order on the tables:

Table 5. Table Header Information

Header Information	*Required (check)*	*Comments*
Client Sample ID	√	
Battelle Sample ID	√	
Client Description	√	If on COC
Battelle Batch ID	√	
Analytical Method	√	
Collection Date	√	
Receipt Date	√	
Extraction Date	√	
Analysis Date	√	
Dilution Factor	√	
% Moisture	√	
% Dry Weight		
Sample Dry Weight (g)	√	
Sample Wet Weight		
Units	√	mg/kg (product), ug/kg (soil), ng/l (water)
% Lipid		

Deliverables will include:

Sample Preparation:
Pre- and post column gravimetric measurements of TEH.

GC/FID:
TPH table as a target. (format to be discussed with PM).
GC chromatograms with client ID, OTP and Androstane identified.

GC/MS Semi-volatile:
Data table (format to be discussed with PM).
Histograms (from data table) for samples and reference materials (use PM template).
Chromatograms for samples and reference materials.

GC/MS Semi-volatile (whole oil):
GC chromatogram (TIC) with client ID.

2.0 QUALITY

2.1 Quality Assurance

The Quality Assurance Unit (QAU) at Battelle will remain independent of all work activities pertaining to this project. The QAU will monitor the Battelle components of the project according to existing Battelle SOPs to ensure the accuracy, integrity, and completeness of the data. Additionally, the QAU will monitor the project activities to ensure consistency with the applicable requirements described in this QAPP. The QAU scope may includes system inspections, data audits, and reviews of documents and deliverables.

2.2 Quality Control

Project staff will be responsible for ensuring that sample tracking, sample preparation, and analytical instrument operation all meet the quality control criteria detailed in the applicable analytical SOPs. The type and frequency of analysis of QC samples is specified in Section 2.

The data quality objectives (DQO) are outlined in Attachment 3. Analytical results that do not meet the listed DQOs will be submitted to and reviewed with the Project Manager in a timely manner for assessment of the potential impact of the results. Affected samples may be reanalyzed at the Project Manager's discretion. Quality control sample data that are accepted outside these criteria will be indicated with the appropriate data qualifier, and the rationale for accepting the analysis will be documented in the project files.

2.3 Documentation

All laboratory records, including all sample preparation forms/records and analytical data, will be maintained in three-ring binders. All data will be recorded in black ink, entries signed and dated on date of entry, and any changes initialed, dated, and explained. All raw and reduced analytical data will be archived with the study record.

4.0 ORGANIZATION AND COMMUNICATION

Task-specific communication should initially be directed to the Task Leaders. The task leaders will keep the Project Manager informed of the status of the project and any technical issues will be brought to the Project Manager's attention in a timely manner. The Battelle project team and responsibilities are as follows:

Table 6. Project Team and Roles

Staff Member	Role
Stephen Emsbo-Mattingly	Project Manager
Mike Meara/TBD	Task Leader - Sample Preparation
Andy Cram	Task Leader: GC/MS-PAH Analysis
Bill Naples	Task Leader: GC/MS-Biomarker Analysis
Ted Healey	Task Leader: GC/MS-whole oil Analysis
Lyle Roberts	Task Leader: GC/FID Analysis
Rich Restucci	GC/FID Analysis
Mark Guilmain	Quality Assurance

5.0 SCHEDULE

The approximate schedule of activities is as follows:

Table 7. Schedule of Project Activities

Activity	Start Date	Status Check Date	End Date
Sample Receipt	TBD		
Sample Extraction/Preparation	TBD + 1 day	Real time	TBD + 7 days
Instrumental Analysis	TBD + 5 days	Real time	TBD + 14 days
Quality Assurance	TBD + 14 days	Real time	TBD + 21 days[1]

Status Check Date is when the PM will check on the status of the project, to determine sample/deliverable status.

[1] This reflects data packages as FINAL (through QA, with all appropriate signatures).

ATTACHMENTS

Attachment 1: Target Analytes-PAH
Attachment 2: Target Analytes-VOC
Attachment 3: Data Quality Objectives
Attachment 4: Data Qualifiers
Attachment 5: Project Manager Review Form
Attachment 6: Sample Custody/Log-In Information

Attachment 1

Target Analytes – PAH and Heteroatomics

Analyte/Analyte Groups	Abbr.	Analyte/Analyte Groups	Abbr.
Decalin	DC	Dibenzothiophene	D
C1-decalins	DC1	C1-dibenzothiophenes	D1
C2-decalins	DC2	C2-dibenzothiophenes	D2
C3-decalins	DC3	C3-dibenzothiophenes	D3
C4-decalins	DC4	C4-dibenzothiophenes	D4
Benzo(b)thiophene	BT	Fluoranthene	FL
C1-benzo(b)thiophenes	BT1	Pyrene	PY
C2-benzo(b)thiophenes	BT2	C1-fluoranthenes/pyrenes	FP1
C3-benzo(b)thiophenes	BT3	C2-fluoranthenes/pyrenes	FP2
C4-benzo(b)thiophenes	BT4	C3-fluoranthenes/pyrenes	FP3
Naphthalene	N	Benz(a)anthracene	BA
C1-naphthalenes	N1	Chrysene	C
C2-naphthalenes	N2	C1-chrysenes	C1
C3-naphthalenes	N3	C2-chrysenes	C2
C4-naphthalenes	N4	C3-chrysenes	C3
Biphenyl	BI	C4-chrysenes	C4
Acenaphthylene	ACY	Benzo(b)fluoranthene	BB
Acenaphthene	ACE	Benzo(k)fluoranthene	BK
Dibenzofuran	DI	Benzo(e)pyrene	BE
Fluorene	F	Benzo(a)pyrene	BAP
C1-fluorenes	F1	Perylene	PER
C2-fluorenes	F2	Indeno(1,2,3-c,d)pyrene	IP
C3-fluorenes	F3	Dibenz(a,h)anthracene	DA
Anthracene	A	Benzo(g,h,i)perylene	GHI
Phenanthrene	P		
C1-phenanthrenes/anthracenes	P1		
C2-phenanthrenes/anthracenes	P2		
C3-phenanthrenes/anthracenes	P3		
C4-phenanthrenes/anthracenes	P4	TPAH = sum N through GHI	TPAH

Target Analytes – Biomarkers

TRITERPANES	Quant. Ion	Key
C23 Tricyclic terpane	191	-
C24 Tricyclic terpane	191	-
C25 Tricyclic terpane	191	-
C26 Tricyclic terpanes	191	-
C28 Tricyclic terpanes	191	1
C29 Tricyclic terpanes	191	2
18α(H)-22,29,30-trisnorhopane (Ts)	191	3
17α(H)-22,29,30-trisnorhopane (Tm)	191	4
C30 Tricyclic terpanes	191	5
17α(H),21β(H)-28,30-bisnorhopane (Tent. - A)	191	6
C29 25-nor-17α(H)-hopane (Tent. – B)	191	7
17α(H),21β(H)-30-norhopane	191	8
18α(H)-30-norneohopane (C29Ts)	191	9
17β(H),21α(H)-normoretane	191	10
18α(H) and 18β(H) oleanane	191	11
17α(H),21β(H)-hopane	191	12
17β(H),21α(H)-moretane	191	13
22S-17α(H),21β(H)-30-homohopane	191	14
22R-17α(H),21β(H)-30-homohopane	191	15
gammacerane	191	-
22S-17α(H),21β(H)-30-bishomohopane	191	-
22R-17α(H),21β(H)-30-bishomohopane	191	-
22S-17α(H),21β(H)-30-trishomohopane	191	-
22R-17α(H),21β(H)-30-trishomohopane	191	-
22S-17α(H),21β(H)-30-tetrakishomohopane	191	-
22R-17α(H),21β(H)-30-tetrakishomohopane	191	-
22S-17α(H),21β(H)-30-pentakishomohopane	191	-
22R-17α(H),21β(H)-30-pentakishomohopane	191	-

RF of 17β(H),21α(H)-moretane applied

Target Analytes – Biomarkers (continued)

STERANES	Quant. Ion	Key
13β,17α-diacholestane(20S)	217	16
13β,17α-diacholestane(20R)	217	17
5α,14β,17β-cholestane(20R)	218	18
5α,14β,17β-cholestane(20S)	218	19
5α,14α,17α-cholestane(20R)	217	20
5α,14β,17β,24-methylcholestane(20R)	218	21
5α,14β,17β,24-methylcholestane(20S)	218	22
5α,14α,17α,24-methylcholestane(20R)	217	23
5α,14α,17α,24-ethylcholestane(20S)	217	24
5α,14β,17β,24-ethylcholestane(20R)	218	25
5α,14β,17β,24-ethylcholestane(20S)	218	26
5α,14α,17α,24-ethylcholestane(20R)	217	27

RF of 5 β Cholane applied

Attachment 2

Data Quality Objectives

QC Measurement	Frequency	Acceptability Limits	Corrective Action
Procedural Blank	1 per analytical batch	<5X RL	Qualification of data*
LCS	1 per analytical batch	40% - 120% PAH/TPH	Qualification of data*
Field Duplicates	1 per 10	30% RPD for analytes 10X RL	Qualification of data*
Surrogate Recovery	per sample	40% - 120% PAH/TPH	Qualification of data*
Instrument Calibration	Initial - once Continuing - at least every ten samples	**Initial:** ≤25% RSD **Continuing:** 15% avg percent diff. No more than 5 analytes >25% diff	Re-calibration Maintenance/justify

* Project Manager will determine if re-analysis is necessary.

All calibrations reviewed with project manager prior to running authentic samples. Mid check calibration standard run and reviewed prior to initial calibrations.

* This is generous with limits. Should for LCS, failure is indicative of problems in analytical system

Attachment 3

Data Qualifiers

Qualifier	Use
J	Analyte detected below the RL.
B	Analyte detected at level greater than 5 X RL in the PB (procedural blank value is qualified).
D	Analyte reported from a diluted run.
ME	Significant matrix interference — estimated value
MI	Significant matrix interference — value could not be determined or estimated
U	Analyte not detected.
&	QC value outside the accuracy or precision data quality objective. (e.g., LCS/SIS recoveries).

Attachment 4: Project Manager Review Form

Staff Member Reviewed:	Assignment or Task Title:
Reviewer:	Reviewer's Project Title:
Period of Performance:	

Unsatisfactory -1-	Needs Improvement -2-	Effective Achievement -3-	Excellent -4-	Outstanding -5-	Not Applicable NA

Note: Use this form to evaluate Project Manager on a project. Please evaluate the staff member only on the job dimensions that are relevant to your interaction with him/her.

Criteria – Project Manager

Rating	Resource Manager Evaluation
	Client feedback
	Staff feedback

Project Design and Initiation

	Work Plan: prepared and distributed clear, accurate, and detailed work plans
	Start-up: Communicated project objectives and coordinated appropriate staff and equipment needs through kick-off meeting or other means of communication (e.g., memo)
	Staff mentoring and training activities: built into project design and implemented effectively

Project/Technical Performance

	Client communication: (oral and written) e.g., progress, problems, deliverables and follow-on work
	Staff communication (oral and written) e.g., changes in scope or schedule; available and approachable to staff
	Technical leadership: provided technical insight; conducted assessments of work in progress
	Innovation: identified and/or applied new technology, technique or ideas
	Issues and Corrective Action: anticipated/identified problems, directed corrective action in real time, notified resource manager of potential overruns, schedule/scope problems, and safety issues
	Attitude (e.g., willingness to provide assistance, positive attitude)
	Multi-tasking: manage multiple projects/tasks simultaneously (e.g., number of projects managed)
	Deliverable Quality: well-written (per Battelle technical/editorial or other review), and timely; incorporates current science, met or exceeded client's expectations (accurate, complete)

Project Closure

	Project Debriefing: conducted debriefings/evaluations, and identified lessons learned with project staff and resource manager, documentation
	Project Performance Reviews: completed technical and support staff reviews
	Closeout: e.g., lab cleanup, data archive, electronic file storage, sample disposal/storage

Record supporting comments (mandatory) on the other side for additional comments.

Reviewer:	Date:

Attachment 5: Sample Custody Information