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September 30, 2013 Reference Nos. 056393 and 056394

Mr. Michael Berkoff
Remedial Project Manager
U.S. EPA – Region V
77 West Jackson Boulevard (SR – 6J)
Chicago, Illinois 60604 – 3590

Ms. Sheila Desai
Remedial Project Manager
U.S. EPA – Region V
77 West Jackson Boulevard (SR – 6J)
Chicago, Illinois 60604 – 3590

Dear Mr. Berkoff and Ms. Desai:

Re: Responses to U.S. EPA Comments
Quality Assurance Project Plan Revision 03, Addendum 06
12th Street Landfill Operable Unit No. 04
Former Plainwell, Inc Mill Property Operable Unit No. 07
Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site
Allegan and Kalamazoo County

Conestoga-Rovers & Associates (CRA) has prepared this letter, on behalf of the Weyerhaeuser NR Company (Weyerhaeuser), in response to the June 18, 2013 United States Environmental Protection Agency's (U.S. EPA's) comments on the Revision 03, Addendum 06 (Addendum) to the Multi-Area Quality Assurance Project Plan (QAPP) for the 12th Street Landfill and former Plainwell, Inc. Mill Property, which was submitted to the U.S. EPA on May 15, 2013.

The scope of the QAPP Addendum included the following:

- Updating the QAPP to reflect changes in project personnel.
- Updating the QAPP to reflect the name change from Columbia Analytical Services (CAS) to ALS-Kelso, Washington.
- The addition of ALS-Holland, Michigan (ALS-Holland) to complete the full suite of analytical parameters for the various media included in the project. The Addendum would allow ALS-Holland to complete all of the analysis required for the projects, which would ensure hold times are met and reduce shipping costs for the projects.

In addition to the items identified in the Worksheet revisions prepared in response to the U.S. EPA comments listed below, corrections have been made regarding the analytical method references for A-27 (nitrate/nitrite), A-37 (nitrite), and A-36 (hexavalent chromium) in Work Sheet #23 Analytical Standard Operating Procedure (SOP) References; Worksheet #24 Analytical Instrument Calibration; Worksheet # 28-22 QC Samples – Nitrite-N (Soil); and

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ENGINEERING DESIGN

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Worksheet #30-3 Analytical Services – ALS-Holland. The three (3) revised SOPs associatedwith the procedures for nitrate, nitrite and hexavalent chromium have also been provided.

The following presents responses to the U.S. EPA's comments consistent with the revisions to the QAPP (Revision 03, Addendum 06) dated May 15, 2013 and subsequent discussions between U.S. EPA and CRA on July 31, 2013.

GENERAL REPORT COMMENTS

U.S. EPA Comment #1

The signature page should be provided.

Response

Signature pages are attached (Worksheets #1, 4-3, 4-4 and 4-5).

U.S. EPA Comment #2

The list of Acronyms should be submitted.

Response

The list of acronyms is attached.

U.S. EPA Comment #3

The title of the submitted document is "Quality Assurance Project Plan Revision 3, Addendum 6 Allied Paper, Inc/Portage Creek/Kalamazoo River Superfund Site". Please explain who prepared and approved addendum 6 revision 1 and 2 and when?

Response

A summary of the previous submittals is included in Worksheet #1. For these projects revisions to the QAPP have been issued when major edits to the QAPP have been made. Addenda to a revision have been issued to address minor changes to the QAPP which have occurred between revisions. The most recent revision to the QAPP, prior to this submittal, was Revision 03, Addendum 05, dated May 13, 2010. Revision 03, Addendum 05 was approved by Mr. Michael Berkoff on June 17, 2010.

U.S. EPA Comment #4

QAPP Work Sheets from #12-11 to #12-18. Measurement Performance Criteria. QA limits for all analytical groups and matrices should be provided in this column. The appropriate SOPs should contain the correct QA limits.

Response

The Quality Control (QC) acceptance limits are not included in most laboratory Method SOPs because the frequency at which these limits are updated is independent of and more frequent than laboratory SOP revisions. The Quality Assurance (QA) limits of all analytical groups and matrices supported by the ALS laboratories identified for current activities have been supplied in Attachment 1-7 – Laboratory Accuracy and Precision Objectives (Tables 7-1 through 7-10). Reference to these Attachment Tables has been added to Worksheets #12-1 through #12-19.

U.S. EPA Comment #5

QAPP Work Sheets from #15-2 and #15-3. Part 201 FDL: Pentachlorophenol is 20 ug/L. The WATS report limit is 330 ug/L. Please explain how you plan to achieve the FDL. These same comments also apply to the 18 semi volatile organic compounds on page 4 of 6 WH # 15-3. Please double-check this information.

Response

The information provided in QAPP Worksheets #15-2 and #15-3 are unchanged from the previously approved version of the QAPP (i.e., Revision 03, Addendum 05) and remain applicable in that context. Additionally, WATS will not be utilized for future sample analysis for these projects, to some extent due to the Reporting Limits (RLs) and Method Detection Limits (MDLs) available from the laboratory. One reason for the addition of ALS-Holland to the QAPP was to utilize a laboratory that could achieve RLs and/or MDLs that meet the Michigan Act 451, Part 201 (Part 201) Target Detection Limits (TDLs) and/or the Part 201 Generic Residential Cleanup Criteria (Part 201 GRCC) for the majority of the requested constituents.

U.S. EPA Comment #6

QAPP Work Sheets #15-6. These comments also apply to the Cyanide, Dibromochloropropane and 23 analytes on page 6 of 7. Paging numbers in QAPP Worksheet #15-6 should be corrected (each page numbered as 1 of 1).

Response

It should be noted that CRA's below response includes reference to additional Worksheets not specified in U.S. EPA Comment #6; however, were discussed during our conference call on July 31, 2013 with U.S. EPA.

In instances where the Reporting Limit (RL) for a given compound exceeds either the Part 201 TDL and/or the Part 201 GRCC, ALS-Kelso (formerly CAS) or ALS-Holland will report down to the MDL to meet the TDL and/or Part 201 GRCC. This addresses the majority of the discrepancies between the RLs and the TDLs/Part 201 GRCC.

Exceptions where the MDL does not achieve the TDL and/or Part 201 GRCC in the QAPP by laboratory and media are listed below:

ALS-Kelso – Soil (Worksheet #15-5)

- dibromochloropropane

ALS-Kelso – Groundwater (Worksheet #15-6)

- 1,2-dibromoethane
- dibromochloropropane
- 3,3-dichlorobenzidine
- dibenzo(a,h)anthracene
- anthracene
- hexachlorobenzene (C-66)
- hexachlorobutadiene (C-46)
- indeno(1,2,3-cd)pyrene
- pentachlorophenol

ALS-Holland – Soil (Worksheet #15-9)

- ammonia-N
- dibromochloropropane

ALS-Holland – Groundwater (Worksheet #15-10)

- 1,2-dibromoethane
- dibromochloropropane
- 3,3-dichlorobenzidine
- indeno(1,2,3-cd)pyrene

None of the constituents listed above have been identified as chemicals of concern (COCs) in their respective media at either the 12th Street Landfill or former Plainwell, Inc. Mill Property.

The page numbers in QAPP Worksheet #15-6 have been corrected.

U.S. EPA Comment #7

QAPP Worksheet # 28-7 QC Samples-Metals (Soil/SPLP). In the column Method/SOP QC acceptance limits should be provided as the SOPs are reported.

Response

The QC acceptance limits are not included in most laboratory Method SOPs because the frequency at which these limits are updated is independent of and more frequent than laboratory SOP revisions. The QC acceptance limits are referenced in Worksheets #12-1 through #12-19 as detailed in the response to U.S. EPA Comment #4 above.

Should you have any questions on the above, please do not hesitate to contact us.

Yours truly,

CONESTOGA-ROVERS & ASSOCIATES

Gregory A. Carli, P.E.

JD/JQ/PW/2/Pwl.

Encl.

cc: Jim Saric (U.S. EPA) – electronic only
Leslie Kirby-Miles (U.S. EPA) – electronic only
Samuel Borries (U.S. EPA) – electronic only
Rebecca Frey (U.S. EPA) – electronic only
Paul Bucholtz (MDEQ) – three hard copies
Kristi Zakrzewski (MDEQ) – three hard copies
Erik Wilson (City of Plainwell) – one hard copy
Richard Gay (Weyerhaeuser) – one hard copy
Martin Lebo (Weyerhaeuser) – electronic only
Joe Jackowski (Weyerhaeuser) - electronic only
Garret Bondy (AMEC) – electronic only
Cynthia Draper (AMEC) – electronic only
Garry Griffith (Georgia-Pacific, LLC) – electronic only
Chase Fortenberry (Georgia-Pacific, LLC) – electronic only
Jeff Keiser (CH2M Hill) – electronic only
Jeffrey Lifka (Tetra Tech) – electronic only
Jennifer Quigley (CRA) – electronic only
Jodie Dembowske (CRA) – electronic only
Paul Wiseman (CRA) – electronic only
Susan Scrocchi (CRA) – electronic only

UPDATED REPORT CONTENT LISTS
INCLUDING UPDATED LIST OF ACRONYMS AND ABBREVIATIONS

(FOR REPLACEMENT IN REPORT)

LIST OF ATTACHMENTS
(following text)

ATTACHMENT	DATE OF LAST REVISION	TITLE	LOCATION OF LAST REVISION
ATTACHMENT 1-1	November 2008	LABORATORY ACCURACY AND PRECISION OBJECTIVES	Rev. 02, Add. 03
ATTACHMENT 1-2	November 2008	SURROGATE COMPOUND RECOVERY LIMITS	Rev. 02, Add. 03
ATTACHMENT 1-3	November 2008	SAMPLE CHAIN-OF-CUSTODY RECORD	Rev. 03, Add. 04
ATTACHMENT 1-4	September 2009	LABORATORY QUALITY ASSURANCE MANUAL	Rev. 02, Add. 03
ATTACHMENT 1-5	September 2013	LABORATORY SOPS	Rev. 03, Add. 06
ATTACHMENT 1-6	November 2008	LABORATORY POLICIES AND GUIDELINES	Rev. 02, Add. 03
ATTACHMENT 1-7	September 2013	LABORATORY ACCURACY AND PRECISION	Rev. 03 Add. 06

LIST OF WORKSHEETS
(following text)

WORKSHEET	DATE OF LAST REVISION	TITLE	LOCATION OF LAST REVISION
Worksheet #1	September 2013	Title and Approval Page	Rev. 03, Add. 06
Worksheet #2	April 2013	Identifying Information	Rev. 03, Add. 06
Worksheet #3	April 2013	Distribution List	Rev. 03, Add. 06
Worksheet #4-1	April 2008	Project Personnel Sign-Off Sheet (RMT)	Rev. 02, Add. 03
Worksheet #4-2	September 2009	Project Personnel Sign-Off Sheet (WATS)	Rev. 03, Add. 04
Worksheet #4-3	September 2013	Project Personnel Sign-Off Sheet (ALS-Kelso)	Rev. 03, Add. 06
Worksheet #4-4	September 2013	Project Personnel Sign-Off Sheet (CRA)	Rev. 03, Add. 06
Worksheet #4-5	September 2013	Project Personnel Sign-Off Sheet (ALS-Holland)	Rev. 03, Add. 06
Worksheet #5-1	September 2007	Project Organizational Chart (Emergency Response Activities for the 12th Street Landfill and the Plainwell Mill Banks)	Rev. 02, Add. 03
Worksheet #5-2	April 2008	Project Organization Chart (Predesign Investigations for the Remedial Design for the 12th Street Landfill)	Rev. 02, Add. 03
Worksheet #5-3	November 2008	Project Organization Chart (Phase 2 of Addendum No. 1 [Test Pits] and Plainwell Mill RI/FS – Phase I Initial Groundwater Assessment)	Rev. 02, Add. 03
Worksheet #5-4	April 2013	Project Organization Chart (Plainwell Mill Phase II RI Work Plan)	Rev. 03, Add. 06
Worksheet #5-5	April 2013	Project Organization Chart (12th Street Landfill Remedial Action Work Plan)	Rev. 03, Add. 06
Worksheet #6-1	September 2007	Communication Pathways (Emergency Response Activities for the 12th Street Landfill and the Plainwell Mill Banks)	Rev. 02, Add. 03
Worksheet #6-2	April 2008	Communication Pathways (Predesign Investigations for the Remedial Design for the 12th Street Landfill)	Rev. 02, Add. 03

WORKSHEET	DATE OF LAST REVISION	TITLE	LOCATION OF LAST REVISION
Worksheet #6-3	November 2008	Communication Pathways (Phase 2 of Addendum No. 1 [Test Pits] and Plainwell Mill RI/FS – Phase I Initial Groundwater Assessment)	Rev. 02, Add. 03
Worksheet #6-4	April 2013	Communication Pathways (Plainwell Mill Phase II RI Work Plan)	Rev. 03, Add. 06
Worksheet #6-5	April 2013	Communication Pathways (12th Street Landfill Remedial Action Work Plan)	Rev. 03, Add. 06
Worksheet #7	April 2013	Personnel Responsibilities and Qualifications	Rev. 03, Add. 06
Worksheet #8	April 2013	Special Personnel Training Requirements	Rev. 03, Add. 06
Worksheet #9-1	June 2007	Project Scoping Session Participants Sheet (May 8, 2007)	Rev. 02, Add. 03
Worksheet #9-2	June 2007	Project Scoping Session Participants Sheet (June 6, 2007)	Rev. 02, Add. 03
Worksheet #9-3	April 2008	Project Scoping Session Participants Sheet (December 7, 2007)	Rev. 02, Add. 03
Worksheet #9-4	September 2009	Project Scoping Session Participants Sheet (January 9, 2008)	Rev. 02, Add. 03
Worksheet #9-5	September 2009	Project Scoping Session Participants Sheet (June, 2008)	Rev. 02, Add. 03
Worksheet #9-6	September 2009	Project Scoping Session Participants Sheet (May/June, 2009)	Rev. 02, Add. 03
Worksheet #9-7	September 2009	Project Scoping Session Participants Sheet (April-June, 2009)	Rev. 02, Add. 03
Worksheet #9-8	April 2013	Project Scoping Session Participants Sheet (January 2013)	Rev. 03, Add. 06
Worksheet #9-9	April 2013	Project Scoping Session Participants Sheet (March 2013)	Rev. 03, Add. 06
Worksheet #10-1	June 2007	Problem Definition - DQOs (Emergency Response Activities in the Former Powerhouse Discharge Channel)	Rev. 02, Add. 03
Worksheet #10-2	September 2007	Problem Definition - DQOs (Emergency Response on the Plainwell Mill Banks)	Rev. 02, Add. 03
Worksheet #10-3	April 2008	Problem Definition - DQOs (Predesign Investigations for the Remedial Design for the 12th Street Landfill)	Rev. 02, Add. 03
Worksheet #10-4	November 2008	Problem Definition - DQOs (Phase 2 of Addendum No. 1 [Test Pits] and Plainwell Mill RI/FS – Phase I Initial Groundwater Assessment)	Rev. 02, Add. 03

WORKSHEET	DATE OF LAST REVISION	TITLE	LOCATION OF LAST REVISION
Worksheet #10-5	September 2009	Problem Definition - DQOs (Plainwell Mill Phase II RI Work Plan)	Rev. 03, Add. 04
Worksheet #10-6	September 2009	Problem Definition - DQOs (12th Street Landfill RA Work Plan)	Rev. 03, Add. 04
Worksheet #11-1	September 2007	Project Quality Objectives/Systematic Planning Process Statements (Emergency Response Activities in the Former Powerhouse Discharge Channel)	Rev. 02, Add. 03
Worksheet #11-2	September 2007	Project Quality Objectives/Systematic Planning Process Statements (Emergency Response on the Plainwell Mill Banks)	Rev. 02, Add. 03
Worksheet #11-3	April 2008	Project Quality Objectives/Systematic Planning Process Statements (Predesign Investigations for the Remedial Design for the 12th Street Landfill)	Rev. 02, Add. 03
Worksheet #11-4	November 2008	Project Quality Objectives/Systematic Planning Process Statements (Phase 2 of Addendum No. 1 [Test Pits] and Plainwell Mill RI/FS – Phase I Initial Groundwater Assessment)	Rev. 02, Add. 03
Worksheet #11-5	September 2009	Project Quality Objectives/Systematic Planning Process Statements (Plainwell Mill Phase II RI Work Plan)	Rev. 03, Add. 04
Worksheet #11-6	April 2013	Project Quality Objectives/Systematic Planning Process Statements (12th Street Landfill Operation, Maintenance and Monitoring Plan)	Rev. 03, Add. 06
Worksheet #12-1	September 2013	Measurement Performance Criteria (PCBs - Surface Water)	Rev. 03, Add. 06
Worksheet #12-2	September 2013	Measurement Performance Criteria (Wet Chemistry - Surface Water)	Rev. 03, Add. 06
Worksheet #12-3	September 2013	Measurement Performance Criteria (PCBs - Soil/Sediment)	Rev. 03, Add. 06
Worksheet #12-4	September 2013	Measurement Performance Criteria (PCBs – Free Product)	Rev. 03, Add. 06
Worksheet #12-5	September 2013	Measurement Performance Criteria (TAL Metals – Groundwater / SPLP Metals - Soil)	Rev. 03, Add. 06
Worksheet #12-6	September 2013	Measurement Performance Criteria (TAL Metals – Soil)	Rev. 03, Add. 06
Worksheet #12-7	September 2013	Measurement Performance Criteria (Cyanide – Groundwater)	Rev. 03, Add. 06
Worksheet #12-8	September 2013	Measurement Performance Criteria (Cyanide – Soil)	Rev. 03, Add. 06

WORKSHEET	DATE OF LAST REVISION	TITLE	LOCATION OF LAST REVISION
Worksheet #12-9	September 2013	Measurement Performance Criteria (Low-Level Mercury – Groundwater)	Rev. 03, Add. 06
Worksheet #12-10	September 2013	Measurement Performance Criteria (SVOCs – Groundwater)	Rev. 03, Add. 06
Worksheet #12-11	September 2013	Measurement Performance Criteria (SVOCs – Soil)	Rev. 03, Add. 06
Worksheet #12-12	September 2013	Measurement Performance Criteria (VOCs – Groundwater)	Rev. 03, Add. 06
Worksheet #12-13	September 2013	Measurement Performance Criteria (VOCs – Soil)	Rev. 03, Add. 06
Worksheet #12-14	September 2013	Measurement Performance Criteria (DRO & GRO – Soil)	Rev. 03, Add. 06
Worksheet #12-15	September 2013	Measurement Performance Criteria (PCDD/PCDF – Groundwater)	Rev. 03, Add. 06
Worksheet #12-16	September 2013	Measurement Performance Criteria (PCDD/PCDF – Soil)	Rev. 03, Add. 06
Worksheet #12-17	September 2013	Measurement Performance Criteria (Wet Chemistry – Soil)	Rev. 03, Add. 06
Worksheet #12-18	September 2013	Measurement Performance Criteria (Low Level Mercury and Methyl Mercury – Surface Water)	Rev. 03, Add. 06
Worksheet #12-19	September 2013	Measurement Performance Criteria (PCBs - Groundwater)	Rev. 03, Add. 06
Worksheet #13-1	September 2009	Secondary Data Criteria and Limitations (12th Street Landfill)	Rev. 03, Add. 04
Worksheet #13-2	September 2009	Secondary Data Criteria and Limitations (Plainwell Mill)	Rev. 03, Add. 04
Worksheet #14	April 2013	Summary of Project Tasks	Rev. 03, Add. 06
Worksheet #15-1	May 2010	Reference Limits and Evaluation (Surface Water)	Rev. 03, Add. 05
Worksheet #15-2	May 2010	Reference Limits and Evaluation (Soil/Sediment)	Rev. 03, Add. 05
Worksheet #15-3	May 2010	Reference Limits and Evaluation (Groundwater)	Rev. 03, Add. 05
Worksheet #15-4	September 2013	Reference Limits and Evaluation (Surface Water)	Rev. 03, Add. 06
Worksheet #15-5	September 2013	Reference Limits and Evaluation (Soil/Sediment)	Rev. 03, Add. 06

WORKSHEET	DATE OF LAST REVISION	TITLE	LOCATION OF LAST REVISION
Worksheet #15-6	September 2013	Reference Limits and Evaluation (Groundwater)	Rev. 03, Add. 06
Worksheet #15-7	September 2013	Reference Limits and Evaluation (Free Product)	Rev. 03, Add. 06
Worksheet #15-8	September 2013	Reference Limits and Evaluation (Surface Water)	Rev. 03, Add. 06
Worksheet #15-9	September 2013	Reference Limits and Evaluation (Soil/Sediment)	Rev. 03, Add. 06
Worksheet #15-10	September 2013	Reference Limits and Evaluation (Groundwater)	Rev. 03, Add. 06
Worksheet #15-11	September 2013	Reference Limits and Evaluation (Free Product)	Rev. 03, Add. 06
Worksheet #16-1	June 2007	Project Schedule/Timeline (Emergency Response Activities in the Former Powerhouse Discharge Channel)	Rev. 02, Add. 03
Worksheet #16-2	September 2007	Project Schedule/Timeline (Emergency Response Activities on the Plainwell Mill Banks)	Rev. 02, Add. 03
Worksheet #16-3	April 2008	Project Schedule/Timeline (Predesign Investigations for the Remedial Design for the 12th Street Landfill)	Rev. 02, Add. 03
Worksheet #16-4	November 2008	Project Schedule/Timeline (Phase 2 of Addendum No. 1 [Test Pits] and Plainwell Mill RI/FS – Phase I Initial Groundwater Assessment)	Rev. 02, Add. 03
Worksheet #16-5	April 2013	Project Schedule/Timeline (Plainwell Mill Phase II RI Work Plan)	Rev. 03, Add. 06
Worksheet #16-6	April 2013	Project Schedule/Timeline (12th Street Landfill RA Work Plan)	Rev. 03, Add. 06
Worksheet #17-1	June 2007	Sampling Design and Rationale (Former Powerhouse Discharge Channel)	Rev. 02, Add. 03
Worksheet #17-2	September 2007	Sampling Design and Rationale (Emergency Response on the Plainwell Mill Banks)	Rev. 02, Add. 03
Worksheet #17-3	April 2008	Sampling Design and Rationale (Predesign Investigations for the Remedial Design For the 12th Street Landfill)	Rev. 02, Add. 03
Worksheet #17-4	September 2009	Sampling Design and Rationale (Phase 2 of Addendum No. 1 [Test Pits] and Plainwell Mill RI/FS – Phase I Initial Groundwater Assessment)	Rev. 03, Add. 04
Worksheet #17-5	September 2009	Sampling Design and Rationale (Plainwell Mill Phase II RI Work Plan)	Rev. 03, Add. 04

WORKSHEET	DATE OF LAST REVISION	TITLE	LOCATION OF LAST REVISION
Worksheet #17-6	November 2008	Sampling Design and Rationale (12th Street Landfill)	Rev. 02, Add. 03
Worksheet #18-1	September 2007	Sampling Locations and Methods/SOP Requirements (Emergency Response Activities)	Rev. 02, Add. 03
Worksheet #18-2	April 2008	Sampling Locations and Methods/SOP Requirements (Predesign Investigations for the Remedial Design For the 12th Street Landfill)	Rev. 02, Add. 03
Worksheet #18-3	November 2008	Sampling Locations and Methods/SOP Requirements (Phase 2 of Addendum No. 1 [Test Pits] and Plainwell Mill RI/FS – Phase I Initial Groundwater Assessment)	Rev. 02, Add. 03
Worksheet #18-4	September 2009	Sampling Locations and Methods/SOP Requirements (Plainwell Mill Phase II RI Work Plan)	Rev. 03, Add. 04
Worksheet #18-5	September 2009	Sampling Locations and Methods/SOP Requirements (12th Street Landfill RA Work Plan)	Rev. 03, Add. 04
Worksheet #19	April 2013	Analytical SOP Requirements	Rev. 03, Add. 06
Worksheet #20	April 2013	Field Quality Control Sample Summary	Rev. 03, Add. 04
Worksheet #21	September 2009	Project Sampling SOP Reference	Rev. 03, Add. 04
Worksheet #22	September 2009	Field Equipment Calibration, Maintenance, Testing, and Inspection	Rev. 03, Add. 04
Worksheet #23	September 2013	Analytical SOP References	Rev. 03, Add. 06
Worksheet #24	September 2013	Analytical Instrument Calibration	Rev. 03, Add. 06
Worksheet #25	April 2013	Analytical Instrument and Equipment Maintenance, Testing, and Inspection	Rev. 03, Add. 06
Worksheet #26	April 2013	Sample Handling System (WATS/ALS-Kelso/ALS-Holland)	Rev. 03, Add. 06
Worksheet #27	September 2009	Sample Custody Requirements	Rev. 03, Add. 04
Worksheet #28-1	September 2013	QC Samples - PCBs (Surface Water/ Groundwater)	Rev. 03, Add. 06
Worksheet #28-2	September 2013	QC Samples - TSS (Surface Water)	Rev. 03, Add. 06
Worksheet #28-3	September 2013	QC Samples - Phosphorus (Surface Water)	Rev. 03, Add. 06

WORKSHEET	DATE OF LAST REVISION	TITLE	LOCATION OF LAST REVISION
Worksheet #28-4	September 2013	QC Samples - PCBs (Soil/Sediment)	Rev. 03, Add. 06
Worksheet #28-5	September 2013	QC Samples - PCBs (Free Product)	Rev. 03, Add. 06
Worksheet #28-6	September 2013	QC Samples - TAL Metals (Groundwater)	Rev. 03, Add. 06
Worksheet #28-7	September 2013	QC Samples - TAL Metals (Soil/SPLP)	Rev. 03, Add. 06
Worksheet #28-8	September 2013	QC Samples – Chromium (VI, III) (Groundwater)	Rev. 03, Add. 06
Worksheet #28-9	September 2013	QC Samples - Cyanide (Groundwater)	Rev. 03, Add. 06
Worksheet #28-10	September 2013	QC Samples - Cyanide (Soil)	Rev. 03, Add. 06
Worksheet #28-11	September 2013	QC Samples - Low-Level Mercury (Surface Water/'Groundwater)	Rev. 03, Add. 06
Worksheet #28-12	September 2013	QC Samples - SVOCs (Groundwater)	Rev. 03, Add. 06
Worksheet #28-13	September 2013	QC Samples - SVOCs (Soil)	Rev. 03, Add. 06
Worksheet #28-14	September 2013	QC Samples - VOCs (Groundwater)	Rev. 03, Add. 06
Worksheet #28-15	September 2013	QC Samples - VOCs (Soil)	Rev. 03, Add. 06
Worksheet #28-16	September 2013	QC Samples - DRO and GRO (Soil)	Rev. 03, Add. 06
Worksheet #28-17	September 2013	QC Samples – Hardness (Surface Water)	Rev. 03, Add. 06
Worksheet #28-18	September 2013	QC Samples – Methyl Mercury (Surface Water/ Groundwater)	Rev. 03, Add. 06
Worksheet #28-19	September 2013	QC Samples – Phosphorus (Soil)	Rev. 03, Add. 06
Worksheet #28-20	September 2013	QC Samples – Ammonia – N (Soil)	Rev. 03, Add. 06
Worksheet #28-21	September 2013	QC Samples – Nitrate – N (Soil)	Rev. 03, Add. 06
Worksheet #28-22	September 2013	QC Samples – Nitrite – N (Soil)	Rev. 03, Add. 06

WORKSHEET	DATE OF LAST REVISION	TITLE	LOCATION OF LAST REVISION
Worksheet #28-23	September 2013	QC Samples – PCDD/PCDDFs (Groundwater)	Rev. 03, Add. 06
Worksheet #28-24	September 2013	QC Samples – PCDD/PCDDFs (Soil)	Rev. 03, Add. 06
Worksheet #29	June 2007	Project Documents and Records	Rev. 02, Add. 03
Worksheet #30-1	April 2013	Analytical Services – WATS	Rev. 03, Add. 06
Worksheet #30-2	April 2013	Analytical Services – ALS-Kelso	Rev. 03, Add. 06
Worksheet #30-3	September 2013	Analytical Services – ALS-Holland	Rev. 03, Add. 06
Worksheet #31-1	April 2008	Planned Project Assessments (Emergency Response Activities)	Rev. 02, Add. 03
Worksheet #31-2	April 2008	Planned Project Assessments (Predesign Investigations for the Remedial Design For the 12th Street Landfill)	Rev. 02, Add. 03
Worksheet #31-3	November 2008	Planned Project Assessments (Phase 2 of Addendum No. 1 [Test Pits] and Plainwell Mill RI/FS – Phase I Initial Groundwater Assessment)	Rev. 02, Add. 03
Worksheet #31-4	April 2013	Planned Project Assessments (Plainwell Mill Phase II RI Work Plan)	Rev. 03, Add. 06
Worksheet #31-5	April 2013	Planned Project Assessments (12th Street Landfill RA Work Plan)	Rev. 03, Add. 06
Worksheet #32-1	April 2008	Assessment Findings and Corrective Action Responses (Emergency Response Activities)	Rev. 02, Add. 03
Worksheet #32-2	April 2008	Assessment Findings and Corrective Action Responses (Predesign Investigations for the Remedial Design For the 12th Street Landfill)	Rev. 02, Add. 03
Worksheet #32-3	April 2013	Assessment Findings and Corrective Action Responses (Plainwell Mill Phase II RI Work Plan)	Rev. 03, Add. 06
Worksheet #32-4	April 2013	Assessment Findings and Corrective Action Responses (12th Street Landfill RA Work Plan)	Rev. 03, Add. 06
Worksheet #33	April 2013	QA Management Reports	Rev. 03, Add. 06
Worksheet #34	April 2013	Verification (Step I) Process	Rev. 03, Add. 06
Worksheet #35	April 2013	Validation (Step I) Process	Rev. 03, Add. 06

WORKSHEET	DATE OF LAST REVISION	TITLE	LOCATION OF LAST REVISION
Worksheet #36	September 2009	Validation (Steps IIa and IIb) Summary	Rev. 03, Add. 04
Worksheet #37	September 2009	Usability Assessment	Rev. 03, Add. 04

LIST OF ACRONYMS AND ABBREVIATIONS

µg/L	micrograms per liter
µg/kg	micrograms per kilogram
AA	atomic absorption
ALS	ALS Environmental Laboratories
ALS-Holland	ALS Environmental Laboratories – Holland, Michigan
ALS-Kelso	ALS Environmental Laboratories – Kelso, Washington
ARAR	Applicable, or Relevant and Appropriate Requirement
ASTM	American Society for Testing and Materials
BFB	p-bromofluorobenzene
BNA	base-neutral-acid extractable
Ca	calcium
CAS	Columbia Analytical Services
CCB	continuing calibration blank
CCC	calibration check compound
CCV	continuing calibration verification
CD	Consent Decree
CFR	Code of Federal Regulations
CLP	Contract Laboratory Program
COC	Chain-of-Custody
COPC	constituent of potential concern
CRA	Conestoga-Rovers & Associates
CVAA	cold vapor atomic absorption
DFTPP	decafluorotriphenylphosphine
DI	deionized
DO	dissolved oxygen
DQI	data quality indicators
DQO	Data Quality Objective
ECD	electron capture detector
EDD	electronic data deliverable
EDL	estimated detection limit
Eh	redox
FB	field blank
FS	Feasibility Study
FSP	Field Sampling Plan
GC/MS	gas chromatograph/mass spectrophotometer
GRCC	Generic Residential Cleanup Criteria

LIST OF ACRONYMS AND ABBREVIATIONS
(Continued)

HSP	Health and Safety Plan
ICB	initial calibration blank
ICP	inductively coupled plasma
ICPMS	inductively coupled plasma mass spectroscopy
ICS	interface check samples
ICV	initial calibration verification
IDW	investigation-derived waste
kg	kilogram
KRSG	Kalamazoo River Study Group
L	liter
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
LRA	linear range analysis
MDEQ	Michigan Department of Environmental Quality
MDL	Method Detection Limit
Mg	magnesium
MS	matrix spike
MS/MSD	matrix spike/matrix spike duplicate
MSD	matrix spike duplicate
NA	not available
NCP	National Contingency Plan
ng	nanograms
NIST	National Institute of Standards and Technology
NTU	nephelometric turbidity unit
OSC	On-Scene Coordinator
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
pg	pictograms
pH	negative logarithm (base 10) of hydrogen ion activity
PID	photoionization detector
PQO	Project Quality Objective
POTW	publicly-owned treatment works
PM	Project Manager
QA	quality assurance

LIST OF ACRONYMS AND ABBREVIATIONS
(Continued)

QA/QC	quality assurance/quality control
QAPP	Quality Assurance Project Plan
QC	quality control
QL	Quantitation Limit
RASs	routine analytical service
RCRA	Resource Conservation and Recovery Act
RD/RA	Remedial Design/Remedial Action
RF	response factor
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
RPD	relative percent difference
RL	reporting limit
RPM	Remedial Project Manager
RSD	relative standard deviation
RT	retention time
SAP	Sampling and Analysis Plan
SAS	special analytical services
SOP	standard operating procedure
SOW	Statement of Work
SPCC	system performance check compound
SRI/FS	Supplemental Remedial Investigation/Feasibility Study
SRM	standard reference material
SW846	Test Methods for Evaluating Solid Waste, 1996
TAL	Target Analyte List
TCL	Target Compound List
TCLP	Toxicity Characteristic Leaching Procedure
TCRA	Time-Critical Removal Action
TEMP	temperature
TB	trip blank
TSS	Total suspended solids
µg	micrograms
U.S. EPA	United States Environmental Protection Agency
UFP	Uniform Federal Policy

LIST OF ACRONYMS AND ABBREVIATIONS
(Continued)

VOC	volatile organic compound
WATS	Weyerhaeuser Analytical Testing Service

REVISED WORKSHEETS

QAPP Worksheet No.	*QAPP Worksheet Title*
1	Title and Approval Page
4-3	Project Personnel Sign-Off Sheet (ALS-Kelso)
4-4	Project Personnel Sign-Off Sheet (CRA)
4-5	Project Personnel Sign-Off Sheet (ALS-Holland)
12-1 to 12-19	Measurement Performance Criteria
15-4 to 15-7	Reference Limits and Evaluation – ALS-Kelso
15-8 to 15-11	Reference Limits and Evaluation –ALS-Holland
23	Analytical SOP References
24	Analytical Instrument Calibration
28-22	QC Samples
30-3	Analytical Services

(

QAPP Worksheet #1
Title and Approval Page

Site Name/Project Name:	Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site
Site Location:	Kalamazoo and Allegan Counties, including (but not limited to) 3 miles of Portage Creek and the Kalamazoo River from the City of Kalamazoo to Lake Michigan ▪ Operable Unit No. 4 - 12th Street Landfill ▪ Operable Unit No. 7 - Plainwell Mill
Document Title:	Multi-Area Quality Assurance Project Plan, Weyerhaeuser Company
Lead Organization:	U.S. EPA Region 5
Preparer's Name and Organizational Affiliation:	Gregory A. Carli, P. E., CRA
Preparer's Contact Information:	2055 Niagara Falls Boulevard, Suite #3, Niagara Falls, New York, 14304 gcarli@craworld.com
Preparation Date: (1) Revision 03, Addendum No. 6 represents the addition of laboratory services provided by ALS Environmental in Holland, Michigan (ALS-Holland) to include all active testing (with the inclusion of dioxins/furans) and the laboratory name change of Columbia Analytical Services (CAS) to ALS Environmental (ALS-Kelso) due to the laboratory's acquisition.	Revision 00 - June 2007 Revision 01-August 2007 Revision 02, Addendum 01- September 2007 Revision 02, Addendum 02- February 2008 Revision 02, Addendum 03 - September 2008; Revision 02, Addendum 03 - November 2008; Revision 03, Addendum 04 - June 2009; Revision 03, Addendum 04 – September 2009; Revision 03, Addendum 05 – May 2010; Revision 03, Addendum 6(1)– April and September 2013
Investigative Organization's Project Manager For Investigative Activities at the Plainwell Mill (Operable Unit No. 7):	Signature: Jennifer Quigley, CRA
Investigative Organization's Project Manager For Investigative Activities at the 12th Street Landfill (Operable Unit No. 4):	Signature: Jodie Dembowske, CRA
Investigative Organization's QA Officer:	Signature: Paul Wiseman, CRA
Lead Organization's Program Manager for the 12th Street Landfill (Operable Unit No. 4):	Signature: Michael Berkoff, U.S. EPA Region 5

QAPP Worksheet #1
Title and Approval Page

Lead Organization's Program Manager for the Plainwell Mill (Operable Unit No. 7):	Signature:	Sheila Desai, U.S. EPA Region 5
ALS Environmental (ALS-Holland) Laboratory Manager	Signature:	Jeff Glaser, ALS Environmental - Holland
ALS Environmental (ALS-Kelso) - formerly Columbia Analytical Services, Inc. (CAS)) Laboratory Manager:	Signature:	Jeff Christian, ALS Environmental - Kelso (formerly CAS)
U.S. EPA Quality Assurance Reviewer:	Signature:	U.S. EPA Region 5

Document Control Number: 56394 (3)-001

QAPP Worksheet #4-3
Project Personnel Sign-Off Sheet (ALS-Kelso)

PROJECT PERSONNEL	TITLE	TELEPHONE NUMBER	SIGNATURE	DATE QAPP READ
Jeff Christian	Laboratory Manager	360.557.7222	Jeff Christian	10/01/2013

QAPP Worksheet #4-4
Project Personnel Sign-Off Sheet (CRA)

PROJECT PERSONNEL	TITLE	TELEPHONE NUMBER	SIGNATURE	DATE QAPP READ
Jennifer Quigley	Project Manager (Plainwell Mill)	269.685.5181	Jenni Quigley	9/30/13
Jodie Dembowske	Project Manager (12th Street Landfill)	269.685.5181	Jodie Dembowske	9/30/13
Paul Wiseman	QA Officer	734.453.5123		9/30/13
Matthew Ramsey	Field QA Officer	269.685.5181	Matt R	9/30/13
Gregory Carli	Project Advisor	716.297.6150		9/30/13

QAPP Worksheet #4-5
Project Personnel Sign-Off Sheet (ALS-Holland)

PROJECT PERSONNEL	TITLE	TELEPHONE NUMBER	SIGNATURE	DATE QAPP READ
Jeff Glaser	Laboratory Manager	616.399-6070	Jeff Glaser	10/1/13

QAPP Worksheet #12-1
Measurement Performance Criteria (PCBs - Surface Water)

Matrix: Aqueous
Analytical Group: PCBs
Concentration Level: All

SAMPLING PROCEDURE[1]	ANALYTICAL METHOD/SOP[2]	DATA QUALITY INDICATORS (DQIs)	MEASUREMENT PERFORMANCE CRITERIA	QC SAMPLE AND/OR ACTIVITY USED TO ASSESS MEASUREMENT PERFORMANCE	QC SAMPLE ASSESSES ERROR FOR SAMPLING(S), ANALYTICAL(A), OR BOTH (S&A)
F-16	W-1, C-13, A-14	Precision - Overall	Relative percent difference (RPD) < 50%	Field duplicate	S&A
		Accuracy/Bias	% Recovery (%R) laboratory-generated limits[3][*]	Surrogate	A
		Accuracy/Bias Contamination	< Reporting limit (RL)	Blanks (field, equipment, method)	S&A
		Accuracy/Bias	%R laboratory-generated limits[*]	Laboratory control sample (LCS)	A
		Accuracy/Bias and Precision	Retention times, see analytical SOP	Retention time windows	A
		Accuracy/Bias	%R, same as LCS[*]	Matrix spike (MS)[3]	A
		Accuracy/Bias	%R, same as LCS[*]	Matrix spike duplicate (MSD) or laboratory control sample duplicate (LCSD)[3]	A
		Precision	RPD laboratory-generated limits[3][*]	MS/MSD or LCS/LCSD[3]	A

QAPP Worksheet #12-1
Measurement Performance Criteria (PCBs - Surface Water)

Footnotes:
(1) Reference number from QAPP Worksheet #21. See the project-specific Field Sampling Plan for sampling procedures.
(2) Reference number from QAPP Worksheet #23.
(3) MS and MSD must be client-provided. LCS/LCSD performed when no MS/MSD is supplied.
(*) See Attachments 1-1, 1-2 and 1-7
RPD = relative percent difference.

QAPP Worksheet #12-2
Measurement Performance Criteria (Wet Chemistry - Surface Water/Groundwater)

Matrix: Water

Analytical Group: Wet chemistry

Concentration Level: All

SAMPLING PROCEDURE[1]	ANALYTICAL METHOD/SOP[2]	DATA QUALITY INDICATORS (DQIs)	MEASUREMENT PERFORMANCE CRITERIA	QC SAMPLE AND/OR ACTIVITY USED TO ASSESS MEASUREMENT PERFORMANCE	QC SAMPLE ASSESSES ERROR FOR SAMPLING(S), ANALYTICAL(A), OR BOTH (S&A)
F-16	W-2, W-3, W-5, W-26, A-25, A-26, A-27, A-28, A-30, A-31, A-32, A-36, A-37	Precision - Overall	RPD < 50%	Field duplicate	S&A
		Accuracy/Bias Contamination	< RL	Blanks (field, equipment, calibration, preparation)	S&A
		Accuracy/Bias	%R (90-110)	Continuing calibration verification	A
		Accuracy/Bias	%R (75-125)	MS[3]	A
		Accuracy/Bias	%R (75-125)	MSD[3]	A
		Precision	%R < 20%	MS/MSD[3]	A
		Accuracy/Bias	%R laboratory-generated limit[*]	LCS	A

QAPP Worksheet #12-2
Measurement Performance Criteria (Wet Chemistry - Surface Water/Groundwater)

Footnotes:

(1) Reference number from QAPP Worksheet #21. See the project-specific Field sampling Plan for sampling procedures.

(2) Reference number from QAPP Worksheet #23.

(3) MS and MSD not applicable for TSS

(*) See Attachment 1-1 and 1-7.

QAPP Worksheet #12-3
Measurement Performance Criteria (PCBs - Soil/Sediment)

Matrix: Soil/Sediment

Analytical Group:[1] PCBs

Concentration Level: All

SAMPLING PROCEDURE[2]	ANALYTICAL METHOD/SOP[3]	DATA QUALITY INDICATORS (DQIs)	MEASUREMENT PERFORMANCE CRITERIA	QC SAMPLE AND/OR ACTIVITY USED TO ASSESS MEASUREMENT PERFORMANCE	QC SAMPLE ASSESSES ERROR FOR SAMPLING(S), ANALYTICAL(A), OR BOTH (S&A)
F-4, F-5, F-6	W-4, C-13, A-14	Precision-Overall	RPD < 100%	Field duplicate	S&A
		Accuracy/Bias	%R, laboratory-generated limits[*]	Surrogate	A
		Accuracy/Bias Contamination	< RL	Blanks (field, equipment, method)	S&A
		Accuracy/Bias	%R, laboratory-generated limits[*]	LCS	A
		Accuracy/Bias and Precision	Retention times, see analytical SOP	Retention time windows	A
		Accuracy/Bias	%R, same as LCS[*]	MS[3]	A
		Accuracy/Bias	%R, same as LCS[*]	MSD or LCSD[3]	A
		Precision	%RPD laboratory-generated limits[3][*]	MS/MSD or LCS/LCSD[3]	A

QAPP Worksheet #12-3
Measurement Performance Criteria (PCBs - Soil/Sediment)

Footnotes:

(1) Reference number from QAPP Worksheet #21. See the project-specific Field Sampling Plan for sampling procedures.

(2) Reference number from QAPP Worksheet #23.

(3) MS and MSD must be client-provided. LCS/LCSD performed when no MS/MSD is supplied.

(*) See Attachments 1-1, 1-2 and 1-7.

QAPP Worksheet #12-4
Measurement Performance Criteria (PCBs – Free Product)

Matrix: Free Product
Analytical Group: PCBs
Concentration Level: All

SAMPLING PROCEDURE[1]	ANALYTICAL METHOD/SOP[2]	DATA QUALITY INDICATORS (DQIs)	MEASUREMENT PERFORMANCE CRITERIA[3]	QC SAMPLE AND/OR ACTIVITY USED TO ASSESS MEASUREMENT PERFORMANCE	QC SAMPLE ASSESSES ERROR FOR SAMPLING(S), ANALYTICAL(A), OR BOTH (S&A)
F-8	C-13, C-14, C-15, A-14	Precision-Overall	RPD < 100%	Field duplicate	S&A
		Accuracy/Bias	%R, laboratory-generated limits[(*)]	Surrogate	A
		Accuracy/Bias Contamination	< 2 x MDL	Blanks (field, equipment, method)	S&A
		Accuracy/Bias	%R, laboratory-generated limits[(*)]	LCS	A
		Accuracy/Bias	%R, laboratory-generated limits[(*)]	MS[4]	A
		Accuracy/Bias	%R, laboratory-generated limits[(*)]	MSD or LCSD[4]	A
		Precision	RPD laboratory-generated limits[3][(*)]	MS/MSD or LCS/LCSD[4]	A

Footnotes:

(1) Reference number from QAPP Worksheet #21. See the project-specific Field Sampling Plan for sampling procedures.

(2) Reference number from QAPP Worksheet #23.

(3) Measurement performance criteria listed are current criteria at the time this document was created, but are subject to change as control limits are updated.

(4) MS and MSD must be client-provided. LCS/LCSD performed when no MS/MSD is supplied.

(*) See Attachments 1-1, 1-2 and 1-7.

RPD = relative percent difference.

QAPP Worksheet #12-5
Measurement Performance Criteria (TAL Metals – Groundwater / SPLP Metals-Soil)

Matrix: Aqueous
Analytical Group: TAL Metals / SPLP Metals
Concentration Level: All (Except Low-Level Mercury)

SAMPLING PROCEDURE(1)	ANALYTICAL METHOD/SOP(2)	DATA QUALITY INDICATORS (DQIs)	MEASUREMENT PERFORMANCE CRITERIA(3)	QC SAMPLE AND/OR ACTIVITY USED TO ASSESS MEASUREMENT PERFORMANCE	QC SAMPLE ASSESSES ERROR FOR SAMPLING(S), ANALYTICAL(A), OR BOTH (S&A)
F-8 F-11, F-5, F-6	W-14, C-18, C-31, C-33, A-21, A-23	Precision-Overall	RPD < 100%	Field duplicate	S&A
		Accuracy/Bias Contamination	< RL	Blanks (field, equipment, method)	S&A
		Accuracy/Bias	%R, laboratory-generated limits(*)	LCS	A
		Precision	sample > 5 x QL; RPD ≤ 20% sample ≤ 5 x QL; No limit	Laboratory duplicate	A
		Accuracy/Bias	%R, laboratory-generated limits(*)	MS(4)	A
		Accuracy/Bias	%R, laboratory-generated limits(*)	MSD or LCSD(4)	A
		Precision	RPD laboratory-generated limits(3)(*)	MS/MSD or LCS/LCSD(4)	A
		Accuracy	%R > 80%	Interference check sample	A
		Accuracy	RPD ≤ 10%	Serial dilution	A

QAPP Worksheet #12-5
Measurement Performance Criteria (TAL Metals – Groundwater / SPLP Metals-Soil)

Footnotes:

(1) Reference number from QAPP Worksheet #21. See the project-specific Field Sampling Plan for sampling procedures.
(2) Reference number from QAPP Worksheet #23.
(3) Measurement performance criteria listed are current criteria at the time this document was created, but are subject to change as control limits are updated.
(4) MS and MSD must be client-provided. LCS/LCSD performed when no MS/MSD is supplied.
(*) See Attachments 1-1and 1-7

RPD = relative percent difference.

QAPP Worksheet #12-6
Measurement Performance Criteria (TAL Metals-Soil)

Matrix: Soil
Analytical Group: TAL Metals
Concentration Level: All (Except Low-Level Mercury)

SAMPLING PROCEDURE(1)	ANALYTICAL METHOD/SOP(2)	DATA QUALITY INDICATORS (DQIs)	MEASUREMENT PERFORMANCE CRITERIA(3)	QC SAMPLE AND/OR ACTIVITY USED TO ASSESS MEASUREMENT PERFORMANCE	QC SAMPLE ASSESSES ERROR FOR SAMPLING(S), ANALYTICAL(A), OR BOTH (S&A)
F-5, F-6	W-14, C-18, C-31, C-32, A-21, A-22	Precision-Overall	RPD < 100%	Field duplicate	S&A
		Accuracy/Bias Contamination	< RL	Blanks (field, equipment, method)	S&A
		Accuracy/Bias	%R, laboratory-generated limits(*)	LCS	A
		Precision	sample > 5 x QL; RPD ≤ 20% sample ≤ 5 x QL; No limit	Laboratory duplicate	A
		Accuracy/Bias	%R, laboratory-generated limits(*)	MS(4)	A
		Accuracy/Bias	%R, laboratory-generated limits(*)	MSD or LCSD(4)	A
		Precision	%RPD laboratory-generated limits(3)	MS/MSD or LCS/LCSD(4)	A
		Accuracy	%R > 80%	Interference check sample	A
		Accuracy	RPD ≤ 10%	Serial dilution	A

QAPP Worksheet #12-6
Measurement Performance Criteria (TAL Metals-Soil)

Footnotes:
(1) Reference number from QAPP Worksheet #21. See the project-specific Field Sampling Plan for sampling procedures.
(2) Reference number from QAPP Worksheet #23.
(3) Measurement performance criteria listed are current criteria at the time this document was created, but are subject to change as control limits are updated.
(4) MS and MSD must be client-provided. LCS/LCSD performed when no MS/MSD is supplied.
(*) See Attachments 1-1 and 1-7
RPD = relative percent difference.

QAPP Worksheet #12-7
Measurement Performance Criteria (Cyanide - Groundwater)

Matrix: Aqueous
Analytical Group: Cyanide
Concentration Level: All, Total / Amenable

SAMPLING PROCEDURE[1]	ANALYTICAL METHOD/SOP[2]	DATA QUALITY INDICATORS (DQIs)	MEASUREMENT PERFORMANCE CRITERIA[3]	QC SAMPLE AND/OR ACTIVITY USED TO ASSESS MEASUREMENT PERFORMANCE	QC SAMPLE ASSESSES ERROR FOR SAMPLING(S), ANALYTICAL(A), OR BOTH (S&A)
F-8, F-11	W-24, C-19, A-30	Precision-Overall	RPD < 100%	Field duplicate	S&A
		Accuracy/Bias Contamination	< RL	Blanks (field, equipment, method)	S&A
		Accuracy/Bias	%R, laboratory-generated limits	LCS	A
		Precision	%RPD <20%	Laboratory duplicate	A
		Accuracy/Bias	%R, laboratory-generated limits[*]	MS[4]	A
		Accuracy/Bias	%R, laboratory-generated limits[*]	MSD or LCSD[4]	A
		Precision	%RPD <20%	MS/MSD or LCS/LCSD[4]	A

Footnotes:

(1) Reference number from QAPP Worksheet #21. See the project-specific Field Sampling Plan for sampling procedures.

(2) Reference number from QAPP Worksheet #23.

(3) Measurement performance criteria listed are current criteria at the time this document was created, but are subject to change as control limits are updated.

(4) MS and MSD must be client-provided. LCS/LCSD performed when no MS/MSD is supplied.

(*) See Attachments 1-1and 1-7.

RPD = relative percent difference.

QAPP Worksheet #12-8
Measurement Performance Criteria (Cyanide - Soil)

Matrix: Soil
Analytical Group: Cyanide
Concentration Level: All, total

SAMPLING PROCEDURE(1)	ANALYTICAL METHOD/SOP(2)	DATA QUALITY INDICATORS (DQIs)	MEASUREMENT PERFORMANCE CRITERIA(3)	QC SAMPLE AND/OR ACTIVITY USED TO ASSESS MEASUREMENT PERFORMANCE	QC SAMPLE ASSESSES ERROR FOR SAMPLING(S), ANALYTICAL(A), OR BOTH (S&A)
F-5, F-6	W-25, C-19, A-30	Precision-Overall	RPD < 100%	Field duplicate	S&A
		Accuracy/Bias Contamination	< RL	Blanks (field, equipment, method)	S&A
		Accuracy/Bias	%R, laboratory-generated limits	LCS	A
		Precision	%RPD <20%	Laboratory duplicate	A
		Accuracy/Bias	%R, laboratory-generated limits(*)	MS(4)	A
		Accuracy/Bias	%R, laboratory-generated limits(*)	MSD or LCSD(4)	A
		Precision	%RPD <20%	MS/MSD or LCS/LCSD(4)	A

Footnotes:
(1) Reference number from QAPP Worksheet #21. See the project-specific Field Sampling Plan for sampling procedures.
(2) Reference number from QAPP Worksheet #23.
(3) Measurement performance criteria listed are current criteria at the time this document was created, but are subject to change as control limits are updated.
(4) MS and MSD must be client-provided. LCS/LCSD performed when no MS/MSD is supplied.
(*) See Attachments 1-1 and 1-7.
RPD = relative percent difference.

QAPP Worksheet #12-9
Measurement Performance Criteria (Low-Level Mercury and Methyl Mercury - Groundwater)

Matrix: Aqueous
Analytical Group: Mercury
Concentration Level: Low-Level

SAMPLING PROCEDURE[1]	ANALYTICAL METHOD/SOP[2]	DATA QUALITY INDICATORS (DQIs)	MEASUREMENT PERFORMANCE CRITERIA[3]	QC SAMPLE AND/OR ACTIVITY USED TO ASSESS MEASUREMENT PERFORMANCE	QC SAMPLE ASSESSES ERROR FOR SAMPLING(S), ANALYTICAL(A), OR BOTH (S&A)
F-8, F-11	C-4, C-7, C-33, A-24	Precision-Overall	RPD < 100%	Field duplicate	S&A
		Accuracy/Bias Contamination	< RL	Blanks (field, equipment, method)	S&A
		Accuracy/Bias	%R, laboratory-generated limits[*]	LCS	A
		Precision	RPD	Laboratory duplicate	A
		Accuracy/Bias	%R, laboratory-generated limits[*]	MS[4]	A
		Accuracy/Bias	%R, laboratory-generated limits[*]	MSD or LCSD[4]	A
		Precision	%RPD <24%	MS/MSD or LCS/LCSD[4]	A

Footnotes:

(1) Reference number from QAPP Worksheet #21. See the project-specific Field Sampling Plan for sampling procedures.

(2) Reference number from QAPP Worksheet #23.

(3) Measurement performance criteria listed are current criteria at the time this document was created, but are subject to change as control limits are updated.

(4) MS and MSD must be client-provided. LCS/LCSD performed when no MS/MSD is supplied.

(*) See Attachments 1-1 and 1-7.

RPD = relative percent difference.

QAPP Worksheet #12-10
Measurement Performance Criteria (SVOCs - Groundwater)

Matrix: Aqueous
Analytical Group: SVOCs
Concentration Level: All

SAMPLING PROCEDURE[1]	ANALYTICAL METHOD/SOP[2]	DATA QUALITY INDICATORS (DQIs)	MEASUREMENT PERFORMANCE CRITERIA[3]	QC SAMPLE AND/OR ACTIVITY USED TO ASSESS MEASUREMENT PERFORMANCE	QC SAMPLE ASSESSES ERROR FOR SAMPLING(S), ANALYTICAL(A), OR BOTH (S&A)
F-8, F-11	W-15, C-20, A-11	Precision-Overall	RPD < 100%	Field duplicate	S&A
		Accuracy/Bias Contamination	< RL	Blanks (field, equipment, method)	S&A
		Accuracy/Bias	%R, Laboratory-generated limits[(*)]	LCS	A
		Accuracy/Bias	%R, Laboratory-generated limits[(*)]	MS[4]	A
		Accuracy/Bias	%R, Laboratory-generated limits[(*)]	MSD or LCSD[4]	A
		Precision	%RPD laboratory-generated limits[3]	MS/MSD or LCS/LCSD[4]	A
		Accuracy/Bias	%R, Laboratory-generated limits[(*)]	Surrogates	A
		Accuracy/Bias	+100%, -50% of ICAL	Internal standards	A
		Accuracy/Bias	Established mass limits	DFTPP Tuning	A

Footnotes:

(1) Reference number from QAPP Worksheet #21. See the project-specific Field Sampling Plan for sampling procedures.

(2) Reference number from QAPP Worksheet #23.

(3) Measurement performance criteria listed are current criteria at the time this document was created, but are subject to change as control limits are updated.

(4) MS and MSD must be client-provided. LCS/LCSD performed when no MS/MSD is supplied.

(*) See Attachments 1-1, 1-2 and 1-7.

RPD = relative percent difference.

QAPP Worksheet #12-11
Measurement Performance Criteria (SVOCs - Soil)

Matrix: Soil
Analytical Group: SVOCs
Concentration Level: All

SAMPLING PROCEDURE[1]	ANALYTICAL METHOD/SOP[2]	DATA QUALITY INDICATORS (DQIs)	MEASUREMENT PERFORMANCE CRITERIA[3]	QC SAMPLE AND/OR ACTIVITY USED TO ASSESS MEASUREMENT PERFORMANCE	QC SAMPLE ASSESSES ERROR FOR SAMPLING(S), ANALYTICAL(A), OR BOTH (S&A)
F-5, F-6	W-15, C-20, A-11	Precision-Overall	RPD < 100%	Field duplicate	S&A
		Accuracy/Bias Contamination	< RL	Blanks (field, equipment, method)	S&A
		Accuracy/Bias	%R, Laboratory-generated limits[(*)]	LCS	A
		Accuracy/Bias	%R, Laboratory-generated limits[(*)]	MS[4]	A
		Accuracy/Bias	%R, Laboratory-generated limits[(*)]	MSD or LCSD[4]	A
		Precision	%RPD laboratory-generated limits[3][(*)]	MS/MSD or LCS/LCSD[4]	A
		Accuracy/Bias	%R, Laboratory-generated limits[(*)]	Surrogates	A
		Accuracy/Bias	+100%, -50% of ICAL	Internal standards	A
		Accuracy/Bias	Established mass limits	DFTPP Tuning	A

Footnotes:

(1) Reference number from QAPP Worksheet #21. See the project-specific Field Sampling Plan for sampling procedures.

(2) Reference number from QAPP Worksheet #23.

(3) Measurement performance criteria listed are current criteria at the time this document was created, but are subject to change as control limits are updated.

(4) MS and MSD must be client-provided. LCS/LCSD performed when no MS/MSD is supplied.

(*) See Attachments 1-1, 1-2 and 1-7.

RPD = relative percent difference.

QAPP Worksheet #12-12
Measurement Performance Criteria (VOCs - Groundwater)

Matrix: Aqueous
Analytical Group: VOCs
Concentration Level: All

SAMPLING PROCEDURE[1]	ANALYTICAL METHOD/SOP[2]	DATA QUALITY INDICATORS (DQIs)	MEASUREMENT PERFORMANCE CRITERIA[3]	QC SAMPLE AND/OR ACTIVITY USED TO ASSESS MEASUREMENT PERFORMANCE	QC SAMPLE ASSESSES ERROR FOR SAMPLING(S), ANALYTICAL(A), OR BOTH (S&A)
F-8, F-11	W-21, C-5, A-8, A-9	Precision-Overall	RPD < 100%	Field duplicate	S&A
		Accuracy/Bias Contamination	< RL	Blanks (field, equipment, method)	S&A
		Accuracy/Bias	%R, laboratory-generated limits[*]	LCS	A
		Accuracy/Bias	%R, laboratory-generated limits[*]	MS[4]	A
		Accuracy/Bias	%R, laboratory-generated limits[*]	MSD or LCSD[4]	A
		Precision	%RPD <20%	MS/MSD or LCS/LCSD[4]	A
		Accuracy/Bias	%R, laboratory-generated limits[*]	Surrogates	A
		Accuracy/Bias	+100%, -50% of ICAL	Internal standards	A
		Accuracy/Bias	Established mass limits	BFB Tuning	A

Footnotes:

(1) Reference number from QAPP Worksheet #21. See the project-specific Field Sampling Plan for sampling procedures.

(2) Reference number from QAPP Worksheet #23.

(3) Measurement performance criteria listed are current criteria at the time this document was created, but are subject to change as control limits are updated.

(4) MS and MSD must be client-provided. LCS/LCSD performed when no MS/MSD is supplied.

(*) See Attachments 1-1, 1-2 and 1-7.

RPD = relative percent difference.

QAPP Worksheet #12-13
Measurement Performance Criteria (VOCs - Soil)

Matrix: Soil
Analytical Group: VOCs
Concentration Level: All

SAMPLING PROCEDURE[1]	ANALYTICAL METHOD/SOP[2]	DATA QUALITY INDICATORS (DQIs)	MEASUREMENT PERFORMANCE CRITERIA[3]	QC SAMPLE AND/OR ACTIVITY USED TO ASSESS MEASUREMENT PERFORMANCE	QC SAMPLE ASSESSES ERROR FOR SAMPLING(S), ANALYTICAL(A), OR BOTH (S&A)
F-5, F-6	C-5, A-8, A-9	Precision-Overall	RPD < 100%	Field duplicate	S&A
		Accuracy/Bias Contamination	< RL	Blanks (field, equipment, method)	S&A
		Accuracy/Bias	%R, laboratory-generated limits[*]	LCS	A
		Accuracy/Bias	%R, laboratory-generated limits[*]	MS[4]	A
		Accuracy/Bias	%R, laboratory-generated limits[*]	MSD or LCSD[4]	A
		Precision	%RPD <40%	MS/MSD or LCS/LCSD[4]	A
		Accuracy/Bias	%R, laboratory-generated limits[*]	Surrogates	A
		Accuracy/Bias	Established mass limits	BFB Tuning	A

Footnotes:

(1) Reference number from QAPP Worksheet #21. See the project-specific Field Sampling Plan for sampling procedures.

(2) Reference number from QAPP Worksheet #23.

(3) Measurement performance criteria listed are current criteria at the time this document was created, but are subject to change as control limits are updated.

(4) MS and MSD must be client-provided. LCS/LCSD performed when no MS/MSD is supplied.

(*) See Attachments 1-1, 1-2 and 1-7.

RPD = relative percent difference.

2

QAPP Worksheet #12-14
Measurement Performance Criteria (DRO & GRO - Soil)

Matrix: Soil
Analytical Group: DRO, GRO
Concentration Level: All

SAMPLING PROCEDURE[1]	ANALYTICAL METHOD/SOP[2]	DATA QUALITY INDICATORS (DQIs)	MEASUREMENT PERFORMANCE CRITERIA[3]	QC SAMPLE AND/OR ACTIVITY USED TO ASSESS MEASUREMENT PERFORMANCE	QC SAMPLE ASSESSES ERROR FOR SAMPLING(S), ANALYTICAL(A), OR BOTH (S&A)
F-5, F-6	W-22, C-23, A-13 (DRO)	Precision-Overall	RPD < 100%	Field duplicate	S&A
	W-23, C-22, A-12 (GRO)	Accuracy/Bias Contamination	< RL	Blanks (field, equipment, method)	S&A
		Accuracy/Bias	%R, Laboratory-generated limits [(*)]	LCS	A
		Accuracy/Bias	%R, laboratory-generated limits[(3)(*)]	MS	A
		Accuracy/Bias	%R, laboratory-generated limits[(*)]	MSD or LCSD[(4)]	A
		Precision	%RPD laboratory-generated limits[(3)(*)]	MS/MSD or LCS/LCSD[(4)]	A
		Accuracy/Bias	%R, Laboratory-generated limits [(*)]	Surrogate	A

Footnotes:

(1) Reference number from QAPP Worksheet #21. See the project-specific Field Sampling Plan for sampling procedures.

(2) Reference number from QAPP Worksheet #23.

(3) Measurement performance criteria listed are current criteria at the time this document was created, but are subject to change as control limits are updated.

(4) MS and MSD must be client-provided. LCS/LCSD performed when no MS/MSD is supplied.

(*) See Attachments 1-1, 1-2 and 1-7.

RPD = relative percent difference.

QAPP Worksheet #12-15
Measurement Performance Criteria (PCDD/PCDF - Groundwater)

Matrix: Aqueous
Analytical Group: PCDD/PCDFs
Concentration Level: All

SAMPLING PROCEDURE(1)	ANALYTICAL METHOD/SOP(2)	DATA QUALITY INDICATORS (DQIs)	MEASUREMENT PERFORMANCE CRITERIA(3)	QC SAMPLE AND/OR ACTIVITY USED TO ASSESS MEASUREMENT PERFORMANCE	QC SAMPLE ASSESSES ERROR FOR SAMPLING(S), ANALYTICAL(A), OR BOTH (S&A)
F-8, F-11	A-35	Precision-Overall	RPD < 100%	Field duplicate	S&A
		Accuracy/Bias Contamination	< RL	Blanks (field, equipment, method)	S&A
		Accuracy/Bias	%R, laboratory-generated limits(*)	LCS	A
		Accuracy/Bias	%R, laboratory-generated limits(*)	MS(4)	A
		Accuracy/Bias	%R, laboratory-generated limits(*)	MSD or LCSD(4)	A
		Precision	%RPD <20%	MS/MSD or LCS/LCSD(4)	A
		Accuracy/Bias	%R, laboratory-generated limits(*)	Surrogates	A
		Accuracy/Bias	40-135%	Internal standards	A
		Accuracy/Bias	Mass resolution – see analytical SOP	Mass Resolution Check	A
		Accuracy/Bias	Retention Time – see analytical SOP	Window Defining Mix	A

QAPP Worksheet #12-15
Measurement Performance Criteria (PCDD/PCDF - Groundwater)

Footnotes:

(1) Reference number from QAPP Worksheet #21. See the project-specific Field Sampling Plan for sampling procedures.

(2) Reference number from QAPP Worksheet #23.

(3) Measurement performance criteria listed are current criteria at the time this document was created, but are subject to change as control limits are updated.

(4) MS and MSD must be client-provided. LCS/LCSD performed when no MS/MSD is supplied.

(*) See Attachments 1-1, 1-2 and 1-7.

RPD = relative percent difference.

QAPP Worksheet #12-16
Measurement Performance Criteria (PCDD/PCDF - Soil)

Matrix: Soil
Analytical Group: PCDD/PCDFs
Concentration Level: All

SAMPLING PROCEDURE[1]	ANALYTICAL METHOD/SOP[2]	DATA QUALITY INDICATORS (DQIs)	MEASUREMENT PERFORMANCE CRITERIA[3]	QC SAMPLE AND/OR ACTIVITY USED TO ASSESS MEASUREMENT PERFORMANCE	QC SAMPLE ASSESSES ERROR FOR SAMPLING(S), ANALYTICAL(A), OR BOTH (S&A)
F-5, F-6	A-35	Precision-Overall	RPD < 100%	Field duplicate	S&A
		Accuracy/Bias Contamination	< RL	Blanks (field, equipment, method)	S&A
		Accuracy/Bias	%R, laboratory-generated limits[(*)]	LCS	A
		Accuracy/Bias	%R, laboratory-generated limits[(*)]	MS[4]	A
		Accuracy/Bias	%R, laboratory-generated limits[(*)]	MSD or LCSD[4]	A
		Precision	%RPD <40%	MS/MSD or LCS/LCSD[4]	A
		Accuracy/Bias	%R, laboratory-generated limits[(*)]	Surrogates	A
		Accuracy/Bias	40-135%	Internal standards	A
		Accuracy/Bias	Mass resolution – see analytical SOP	Mass Resolution Check	A
		Accuracy/Bias	Retention Time – see analytical SOP	Window Defining Mix	A

QAPP Worksheet #12-16
Measurement Performance Criteria (PCDD/PCDF - Soil)

Footnotes:

(1) Reference number from QAPP Worksheet #21. See the project-specific Field Sampling Plan for sampling procedures.

(2) Reference number from QAPP Worksheet #23.

(3) Measurement performance criteria listed are current criteria at the time this document was created, but are subject to change as control limits are updated.

(4) MS and MSD must be client-provided. LCS/LCSD performed when no MS/MSD is supplied.

(*) See Attachments 1-1, 1-2 and 1-7.

RPD = relative percent difference.

QAPP Worksheet #12-17
Measurement Performance Criteria (Wet Chemistry – Soil)

Matrix: Soil

Analytical Group: Wet chemistry

Concentration Level: All

SAMPLING PROCEDURE[1]	ANALYTICAL METHOD/SOP[2]	DATA QUALITY INDICATORS (DQIs)	MEASUREMENT PERFORMANCE CRITERIA	QC SAMPLE AND/OR ACTIVITY USED TO ASSESS MEASUREMENT PERFORMANCE	QC SAMPLE ASSESSES ERROR FOR SAMPLING(S), ANALYTICAL(A), OR BOTH (S&A)
F-5, F-6	C-8, C-9 and C-10 A-25, A-27, A-28, A-32, A-36 and A-37	Precision - Overall	RPD < 100%	Field duplicate	S&A
		Accuracy/Bias Contamination	< RL	Blanks (field, equipment, calibration, preparation)	S&A
		Accuracy/Bias	%R laboratory-generated limit[*]	Continuing calibration verification	A
		Accuracy/Bias	%R laboratory-generated limit[*]	MS[3]	A
		Accuracy/Bias	%R laboratory-generated limit[*]	MSD[3]	A
		Precision	%R laboratory-generated limit[*]	MS/MSD[3]	A
		Accuracy/Bias	%R laboratory-generated limit[*]	LCS	A

QAPP Worksheet #12-17
Measurement Performance Criteria (Wet Chemistry – Soil)

Footnotes:

(1) Reference number from QAPP Worksheet #21. See the project-specific Field sampling Plan for sampling procedures.

(2) Reference number from QAPP Worksheet #23.

(3) MS and MSD not applicable for Nitrogen compounds (Ammonia-N, Nitrate and Nitrite) and phosphorous.

(*) See Attachment 1-1 and 1-7.

QAPP Worksheet #12-18
Measurement Performance Criteria (Low-Level Mercury and Methyl Mercury – Surface Water)

Matrix: Aqueous
Analytical Group: Mercury
Concentration Level: Low-Level

SAMPLING PROCEDURE[1]	ANALYTICAL METHOD/SOP[2]	DATA QUALITY INDICATORS (DQIs)	MEASUREMENT PERFORMANCE CRITERIA[3]	QC SAMPLE AND/OR ACTIVITY USED TO ASSESS MEASUREMENT PERFORMANCE	QC SAMPLE ASSESSES ERROR FOR SAMPLING(S), ANALYTICAL(A), OR BOTH (S&A)
F-16	C-4, C-7, C-33, A-24	Precision-Overall	RPD < 100%	Field duplicate	S&A
		Accuracy/Bias Contamination	< RL	Blanks (field, equipment, method)	S&A
		Accuracy/Bias	%R, laboratory-generated limits[*]	LCS	A
		Precision	RPD, laboratory-generated limits	Laboratory duplicate	A
		Accuracy/Bias	%R, laboratory-generated limits[*]	MS[4]	A
		Accuracy/Bias	%R, laboratory-generated limits[*]	MSD or LCSD[4]	A
		Precision	%R, laboratory-generated limits[*]	MS/MSD or LCS/LCSD[4]	A

Footnotes:

(1) Reference number from QAPP Worksheet #21. See the project-specific Field Sampling Plan for sampling procedures.

(2) Reference number from QAPP Worksheet #23.

(3) Measurement performance criteria listed are current criteria at the time this document was created, but are subject to change as control limits are updated.

(4) MS and MSD must be client-provided. LCS/LCSD performed when no MS/MSD is supplied.

(*) See Attachments 1-1, 1-2 and 1-7.

RPD = relative percent difference.

QAPP Worksheet #12-19
Measurement Performance Criteria (PCBs - Groundwater)

Matrix: Aqueous
Analytical Group: PCBs
Concentration Level: All

SAMPLING PROCEDURE[1]	ANALYTICAL METHOD/SOP[2]	DATA QUALITY INDICATORS (DQIs)	MEASUREMENT PERFORMANCE CRITERIA	QC SAMPLE AND/OR ACTIVITY USED TO ASSESS MEASUREMENT PERFORMANCE	QC SAMPLE ASSESSES ERROR FOR SAMPLING(S), ANALYTICAL(A), OR BOTH (S&A)
F-3, F-11, F-16	W-1, C-13, A-14	Precision - Overall	Relative percent difference (RPD) < 50%	Field duplicate	S&A
		Accuracy/Bias	% Recovery (%R) laboratory-generated limits[3][*]	Surrogate	A
		Accuracy/Bias Contamination	< Reporting limit (RL)	Blanks (field, equipment, method)	S&A
		Accuracy/Bias	%R laboratory-generated limits[*]	Laboratory control sample (LCS)	A
		Accuracy/Bias and Precision	Retention times, see analytical SOP	Retention time windows	A
		Accuracy/Bias	%R, same as LCS[*]	Matrix spike (MS)[3]	A
		Accuracy/Bias	%R, same as LCS[*]	Matrix spike duplicate (MSD) or laboratory control sample duplicate (LCSD)[3]	A
		Precision	RPD laboratory-generated limits[3][*]	MS/MSD or LCS/LCSD[3]	A

QAPP Worksheet #12-19
Measurement Performance Criteria (PCBs - Groundwater)

Footnotes:
(1) Reference number from QAPP Worksheet #21. See the project-specific Field Sampling Plan for sampling procedures.
(2) Reference number from QAPP Worksheet #23.
(3) MS and MSD must be client-provided. LCS/LCSD performed when no MS/MSD is supplied.
(*) See Attachments 1-1, 1-2 and 1-7.
RPD = relative percent difference.

QAPP Worksheet #15-4
Reference Limits and Evaluation (Surface Water) – ALS-Kelso (formerly CAS)

ANALYTE	CAS NUMBER	PROJECT ACTION LIMIT[1]	WATER (µg/L)[2]	
			CAS LABORATORY MDL	CAS LABORATORY RL
PCBs (U.S. EPA 608)[3]				
Aroclor - 1016	12674-11-2	--	0.0041	0.02
Aroclor - 1221	11104-28-2	--	0.0041	0.04
Aroclor - 1232	11141-16-5	--	0.0041	0.02
Aroclor - 1242	53469-21-9	--	0.0041	0.02
Aroclor - 1248	12672-29-6	--	0.0041	0.02
Aroclor - 1254	11097-69-1	--	0.0041	0.02
Aroclor - 1260	11096-82-5	--	0.0041	0.02
Total PCBs	1336-36-3	0.2 µg/L	0.0041	0.04
Metals				
Low Level Mercury	7439-97-6	--	0.08 ng/L	1 ng/L
Methyl Mercury	22967-92-6	--	0.05 ng/L	0.1 ng/L

Notes:

(1) Standards are consistent with the Multi-Area Quality Assurance Project Plan (Rev. 00) for the Kalamazoo River Study Group (Arcadis BBL, 2007b), which are from the MDEQ's Substantive Requirements Document for the Plainwell Dam Superfund Site, dated February 13, 2007.
(2) Concentrations are in µg/L, except where noted.
(3) U.S. EPA. *Appendix A to Part 136 Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater Method 608—Organochlorine Pesticides and PCBs*. July 1995.
(4) U.S. EPA. *Methods for Chemical Analysis of Water and Wastes.* EPA/600/4-79/020.
(5) The actual Reporting Limit will depend on the volume of sample filtered.

RL = report limit.
MDL = Method Detection Limit.
µg/L = micrograms per liter.
ng/L = nanograms per liter.
PCBs = polychlorinated biphenyls.

QAPP Worksheet #15-5
Reference Limits and Evaluation (Soil/Sediment) – ALS-Kelso (formerly CAS)

PARAMETER[1]	CHEMICAL ABSTRACT SERVICE NUMBER	RANGE OF POTENTIALLY APPLICABLE PART 201 CRITERIA[3] (µg/kg)			PART 201 TDLs (µg/kg)	CAS REPORT LIMIT[2] (µg/kg)	CAS METHOD DETECTION LIMIT[2] (µg/kg)
INORGANICS (METALS AND WET CHEMISTRY)							
Aluminum	7429905	1,000	--	1,000,000,000	1,000	2,000	400
Antimony	7440360	4,300	--	49,000,000	300	50	20
Arsenic	7440382	5,800	--	2,000,000	100	500	60
Barium	7440393	440,000	--	1,000,000,000	1,000	50	5
Beryllium	7440417	51,000	--	1,000,000,000	500	20	3
Cadmium	7440439	3,000	--	230,000,000	200	20	4
Chromium (Total) [5]	7440473	3,300	--	140,000,000	2,000	200	30
Cobalt	7440484	6,800	--	48,000,000	500	20	3
Copper	7440508	75,000	--	1,000,000,000	1,000	100	80
Iron	7439896	12,000	--	1,000,000,000	5,000	4,000	700
Lead	7439921	400,000	--	100,000,000	1,000	50	9
Magnesium	7439954	8,000,000	--	6,700,000,000	4,000	4,000	300
Manganese	7439965	440,000	--	180,000,000	1,000	50	30
Mercury (total)	7439976	130	--	20,000,000	50	20	2
Nickel	7440020	100,000	--	1,000,000,000	1,000	200	30
Selenium	7782492	410	--	130,000,000	200	1,000	200
Silver	7440224	1,000	--	200,000,000	100	20	8
Sodium	17341252	2,500,000	--	1,000,000,000	10,000	40,000	4,000
Thallium	7440280	2,300	--	15,000,000	500	20	3
Vanadium	7440622	72,000	--	1,000,000,000	1,000	200	20
Zinc	7440666	47,000	--	1,000,000,000	1,000	500	200
Cyanide (Total)	57125	390	--	250,000	100	10	3
Ammonia-N (U.S. EPA 350.1)	7664-41-7	10,000,000	--	6,700,000,000	1,000	500	40
Nitrate-N (U.S. EPA 300.0)	14797-55-8	200,000	--	1,000,000,000	--	1,000	40
Nitrite-N (U.S. EPA 300.0)	14797-65-0	20,000	--	380,000,000	--	1,000	20
Total phosphorus as P (U.S. EPA 365.3)	7723140	1,300,000	--	1,000,000,000	--	100	NA

QAPP Worksheet #15-5
Reference Limits and Evaluation (Soil/Sediment) – ALS-Kelso (formerly CAS)

PARAMETER[1]	CHEMICAL ABSTRACT SERVICE NUMBER	RANGE OF POTENTIALLY APPLICABLE PART 201 CRITERIA[3] (µg/kg)			PART 201 TDLs (µg/kg)	CAS REPORT LIMIT[2] (µg/kg)	CAS METHOD DETECTION LIMIT[2] (µg/kg)
POLYCHLORINATED BIPHENYLS (PCBs)-Low Level							
Total PCBs	1336363	4,000	-	28,000,000	330	20	2.1
Aroclor-1016	12674112	--	N/A	--	--	10	2.1
Aroclor-1221	11104282	--	N/A	--	--	20	2.1
Aroclor-1232	11141165	--	N/A	--	--	10	2.1
Aroclor-1242	53469219	--	N/A	--	--	10	2.1
Aroclor-1248	12672296	--	N/A	--	--	10	2.1
Aroclor-1254	11097691	--	N/A	--	--	10	2.1
Aroclor-1260	11096825	--	N/A	--	--	10	2.1
VOLATILE ORGANIC COMPOUNDS – Low/Med							
1,1,1-Trichloroethane	71556	1,800	--	67,000,000,000	50	50	11.10
1,1,2,2-Tetrachloroethane	79345	170	--	68,000,000	50	50	13.80
1,1,2-Trichloroethane	79005	100	--	250,000,000	50	50	10.40
1,1-Dichloroethane	75343	15,000	--	33,000,000,000	50	50	9.06
1,1-Dichloroethylene	75354	62	--	78,000,000	50	50	19.80
1,2,4-Trichlorobenzene	120821	4,200	--	25,000,000,000	330	200	21.80
1,2-Dibromoethane (ethylene dibromide)	106934	20	--	18,000,000	20	200	0.73
1,2-Dichlorobenzene	95501	280	--	100,000,000,000	100	50	8.47
1,2-Dichloroethane	107062	100	--	150,000,000	50	50	11.40
1,2-Dichloropropane	78875	100	--	270,000,000	50	50	19.00
1,3-Dichlorobenzene	541731	170	--	200,000,000	100	50	10.20
1,4-Dichlorobenzene	106467	360	--	570,000,000	100	50	8.69
2-Butanone (MEK)	78933	44,000	--	67,000,000,000	750	2,000	322
2-Hexanone	591786	20,000	--	2,700,000,000	2,500	2,000	396
4-Methyl-2-pentanone (MIBK)	108101	36,000	--	140,000,000,000	2,500	2,000	340
Acetone	67641	15,000	--	390,000,000,000	1,000	2,000	240

QAPP Worksheet #15-5
Reference Limits and Evaluation (Soil/Sediment) – ALS-Kelso (formerly CAS)

PARAMETER[1]	CHEMICAL ABSTRACT SERVICE NUMBER	RANGE OF POTENTIALLY APPLICABLE PART 201 CRITERIA[3] (µg/kg)			PART 201 TDLs (µg/kg)	CAS REPORT LIMIT[2] (µg/kg)	CAS METHOD DETECTION LIMIT[2] (µg/kg)
Benzene	71432	100	--	470,000,000	50	50	10.50
Bromodichloromethane	75274	1,200	--	110,000,000	100	50	8.70
Bromoform	75252	1,600	--	3,600,000,000	100	50	27.90
Bromomethane	74839	200	--	330,000,000	200	50	21.70
Carbon disulfide	75150	16,000	--	47,000,000,000	250	50	15.90
Carbon tetrachloride	56235	100	--	170,000,000	50	50	13.00
Chlorobenzene	108907	500	--	4,700,000,000	50	50	9.33
Chloroethane	75003	8,600	--	670,000,000,000	250	50	17.30
Chloroform	67663	1,600	--	1,600,000,000	50	50	9.58
Chloromethane	74873	2,300	--	4,900,000,000	250	50	13.60
cis-1,2-Dichloroethylene	156592	1,400	--	2,300,000,000	50	50	11.60
cis-1,3-Dichloropropene	542756	--	NA	--	100	50	8.90
Dibromochloromethane	124481	1,600	--	160,000,000	100	50	8.17
Dibromochloropropane	96128	10	--	700,000	10	200	99.10
Dichlorodifluoromethane	75718	95,000	--	3,300,000,000,000	250	50	16.60
Ethylbenzene	100414	360	--	13,000,000,000	50	50	9.74
Isopropyl benzene	98828	3,200	--	5,800,000,000	250	200	9.30
Methylene chloride	75092	100	--	8,300,000,000	100	200	19.30
Methyl-tert-butyl ether (MTBE)	1634044	800	--	200,000,000,000	250	50	15.00
Styrene	100425	2,100	--	6,900,000,000	50	50	9.43
Tetrachloroethylene	127184	100	--	2,700,000,000	50	50	14.0
Toluene	108883	5,400	--	27,000,000,000	100	50	9.75
trans-1,2-Dichloroethylene	156605	2,000	--	4,700,000,000	50	50	13.90
trans-1,3-Dichloropropene	542756	--	NA	--	100	50	9.10
Trichloroethylene (Trichloroethene)	79016	100	--	130,000,000	50	50	18.80
Trichlorofluoromethane	75694	52,000	--	3,800,000,000,000	100	50	17.0
Vinyl chloride	75014	40	--	890,000,000	40	50	21.10

QAPP Worksheet #15-5
Reference Limits and Evaluation (Soil/Sediment) – ALS-Kelso (formerly CAS)

PARAMETER[1]	CHEMICAL ABSTRACT SERVICE NUMBER	RANGE OF POTENTIALLY APPLICABLE PART 201 CRITERIA[3] (µg/kg)			PART 201 TDLs (µg/kg)	CAS REPORT LIMIT[2] (µg/kg)	CAS METHOD DETECTION LIMIT[2] (µg/kg)
m,p-Xylenes	1330207	--	NA	--	150	50	18.60
o-Xylenes	1330207	5,600	--	290,000,000,000	150	50	7.85
SEMI VOLATILE ORGANIC COMPOUNDS							
2,4,5-Trichlorophenol	95954	39,000	--	23,000,000,000	330	10	1.5
2,4,6-Trichlorophenol	88062	330	--	1,300,000,000	330	10	1.4
2,4-Dichlorophenol	120832	330	--	5,100,000,000	330	10	1.0
2,4-Dimethylphenol	105679	7,400	--	4,700,000,000	330	50	5.5
2,4-Dinitrotoluene	121142	430	--	20,000,000	330	200	1.7
2-Chlorophenol	95578	360	--	1,200,000,000	330	10	2.0
2-Methylnaphthalene	91576	4,200	--	670,000,000	330	10	2.2
2-Methylphenols (J)	1319773	1,000	--	6,700,000,000	330	10	1.5
2-Nitrophenol	88755	400	--	2,000,000	330	10	1.5
3,3-Dichlorobenzidine	91941	2,000	--	8,200,000	2,000	100	3.7
4,6-Dinitro-2-methylphenol (2-methyl-4,6-dinitrophenol)	534521	830	--	130,000,000	830	100	1.4
4-Chloro-3-methylphenol	59507	280	--	15,000,000	280	10	1.4
4-Methylphenol (J)	1319773	1,000	--	6,700,000,000	330	10	1.5
Acenaphthene	83329	8,700	--	14,000,000,000	330	10	1.4
Acenaphthylene	208968	5,900	--	2,300,000,000	330	10	1.2
Anthracene	120127	41,000	--	67,000,000,000	330	10	1.6
Benzo(a)anthracene	56553	20,000	--	80,000	330	10	1.7
Benzo(a)pyrene	50328	2,000	--	1,900,000	330	10	1.7
Benzo(b)fluoranthene	205992	20,000	--	80,000	330	10	1.2
Benzo(g,h,i)perylene	191242	2,500,000	--	800,000,000	330	10	1.5
Benzo(k)fluoranthene	207089	200,000	--	800,000	330	10	1.4
bis(2-Chloroethyl)ether (I)	111444	100	--	12,000,000	100	10	1.9
bis(2-Ethylhexyl)phthalate	117817	2,800,000	--	890,000,000	330	100	7.0

QAPP Worksheet #15-5
Reference Limits and Evaluation (Soil/Sediment) – ALS-Kelso (formerly CAS)

PARAMETER[1]	CHEMICAL ABSTRACT SERVICE NUMBER	RANGE OF POTENTIALLY APPLICABLE PART 201 CRITERIA[3] (µg/kg)			PART 201 TDLs (µg/kg)	CAS REPORT LIMIT[2] (µg/kg)	CAS METHOD DETECTION LIMIT[2] (µg/kg)
Butyl benzyl phthalate	85687	120,000	--	47,000,000,000	330	10	3.2
Carbazole	86748	1,100	--	78,000,000	330	10	1.3
Chrysene	218019	2,000,000	--	8,000,000	330	10	1.5
Dibenzo(a,h)anthracene	53703	2,000	--	8,000	330	10	1.5
Dibenzofuran	132649	1,700--	--	6,700,000	330	10	1.2
Diethyl phthalate	84662	2,200	--	3,300,000,000	330	10	1.3
Dimethyl phthalate	131113	790,000	--	3,300,000,000	330	10	1.0
Di-n-butylphthalate	84742	11,000	--	3,300,000,000	330	20	7.9
Di-n-octyl phthalate	117840	6,900,000	--	31,000,000,000	330	10	1.7
Fluoranthene	206440	5,500	--	9,300,000,000	330	10	1.6
Fluorene	86737	5,300	--	9,300,000,000	330	10	1.1
Hexachlorobenzene (C-66)	118741	350	--	8,500,000	330	10	1.2
Hexachlorobutadiene (C-46)	87683	91	--	180,000,000	50	10	2.5
Hexachlorocyclopentadiene (C-56)	77474	30,000	--	13,000,000	330	50	29
Hexachloroethane	67721	430	--	230,000,000	300	10	3.1
Indeno(1,2,3-cd)pyrene	193395	20,000	--	80,000	330	10	1.5
Isophorone	78591	15,000	--	12,000,000,000	330	10	1.0
Naphthalene	91203	730	--	200,000,000	330	10	2.3
Nitrobenzene (I)	98953	330	--	47,000,000	330	10	2.2
n-Nitroso-di-n-propylamine	621647	330	--	2,000,000	330	10	2.4
N-Nitrosodiphenylamine	86306	5,400	--	2,800,000,000	330	10	1.6
Pentachlorophenol	87865	22	--	130,000,000	20	100	20
Phenanthrene	85018	2,100	--	6,700,000	330	10	1.4
Phenol	108952	9,000	--	40,000,000,000	330	30	2.0
Pyrene	129000	480,000	--	6,700,000,000	330	10	1.5

QAPP Worksheet #15-5
Reference Limits and Evaluation (Soil/Sediment) – ALS-Kelso (formerly CAS)

PARAMETER[1]	CHEMICAL ABSTRACT SERVICE NUMBER	RANGE OF POTENTIALLY APPLICABLE PART 201 CRITERIA[3] (µg/kg)	PART 201 TDLs (µg/kg)	CAS REPORT LIMIT[2] (µg/kg)	CAS METHOD DETECTION LIMIT[2] (µg/kg)

Notes:
[1] The parameters included in this table are those included in the U.S. EPA Contract Laboratory Program (CLP) Target Compound List (TCL) and Target Analyte List (TAL), except those that are not on the Part 201 list; Calcium, Potassium, 1,2,3-Trichlorobenzene, Bromochloromethane, Cyclohexane, Methyl Acetate, Methylcyclohexane (methyl phenol), 1,1-Biphenyl, 2,2-oxybis(1-Chloropropane), 2,4-Dinitrophenol, 2,6-Dinitrotoluene, 2-Nitroaniline, 3-Nitroaniline, 4-Bromophenyl-phenylether, 4-Chloroaniline, 4-Chlorophenyl-phenylether, 4-Nitroaniline, 4-Nitrophenol, Benzaldehyde, bis(2-Chloroethoxy)methane. Or those that are not typically analyzed by WATS, ALS-Kelso, or ALS-Holland: 1,1,2-Trichloro-1,2,2-triflouroethane, 1,2,4,5-Tetrachlorobenzene, Acetophenone, Atrazine, beta-Chloronaphthalene, Caprolactum.
[2] The actual Report Limits and Method Detection Limits will vary with sample size, for the analysis of PCBs and PAHs.
[3] Potentially applicable Michigan Part 201 Criteria are from the Michigan Department of Environmental Quality (MDEQ) Remediation and Redevelopment Division (RRD) updated 9/28/13 pursuant to 1994 PA 451 as amended.
[4] The MDL actually achievable in a given analysis will vary depending on detector response characteristics, irreducible noise from instrument electronics, and matrix effects.
[5] The Michigan Part 201 Criteria for Hexavalent Chromium will be used for Chromium (total) as there is no total chromium criteria established.
ALS = ALS Environmental Laboratories
CAS = Columbia Analytical Services.
MDL = Method Detection Limit
NA = Not Available
RL = Reporting Limit
µg/kg = micrograms per kilogram

QAPP Worksheet #15-6
Reference Limits and Evaluation (Groundwater) – ALS-Kelso (formerly CAS)

PARAMETER[1]	CHEMICAL ABSTRACT SERVICE NUMBER	RANGE OF POTENTIALLY APPLICABLE PART 201 CRITERIA[3] (µg/L)			PART 201 TARGET DETECTION LIMIT (µg/L)	CAS AQUEOUS REPORT LIMIT[2] (µg/L)	CAS METHOD DETECTION LIMIT[2] (µg/L)
METALS (TOTAL/SPLP) AND CYANIDE							
Aluminum	7429905	50	--	64,000,000	50	2	0.3
Antimony	7440360	6	--	68,000	2	0.05	0.02
Arsenic	7440382	10	--	4,300	5	0.5	0.1
Barium	7440393	670	--	14,000,000	100	0.05	0.02
Beryllium	7440417	4	--	290,000	1	0.02	0.006
Cadmium	7440439	3	--	190,000	1	0.02	0.005
Chromium (Total) [6]	7440473	11	--	460,000	10	0.2	0.04
Cobalt	7440484	40	--	2,400,000	20	0.02	0.006
Copper	7440508	13	--	7,400,000	4	0.1	0.02
Iron	7439896	300	--	58,000,000	200	20	3.0
Lead	7439921	4	--	29	3	0.02	0.005
Magnesium	7439954	400,000	--	1,000,000,000	1,000	20	2.0
Manganese	7439965	50	--	9,100,000	50	0.05	0.006
Mercury (total) SW846 7470	7439976		--			0.2	0.02
Mercury (total) EPA 245.1	7439976		--			0.2	0.02
Low Level Mercury (total) EPA 1631[4]	7439976	0.0013	--	56	0.001	1 (ng/L)	0.06 (ng/L)
Methyl Mercury [4]	22967926	0.0013	--	56	0.001	0.1 (ng/L)	0.05 (ng/L)
Nickel	7440020	73	--	74,000,000	20	0.2	0.03
Selenium	7782492	5	--	970,000	5	1	0.3
Silver	7440224	0.2	--	1,500,000	0.2	0.02	0.004
Sodium	17341252	120,000	--	1,000,000,000	1,000	200	70
Thallium	7440280	2	--	13,000	2	0.02	0.005
Vanadium	7440622	4.5	--	970,000	4	0.2	0.03
Zinc	7440666	170	--	110,000,000	50	0.5	0.2
Cyanide (amenable)	57125	5.2	--	57,000	5	10	2.0

QAPP Worksheet #15-6
Reference Limits and Evaluation (Groundwater) – ALS-Kelso (formerly CAS)

PARAMETER[1]	CHEMICAL ABSTRACT SERVICE NUMBER	RANGE OF POTENTIALLY APPLICABLE PART 201 CRITERIA[3] (µg/L)			PART 201 TARGET DETECTION LIMIT (µg/L)	CAS AQUEOUS REPORT LIMIT[2] (µg/L)	CAS METHOD DETECTION LIMIT[2] (µg/L)
POLYCHLORINATED BIPHENYLS (PCBs)							
Total PCBs	1336363	0.2	--	45	0.2	0.04	0.0041
Aroclor-1016	12674112	--	N/A	--	--	0.02	0.0041
Aroclor-1221	11104282	--	N/A	--	--	0.04	0.0041
Aroclor-1232	11141165	--	N/A	--	--	0.02	0.0041
Aroclor-1242	53469219	--	N/A	--	--	0.02	0.0041
Aroclor-1248	12672296	--	N/A	--	--	0.02	0.0041
Aroclor-1254	11097691	--	N/A	--	--	0.02	0.0041
Aroclor-1260	11096825	--	N/A	--	--	0.02	0.0041
VOLATILE ORGANIC COMPOUNDS							
1,1,1-Trichloroethane	71556	89	--	1,330,000	1	0.5	0.050
1,1,2,2-Tetrachloroethane	79345	8.5	--	2,970,000	1	0.5	0.064
1,1,2-Trichloroethane	79005	5	--	4,420,000	1	0.5	0.061
1,1-Dichloroethane	75343	740	--	5,060,000	1	0.5	0.042
1,1-Dichloroethylene	75354	7	--	2,50,000	1	0.5	0.10
1,2,4-Trichlorobenzene	120821	70	--	300,000	5	2	0.13
1,2-Dibromoethane (ethylene dibromide)	106934	0.05	--	4,200,000	0.05	2	0.084
1,2-Dichlorobenzene	95501	13	--	160,000	1	0.5	0.044
1,2-Dichloroethane	107062	5	--	8,520,000	1	0.5	0.073
1,2-Dichloropropane	78875	5	--	2,800,000	1	0.5	0.042
1,3-Dichlorobenzene	541731	6.6	--	111,000	1	0.5	0.041
1,4-Dichlorobenzene	106467	17	--	74,000	1	0.5	0.054
2-Butanone (MEK)	78933	2,200	--	240,000,000	25	20	3.8
2-Hexanone	591786	1,000	--	16,000,000	50	20	2.9
4-Methyl-2-pentanone (MIBK)	108101	1,800	--	20,000,000	50	20	3.0
Acetone	67641	730	--	1,000,000,000	50	20	2.5
Benzene	71432	5	--	1,750,000	1	0.5	0.045

QAPP Worksheet #15-6
Reference Limits and Evaluation (Groundwater) – ALS-Kelso (formerly CAS)

PARAMETER[1]	CHEMICAL ABSTRACT SERVICE NUMBER	RANGE OF POTENTIALLY APPLICABLE PART 201 CRITERIA[3] (µg/L)			PART 201 TARGET DETECTION LIMIT (µg/L)	CAS AQUEOUS REPORT LIMIT[2] (µg/L)	CAS METHOD DETECTION LIMIT[2] (µg/L)
Bromodichloromethane	75274	80	--	6,740,000	1	0.5	0.036
Bromoform	75252	80	--	3,100,000	1	0.5	0.080
Bromomethane	74839	10	--	14,500,000	5	0.5	0.072
Carbon disulfide	75150	800	--	1,200,000	5	0.5	0.045
Carbon tetrachloride	56235	5	--	793,000	1	0.5	0.068
Chlorobenzene	108907	25	--	472,000	1	0.5	0.045
Chloroethane	75003	430	--	5,740,000	5	0.5	0.13
Chloroform	67663	80	--	7,920,000	1	0.5	0.042
Chloromethane	74873	260	--	6,340,000	5	0.5	0.053
cis-1,2-Dichloroethylene	156592	70	--	3,500,000	1	0.5	0.045
cis-1,3-Dichloropropene	542756		--		1	0.5	0.038
Dibromochloromethane	124481	80	--	2,600,000	5	0.5	0.057
Dibromochloropropane	96128	0.20	--	1,230	0.2	2	0.22
Dichlorodifluoromethane	75718	1,700	--	300,000	5	0.5	0.083
Ethylbenzene	100414	18	--	170,000	1	0.5	0.042
Isopropyl benzene	98828	28	--	56,000	5	2	0.031
Methylene chloride	75092	5	--	17,000,000	5	2	0.23
Methyl-tert-butyl ether (MTBE)	1634044	40	--	47,000,000	5	0.5	0.070
Styrene	100425	80	--	310,000	1	0.5	0.039
Tetrachloroethylene	127184	5	--	200,000	1	0.5	0.077
Toluene	108883	270	--	530,000	1	0.5	0.048
trans-1,2-Dichloroethylene	156605	100	--	6,300,000	1	0.5	0.048
trans-1,3-Dichloropropene	542756		--		1	0.5	0.041
Trichloroethylene	79016	5	--	1,100,000	1	0.5	0.061
Trichlorofluoromethane	75694	2,600	--	1,100,000	1	0.5	0.086
Vinyl chloride	75014	2	--	2,760,000	1	0.5	0.071
m,p-Xylene	1330207		--		3	0.5	0.078

QAPP Worksheet #15-6
Reference Limits and Evaluation (Groundwater) – ALS-Kelso (formerly CAS)

PARAMETER[1]	CHEMICAL ABSTRACT SERVICE NUMBER	RANGE OF POTENTIALLY APPLICABLE PART 201 CRITERIA[3] (µg/L)			PART 201 TARGET DETECTION LIMIT (µg/L)	CAS AQUEOUS REPORT LIMIT[2] (µg/L)	CAS METHOD DETECTION LIMIT[2] (µg/L)
o-Xylene	1330207	41	--	190,000	3	0.5	0.037
SEMI VOLATILE ORGANIC COMPOUNDS							
2,4,5-Trichlorophenol	95954	730	--	1,200,000	5	10	0.381
2,4,6-Trichlorophenol	88062	5	--	800,000	4	10	0.203
2,4-Dichlorophenol	120832	11	--	4,500,000	10	10	0.297
2,4-Dimethylphenol	105679	370	--	7,870,000	5	10	0.264
2,4-Dinitrotoluene	121142	7.7	--	270,000	5	10	0.274
2-Chlorophenol	95578	18	--	22,000,000	10	10	0.311
2-Methylnaphthalene	91576	19	--	25,000	5	10	0.239
2-Methylphenol (J)	1319773	30	--	28,000,000	10	10	0.328
2-Nitrophenol	88755	20	--	2,500,000	5	10	0.373
3,3-Dichlorobenzidine	91941	0.3	--	3,110	0.3	25	0.27
4,6-Dinitro-2-methylphenol (2-methyl-4,6-dinitrophenol)	534521	20	--	200,000	20	10	2.12
4-Chloro-3-methylphenol	59507	7.4	--	3,900,000	5	10	0.49
4-Methylphenol (J)	1319773	30	--	28,000,000	10	10	0.478
Acenaphthene	83329	38	--	4240	5	10	0.281
Acenaphthylene	208968	52	--	3,930	5	10	0.236
Anthracene	120127	43	--	43.4	5	10	0.612
Benzo(a)anthracene	56553	2.1	--	9	1	10	0.591
Benzo(a)pyrene	50328	1	--	5	1	10	0.651
Benzo(b)fluoranthene	205992	--	1.5	--	1	10	0.584
Benzo(g,h,i)perylene	191242	0.26	--	1	1	10	0.812
Benzo(k)fluoranthene	207089	0.8	--	1	1	10	0.827
bis(2-Chloroethyl)ether (I)	111444	1	--	17,200,000	1	10	0.333
bis(2-Ethylhexyl)phthalate	117817	6	--	340	5	10	1.89
Butyl benzyl phthalate	85687	67	--	2,700	5	10	0.47

QAPP Worksheet #15-6
Reference Limits and Evaluation (Groundwater) – ALS-Kelso (formerly CAS)

PARAMETER[1]	CHEMICAL ABSTRACT SERVICE NUMBER	RANGE OF POTENTIALLY APPLICABLE PART 201 CRITERIA[3] (µg/L)			PART 201 TARGET DETECTION LIMIT (µg/L)	CAS AQUEOUS REPORT LIMIT[2] (µg/L)	CAS METHOD DETECTION LIMIT[2] (µg/L)
Carbazole	86748	10	--	7,480	10	10	0.364
Chrysene	218019	--	1.6	--		10	0.787
Dibenzo(a,h)anthracene	53703	2		2.49		10	0.752
Dibenzofuran	132649	4	--	10,000	4	10	0.325
Diethyl phthalate	84662	110	--	1,100,000	5	10	0.289
Dimethyl phthalate	131113	73,000	--	4,200,000	5	10	0.254
Di-n-butylphthalate	84742	9.70	--	11,200	5	10	0.652
Di-n-octyl phthalate	117840	130	--	3,000	5	10	0.626
Fluoranthene	206440	1.6	--	210	1	10	0.652
Fluorene	86737	12	--	2,000	5	10	0.323
Hexachlorobenzene (C-66)	118741	0.20	--	6,200	0.2	10	0.628
Hexachlorobutadiene (C-46)	87683	0.053	--	3,230	0.05	10	0.291
Hexachlorocyclopentadiene (C-56)	77474	50	--	1,800	5	10	1.21
Hexachloroethane	67721	6.7	--	50,000	5	10	0.289
Indeno(1,2,3-cd)pyrene	193395	0.022	--	2		10	0.684
Isophorone	78591	770	--	12,000,000	5	10	0.246
Naphthalene	91203	11	--	31,000	5	10	0.365
Nitrobenzene (I)	98953	3.4	--	2,090,000	3	10	0.567
n-Nitroso-di-n-propylamine	621647	5	--	0=9,890,000	5	10	0.496
N-Nitrosodiphenylamine	86306	270	--	35,100	5	10	0.48
Pentachlorophenol	87865	1	--	1,850,000	1	25	2.44
Phenanthrene	85018	2.4	--	1,000	2	10	0.482
Phenol	108952	450	--	82,800,000	5	10	0.324
Pyrene	129000	135	--	140	5	10	0.731

QAPP Worksheet #15-6
Reference Limits and Evaluation (Groundwater) – ALS-Kelso (formerly CAS)

PARAMETER[1]	CHEMICAL ABSTRACT SERVICE NUMBER	RANGE OF POTENTIALLY APPLICABLE PART 201 CRITERIA[3] (µg/L)	PART 201 TARGET DETECTION LIMIT (µg/L)	CAS AQUEOUS REPORT LIMIT[2] (µg/L)	CAS METHOD DETECTION LIMIT[2] (µg/L)

Notes:
[1] The parameters included in this table are those included in the U.S. EPA Contract Laboratory Program (CLP) Target Compound List (TCL) and Target Analyte List (TAL), except those that are not on the Part 201 list Calcium, Potassium, 1,2,3-Trichlorobenzene, Bromochloromethane, Cyclohexane, Methyl Acetate, Methylcyclohexane (methyl phenol), 1,1-Biphenyl, 2,2-oxybis(1-Chloropropane), 2,4-Dinitrophenol, 2,6-Dinitrotoluene, 2-Nitroaniline, 3-Nitroaniline, 4-Bromophenyl-phenylether, 4-Chloroaniline, 4-Chlorophenyl-phenylether, 4-Nitroaniline, 4-Nitrophenol, Benzaldehyde, bis(2-Chloroethoxy)methane. Or those that are not typically analyzed by WATS, ALS-Kelso or ALS-Holland 1,1,2-Trichloro-1,2,2-triflouroethane, 1,2,4,5-Tetrachlorobenzene, Acetophenone, Atrazine, beta-Chloronaphthalene, Caprolactum.
[2] The actual Report Limits and Method Detection Limits will vary with sample size, for the analysis of PCBs and PAHs.
[3] Potentially applicable Michigan Part 201 Criteria are from the Michigan Department of Environmental Quality (MDEQ) Remediation and Redevelopment Division (RRD) updated 9/28/12 pursuant to 1994 PA 451 as amended.
[4] Low level and methyl mercury will be analyzed by ALS Environmental (ALS) formerly Columbia Analytical Services (CAS), or ALS Holland
[5] The MDL actually achievable in a given analysis will vary depending on detector response characteristics, irreducible noise from instrument electronics, and matrix effects.
[6] The Michigan Part 201 Criteria for Hexavalent Chromium will be used for Chromium (total) as there is no total chromium criteria established.
ALS = ALS Environmental Laboratories
CAS = Columbia Analytical Services.
MDL = Method Detection Limit
NA = Not Available
RL = Reporting Limit
µg/L = micrograms per liter
ng/L = nanograms per liter

QAPP Worksheet #15-7
Reference Limits and Evaluation (Free Product) – ALS-Kelso (formerly CAS)

ANALYTE	CAS NUMBER	PROJECT ACTION LIMIT[1]	FREE PRODUCT (µg/L)[2]	
			CAS LABORATORY MDL	CAS LABORATORY RL
PCBs (U.S. EPA 8082)				
Aroclor - 1016	12674-11-2	--	--	1.0
Aroclor - 1221	11104-28-2	--	--	2.0
Aroclor - 1232	11141-16-5	--	--	1.0
Aroclor - 1242	53469-21-9	--	--	1.0
Aroclor - 1248	12672-29-6	--	--	1.0
Aroclor - 1254	11097-69-1	--	--	1.0
Aroclor - 1260	11096-82-5	--	--	1.0
Total PCBs	1336-36-3	--	--	2.0
Physical Properties				
Specific Gravity (ASTM D854-83)	--	--	--	--

Notes:

(1) Standards are consistent with the Multi-Area Quality Assurance Project Plan (Rev. 00) for the Kalamazoo River Study Group (Arcadis BBL, 2007b), which are from the MDEQ's Substantive Requirements Document for the Plainwell Dam Superfund Site, dated February 13, 2007. The TSS standards are on a monthly and daily basis, respectively.

(2) Concentrations are in µg/L, except where noted.

(3) U.S. EPA. *Appendix A to Part 136 Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater Method 608—Organochlorine Pesticides and PCBs*. July 1995.

(4) U.S. EPA. *Methods for Chemical Analysis of Water and Wastes.* EPA/600/4-79/020.

(5) The actual Reporting Limit will depend on the volume of sample filtered.

RL = report limit.
MDL = Method Detection Limit.
µg/L – micrograms per liter
PCBs = polychlorinated biphenyls.

QAPP Worksheet #15-8
Reference Limits and Evaluation (Surface Water) – ALS-Holland

ANALYTE	CAS NUMBER	PROJECT ACTION LIMIT[1]	WATER (µg/L)[2]	
			ALS-HOLLAND LABORATORY MDL	ALS-HOLLAND LABORATORY RL
PCBs (U.S. EPA 608)[3]				
Aroclor - 1016	12674-11-2	--	0.067	0.25
Aroclor - 1221	11104-28-2	--	0.067	0.25
Aroclor - 1232	11141-16-5	--	0.067	0.25
Aroclor - 1242	53469-21-9	--	0.067	0.25
Aroclor - 1248	12672-29-6	--	0.067	0.25
Aroclor - 1254	11097-69-1	--	0.067	0.25
Aroclor - 1260	11096-82-5	--	0.067	0.25
Total PCBs	1336-36-3	0.2 µg/L	0.067	0.25
Metals				
Low Level Mercury	7439-97-6	--	0.068 ng/L	0.5 ng/L
Methyl Mercury	22967-92-6	--	0.05 ng/L	0.1 ng/L

Notes:

(1) Standards are consistent with the Multi-Area Quality Assurance Project Plan (Rev. 00) for the Kalamazoo River Study Group (Arcadis BBL, 2007b), which are from the MDEQ's Substantive Requirements Document for the Plainwell Dam Superfund Site, dated February 13, 2007.

(2) Concentrations are in µg/L, except where noted.

(3) U.S. EPA. *Appendix A to Part 136 Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater Method 608—Organochlorine Pesticides and PCBs*. July 1995.

(4) U.S. EPA. *Methods for Chemical Analysis of Water and Wastes.* EPA/600/4-79/020.

(5) The actual Reporting Limit will depend on the volume of sample filtered.

RL = report limit.
MDL = Method Detection Limit.
µg/L = micrograms per liter.
ng/L = nanograms per liter.
PCBs = polychlorinated biphenyls.
ALS – ALS Environmental Laboratories

QAPP Worksheet #15-9
Reference Limits and Evaluation (Soil/Sediment) – ALS-Holland

PARAMETER[1]	CHEMICAL ABSTRACT SERVICE NUMBER	RANGE OF POTENTIALLY APPLICABLE PART 201 CRITERIA[3] (µg/kg)			PART 201 TDLs (µg/kg)	ALS-Holland REPORT LIMIT[2] (µg/kg)	ALS-Holland METHOD DETECTION LIMIT[2] (µg/kg)
INORGANICS (METALS AND WET CHEMISTRY)							
Aluminum	7429905	1,000	--	1,000,000,000	1,000	500	36
Antimony	7440360	4,300	--	49,000,000	300	250	6
Arsenic	7440382	5,800	--	2,000,000	100	250	30
Barium	7440393	440,000	--	1,000,000,000	1,000	250	9
Beryllium	7440417	51,000	--	1,000,000,000	500	100	3
Cadmium	7440439	3,0 00	--	230,000,000	200	100	1
Chromium (Total) [5]	7440473	3,300	--	140,000,000	2,000	250	7
Cobalt	7440484	6,800	--	48,000,000	500	250	1
Copper	7440508	75,000	--	1,000,000,000	1,000	250	7
Iron	7439896	12,000	--	1,000,000,000	5,000	4,000	844
Lead	7439921	400,000	--	100,000,000	1,000	250	1
Magnesium	7439954	8,000,000	--	6,700,000,000	4,000	10,000	127
Manganese	7439965	440,000	--	180,000,000	1,000	250	7
Mercury (total)	7439976	130	--	20,000,000	50	20	1
Nickel	7440020	100,000	--	1,000,000,000	1,000	250	3
Selenium	7782492	410	--	130,000,000	200	250	18
Silver	7440224	1,000	--	200,000,000	100	250	1
Sodium	17341252	2,500,000	--	1,000,000,000	10,000	10,000	581
Thallium	7440280	2,300	--	15,000,000	500	250	4
Vanadium	7440622	72,000	--	1,000,000,000	1,000	250	13
Zinc	7440666	47,000	--	1,000,000,000	1,000	500	26
Cyanide (total)	57125	390	--	250,000	100	500	9
Ammonia-N (SM 4500-NH3 G)	7664-41-7	10,000,000	--	6,700,000,000	1,000	15,000	3331
Nitrate-N (U.S. EPA 353.2/SM 4500-NO2 B)	14797-55-8	200,000	--	1,000,000,000	--	1000	137
Nitrite-N (U.S. EPA 353.2/SM 4500-NO2 B)	14797-65-0	20,000	--	380,000,000	--	700	13
Total phosphorus as P (U.S. EPA 365.1)	7723140	1,300,000	--	1,000,000,000	--	1,000	62

QAPP Worksheet #15-9
Reference Limits and Evaluation (Soil/Sediment) – ALS-Holland

PARAMETER[1]	CHEMICAL ABSTRACT SERVICE NUMBER	RANGE OF POTENTIALLY APPLICABLE PART 201 CRITERIA[3] (µg/kg)			PART 201 TDLs (µg/kg)	ALS-Holland REPORT LIMIT[2] (µg/kg)	ALS-Holland METHOD DETECTION LIMIT[2] (µg/kg)
POLYCHLORINATED BIPHENYLS (PCBs)-Low Level							
Total PCBs	1336363	4,000	-	28,000,000	330		
Aroclor-1016	12674112	--	Part 201 N/A	--	--	40	35.59
Aroclor-1221	11104282	--	Part 201 N/A	--	--	40	35.59
Aroclor-1232	11141165	--	Part 201 N/A	--	--	40	35.59
Aroclor-1242	53469219	--	Part 201 N/A	--	--	40	35.59
Aroclor-1248	12672296	--	Part 201 N/A	--	--	40	35.59
Aroclor-1254	11097691	--	Part 201 N/A	--	--	40	35.59
Aroclor-1260	11096825	--	Part 201 N/A	--	--	40	11.16
VOLATILE ORGANIC COMPOUNDS – Low/Med							
1,1,1-Trichloroethane	71556	1,800	--	67,000,000,000	50	30	11.42
1,1,2,2-Tetrachloroethane	79345	170	--	68,000,000	50	30	13.2
1,1,2-Trichloroethane	79005	100	--	250,000,000	50	30	10.61
1,1-Dichloroethane	75343	15,000	--	33,000,000,000	50	30	10.98
1,1-Dichloroethylene	75354	62	--	78,000,000	50	30	12.6
1,2,4-Trichlorobenzene	120821	4,200	--	25,000,000,000	330	30	15.51
1,2-Dibromoethane (ethylene dibromide)	106934	20	--	18,000,000	20	30	11.83
1,2-Dichlorobenzene	95501	280	--	100,000,000,000	100	30	12
1,2-Dichloroethane	107062	100	--	150,000,000	50	30	14.23
1,2-Dichloropropane	78875	100	--	270,000,000	50	30	9.94
1,3-Dichlorobenzene	541731	170	--	200,000,000	100	30	12.02
1,4-Dichlorobenzene	106467	360	--	570,000,000	100	30	11.44
2-Butanone (MEK)	78933	44,000	--	67,000,000,000	750	200	74.22
2-Hexanone	591786	20,000	--	2,700,000,000	2,500	30	7.36
4-Methyl-2-pentanone (MIBK)	108101	36,000	--	140,000,000,000	2,500	30	10.14
Acetone	67641	15,000	--	390,000,000,000	1,000	100	63.52
Benzene	71432	100	--	470,000,000	50	30	12.04

QAPP Worksheet #15-9
Reference Limits and Evaluation (Soil/Sediment) – ALS-Holland

PARAMETER[1]	CHEMICAL ABSTRACT SERVICE NUMBER	RANGE OF POTENTIALLY APPLICABLE PART 201 CRITERIA[3] (µg/kg)			PART 201 TDLs (µg/kg)	ALS-Holland REPORT LIMIT[2] (µg/kg)	ALS-Holland METHOD DETECTION LIMIT[2] (µg/kg)
Bromodichloromethane	75274	1,200	--	110,000,000	100	30	6.73
Bromoform	75252	1,600	--	3,600,000,000	100	30	5.91
Bromomethane	74839	200	--	330,000,000	200	75	11.49
Carbon disulfide	75150	16,000	--	47,000,000,000	250	30	14.86
Carbon tetrachloride	56235	100	--	170,000,000	50	30	8.53
Chlorobenzene	108907	500	--	4,700,000,000	50	30	12.22
Chloroethane	75003	8,600	--	670,000,000,000	250	100	63.68
Chloroform	67663	1,600	--	1,600,000,000	50	30	12.36
Chloromethane	74873	2,300	--	4,900,000,000	250	100	16.7
cis-1,2-Dichloroethylene	156592	1,400	--	2,300,000,000	50	30	12.17
cis-1,3-Dichloropropene	542756	--	NA	--	100	30	10.26
Dibromochloromethane	124481	1,600	--	160,000,000	100	30	5.55
Dibromochloropropane	96128	10	--	13,000,000	10	30	14.61
Dichlorodifluoromethane	75718	95,000	--	3,300,000,000,000	250	30	13.55
Ethylbenzene	100414	360	--	13,000,000,000	50	30	11.14
Isopropyl benzene	98828	3,200	--	5,800,000,000	250	30	12.92
Methylene chloride	75092	100	--	8,300,000,000	100	30	11.76
Methyl-tert-butyl ether (MTBE)	1634044	800	--	200,000,000,000	250	30	12.7
Styrene	100425	2,100	--	6,900,000,000	50	30	11.18
Tetrachloroethylene	127184	100	--	2,700,000,000	50	30	13.36
Toluene	108883	5,400	--	27,000,000,000	100	30	11.26
trans-1,2-Dichloroethylene	156605	2,000	--	4,700,000,000	50	30	9.24
trans-1,3-Dichloropropene	542756	--	NA	--	100	30	10.04
Trichloroethylene (Trichloroethene)	79016	100	--	130,000,000	50	30	14.01
Trichlorofluoromethane	75694	52,000	--	3,800,000,000,000	100	30	8.26
Vinyl chloride	75014	40	--	890,000,000	40	30	13.54
m,p-Xylenes	1330207	--	NA	--	150	60	22.72

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Reference Limits and Evaluation (Soil/Sediment) – ALS-Holland

PARAMETER[1]	CHEMICAL ABSTRACT SERVICE NUMBER	RANGE OF POTENTIALLY APPLICABLE PART 201 CRITERIA[3] (µg/kg)			PART 201 TDLs (µg/kg)	ALS-Holland REPORT LIMIT[2] (µg/kg)	ALS-Holland METHOD DETECTION LIMIT[2] (µg/kg)
o-Xylenes	1330207	5,600	--	290,000,000,000	150	30	12.73
SEMI VOLATILE ORGANIC COMPOUNDS							
2,4,5-Trichlorophenol	95954	39,000	--	23,000,000,000	330	160	7.97
2,4,6-Trichlorophenol	88062	330	--	1,300,000,000	330	160	7.96
2,4-Dichlorophenol	120832	330	--	5,100,000,000	330	160	9.71
2,4-Dimethylphenol	105679	7,400	--	4,700,000,000	330	330	40.75
2,4-Dinitrotoluene	121142	430	--	20,000,000	330	160	8.93
2-Chlorophenol	95578	360	--	1,200,000,000	330	160	8.95
2-Methylnaphthalene	91576	4,200	--	670,000,000	330	80	9.82
2-Methylphenols (J)	1319773	1,000	--	6,700,000,000	330	160	9.62
2-Nitrophenol	88755	400	--	2,000,000	330	160	8.7
3,3-Dichlorobenzidine	91941	2,000	--	8,200,000	2,000	660	9.33
4,6-Dinitro-2-methylphenol (2-methyl-4,6-dinitrophenol)	534521	830	--	130,000,000	830	330	48.1
4-Chloro-3-methylphenol	59507	280	--	15,000,000	280	160	9.03
4-Methylphenol (J)	1319773	1,000	--	6,700,000,000	330	160	9.81
Acenaphthene	83329	8,700	--	14,000,000,000	330	30	9.12
Acenaphthylene	208968	5,900	--	2,300,000,000	330	30	9.46
Anthracene	120127	41,000	--	67,000,000,000	330	30	10.17
Benzo(a)anthracene	56553	20,000	--	80,000	330	30	12.17
Benzo(a)pyrene	50328	2,000	--	1,900,000	330	30	15.44
Benzo(b)fluoranthene	205992	20,000	--	80,000	330	30	16.11
Benzo(g,h,i)perylene	191242	2,500,000	--	800,000,000	330	30	23.54
Benzo(k)fluoranthene	207089	200,000	--	800,000	330	30	13.6
bis(2-Chloroethyl)ether (I)	111444	100	--	12,000,000	100	160	8.33
bis(2-Ethylhexyl)phthalate	117817	2,800,000	--	890,000,000	330	330	9.9
Butyl benzyl phthalate	85687	120,000	--	47,000,000,000	330	160	13.83

QAPP Worksheet #15-9
Reference Limits and Evaluation (Soil/Sediment) – ALS-Holland

PARAMETER[1]	CHEMICAL ABSTRACT SERVICE NUMBER	RANGE OF POTENTIALLY APPLICABLE PART 201 CRITERIA[3] (µg/kg)			PART 201 TDLs (µg/kg)	ALS-Holland REPORT LIMIT[2] (µg/kg)	ALS-Holland METHOD DETECTION LIMIT[2] (µg/kg)
Carbazole	86748	1,100	--	78,000,000	330	160	11.4
Chrysene	218019	2,000,000	--	8,000,000	330	30	11.31
Dibenzo(a,h)anthracene	53703	2,000	--	8,000	330	30	17.06
Dibenzofuran	132649	1,700		6,700,000	330	160	9.13
Diethyl phthalate	84662	2,200	--	3,300,000,000	330	330	8.3
Dimethyl phthalate	131113	790,000	--	3,300,000,000	330	330	8.33
Di-n-butylphthalate	84742	11,000	--	3,300,000,000	330	330	10.04
Di-n-octyl phthalate	117840	6,900,000	--	31,000,000,000	330	160	12.31
Fluoranthene	206440	5,500	--	9,300,000,000	330	30	11.89
Fluorene	86737	5,300	--	9,300,000,000	330	30	8.74
Hexachlorobenzene (C-66)	118741	350	--	8,500,000	330	160	9.09
Hexachlorobutadiene (C-46)	87683	91	--	180,000,000	50	160	8.44
Hexachlorocyclopentadiene (C-56)	77474	30,000	--	13,000,000	330	330	34.89
Hexachloroethane	67721	430	--	230,000,000	300	160	8.74
Indeno(1,2,3-cd)pyrene	193395	20,000	--	80,000	330	30	18.93
Isophorone	78591	15,000	--	12,000,000,000	330	160	8.67
Naphthalene	91203	730	--	200,000,000	330	30	8.53
Nitrobenzene (I)	98953	330	--	47,000,000	330	160	8.65
n-Nitroso-di-n-propylamine	621647	330	--	2,000,000	330	160	8.74
N-Nitrosodiphenylamine	86306	5,400	--	2,800,000,000	330	160	59.33
Pentachlorophenol	87865	22	--	130,000,000	20	330	14.75
Phenanthrene	85018	2,100	--	6,700,000	330	30	30
Phenol	108952	9,000	--	40,000,000,000	330	160	8.46
Pyrene	129000	480,000	--	6,700,000,000	330	30	12.47

QAPP Worksheet #15-9
Reference Limits and Evaluation (Soil/Sediment) – ALS-Holland

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POLYCHLORINATED DIBENZODIOXINS / POLYCHLORINATED DIBENZOFURANS (PCDD/PCDFs)							
2378-TCDD	1746-01-6				1.0 ng/kg	0.5 ng/kg	0.0562 ng/kg
12378-PeCDD	40321-76-4				--	2.5 ng/kg	0.0312 ng/kg
123478-HxCDD	39227-28-6				--	2.5 ng/kg	0.0322 ng/kg
123678-HxCDD	57653-85-7				--	2.5 ng/kg	0.0304 ng/kg
123789-HxCDD	19408-74-3				--	2.5 ng/kg	0.0291 ng/kg
1234678-HpCDD	35822-46-9				--	2.5 ng/kg	0.0208 ng/kg
OCDD	3268-87-9				--	5 ng/kg	0.0381 ng/kg
2378-TCDF	51207-31-9				--	0.5 ng/kg	0.0415 ng/kg
12378-PeCDF	57117-41-6				--	2.5 ng/kg	0.0324 ng/kg
23478-PeCDF	57117-31-4				--	2.5 ng/kg	0.0351 ng/kg
123478-HxCDF	70648-26-9				--	2.5 ng/kg	0.0195 ng/kg
123678-HxCDF	57117-44-9				--	2.5 ng/kg	0.0188 ng/kg
123789-HxCDF	72918-21-9				--	2.5 ng/kg	0.0248 ng/kg
234678-HxCDF	60851-34-5				--	2.5 ng/kg	0.0204 ng/kg
1234678-HpCDF	67562-39-4				--	2.5 ng/kg	0.0278 ng/kg
1234789-HpCDF	55673-89-7				--	2.5 ng/kg	0.0373 ng/kg
OCDF	39001-02-0				--	5 ng/kg	0.0661 ng/kg

QAPP Worksheet #15-9
Reference Limits and Evaluation (Soil/Sediment) – ALS-Holland

PARAMETER[1]	CHEMICAL ABSTRACT SERVICE NUMBER	RANGE OF POTENTIALLY APPLICABLE PART 201 CRITERIA[3] (µg/kg)	PART 201 TDLs (µg/kg)	ALS-Holland REPORT LIMIT[2] (µg/kg)	ALS-Holland METHOD DETECTION LIMIT[2] (µg/kg)

Notes:
[1] The parameters included in this table are those included in the USEPA Contract Laboratory Program (CLP) Target Compound List (TCL) and Target Analyte List (TAL), except those that are not on the Part 201 list; Calcium, Potassium, 1,2,3-Trichlorobenzene, Bromochloromethane, Cyclohexane, Methyl Acetate, Methylcyclohexane (methyl phenol), 1,1-Biphenyl, 2,2-oxybis(1-Chloropropane), 2,4-Dinitrophenol, 2,6-Dinitrotoluene, 2-Nitroaniline, 3-Nitroaniline, 4-Bromophenyl-phenylether, 4-Chloroaniline, 4-Chlorophenyl-phenylether, 4-Nitroaniline, 4-Nitrophenol, Benzaldehyde, bis(2-Chloroethoxy)methane. Or those that are not typically analyzed by WATS, ALS-Kelso or ALS-Holland: 1,1,2-Trichloro-1,2,2-triflouroethane, 1,2,4,5-Tetrachlorobenzene, Acetophenone, Atrazine, beta-Chloronaphthalene, Caprolactum.
[2] The actual Report Limits and Method Detection Limits will vary with sample size.
[3] Potentially applicable Michigan Part 201 Criteria are from the Michigan Department of Environmental Quality (MDEQ) Remediation and Redevelopment Division (RRD) updated 9/28/2012 pursuant to 1994 PA 451 as amended.
[4] The MDL actually achievable in a given analysis will vary depending on detector response characteristics, irreducible noise from instrument electronics, and matrix effects. The dioxin/furan MDL is actually the EDL which is determined for each individual sample. The value provided was obtained from most recent Limit of Detection verification, provided for example only.
[5] The Michigan Part 201 Criteria for Hexavalent Chromium will be used for Chromium (total) as there is no total chromium criteria established.
ALS = ALS Environmental Laboratories
EDL = Estimated Detection Limit
MDL = Method Detection Limit
NA = Not Available
RL = Report Limit
µg/kg = micrograms per kilogram.
ng/kg = nanograms per kilogram.

QAPP Worksheet #15-10
Reference Limits and Evaluation (Groundwater) – ALS-Holland

PARAMETER[1]	CHEMICAL ABSTRACT SERVICE NUMBER	RANGE OF POTENTIALLY APPLICABLE PART 201 CRITERIA[3] (µg/L)			PART 201 TARGET DETECTION LIMIT (µg/L)	ALS-HOLLAND AQUEOUS REPORT LIMIT[2] (µg/L)	ALS-HOLLAND METHOD DETECTION LIMIT[2] (µg/L)
METALS (TOTAL/SPLP) AND CYANIDE							
Aluminum	7429905	50	--	64,000,000	50	10	1.741
Antimony	7440360	6	--	68,000	2	5	0.039
Arsenic	7440382	10	--	4,300	5	5	0.717
Barium	7440393	670	--	14,000,000	100	5	0.274
Beryllium	7440417	4	--	290,000	1	2	0.048
Cadmium	7440439	3	--	190,000	1	2	0.034
Chromium (Total) [6]	7440473	11	--	460,000	10	5	0.042
Chromium (Hexavalent)	18540299				10	5	5
Chromium (Trivalent)-calculation	16065831				10		
Cobalt	7440484	40	--	2,400,000	20	5	0.039
Copper	7440508	13	--	7,400,000	4	5	0.123
Iron	7439896	300	--	58,000,000	200	80	2.832
Lead	7439921	4	--	29	3	5	0.027
Magnesium	7439954	400,000	--	1,000,000,000	1,000	200	2.424
Manganese	7439965	50	--	9,100,000	50	5	0.111
Mercury (total)	7439976		--			0.2	0.008
Low Level Mercury (total)[4]	7439976	0.0013	--	56	0.001	0.0005	0.000068
Methyl Mercury [4]	22967926	0.0013	--	56	0.001	NA	NA
Nickel	7440020	73	--	74,000,000	20	5	0.169
Selenium	7782492	5	--	970,000	5	5	0.411
Silver	7440224	0.2	--	1,500,000	0.2	5	0.025
Sodium	17341252	120,000	--	1,000,000,000	1,000	200	6.939
Thallium	7440280	2	--	13,000	2	5	0.029
Vanadium	7440622	4.50	--	970,000	4	5	0.305
Zinc	7440666	170	--	110,000,000	50	10	0.588

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Reference Limits and Evaluation (Groundwater) – ALS-Holland

PARAMETER[1]	CHEMICAL ABSTRACT SERVICE NUMBER	RANGE OF POTENTIALLY APPLICABLE PART 201 CRITERIA[3] (µg/L)			PART 201 TARGET DETECTION LIMIT (µg/L)	ALS-HOLLAND AQUEOUS REPORT LIMIT[2] (µg/L)	ALS-HOLLAND METHOD DETECTION LIMIT[2] (µg/L)
Cyanide (amenable)	57125	5.2	--	57,000	5	5	1

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Reference Limits and Evaluation (Groundwater) – ALS-Holland

PARAMETER[1]	CHEMICAL ABSTRACT SERVICE NUMBER	RANGE OF POTENTIALLY APPLICABLE PART 201 CRITERIA[3] (µg/L)			PART 201 TARGET DETECTION LIMIT (µg/L)	ALS-HOLLAND AQUEOUS REPORT LIMIT[2] (µg/L)	ALS-HOLLAND METHOD DETECTION LIMIT[2] (µg/L)
POLYCHLORINATED BIPHENYLS (PCBs)							
Total PCBs	1336363	0.2	--	45	0.2	0.25	0.133
Aroclor-1016	12674112	--	N/A	--	--	0.25	0.133
Aroclor-1221	11104282	--	N/A	--	--	0.25	0.133
Aroclor-1232	11141165	--	N/A	--	--	0.25	0.133
Aroclor-1242	53469219	--	N/A	--	--	0.25	0.133
Aroclor-1248	12672296	--	N/A	--	--	0.25	0.133
Aroclor-1254	11097691	--	N/A	--	--	0.25	0.025
Aroclor-1260	11096825	--	N/A	--	--	0.25	0.025
Inorganics (Wet Chemistry)							
TSS (U.S. EPA 160.2)	--	30,000	--	45,000	--	2400	1980
Total phosphorus as P (U.S. EPA 365.2)	7723-14-0	--	--	--	--	50	10
Hardness (EPA 6020)-Calculation of Ca & Mg	14797-65-0	--	--	--	--	2000	28.32
VOLATILE ORGANIC COMPOUNDS							
1,1,1-Trichloroethane	71556	89	--	1,330,000	1	1	0.135
1,1,2,2-Tetrachloroethane	79345	8.5	--	2,970,000	1	1	0.13
1,1,2-Trichloroethane	79005	5	--	4,420,000	1	1	0.084
1,1-Dichloroethane	75343	740	--	5,060,000	1	1	0.11
1,1-Dichloroethylene Dichloroethene	75354	7	--	2,250,000	1	1	0.116
1,2,4-Trichlorobenzene	120821	70	--	300,000	5	1	0.164
1,2-Dibromoethane (ethylene dibromide)	106934	0.05	--	4,200,000	0.05	1	0.165
1,2-Dichlorobenzene	95501	13	--	160,000	1	1	0.132
1,2-Dichloroethane	107062	5	--	28,520,000	1	1	0.152
1,2-Dichloropropane	78875	5	--	2,800,000	1	2	0.131
1,3-Dichlorobenzene	541731	6.60	--	111,000	1	2	0.16
1,4-Dichlorobenzene	106467	17	--	74,000	1	2	0.146

QAPP Worksheet #15-10
Reference Limits and Evaluation (Groundwater) – ALS-Holland

PARAMETER[1]	CHEMICAL ABSTRACT SERVICE NUMBER	RANGE OF POTENTIALLY APPLICABLE PART 201 CRITERIA[3] (µg/L)			PART 201 TARGET DETECTION LIMIT (µg/L)	ALS-HOLLAND AQUEOUS REPORT LIMIT[2] (µg/L)	ALS-HOLLAND METHOD DETECTION LIMIT[2] (µg/L)
2-Butanone (MEK)	78933	2,200	--	240,000,000	25	5	0.22
2-Hexanone	591786	1,000	--	16,000,000	50	5	0.119
4-Methyl-2-pentanone (MIBK)	108101	1,800	--	20,000,000	50	5	0.096
Acetone	67641	730	--	1,000,000,000	50	20	0.328
Benzene	71432	5	--	1,750,000	1	1	0.183
Bromodichloromethane	75274	80	--	6,740,000	1	1	0.116
Bromoform	75252	80	--	3,100,000	1	1	0.147
Bromomethane	74839	10	--	14,500,000	5	1	0.214
Carbon disulfide	75150	800	--	1,200,000	5	2.5	0.174
Carbon tetrachloride	56235	5	--	793,000	1	1	0.123
Chlorobenzene	108907	25	--	472,000	1	1	0.126
Chloroethane	75003	430	--	5,740,000	5	1	0.458
Chloroform	67663	80	--	7,920,000	1	1	0.152
Chloromethane	74873	260	--	6,340,000	5	1	0.16
cis-1,2-Dichloroethylene	156592	70	--	3,500,000	1	1	0.111
cis-1,3-Dichloropropene	542756	--	NA	--	1	1	0.081
Dibromochloromethane	124481	80	--	2,600,000	5	1	0.133
Dibromochloropropane	96128	0.2	--	1,230	0.2	1	0.311
Dichlorodifluoromethane	75718	1,700	--	300,000	5	1	0.198
Ethylbenzene	100414	18	--	170,000	1	1	0.134
Isopropyl benzene	98828	28	--	56,000	5	1	0.135
Methylene chloride	75092	5	--	17,000,000	5	5	0.186
Methyl-tert-butyl ether (MTBE)	1634044	40	--	47,000,000	5	5	0.07
Styrene	100425	80	--	310,000	1	1	0.107
Tetrachloroethylene	127184	5	--	200,000	1	2	0.152
Toluene	108883	270	--	530,000	1	1	0.122
trans-1,2-Dichloroethylene	156605	100	--	6,300,000	1	1	0.124

QAPP Worksheet #15-10
Reference Limits and Evaluation (Groundwater) – ALS-Holland

PARAMETER[1]	CHEMICAL ABSTRACT SERVICE NUMBER	RANGE OF POTENTIALLY APPLICABLE PART 201 CRITERIA[3] (µg/L)			PART 201 TARGET DETECTION LIMIT (µg/L)	ALS-HOLLAND AQUEOUS REPORT LIMIT[2] (µg/L)	ALS-HOLLAND METHOD DETECTION LIMIT[2] (µg/L)
trans-1,3-Dichloropropene	542756	--	NA	--	1	1	0.148
Trichloroethylene	79016	5	--	1,100,000	1	1	0.136
Trichlorofluoromethane	75694	2,600	--	1,100,000	1	1	0.181
Vinyl chloride	75014	2	--	2,760,000	1	1	0.173
m,p-Xylene	1330207	--	NA	--	3	2	0.203
o-Xylene	1330207	41	--	190,000	3	1	0.086
SEMI VOLATILE ORGANIC COMPOUNDS							
2,4,5-Trichlorophenol	95954	730	--	1,200,000	5	5	0.115
2,4,6-Trichlorophenol	88062	5	--	800,000	4	5	0.108
2,4-Dichlorophenol	120832	11	--	4,500,000	10	10	0.216
2,4-Dimethylphenol	105679	370	--	7,870,000	5	5	0.244
2,4-Dinitrotoluene	121142	7.7	--	270,000	5	5	0.785
2-Chlorophenol	95578	18	--	22,000,000	10	5	0.726
2-Methylnaphthalene	91576	19	--	25,000	5	5	0.129
2-Methylphenol (J)	1319773	30	--	28,000,000	10	5	0.605
2-Nitrophenol	88755	20	--	2,500,000	5	5	0.188
3,3-Dichlorobenzidine	91941	0.3	--	3,110	0.3	5	0.537
4,6-Dinitro-2-methylphenol (2-methyl-4,6-dinitrophenol)	534521	20	--	200,000	20	20	0.343
4-Chloro-3-methylphenol	59507	7.4	--	3,900,000	5	5	0.647
4-Methylphenol (J)	1319773	30	--	28,000,000	10	5	0.553
Acenaphthene	83329	38	--	4,240	5	5	0.113
Acenaphthylene	208968	52	--	3,930	5	5	0.124
Anthracene	120127	43	--	43.4	5	5	0.725
Benzo(a)anthracene	56553	2.1	--	9.4	1	5	0.574
Benzo(a)pyrene	50328	1	--	5	1	5	0.103
Benzo(b)fluoranthene	205992	--	1.5	--	1	5	0.739

QAPP Worksheet #15-10
Reference Limits and Evaluation (Groundwater) – ALS-Holland

PARAMETER[1]	CHEMICAL ABSTRACT SERVICE NUMBER	RANGE OF POTENTIALLY APPLICABLE PART 201 CRITERIA[3] (µg/L)			PART 201 TARGET DETECTION LIMIT (µg/L)	ALS-HOLLAND AQUEOUS REPORT LIMIT[2] (µg/L)	ALS-HOLLAND METHOD DETECTION LIMIT[2] (µg/L)
Benzo(g,h,i)perylene	191242	0.26	--	1	1	5	0.701
Benzo(k)fluoranthene	207089	0.80	--	1	1	5	0.174
bis(2-Chloroethyl)ether (I)	111444	1	--	17,200,000	1	5	0.111
bis(2-Ethylhexyl)phthalate	117817	6	--	340	5	5	0.118
Butyl benzyl phthalate	85687	67	--	2,700	5	5	0.107
Carbazole	86748	10	--	7,480	10	10	0.835
Chrysene	218019	--	1.6	--	1	5	0.71
Dibenzo(a,h)anthracene	53703	2	--	2.49	2	5	0.671
Dibenzofuran	132649	4	--	10,000	4	5	0.114
Diethyl phthalate	84662	110	--	1,100,000	5	20	0.686
Dimethyl phthalate	131113	73,000	--	4,200,000	5	20	0.138
Di-n-butylphthalate	84742	9.7	--	11,200	5	5	0.711
Di-n-octyl phthalate	117840	130	--	3,000	5	5	0.122
Fluoranthene	206440	1.6	--	210	1	5	0.774
Fluorene	86737	12	--	2,000	5	5	0.102
Hexachlorobenzene (C-66)	118741	0.2	--	6,200	0.2	5	0.103
Hexachlorobutadiene (C-46)	87683	0.053	--	3,230	0.05	5	0.124
Hexachlorocyclopentadiene (C-56)	77474	50	--	1,800	5	20	0.184
Hexachloroethane	67721	6.7	--	50,000	5	5	0.127
Indeno(1,2,3-cd)pyrene	193395	0.022	--	2	2	5	0.694
Isophorone	78591	770	--	12,000,000	5	5	0.116
Naphthalene	91203	11	--	31,000	5	5	0.123
Nitrobenzene (I)	98953	3.4	--	2,090,000	3	5	0.102
n-Nitroso-di-n-propylamine	621647	5	--	9,890,000	5	5	0.13
N-Nitrosodiphenylamine	86306	270	--	35,100	5	5	0.81
Pentachlorophenol	87865	1	--	1,850,000	1	20	0.11
Phenanthrene	85018	2	--	1,000	2	5	0.862

QAPP Worksheet #15-10
Reference Limits and Evaluation (Groundwater) – ALS-Holland

PARAMETER[1]	CHEMICAL ABSTRACT SERVICE NUMBER	RANGE OF POTENTIALLY APPLICABLE PART 201 CRITERIA[3] (µg/L)			PART 201 TARGET DETECTION LIMIT (µg/L)	ALS-HOLLAND AQUEOUS REPORT LIMIT[2] (µg/L)	ALS-HOLLAND METHOD DETECTION LIMIT[2] (µg/L)
Phenol	108952	450	--	82,800,000	5	5	0.094
Pyrene	129000	135	--	140	5	5	0.652
POLYCHLORINATED DIBENZODIOXINS / POLYCHLORINATED DIBENZOFURANS (PCDD/PCDFs)							
2378-TCDD	1746-01-6	0.00003	--	0.00001	10 pg/L	5 pg/L	0.813 pg/L
12378-PeCDD	40321-76-4				—	25 pg/L	0.328pg/L
123478-HxCDD	39227-28-6				—	25 pg/L	0.585 pg/L
123678-HxCDD	57653-85-7				—	25 pg/L	0.543 pg/L
123789-HxCDD	19408-74-3				—	25 pg/L	0.523 pg/L
1234678-HpCDD	35822-46-9				—	25 pg/L	1.24 pg/L
OCDD	3268-87-9				—	50 pg/L	1.34 pg/L
2378-TCDF	51207-31-9				—	5 pg/L	0.591 pg/L
12378-PeCDF	57117-41-6				—	25 pg/L	0.427pg/L
23478-PeCDF	57117-31-4				—	25 pg/L	0.474 pg/L
123478-HxCDF	70648-26-9				—	25 pg/L	0.319 pg/L
123678-HxCDF	57117-44-9				—	25 pg/L	0.305 pg/L
123789-HxCDF	72918-21-9				—	25 pg/L	0.435 pg/L
234678-HxCDF	60851-34-5				—	25 pg/L	0.313 pg/L
1234678-HpCDF	67562-39-4				—	25 pg/L	0.703 pg/L
1234789-HpCDF	55673-89-7				—	25 pg/L	0.956 pg/L
OCDF	39001-02-0				—	50 pg/L	0.883 pg/L

QAPP Worksheet #15-10
Reference Limits and Evaluation (Groundwater) – ALS-Holland

PARAMETER[1]	CHEMICAL ABSTRACT SERVICE NUMBER	RANGE OF POTENTIALLY APPLICABLE PART 201 CRITERIA[3] (µg/L)	PART 201 TARGET DETECTION LIMIT (µg/L)	ALS-HOLLAND AQUEOUS REPORT LIMIT[2] (µg/L)	ALS-HOLLAND METHOD DETECTION LIMIT[2] (µg/L)

Notes:
[1] The parameters included in this table are those included in the U.S. EPA Contract Laboratory Program (CLP) Target Compound List (TCL) and Target Analyte List (TAL), except those that are not on the Part 201 list Calcium, Potassium, 1,2,3-Trichlorobenzene, Bromochloromethane, Cyclohexane, Methyl Acetate, Methylcyclohexane (methyl phenol), 1,1-Biphenyl, 2,2-oxybis(1-Chloropropane), 2,4-Dinitrophenol, 2,6-Dinitrotoluene, 2-Nitroaniline, 3-Nitroaniline, 4-Bromophenyl-phenylether, 4-Chloroaniline, 4-Chlorophenyl-phenylether, 4-Nitroaniline, 4-Nitrophenol, Benzaldehyde, bis(2-Chloroethoxy)methane. Or those that are not typically analyzed by WATS, ALS-Kelso or ALS-Holland: 1,1,2-Trichloro-1,2,2-triflouroethane, 1,2,4,5-Tetrachlorobenzene, Acetophenone, Atrazine, beta-Chloronaphthalene, Caprolactum.
[2] The actual Report Limits and Method Detection Limits will vary with sample size
[3] Potentially applicable Michigan Part 201 Criteria are from the Michigan Department of Environmental Quality (MDEQ) Remediation and Redevelopment Division (RRD) updated 9/28/13 pursuant to 1994 PA 451 as amended.
[4] Low level and methyl mercury will be analyzed by ALS Environmental formerly Columbia Analytical Services (CAS) or ALS-Holland.
[5] The MDL actually achievable in a given analysis will vary depending on detector response characteristics, irreducible noise from instrument electronics, and matrix effects. The dioxin/furan MDL is actually the EDL which is determined for each individual sample. The value provided was obtained from most recent Limit of Detection verification, provided for example only.
[6] The Michigan Part 201 Criteria for Hexavalent Chromium will be used for Chromium (total) as there is no total chromium criteria established.
ALS – ALS Environmental Laboratories
NA = Not Available
EDL = Estimated Detection Limit
MDL = Method Detection Limit
NA = Not Available
RL = Report Limit
µg/L = micrograms per liter.
pg/L = pictograms per liter

QAPP Worksheet #15-11
Reference Limits and Evaluation (Free Product) – ALS-Holland

ANALYTE	CAS NUMBER	PROJECT ACTION LIMIT[1]	FREE PRODUCT (µg/L)	
			ALS-HOLLAND LABORATORY MDL	ALS-HOLLAND LABORATORY RL
PCBs (U.S. EPA 8082)				
Aroclor - 1016	12674-11-2	--	--	1
Aroclor - 1221	11104-28-2	--	--	1
Aroclor - 1232	11141-16-5	--	--	1
Aroclor - 1242	53469-21-9	--	--	1
Aroclor - 1248	12672-29-6	--	--	1
Aroclor - 1254	11097-69-1	--	--	1
Aroclor - 1260	11096-82-5	--	--	1
Total PCBs	1336-36-3	--	--	1

Notes:
(1) Standards are consistent with the Multi-Area Quality Assurance Project Plan (Rev. 00) for the Kalamazoo River Study Group (Arcadis BBL, 2007b), which are from the MDEQ's Substantive Requirements Document for the Plainwell Dam Superfund Site, dated February 13, 2007.
(2) The actual Reporting Limit will depend on the volume of sample filtered.
RL = report limit.
MDL = Method Detection Limit.
µg/L – micrograms per liter
PCBs = polychlorinated biphenyls.
ALS – ALS Environmental Laboratories

QAPP Worksheet #23
Analytical SOP References

REFERENCE NUMBER	TITLE, REVISION DATE, AND/OR NUMBER	DEFINITIVE OR SCREENING DATA	ANALYTICAL GROUP	INSTRUMENT	ORGANIZATION PERFORMING ANALYSIS	MODIFIED FOR PROJECT WORK? (Y/N)	ADDITIONAL EPA COMMENTS (BEYOND EXPIRATION DATE)?
W-1	Organochlorine and PCB (aroclor) pesticide analysis by GC/ECD, AM E-608, September 11, 2007	Definitive	Total PCB in water	Gas chromatography/ Electron capture detectors (GC/ECD)	Weyerhaeuser Analysis and Testing Services (WATS)	N	No – Approved by EPA with last version of Multi-Area QAPP
W-2	Suspended solids in water and wastewater. AM E-160.2, July 13, 2007	Definitive	TSS	Balance	WATS	N	No – Approved by EPA with last version of Multi-Area QAPP
W-3	Total and total soluble phosphorus in water, AM E-365.3, August 19, 2008	Definitive	Total phosphorus as P in water	Spectrophotometer	WATS	N	No – Approved by EPA with last version of Multi-Area QAPP
W-4	Polychlorinated biphenyl analysis by GC/ECD, AM E-8082, December 4, 2007	Definitive	Total PCB in soil and sediment	GC/ECD	WATS	N	No – Approved by EPA with last version of Multi-Area QAPP
W-5	Daily balance, water, and temperature checks, AQ-O-DLYCHK, February 21, 2007	Definitive	TSS	Balance	WATS	N	No – Approved by EPA with last version of Multi-Area QAPP
W-6	General Procedures for Performing Chromatographic Separations and Calibrations, AL G-8000, September 11, 2007	Definitive	General Procedures	Not Applicable	WATS	N	No – Approved by EPA with last version of Multi-Area QAPP
W-7	Sample Management Procedures, OP S-SMO, July 13, 2007	Definitive	Sample Management	Not Applicable	WATS	N	No – Approved by EPA with last version of Multi-Area QAPP
W-8	Procedure for Training Personnel to Perform Test Methods and Standard Operating Procedures. OQ TRAIN. August 19, 2008.	Not applicable	Training	Not Applicable	WATS	N	No – Approved by EPA with last version of Multi-Area QAPP
W-9	Analytical Procedure 3500, AC G-3500, August 15, 2008	Definitive	PCBs and SVOCs in water	Not Applicable	WATS	N	Yes – But revised by WATS 7/07, per comment 10.6 in 6/07 EPA Letter

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Analytical SOP References

REFERENCE NUMBER	TITLE, REVISION DATE, AND/OR NUMBER	DEFINITIVE OR SCREENING DATA	ANALYTICAL GROUP	INSTRUMENT	ORGANIZATION PERFORMING ANALYSIS	MODIFIED FOR PROJECT WORK? (Y/N)	ADDITIONAL EPA COMMENTS (BEYOND EXPIRATION DATE)?
W-10	Extraction by Continuous Liquid-Liquid Extractor, AC G-3520, August 19, 2008	Definitive	VOCs, SVOCs, and PCBs in water(1)	Not Applicable	WATS	N	Yes – See Footnote (1) per Comment 10.8 in 6/07 EPA Letter.
W-11	Sonication for Soil and Sediments, AC G-3550, July 13, 2007	Definitive	PCBs and SVOCs in soil and sediment(2)	Not Applicable	WATS	N	Yes – See Footnote (2) per comment 10.7 in 6/07 EPA Letter
W-12	Acid Digestion of Aqueous Samples & Extracts for Metals Analysis by ICP & ICPMS, AM E-3010, March 6, 2007	Definitive	Metals in water	Not Applicable	WATS	N	No – Comment 12 in 6/07 EPA letter was suggestion only
W-13	Acid Digestion of Sediments, Soils, Sludges, and Other Solid Samples for Analysis by ICP & ICPMS, AM E-3050, March 6, 2007	Definitive	Metals in soil	Not Applicable	WATS	N	No - Comment 13 in 6/07 EPA letter was suggestion only
W-14	Metals Analysis by ICPMS. AM E-200.8M. August 15, 2008	Definitive	Metals in water and soil	Inductively Coupled Plasma Mass Spectrometer (ICPMS)	WATS	N	Yes – Replaced per Comment 16 in 6/07 EPA Letter
W-15	Capillary GC/MS for Semivolatile Organics. AM E-8270. July 20, 2007	Definitive	SVOCs in water and soil	GC/MS, capillary column	WATS	N	Yes – But revised by WATS 6/07, per comment 10.10 in 6/07 EPA Letter. Revised by WATS 6/09
W-16	Total Solids in Solid and Semi-Solid Samples. AM S-2540G. August 19, 2008.	Definitive	Total solids in soil and sediment	Scale	WATS	N	Added per U.S. EPA 6/07 Comments
W-17	Procedure for Florisil Clean Up of Organic Extracts. AC G-3620. September 11, 2007.	Definitive	PCBs in water, soil, and sediment	Not applicable	WATS	N	Added per U.S. EPA 6/07 Comments

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Analytical SOP References

REFERENCE NUMBER	TITLE, REVISION DATE, AND/OR NUMBER	DEFINITIVE OR SCREENING DATA	ANALYTICAL GROUP	INSTRUMENT	ORGANIZATION PERFORMING ANALYSIS	MODIFIED FOR PROJECT WORK? (Y/N)	ADDITIONAL EPA COMMENTS (BEYOND EXPIRATION DATE)?
W-18	Gel Permeation Clean-Up. AP E-3640. August 19, 2008.	Definitive	PCBs and SVOCs in water, soil, and sediment	Not applicable	WATS	N	Added per U.S. EPA 6/07 Comments
W-19	Condensation and Evaporation Techniques. AC G-CONC. August 19, 2008.	Definitive	PCBs and SVOCs in water, soil, and sediment	Not applicable	WATS	N	Added per U.S. EPA 6/07 Comments
W-20	Organic Laboratory Analytical Standards. AC G-ORGSTD. July 18, 2007.	Definitive	VOCs, SVOCs, and PCBs in water, soil, and sediment	Not applicable	WATS	N	Added per U.S. EPA 6/07 Comments
W-21	Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry, AM E-8260. August 27, 2008.	Definitive	VOCs in water	GC/MS	WATS	N	--
W-22	Diesel and Motor Oil Range Compounds, Analysis of. AM U-WTPH-D. August 20, 2008.	Definitive	Diesel range compounds	GC/FID, Capillary column	WATS	N	--
W-23	Gasoline Range Compounds, Analysis of. AM U-WTPH-G. August 19, 2008.	Definitive	Gasoline range compounds	GC/FID, megabore column	WATS	N	--
W-24	Cyanide, Total, AM E-335.2 CLP-M. August 27, 2008	Definitive	Cyanide	Spectrophotometer	WATS	N	--
W-25	Synthetic Precipitation Leaching Procedure (SPLP) AM E-1312, March 31, 2003	Definitive	Metals in soil	Not applicable	WATS	N	--
W-26	Hardness by Calculation, AM S-2340B, June 12, 2007	Definitive	Hardness in water	Not applicable	WATS	N	--

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REFERENCE NUMBER	TITLE, REVISION DATE, AND/OR NUMBER	DEFINITIVE OR SCREENING DATA	ANALYTICAL GROUP	INSTRUMENT	ORGANIZATION PERFORMING ANALYSIS	MODIFIED FOR PROJECT WORK? (Y/N)	ADDITIONAL EPA COMMENTS (BEYOND EXPIRATION DATE)?
C-1	Sample Disposal, SMO-SDIS, Rev 7, March 26, 2008	Not Applicable	Sample Disposal	Not Applicable	ALS Environmental (ALS-Kelso) - formerly Columbia Analytical Services (CAS)	N	--
C-2	Sample Tracking and Internal Chain-of-Custody, SMO-SCOC, Rev 12, April 23, 2009	Not Applicable	Chain-of-Custody	Not Applicable	ALS-Kelso (formerly CAS)	N	--
C-3	Sample Receiving, SMO-GEN, Rev 25, April 9, 2009	Not Applicable	Sample Receiving	Not Applicable	ALS-Kelso (formerly CAS)	N	--
C-4	Mercury in Water by Atomic Fluorescence Spectrometry, MET-1631, Rev 9. March 21, 2008	Definitive	Low-flow mercury in water	Cold-Vapor Atomic Fluorescence Spectrometer (CVAFS)	ALS-Kelso (formerly CAS)	N	--
C-5	Volatile Organic Compounds by GC/MS (VOC-8260) Rev 14, November 20, 2009	Definitive	VOCs in soil or water	GC/MS, Capillary column	ALS-Kelso (formerly CAS)	N	--
C-6	Purge and Trap/extraction for volatile organics in soil and waste samples, closed system. VOC-5035, REV 7. February 1, 2008.	Definitive	VOCs in soil and waste	Not applicable	ALS-Kelso (formerly CAS)	N	--
C-7	Methyl Mercury in Water by Distillation, Aqueous Ethylation, Purge and Trap, and CVAFS Rev 0, MET-1630W, April 12, 2006	Definitive	Low Level Mercury in Water	Cold-Vapor Atomic Fluorescence Spectrometer (CVAFS)	ALS-Kelso (formerly CAS)	N	--
C-8	Nitrate/Nitrite, Nitrite By Flow Injection Analysis, GEN-353.2, Rev 6, January 5, 2006	Definitive	Nitrate/Nitrite in Soil	Flow injection Analyzer	ALS-Kelso (formerly CAS)	N	--

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Analytical SOP References

REFERENCE NUMBER	TITLE, REVISION DATE, AND/OR NUMBER	DEFINITIVE OR SCREENING DATA	ANALYTICAL GROUP	INSTRUMENT	ORGANIZATION PERFORMING ANALYSIS	MODIFIED FOR PROJECT WORK? (Y/N)	ADDITIONAL EPA COMMENTS (BEYOND EXPIRATION DATE)?
C-9	Ammonia By Flow Injection Analysis GEN-350.1, Rev 7, May 1, 2007	Definitive	Ammonia-N in Soil	Flow injection Analyzer	ALS-Kelso (formerly CAS)	N	--
C-10	Phosphorous Determination Using Colorimetric Procedure GEN-365.3, Rev 10, August 28, 2008	Definitive	Phosphorus in Soil	Spectrophotometer	ALS-Kelso (formerly CAS)	N	--
C-11	Laboratory Balance Monitoring and Calibration, (ADM-BAL.1) August 7, 2008	Definitive	Various (Weighing samples, standards and reagents)	Balance	ALS-Kelso (formerly CAS)	N	--
C-12	Corrective Action (ADM-CA), Rev 5, September 12, 2007	Not Applicable	Corrective Action	Not Applicable	ALS-Kelso (formerly CAS)	N	--
C-13	PCBs as Aroclors (SOC-8082AR) Rev 13, June 25, 2009	Definitive	PCBs in soil, water and oil	GC/ECD	ALS-Kelso (formerly CAS)	N	--
C-14	Waste Dilution Extraction (EXT- 3580) Rev 2, April 30, 2007	Definitive	PCBs in oil	Not Applicable	ALS-Kelso (formerly CAS)	N	--
C-15	Sulfuric Acid Cleanup (EXT-3665) Rev 2, April 30, 2007	Definitive	PCBs in oil	Not Applicable	ALS-Kelso (formerly CAS)	N	--
C-16	Specific Gravity (Gen-SPGRAV) Rev 0, June 6, 2006	Definitive	Specific Gravity	Hydrometer	ALS-Kelso (formerly CAS)	N	--
C-17	Metals and Semivolatiles SPLP Extraction (EPA Method 1312) (MET-SPLP) Rev 0, January 28, 2010	Definitive	Metals in soil	Not Applicable	ALS-Kelso (formerly CAS)	N	--

QAPP Worksheet #23
Analytical SOP References

REFERENCE NUMBER	TITLE, REVISION DATE, AND/OR NUMBER	DEFINITIVE OR SCREENING DATA	ANALYTICAL GROUP	INSTRUMENT	ORGANIZATION PERFORMING ANALYSIS	MODIFIED FOR PROJECT WORK? (Y/N)	ADDITIONAL EPA COMMENTS (BEYOND EXPIRATION DATE)?
C-18	Determination of Metals and Trace Elements by Inductively Coupled-Mass Spectrometry (ICP-MS Method 200.8)	Definitive	Metals in water and soil	ICP-MS	ALS-Kelso (formerly CAS)	N	--
C-19	Total Cyanides and Cyanides Amenable to Chlorination (GEN-CN) Rev 15, October 20, 2009	Definitive	Cyanide (total / amenable)	Spectrophotometer	ALS-Kelso (formerly CAS)	N	--
C-20	Semivolatile Organic Compounds by GC/MS – EPA Method 8270C (SOC-8270C) Rev 12, June 26, 2009	Definitive	SVOCs in water and soil	GC/MS	ALS-Kelso (formerly CAS)	N	--
C-21	Continuous Liquid-Liquid Extraction (EXT-3520) Rev 12, November 16, 2009	Definitive	SVOCs, and PCBs in water(1)	Not Applicable	ALS-Kelso (formerly CAS)	N	--
C-22	Gasoline Range Organics by Gas Chromatography (PET-GRO) Rev 8, July 14, 2008	Definitive	Gasoline range compounds	GC/FID	ALS-Kelso (formerly CAS)	N	--
C-23	Analysis of Water Solids and Soluable Waste Samples for Semi-Volatile Fuel Hydrocarbons (PET-SVF) Rev 11, October 10, 2007	Definitive	Diesel range compounds	GC/FID, Capillary column	ALS-Kelso (formerly CAS)	N	--
C-24	Automated Soxhlet Extraction (EXT-3541) Rev 6, September 28, 2009	Definitive	SVOCs, and PCBs in soil	Not Applicable	ALS-Kelso (formerly CAS)	N	--

QAPP Worksheet #23
Analytical SOP References

REFERENCE NUMBER	TITLE, REVISION DATE, AND/OR NUMBER	DEFINITIVE OR SCREENING DATA	ANALYTICAL GROUP	INSTRUMENT	ORGANIZATION PERFORMING ANALYSIS	MODIFIED FOR PROJECT WORK? (Y/N)	ADDITIONAL EPA COMMENTS (BEYOND EXPIRATION DATE)?
C-25	Ultrasonic Extraction (EXT-3550) Rev 9, April 13, 2006	Definitive	SVOCs, and PCBs in soil	Not Applicable	ALS-Kelso (formerly CAS)	N	--
C-26	Florisil Cleanup (EXT-FLOR) Rev 4, November 13, 2009	Definitive	PCBs in water, soil, and sediment	Not applicable	ALS-Kelso (formerly CAS)	N	--
C-27	Gel Permeation Chromatography (SOC-3640A) Rev 5, January 15, 2004	Definitive	PCBs and SVOCs in water, soil, and sediment	Not applicable	ALS-Kelso (formerly CAS)	N	--
C-28	Total Solids (GEN 160.3) Rev 11, April 10, 2007	Definitive	Total solids in soil and sediment	Scale	ALS-Kelso (formerly CAS)	N	--
C-29	Metals Digestion (MET-3050) Rev 10, July 12, 2007	Definitive	Metals in soil	Not Applicable	ALS-Kelso (formerly CAS)	N	--
C-30	Metals Digestion (MET-DIG) Rev 10, April, 1, 2009	Definitive	Metals in water	Not Applicable	ALS-Kelso (formerly CAS)	N	--
C-31	Determination of Metals and Trace Elements by Inductively Coupled Plasma Atomic Emission Spectrometry (MET-ICP) Rev 21, June 26, 2009	Definitive	Metals in water and soil	ICP	ALS-Kelso (formerly CAS)	N	--
C-32	Mercury in Solid or Semisolid Waste (MET-7471AB) Rev 14, July 28, 2009	Definitive	Mercury in soil	Cold Vapor Atomic Absorption	ALS-Kelso (formerly CAS)	N	--

QAPP Worksheet #23
Analytical SOP References

REFERENCE NUMBER	TITLE, REVISION DATE, AND/OR NUMBER	DEFINITIVE OR SCREENING DATA	ANALYTICAL GROUP	INSTRUMENT	ORGANIZATION PERFORMING ANALYSIS	MODIFIED FOR PROJECT WORK? (Y/N)	ADDITIONAL EPA COMMENTS (BEYOND EXPIRATION DATE)?
C-33	Mercury in Liquid Waste (MET-7470A) Rev 14, September 16, 2009	Definitive	Mercury in water	Cold Vapor Atomic Absorption	ALS-Kelso (formerly CAS)	N	--
C-34	Mercury in Liquid Waste (MET-245.1) Rev 12, March 3, 2012	Definitive	Mercury in water	Cold Vapor Atomic Absorption	ALS-Kelso (formerly CAS)	N	--
A-1	Waste Disposal Procedure	Not Applicable	Sample Disposal	Not Applicable	ALS Environmental – Holland (ALS-Holland)	N	--
A-2	LIMS Log-In Procedure	Not Applicable	Chain-of-Custody	Not Applicable	ALS-Holland	N	--
A-3	Sample Receipt	Not Applicable	Sample Receiving	Not Applicable	ALS-Holland	N	--
A-4	Nonconformance and Corrective Action	Not Applicable	Corrective Action	Not Applicable	ALS-Holland	N	--
A-5	Complaint Resolution	Not Applicable	Complaint Resolution	Not Applicable	ALS-Holland	N	--
A-6	Thermometer and Temperature Monitoring	Definitive	TSS	Temperature	ALS-Holland	N	--
A-7	Purge and Trap – Solids (SW846 5035A)	Definitive	VOCs in soil and waste	Not applicable	ALS-Holland	N	--
A-8	Volatile Organic Compounds (SW5030C/5035A/8260C)	Definitive	VOCs in water, soil and waste	GC/MS	ALS-Holland	N	--
A-9	Volatile Organic Compounds (SW846 5030C/5035A/8260B)	Definitive	VOCs in water, soil and waste	GC/MS	ALS-Holland	N	--
A-10	Liquid-Liquid Extraction (Separatory Funnel) (EXT-3510C)	Definitive	SVOCs, and PCBs in water(1)	Not Applicable	ALS-Holland	N	--
A-11	Semivolatile Organic Compounds (SW846 8270)	Definitive	SVOCs in water and soil	GC/MS	ALS-Holland	N	--

QAPP Worksheet #23
Analytical SOP References

REFERENCE NUMBER	TITLE, REVISION DATE, AND/OR NUMBER	DEFINITIVE OR SCREENING DATA	ANALYTICAL GROUP	INSTRUMENT	ORGANIZATION PERFORMING ANALYSIS	MODIFIED FOR PROJECT WORK? (Y/N)	ADDITIONAL EPA COMMENTS (BEYOND EXPIRATION DATE)?
A-12	Gasoline Range Organics (SW846 8015D)	Definitive	Gasoline range compounds	GC/FID	ALS-Holland	N	--
A-13	Diesel & Oil Range Organics (SW846 8015)	Definitive	Diesel range compounds	GC/FID, Capillary column	ALS-Holland	N	--
A-14	Polychlorinated Biphenyls (SW846 8082)	Definitive	PCBs in soil, water and oil	GC/ECD	ALS-Holland	N	--
A-15	Soxhlet Extraction (EXT-3540C)	Definitive	SVOCs, and PCBs in soil	Not Applicable	ALS-Holland	N	--
A-16	Automated Soxhlet Extraction (EXT-3541)	Definitive	SVOCs, and PCBs in soil	Not Applicable	ALS-Holland	N	--
A-17	Synthetic Precipitation Leaching Procedure – Zero Headspace Extraction (EXT 1312)	Definitive	VOC in soil	Not Applicable	ALS-Holland	N	--
A-18	Synthetic Precipitation Leaching Procedure-Non-Volatile Extraction (EXT 1312)	Definitive	SVOC and Metals in soil	Not Applicable	ALS-Holland	N	--
A-19	ICP-MS Solids Digestion (SW846 3050B)	Definitive	Metals in soil	Not Applicable	ALS-Holland	N	--
A-20	ICP-MS Aqueous Digestion SW846 3005A)	Definitive	Metals in water	Not Applicable	ALS-Holland	N	--
A-21	Metals by ICP-MS (SW846 6020A)	Definitive	Metals in water and soil	ICP-MS	ALS-Holland	N	--
A-22	Mercury-Solid (SW846 7471A)	Definitive	Mercury in soil	Cold Vapor Atomic Absorption	ALS-Holland	N	--
A-23	Mercury – Aqueous (SW846 7470A/245.1)	Definitive	Mercury in water	Cold Vapor Atomic Absorption	ALS-Holland	N	--
A-24	Low-Level Mercury (EPA 1631E)	Definitive	Low-flow mercury in water	Cold-Vapor Atomic Fluorescence Spectrometer (CVAFS)	ALS-Holland	N	--

QAPP Worksheet #23
Analytical SOP References

REFERENCE NUMBER	TITLE, REVISION DATE, AND/OR NUMBER	DEFINITIVE OR SCREENING DATA	ANALYTICAL GROUP	INSTRUMENT	ORGANIZATION PERFORMING ANALYSIS	MODIFIED FOR PROJECT WORK? (Y/N)	ADDITIONAL EPA COMMENTS (BEYOND EXPIRATION DATE)?
A-25	Phosphorus by Flow Injection Analysis (SM 4500P-F / EPA 365.1)	Definitive	Total phosphorus as P in water/soil	Flow injection Analyzer	ALS-Holland	N	--
A-26	Hardness by Calculation (SM 2340B)	Definitive	Hardness in water	Not applicable	ALS-Holland	N	--
A-27	Nitrate & Nitrite by Flow Injection Analysis (SM 4500NO3-F / EPA 353.2)	Definitive	Nitrate/Nitrite in Soil	Flow injection Analyzer	ALS-Holland	N	--
A-28	Ammonia By Flow Injection Analysis (SM 4500NH3-B//EPA 350.1)	Definitive	Ammonia-N in Soil	Flow injection Analyzer	ALS-Holland	N	--
A-29	Use and Maintenance of Balances	Definitive	Various (Weighing samples, standards and reagents)	Balance	ALS-Holland	N	--
A-30	Cyanide by Titration and Flow Injection Analysis (SW 9012A/9010/ EPA 335.4/SM4500D,E,G, I)	Definitive	Cyanide (total/amenable) in soil and water	Spectrophotometer / Flow Injection Analyzer	ALS-Holland	N	--
A-31	Total Suspended, Volatile & Dissolved Solids (EPA 160.4/SM2540C,D, E)	Definitive	TSS	Balance / Scale	ALS-Holland	N	--
A-32	Total, Fixed & Volatile Solids (SM A2540B)	Definitive	Total solids in soil and sediment	Balance / Scale	ALS-Holland	N	--
A-33	Extraction of Liquid Samples for Analysis of PCB and PCDD/F Compounds by High Resolution Mass Spectrometry (EPA 8290A)	Definitive	PCDD/PCDFs in water	Not Applicable	ALS-Holland	N	--

QAPP Worksheet #23
Analytical SOP References

REFERENCE NUMBER	TITLE, REVISION DATE, AND/OR NUMBER	DEFINITIVE OR SCREENING DATA	ANALYTICAL GROUP	INSTRUMENT	ORGANIZATION PERFORMING ANALYSIS	MODIFIED FOR PROJECT WORK? (Y/N)	ADDITIONAL EPA COMMENTS (BEYOND EXPIRATION DATE)?
A-34	Soxhlet Extraction of Solid/Tissue/Air samples for Analysis of PCB and PCDD/F Compounds by High Resolution Mass Spectrometry	Definitive	PCDD/PCDFs in soil	Not Applicable	ALS-Holland	N	--
A-35	Analysis of Polychlorinated Dibenzo-P-Dioxins and Polychlorinated Dibenzofurans by High-Resolution Gas Chromatrography/High-Resolution Mass Spectrometry (EPA 8290A)	Definitive	PCDD/PCDFs in water/soil	GC/MS	ALS-Holland	N	--
A-36	Hexavalent Chromium (SM A3500-CR D / SW846 7196A	Definitive	Hexavalent Chromium / Trivalent Chromium in water	Spectrophotometer	ALS-Holland	N	--
A-37	Nitrite by Colorimetry (SM 4500NO2-B / EPA 354.1)	Definitive	Nitrite in water	Spectrophotometer	ALS-Holland	N	--

Notes:
(1) See appropriate analytical method for a discussion of how the extract will be stored if not immediately analyzed.
(2) Volumes of surrogates and matrix spiking are logged in the laboratory standard log book

QAPP Worksheet #24
Analytical Instrument Calibration

INSTRUMENT	CALIBRATION PROCEDURE	FREQUENCY OF CALIBRATION	ACCEPTANCE CRITERIA	CORRECTIVE ACTION (CA)	PERSON RESPONSIBLE FOR CA	SOP REFERENCE(1)
Cold-Vapor Atomic Fluorescence Spectrometer (CVAFS)	See C-4, C-7, C-32, C-33, A-22, A-23, A-24	At the beginning of each analysis sequence.	See C-4, C-7, C-32, C-33, A-22, A-23, A-24	Correct the problem and repeat the calibration.	Analyst	C-4, C-7, C-32, C-33, A-22, A-23, A-24
ICPMS	See W-14, W-26, C-18, A-21	At the beginning of each analysis sequence. CCV analyzed after calibration, after every 10 samples (max) and at end. Initial calibration blank/verification follow first CCV.	See W-14, W-26, C-18, A-21	Inspect the instrument, correct problems, repeat calibration.	Analyst	W-14, W-26, C-18, A-21
ICP	C-31	At the beginning of each analysis sequence. CCV analyzed after calibration, after every 10 samples (max) and at end. Initial calibration blank/verification follow first CCV.	C-31	Inspect the instrument, correct problems, repeat calibration.	Analyst	C-31

QAPP Worksheet #24
Analytical Instrument Calibration

INSTRUMENT	CALIBRATION PROCEDURE	FREQUENCY OF CALIBRATION	ACCEPTANCE CRITERIA	CORRECTIVE ACTION (CA)	PERSON RESPONSIBLE FOR CA	SOP REFERENCE(1)
GC/MS	Tuning. See C-5, C-20 W-15 & W-21 A-8, A-9, A-11, A-35	Before 12 hr. sample analysis.	See C-5, C-20, W-15 W-21, A-8, A-9, A-11, A-35	Inspect the instrument, correct problems, re-tune and/or recalibrate	Analyst	See C-5, C-20, W-15 W-21, A-8, A-9, A-11, A-35
	Calibration, See C-5, C-20, W-15 & W-21 A-8, A-9, A-11, A-35	Initial calibration at instrument set-up and when calibration verification or tuning fail criteria. Calibration verification before 12 hr. sample analysis	See C-5, C-20, W-15 W-21, A-8, A-9, A-11, A-35	Inspect the instrument, correct problems and recalibrate.	Analyst	See C-5, C-20, W-15 W-21, A-8, A-9, A-11, A-35
GC/FID	See W-22, W-23, C-22, & C-23, A-12, A-13	Initial calibration at instrument set-up and when calibration verification fails criteria. Check mid-point standards after every 10 samples and at the beginning and end of the analysis.	See W-22, W-23, C-22, & C-23, A-12, A-13	Inspect system, correct problem, and rerun calibration on affected samples.	Analyst	See W-22, W-23, C-22, & C-23, A-12, A-13
GC/ECD	See W-1, W-4, C-13 A-14	After initial calibration, a check standard of the match-point Aroclor 1016/1260 mixture is analyzed after every 10 samples and at the end of the sequence.	Initial calibration RSD for 1016/1260 ≤ 20% or linear regression >0.99 Continuing calibration standard must not exceed a percent difference of ± 15	Inspect system, correct problem, and rerun calibration on affected samples.	Analyst	See W-1, W-4, C-13, A-14

QAPP Worksheet #24
Analytical Instrument Calibration

INSTRUMENT	CALIBRATION PROCEDURE	FREQUENCY OF CALIBRATION	ACCEPTANCE CRITERIA	CORRECTIVE ACTION (CA)	PERSON RESPONSIBLE FOR CA	SOP REFERENCE[1]
Balance	See SOP W-5, C-16, A-29	Daily	NA	Inspect system, correct problem, and rerun calibration on affected samples.	Analyst	W-2, W-5, C-16, A-29
Flow Injection Analyzer	See SOP C-8, C-9, A-25, A-27, A-28	Initial calibration at instrument set-up and when calibration verification fails criteria. Verification checked with blank and three standards at the beginning of the analysis. Analyze continuing calibration standard after every 10 samples and at end of sequence.	See SOP C-8 and C-9 A-25, A-27, A-28	Inspect system, correct problem, and rerun calibration on affected samples.	Analyst	C-8, C-9, A-25, A-27, A-28
Spectrophotometer	Construct two 6-point calibration curves of absorbance versus concentration for low and high levels (one curve for Phosphorus).	Before sample analysis, when check standard is outside Confidence Limits; also, after major instrument maintenance	See SOPs W-3, W-24, C-10, C-19, A-30, A-36, A-37	Fix problem and recalibrate.	Analyst	W-3, W-24, C-10, C-19, A-30, A-36, A-37

Footnote:
[1]See Analytical SOP References (Worksheet #23).

QAPP Worksheet #28-22
QC Samples – Nitrite-N (Soil)

Matrix: Soil
Sampling SOP: F-5, F-6
Field Sampling Organization: CRA
Analytical Group: Nitrite-N (Wet Chemistry)
Analytical Method/SOP Reference: C-8, A-37
Analytical Organization: WATS, ALS-Holland
Concentration Level: All
Sampler's Name: NA
Number of Sample Locations: As identified in appropriate WS 18

QC SAMPLE	FREQUENCY/ NUMBER	METHOD/SOP QC ACCEPTANCE LIMITS	CORRECTIVE ACTION	PERSON(S) RESPONSIBLE FOR CORRECTIVE ACTION	DATA QUALITY INDICATOR (DQI)	MEASUREMENT PERFORMANCE CRITERIA
Field duplicate	1 per 10 samples	RPD <100	Qualify data as needed.	CRA QA Officer	Precision	RPD
Method blanks	1 per analytical batch	< Laboratory reporting limit	Re-extraction/ Reanalysis	Laboratory staff	Bias/Contamination	< Laboratory reporting limit
Equipment blanks	1 per 10 samples	< Laboratory reporting limit	Qualify data as needed.	CRA QA Officer	Bias/Contamination	< Laboratory reporting limit
Laboratory control sample (LCS)	1 per analytical batch	Laboratory control limits	Re-extraction/ Reanalysis	Laboratory staff	Accuracy	% Recovery
MS/MSD	1 per 20 samples	Laboratory control limits	Qualify data as needed.	Laboratory staff CRA QA Officer	Accuracy/Precision	% Recovery/RPD

QAPP Worksheet #30-3
Analytical Services-ALS-Holland

MATRIX	ANALYTICAL GROUP	CONCENTRATION LEVEL	SAMPLE LOCATIONS/ ID NUMBERS	ANALYTICAL SOP	DATA PACKAGE TURNAROUND TIME	LABORATORY/ ORGANIZATION (name, address, contact person, and telephone number)	BACKUP LABORATORY/ ORGANIZATION (name, address, contact person, and telephone number)
Groundwater Surface water, SPLP Leachate	PCBs, Metals/SPLP metals, Total Cyanide, SVOCs, VOCs, Chromium (VI, III)	All	TBD	A-14 A-21 A-23 A-30 A-11 A-8 A-9 A-36	Standard turnaround time (14 calendar days)	ALS Environmental-Holland (ALS-Holland) 3352 128th Avenue Holland, Michigan 49424 Jeff Glaser 616.399.6070	ALS-Kelso 1317 South 13th Avenue Kelso, WA 98626 Jeff Christian 360.557.7222
Groundwater Surface water,	PCDD/PCDF	All	TBD	A-35	Standard turnaround time (21 calendar days)	ALS-Holland to Subcontract to ALS Environmental – Houston (ALS-Houston) 10450 Stancliff Rd, Houston, Texas 77099 Jeff Glaser 616.399.6070	TestAmerica, Laboratories, Inc. (TAL) 4101 Shuffel Street NW North Canton, OH 44720 Denise Heckler 800.456.9396
Surface water	Mercury (low level) Methyl Mercury	All	TBD	A-24	Standard turnaround time (14 calendar days)	ALS Environmental-Holland (ALS-Holland) 3352 128th Avenue Holland, Michigan 49424 Jeff Glaser 616.399.6070	ALS-Kelso 1317 South 13th Avenue Kelso, WA 98626 Jeff Christian 360.557.7222

QAPP Worksheet #30-3
Analytical Services-ALS-Holland

MATRIX	ANALYTICAL GROUP	CONCENTRATION LEVEL	SAMPLE LOCATIONS/ ID NUMBERS	ANALYTICAL SOP	DATA PACKAGE TURNAROUND TIME	LABORATORY/ ORGANIZATION (name, address, contact person, and telephone number)	BACKUP LABORATORY/ ORGANIZATION (name, address, contact person, and telephone number)
Free Product	PCBs	All	TBD	A-14	Standard turnaround time (14 calendar days)	ALS Environmental-Holland (ALS-Holland) 3352 128th Avenue Holland, Michigan 49424 Jeff Glaser 616.399.6070	ALS-Kelso 1317 South 13th Avenue Kelso, WA 98626 Jeff Christian 360.557.7222
Soil/ Sediment	PCBs, Metals, SVOCs, DRO/GRO, Cyanide Phosphorous, Ammonia-N Nitrate-N Nitrite-N	All	TBD	A-14, A-21, A-11, A-13, A-12, A-30, A-25, A-28, A-27 A-37	Standard turnaround time (14 calendar days)	ALS Environmental-Holland (ALS-Holland) 3352 128th Avenue Holland, Michigan 49424 Jeff Glaser 616.399.6070	ALS-Kelso 1317 South 13th Avenue Kelso, WA 98626 Jeff Christian 360.557.7222
	VOCs	All	TBD	A-8, A-9	Standard turnaround time (14 calendar days)	ALS Environmental-Holland (ALS-Holland) 3352 128th Avenue Holland, Michigan 49424 Jeff Glaser 616.399.6070	ALS-Kelso 1317 South 13th Avenue Kelso, WA 98626 Jeff Christian 360.557.7222

QAPP Worksheet #30-3
Analytical Services-ALS-Holland

MATRIX	ANALYTICAL GROUP	CONCENTRATION LEVEL	SAMPLE LOCATIONS/ ID NUMBERS	ANALYTICAL SOP	DATA PACKAGE TURNAROUND TIME	LABORATORY/ ORGANIZATION (name, address, contact person, and telephone number)	BACKUP LABORATORY/ ORGANIZATION (name, address, contact person, and telephone number)
Soil / Sediment	PCDD/PCDF	All	TBD	A-35	Standard turnaround time (21 calendar days)	ALS-Holland to Subcontract to ALS Environmental – Houston (ALS-Houston) 10450 Stancliff Rd, Houston, Texas 77099 Jeff Glaser 616.399.6070	TestAmerica, Laboratories, Inc. (TAL) 4101 Shuffel Street NW North Canton, OH 44720 Denise Heckler (800) 456-9396
Independent Data Validation	All	All	--	All	--	Conestoga Rovers & Associates 14496 Sheldon Rd Suite 200 Plymouth, MI 48170 Paul Wiseman 734.453.5123	Conestoga Rovers & Associates 2055 Niagara Falls Blvd, Suite 3 Niagara Falls, NY 14304 Susan Scrocchi 716-297-6150

Notes:
NA = not applicable.
TBD = to be determined.

ATTACHMENT 1-5

NEW /REVISED LABORATORY STANDARD OPERATING PROCEDURES [1,2,3]:

A-27	Nitrate & Nitrite by Flow Injection Analysis
A-36	Hexavalent Chromium
A-37	Nitrite by Colorimetry

[1]SOPs have been periodically updated are included in earlier approved versions of the QAPP.
[2]SOPs submitted by CRA as part of Revision 03, Addendum 06 in April of 2013 are not listed above. A list of the new/revised SOPs was provided with the submittal.
[3]SOPs listed above are utilized by ALS-Holland

ALS Environmental

DOCUMENT TITLE:	*NITRATE & NITRITE BY FLOW INJECTION ANALYSIS*
REFERENCED METHOD:	*SM 4500NO3-F / EPA 353.2*
SOP ID:	*HN-WC-032*
REV. NUMBER:	*R02*
EFFECTIVE DATE:	*07/01/2012*

NITRATE & NITRITE BY FLOW INJECTION ANALYSIS

SM 4500NO3-F / EPA 353.2

SOPID:	HN-WC-032	Rev. Number:	R02	Effective Date:	07/01/2012

Approved By: _____ Date: 6-29-12
Department Supervisor – Jen Jones-Grzan

Approved By: _____ Date: 6/30/12
Operations Manager – Joe Ribar

Approved By: _____ for Date: 6/29/12
Quality Assurance – Dan Delinger

Approved By: _____ Date: 6/29/12
Laboratory Director – Jeff Glaser

Archival Date:	_____	Doc Control ID#:	_____	Editor:	_____

ANNUAL REVIEW

SIGNATURES BELOW INDICATE NO PROCEDURAL CHANGES HAVE BEEN MADE TO THE SOP SINCE THE APPROVAL DATE ABOVE. THIS SOP IS VALID FOR TWELVE ADDITIONAL MONTHS FROM DATE OF THE LAST SIGNATURE UNLESS INACTIVATED OR REPLACED BY SUBSEQUENT REVISIONS.

Signature	Title	Date
Signature	Title	Date
Signature	Title	Date

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NITRATE & NITRITE BY FLOW INJECTION ANALYSIS

1) Scope and Applicability

1.1 The purpose of this method is to determine nitrate/nitrite concentration in aqueous matrices and in domestic/industrial wastewaters.

1.2 The applicable range is documented in the applicable LIMS test code.

1.3 This SOP references the specifications noted in EPA 353.2 and SM 4500NO_3-F.

2) Summary of Procedure

2.1 Nitrate is quantitatively reduced to nitrite by passage of the sample through a copperized cadmium column. The nitrite (reduced nitrate plus original nitrite) is then determined by diazotizing with sulfanilamide followed by coupling with N-(1-naphthyl) ethylenediamine dihydrochloride (NED). The resulting water-soluble dye has a magenta color, which is read at 520 nm. Nitrite alone can be determined by running without the cadmium column.

3) Definitions

3.1 DI: De-ionized reagent water meeting purity characteristics of ASTM Type II laboratory water

3.2 Laboratory Control Sample (LCS): A clean, analyte-free matrix spiked with compound(s) representative of the target analytes and carried through the complete preparation/analytical procedure.

3.3 Method Blank (MB): An analyte-free matrix to which all reagents are added in the same volumes and/or proportions as in the sample processing. The method blank is carried through the complete sample preparation/analytical procedure.

3.4 Matrix Spike (MS): An aliquot of sample spiked with a known concentration of target analyte(s). The spiking procedure is completed prior to sample preparation and analysis.

3.5 Matrix Spike Duplicate (MSD): A sample duplicate spiked with identical concentrations of target analyte(s) as the MS. The spiking procedure is completed prior to sample preparation and analysis.

4) Health and Safety Warnings

4.1 Lab Safety

4.1.1 Due to various hazards in the laboratory, safety glasses, disposable gloves, and laboratory coats or aprons must be worn when working with unknown samples. In addition, heavy-duty gloves and a face shield are recommended when dealing with toxic, caustic, and/or flammable chemicals.

4.1.2 The toxicity or carcinogenicity of each reagent used has not been precisely defined. However, each chemical used must be treated as a potential health hazard and exposure reduced to the lowest possible level. The laboratory maintains a current awareness file of OSHA regulations regarding the safe handling of the chemicals specified in this method. A reference file of data

handling sheets (MSDS) is available to all personnel involved in these analyses.

4.2 Waste Disposal

4.2.1 Procedures for sample disposal are documented in SOP HN-SAF-001, *Waste Disposal Procedures.*

4.2.2 Samples must be disposed according to Federal, State, and local regulations.

4.3 Pollution Prevention

4.3.1 The quantities of chemicals purchased, when possible, must be based on the expected usage during its shelf life.

4.3.2 Standards and reagents must be prepared in volumes consistent with laboratory use to minimize the volume of expired standards or reagents to be disposed.

5) Cautions

5.1 Be knowledgeable of the MSDS information for chemical that is used in the procedure.

5.2 This method determines both nitrite and nitrate concentration. If only nitrate is required, the nitrite concentration must be determined separately with subsequent correction applied.

6) Interferences

6.1 Residual chlorine can interfere by oxidizing the reductor column. Before analysis, samples should be checked for residual chlorine and if present, dechlorinated with sodium thiosulfate or sodium sulfite.

6.2 Low results would be obtained for samples that contain high concentrations of iron, copper, or other metals. In this method, EDTA is added to the buffer to reduce this interference.

6.3 Samples that contain large concentrations of oil and grease will coat the surface of the cadmium. Pre-extracting the sample with an organic solvent can eliminate this interference.

6.4 Sample turbidity may interfere. Turbidity can be removed by filtration through a 0.45um pore diameter membrane filter prior to analysis.

6.5 Build-up of suspended matter in the reduction column will restrict sample flow. Since nitrate and nitrite are found in a soluble state, samples may be filtered prior to analysis.

7) Personnel Qualifications and Responsibilities

7.1 General Responsibilities – This method is restricted to use by or under the supervision of analysts experienced in the method.

7.2 Analyst – It is the responsibility of the analyst(s) to:

7.2.1 Produce contractually compliant data that meets all quality requirements using this procedure and the Data Reduction, Review, and Validation SOP.

7.2.2 Complete the required demonstration of proficiency before performing this procedure without supervision.

7.2.3 Create and populate a data entry batch in LIMS for review by the supervisor or designee.

7.3 Section Supervisor - It is the responsibility of the section supervisor to:

7.3.1 Ensure that all analysts have the technical ability and have received adequate training required to perform this procedure.
7.3.2 Ensure analysts have completed the required demonstration of proficiency before performing this procedure without supervision.
7.3.3 Ensure the production of contractually compliant data that meets all quality requirements using this procedure and the Data Reduction, Review and Validation SOP (HN-QS-009).

7.4 Project Manager - It is the responsibility of the project manager to ensure that all contractual requirements for a client requiring this procedure are understood prior to initiating this procedure for a given set of samples.

8) Sample Collection, Handling, and Preservation

8.1 Sample containers: Plastic or glass, approximately 250 ml. These are purchased by the laboratory and meet EPA specifications for sample containers.

8.2 Preserve the samples with H_2SO_4 at a pH <2 and store at 4 $\pm$ 2°C from the time of collection until analysis.

8.3 Samples must be analyzed within 28 days of collection.

9) Equipment and Supplies

9.1 Balance - analytical, capable of accurately weighing to the nearest 0.0001g.

9.2 Glassware - Class A volumetric flasks and pipettes or plastic containers as required

9.3 Flow injection analysis equipment designed to deliver and react sample and reagents in the required order and ratios.

9.3.1 Sampler
9.3.2 Multi-channel proportioning pump
9.3.3 Reaction unit or manifold
9.3.4 Colorimetric detector
9.3.5 Data system
9.3.6 10 mm, 80 uL, glass flow cell
9.3.7 520 nm interference filter

9.4 50 ml plastic disposable digestion cups with caps

9.5 Finnpipette (or equivalent) autopipette(s)

10) Standards and Reagents

10.1 Reagent water, Type II

10.2 Hydrochloric acid, reagent grade or higher

10.3 Sulfanilamide, reagent grade or higher

10.4 N-(1-naphthyl) ethylenediamine dihydrochloride (NED), reagent grade or higher

10.5 Sodium Hydroxide, reagent grade or higher

10.6 Ammonium chloride, reagent grade or higher

10.7 Disodium ethylenediamine tetraacetate (EDTA), reagent grade or higher

10.8 Ammonium hydroxide, reagent grade or higher

10.9 15N NaOH

10.9.1 To 250 ml DI water, add 150 g NaOH (section 10.5) and stir until dissolved
10.9.2 CAUTION – this reagent will get very HOT!
10.9.3 Transfer to an appropriately labeled container with applicable BPL number and expiration date of one year from preparation.

10.10 Ammonium Chloride Buffer, pH 8.5

10.10.1 In a 1-L Class A volumetric flask, dissolve 85 g ammonium chloride (NH_4Cl) (section 10.6) and 1 g disodium ethylenediamine tetraacetic acid dihydrate ($Na_2EDTA \cdot 2\ H_2O$) (section 10.7) in approximately 800 ml of DI water.
10.10.2 Dilute to the mark and invert to mix.
10.10.3 Adjust the pH to 8.5 with 15N NaOH (section 10.9).
10.10.4 Transfer to an appropriately labeled container with applicable BPL number and expiration date.
10.10.5 Alternatively, this reagent may be purchased from an outside vendor (Hach).

10.11 Sulfanilamide color reagent

10.11.1 In a 1-L Class A volumetric flask, add approximately 600 ml DI water.
10.11.2 Add 100 ml of 85% phosphoric acid (H_3PO_4), 40 g sulfanilamide, and 1 g NED.
10.11.3 Shake to wet the solution and stir to dissolve for 30 minutes.
10.11.4 Dilute to the mark and invert to mix.
10.11.5 Transfer to an appropriately labeled amber container with applicable BPL number and expiration date.
10.11.6 This solution is stable for 1 month.
10.11.7 Alternatively, this reagent may be purchased from a commercial vendor. It is sold as the sulfanilamide reagent and the NED reagent. The analyst must add the contents of the NED vial to the sulfanilamide bottle and stir for 30 minutes prior to use.

10.12 1000 mg/L NO_3 Standard

10.12.1 Purchased from an outside vendor (High Purity or equivalent).

10.13 1000 mg/L NO_3 Check Standard

10.13.1 Purchased from an outside supplier (High Purity or equivalent).
10.13.2 Standard must be from a second source
10.13.3 If a second source supplier is not available, the standard must be prepared from a different lot number than that used in section 10.12.

10.14 10 mg/L NO_3 Standard

10.14.1 In a 100 ml Class A volumetric flask, pipet 1 ml of the 1000 mg/L NO3 standard (section 10.12) and dilute to the mark with DI water.

10.14.2 Prepare fresh daily.
10.14.3 Theoretical concentration of this solution is 10 mg/L NO_3.

10.15 5 mg/L NO_3 Check Standard

10.15.1 In a 100 ml Class A volumetric flask, pipet 0.5 ml of the 1000 mg/L NO_3 check standard (section 10.13) and dilute to the mark with DI water.
10.15.2 Prepare fresh daily.
10.15.3 Theoretical concentration of this solution is 5 mg/L NO_3.

10.16 Dechlorinating Reagents: Two dechlorinating reagents may be used to remove residual chlorine. These include:

10.16.1 Sodium thiosulfate: Dissolve 3.5g $Na_2S_2O_3 \cdot 5\ H_2O$ in DI water and dilute to 1-L. 1 ml of this solution will remove 1 mg/L of residual chlorine in 500 ml of sample.
10.16.2 Sodium sulfite: Dissolve 0.9 g Na_2SO_3 in DI water and dilute to 1-L. 1 ml of this solution will remove 1 mg/L residual chlorine per 500 ml of sample.

11) Method Calibration

11.1 Calibration Standards

11.1.1 Using the 10 mg/L NO_3 standard (section 10.14), prepare a series of standards by pipetting the following volumes into a 50 ml plastic tube or volumetric flask and bring to a final volume of 50 ml.

Standard Amount	Final Volume	Concentration
50.0 ml	50 ml	10 mg/L
40.0ml	50 ml	8 mg/L
25.0 ml	50 ml	5 mg/L
5.00 ml	50 ml	1 mg/L
2.50 ml	50 ml	0.5 mg/L
1.00 ml	50 ml	0.2 mg/L
0.50 ml	50 ml	0.1 mg/L
0.25 ml	50 ml	0.05 mg/L
0.01 ml	50 ml	0.02 mg/L
0.00 ml	50 ml	0.00 mg/L

11.2 Calibrate the instrument as described in section 12. Calculate the correlation coefficient. This value must be $\geq$ 0.995% prior to proceeding.

11.3 Verify the calibration by processing a second source standard at or below the mid-point of the curve. The calculated concentration must meet accuracy performance criteria of 90-110% of the expected concentration.

11.3.1 If the calibration curve fails to yield an acceptable correlation coefficient or if the second source standard fails to achieve acceptance criteria, determine the cause of the problem and repeat the calibration sequence.

12) Sample Preparation/Analysis

12.1 Prepare reagents and standards as described in section 10.

12.2 For soil samples, a 1:10 soil/water extract is used. To prepare, weigh out approximately 5g of sample into a 50 ml disposable digestion tube. Fill to the 50 ml mark with DI water. Shake the sample vigorously to homogenize it. Filter sample through a 0.45µ filter and bring the final filtrate up to 50 ml with DI water. Process as outlined below.

12.3 Set up manifold as shown in section 22.

12.4 Input data system parameters as shown in section 22.

12.5 Pump DI water through all reagent lines and check for leaks and smooth flow. Switch to reagents and allow system to equilibrate until a stable baseline is achieved.

12.6 Place samples and/or standards in the sampler tray. Input the information required by the data system, such as concentration, replicates and Quickchem™ scheme (section 22).

12.7 The data system will associate the concentrations with the instrument responses for each standard. The software will generate a linear regression curve.

12.8 System notes

12.8.1 For information on system maintenance and troubleshooting, refer to the Troubleshooting Guide in the System Operation Manual. This guide is also available on request from Lachat.

12.8.2 Instructions for repacking the cadmium column are available upon customer request from the Lachat Technical Services Department.

12.8.3 Add reagents in the order they appear on the manifold diagram. Be extremely careful not to introduce air into the cadmium column when adding reagents. Pump all reagents through the lines before putting the column in-line.

13) Troubleshooting

13.1 Refer to the Lachat Operator's Manual for specific technical guidance.

14) Data Acquisition

14.1 Typical analytical sequence:

14.1.1 Calibration curve - first-source standard
Initial Calibration Verification (ICV) - second-source standard
Initial Calibration Blank (ICB)
Continuing Calibration Verification (CCV) - first-source standard
Continuing Calibration Blank (CCB)
Method Blank (MB)
Laboratory Control Sample (LCS) - first-source standard
Field Samples
Matrix Spike (MS) - first-source standard
Matrix Spike Duplicate (MSD) - first-source standard
Continuing Calibration Verification (CCV) - first-source standard
Continuing Calibration Blank (CCB)

14.2 Place samples and/or standards in the sampler tray. Input the required information into the data system (sample ID, dilutions, method, etc) and start the sequence. Sample will be calculated from the applicable calibration curve.

14.3 Report only those values that fall between the lowest and highest calibration standards. Samples exceeding the highest standard must be diluted and re-analyzed.

14.4 Results should be reported in mg NO_3/L. NOTE: the results as they come off the Lachat are combined NO_3 + NO_2. The NO_2 value must be analyzed and then subtracted from the combined number in order to find the true NO_3 value. This is done by either having the sample run for nitrite by either the applicable Standard Methods test code, or by running on the Lachat without having the cadmium column in line.

14.5 Instrument printouts of data will be stored in files, labeled for each day and stored.

15) Calculation, and Data Reduction Requirements

15.1 Sample concentrations are calculated from the linear regression curve generated by the data system (section 14).

15.2 If a sample requires dilution, the appropriate dilution factor is applied to the sample result.

15.3 QC calculations: LIMS calculates the percent recovery for various QC samples (MS, MSD, and LCS) according to the following equations:

15.3.1 % Recovery, %R (for standards and LCS)

$$\%R = \frac{SSR}{SA} \times 100$$

Where:

SSR = Spike Sample Result (mg/L or mg/kg)
SA = Spike Amount Added (mg/L or mg/kg)

15.3.2 % Recovery, %R (for MS and MSD samples)

$$\%R = \frac{(SSR - SR)}{SA} \times 100$$

Where:

SSR = Spiked Sample Result (mg/L or mg/kg)
SR = Sample Result (unspiked – mg/L or mg/kg)
SA = Spike Amount Added (mg/L or mg/kg)

15.3.3 % RPD (for precision or replication evaluation)

$$\%RPD = \frac{[SR_1 - SR_2]}{\frac{1}{2}(SR_1 + SR_2)} \times 100$$

Where:

SR_1 = Sample result for Replicate 1
SR_2 = Sample result for Replicate 2

16) Quality Control, Data Assessment and Corrective Action

16.1 Initial Calibration

16.1.1 An initial calibration must be completed prior to processing samples.
16.1.2 The calibration curve must yield a correlation coefficient of $\geq$0.995.
16.1.3 The initial calibration curve must be verified with a mid-level second source standard (ICV).

16.1.3.1 The second-source standard must meet accuracy performance criteria within 90-110% of the expected concentration.

16.1.4 All samples associated with a failed initial calibration or second source verification must be reprocessed. If samples cannot be reprocessed, all associated results must be reported as unusable.

16.2 Continuing Calibration Blank (CCB)

16.2.1 A calibration blank must be processed at the beginning of the analytical run, after every 10 samples, and at the end of the analytical run.
16.2.2 The calibration blank must be less than the MDL.
16.2.3 All samples must be reprocessed if associated with a calibration blank indicative of instrument drift. If samples cannot be reprocessed, all associated results must be flagged and narrated as to possible bias.

16.3 Continuing Calibration Verification (CCV)

16.3.1 Calibration verification must be prepared and analyzed prior to analysis, after every 10 samples, and at the end of the analytical run.
16.3.2 The calibration verification concentration must fall near or below the mid-point of the calibration curve.
16.3.3 The calibration verification concentration must meet accuracy performance criteria within 90-110% of the expected concentration.
16.3.4 The CCV should be prepared from the primary standard.
16.3.5 The calibration verification and laboratory control sample (LCS) may be used interchangeably, but must meet the most stringent criteria.
16.3.6 If the CCV falls outside of acceptance criteria, perform any needed corrective action and re-analyze all samples since the last acceptable CCV. (If the CCV fails high, and all associated samples are non-detect, results may be reported).

16.4 Method Blank

16.4.1 A method blank must be processed with each analytical batch or every 20 samples, whichever occurs first.
16.4.2 The method blank must be:

16.4.2.1 < ½ the PQL, or
16.4.2.2 < 5% the sample concentration, or
16.4.2.3 < 5% of the regulatory limit.

16.4.3 All samples associated with a failed method blank must be reprocessed. If the samples cannot be reprocessed, all associated analytical results must be flagged and narrated as to possible bias.

16.5 Laboratory Control Sample (LCS)

16.5.1 A LCS must be processed with each analytical batch or every 20 samples, whichever occurs first.
16.5.2 Recovery of the LCS must meet accuracy performance criteria as outlined in the applicable LIMS test code.
16.5.3 All sample associated with a failed LCS must be reprocessed. If samples cannot be reprocessed, all associated samples must be flagged and narrated as to possible bias.

16.6 Matrix Spike/Matrix Spike Duplicate (MS/MSD)

16.6.1 A MS/MSD must be processed with each analytical batch or every 20 samples, whichever occurs first.
16.6.2 Must meet accuracy and precision performance criteria as outlined in the applicable LIMS test code.
16.6.3 MS/MSD failure:

16.6.3.1 Samples associated with a failed MS/MSD must be reviewed for possible systemic error.
16.6.3.2 If MS/MSD criteria are not achieved, no systemic error is determined, and the LCS criteria fall within acceptance criteria, the analytical results may be reported. Reported results should be narrated as to possible matrix bias.
16.6.3.3 If MS/MSD criteria are not achieved, systemic error is suspected and/or LCS criteria are not achieved, all associated samples must be flagged and narrated as to possible bias.

17) Data Records Management

17.1 All records must be maintained for a period of no less than 7 years.

17.2 All samples shall be recorded in the instrumental analysis log, with the data file name, sample matrix, dilution factor, and analysis type. After analysis, the analyst must review raw data for accuracy, and completeness. Each report must be initialed and dated by the primary reviewing analyst.

17.3 Each batch must be peer reviewed by the department supervisor (or designee) prior to finalization in LIMS as documented in SOP HN-QS-009, *Data Reduction, Review, and Validation.*

17.4 Hard copy documentation must be maintained for standard/chemical tracking, extraction procedures, instrument maintenance, and run logs as documented in SOP HN-QS-001 and SOP HN-QS-014.

17.5 Instrument hard copy data must be maintained in daily analytical batch folders that are instrument specific. The folder shall contain the associated sequence log, all raw data with quantitation, and batch checklist.

17.6 Upon completion of review, data shall be stored in a designated file cabinet. Data shall be transferred to archive storage as space dictates according to the guidelines documented in SOP HN-QS-011, *Record Archival.*

17.7 All final reports shall be processed according to the guidelines documented in SOP HN-QS-003, *Work Order Reporting.* Any subsequent revisions to previously finalized reports must be processed according to the guidelines documented in SOP HN-QS-002, *Report Revisions.*

17.8 The IT Manager backs data that has been stored on the designated drive of the network server up daily on an external hard drive.

18) Quality Assurance and Quality Control

18.1 Logbooks must be reviewed monthly by the department supervisor.

18.2 Logbooks must be reviewed quarterly by the QA Staff.

18.3 The QA Staff must conduct periodic audits to evaluate compliance with this SOP.

19) Contingencies for Handling Out of Control Data

19.1 When method QC failures occur, the source of the QC failure must be determined, corrected, and all associated samples re-analyzed.

19.2 When affected samples cannot be re-analyzed or if re-analysis can only be performed outside of the specified holding time, the reported data must be qualified accordingly.

19.3 All analysts must provide sufficient comments in either logbooks or in LIMS to ensure that project management has sufficient information for narration.

19.4 All QC failures must be documented on the associated data batch checklist and, if procedural or systemic, a Non-Conformance Report (NCR) initiated and submitted to the QA Department via the NC/CA database per SOP HN-QS-003.

20) Method Performance

20.1 Method Detection Limits (MDL)

20.1.1 An annual method detection limit study must be performed as documented in the applicable SOP (HN-QS-006).

20.2 Demonstration of Proficiency

20.2.1 Each analyst must demonstrate initial proficiency with sample preparation and/or analytical determination by generating 4 sets of data of acceptable accuracy and precision for target analytes in a clean matrix.

20.2.2 Each analyst must demonstrate on-going proficiency annually with each sample preparation and/or analytical determination method by generating 4

sets of data of acceptable accuracy and precision for target analytes in a clean matrix or by passing performance in approved PT evaluations.

21) Summary of Changes

Table 0.1 Summary of Changes

Revision Number	Effective Date	Document Editor	Description of Changes
R02	7/1/12	CES	Formatting

22) References and Related Documents

22.1 U.S. Environmental Protection Agency, Methods for Chemical Analysis of Water and Wastes, Method 353.2.

22.2 Standard Methods for the Examination of Water and Wastewater, Method 4500NO3-F, 19th Edition.

22.3 ALS Environmental Quality Assurance Manual, Version 6.0 (or most current)

22.4 Wendt, Karin, Quickchem™ Method 10-107-04-1-A, Determination of Nitrate/Nitrite in Surface and Wastewaters by Flow Injection Analysis, Lachat Instruments Applications Group.

ALS Environmental

DOCUMENT TITLE:	HEXAVALENT CHROMIUM
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HEXAVALENT CHROMIUM

SM A3500-CR D / SW7196A

SOPID:	HN-WC-008	Rev. Number:	R07	Effective Date:	07/01/2012

Approved By: _____ Date: 6-29-12
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Quality Assurance – Dan Delinger

Approved By: _____ Date: 6/29/12
Laboratory Director – Jeff Glaser

Archival Date:	_____	Doc Control ID#:	_____	Editor:	_____

ANNUAL REVIEW

SIGNATURES BELOW INDICATE NO PROCEDURAL CHANGES HAVE BEEN MADE TO THE SOP SINCE THE APPROVAL DATE ABOVE. THIS SOP IS VALID FOR TWELVE ADDITIONAL MONTHS FROM DATE OF THE LAST SIGNATURE UNLESS INACTIVATED OR REPLACED BY SUBSEQUENT REVISIONS.

Signature	Title	Date
Signature	Title	Date
Signature	Title	Date

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HEXAVALENT CHROMIUM

1) Scope and Applicability

1.1 This method describes the determination of the concentration of dissolved hexavalent chromium [Cr^{+6}] in drinking water, non-potable water, wastewater, ground water, and EP/TCLP characteristic extracts. This method may also be applicable to certain domestic and industrial wastes, provided that no interfering substances are present (see Section 6).

1.2 The method may be used to analyze aqueous samples having concentrations of Chrome VI from 5.0 to 500.0 µg/L. Reporting concentrations may be extended with the incorporation of additional standards.

2) Summary of Procedure

2.1 Dissolved hexavalent chromium, in the absence of interfering amounts of substances such as molybdenum, vanadium, and mercury, may be determined colorimetrically by reaction with diphenylcarbazide in an acidic solution. Addition of an excess of diphenylcarbazide yields the red-violet product, and its absorbance is measured photometrically at 540 nm.

3) Definitions

3.1 DI: De-ionized reagent water meeting purity characteristics of ASTM Type II laboratory distilled water (daily conductivity <1.0 umhos/cm).

3.2 Laboratory Control Sample (LCS): A known matrix spiked with compound(s) representative of the target analytes.

3.3 Matrix: The component or substrate (e.g., surface water, groundwater, soil) containing the analyte of interest.

3.4 Matrix Spike (MS): An aliquot of sample spiked with a known concentration of target analyte(s). The spiking occurs prior to sample preparation and is used to document the bias of a method in a given sample matrix.

3.5 Matrix Spike Duplicate (MSD): An aliquot of sample spiked with a known concentration of target analyte(s) prior to sample preparation. This sample is a duplicate of the MS.

3.6 Method Blank: An analyte-free matrix to which all reagents are added in the same volumes or proportions as used in sample processing. The method blank is carried through the complete sample preparation and analytical procedure.

3.7 Standard Curve: A plot of concentrations of known analyte standards versus the instrument response to the analyte.

3.8 NCR/CAR: Non-Conformance/Corrective Action Report (see SOP HN-QS-003)

4) Health and Safety Warnings

4.1 Lab Safety

4.1.1 Due to various hazards in the laboratory, safety glasses, disposable gloves, and laboratory coats or aprons must be worn when working with unknown

samples. In addition, heavy-duty gloves and a face shield are recommended when dealing with toxic, caustic, and/or flammable chemicals.

4.1.2 The toxicity or carcinogenicity of each reagent used has not been precisely defined. However, each chemical used must be treated as a potential health hazard and exposure reduced to the lowest possible level. The laboratory maintains a current awareness file of OSHA regulations regarding the safe handling of the chemicals specified in this method. A reference file of data handling sheets (MSDS) is available to all personnel involved in these analyses.

4.2 Waste Disposal

4.2.1 Procedures for sample disposal are documented in SOP HN-SAF-001, *Waste Disposal Procedures.*

4.2.2 Samples must be disposed according to Federal, State, and local regulations.

4.3 Pollution Prevention

4.3.1 The quantities of chemicals purchased, when possible, must be based on the expected usage during its shelf life.

4.3.2 Standards and reagents must be prepared in volumes consistent with laboratory use to minimize the volume of expired standards or reagents to be disposed.

5) Cautions

5.1 N/A

6) Interferences

6.1 The chromium reaction with diphenylcarbazide is usually free from interferences. However, certain substances may interfere if the chromium concentration is relatively low. Hexavalent molybdenum and mercury salts also react to form color with the reagent; however, the red-violet intensities produced are much lower than those for chromium at the specified pH. Concentrations of up to 200 mg/L of molybdenum and mercury can be tolerated. Vanadium interferes strongly, but concentrations up to 10 times that of chromium will not cause trouble.

6.2 Iron in concentrations greater than 1 mg/L may produce a yellow color: however, difficulty is not normally encountered if the absorbance is measured photometrically at the appropriate wavelength.

6.3 Presence of Iron II usually indicates chrome VI is not present, as iron II reduces chrome VI to chrome III. Should low MS recoveries result, the presence of iron II should be investigated.

7) Personnel Qualifications and Responsibilities

7.1 General Responsibilities - This method is restricted to use by or under the supervision of analysts experienced in the method.

7.2 Analyst - It is the responsibility of the analyst(s) to:

7.2.1 Read, understand, and follow this SOP as written.
7.2.2 Produce contractually compliant data that meets all quality requirements using this procedure and the Data Reduction, Review and Validation SOP (HN-QS-009).
7.2.3 Complete the required demonstration of proficiency before performing this procedure without supervision.
7.2.4 Create and populate the data entry batch in LIMS.

7.3 Section Supervisor - It is the responsibility of the section supervisor to:

7.3.1 Ensure that all analysts have the technical ability and have received adequate training required to perform this procedure.
7.3.2 Ensure analysts have completed the required demonstration of proficiency before performing this procedure without supervision.
7.3.3 Ensure that peer review of data has been completed and documented.
7.3.4 Produce contractually compliant data that meets all quality requirements using this procedure and the Data Reduction, Review and Validation SOP.

7.4 Project Manager - It is the responsibility of the Project Manager to ensure that all contractual requirements for a client requiring this procedure are understood prior to initiating this procedure for a given set of samples.

8) Sample Collection, Handling, and Preservation

8.1 The recommended minimum sample volume is 200ml for water samples.

8.2 Since the stability of Cr+6 is not completely understood at this time, the analysis should be carried out as soon as possible.

8.3 To retard the chemical activity of hexavalent chromium, the samples and/or extracts should be stored at 4 C until ready for preparation and analysis.

8.4 For aqueous samples, holding time from sampling to analysis should not exceed 24 hours and must not exceed 7 days.

8.5 For alkaline extracts, analysis must be completed within 7 days of digestate preparation.

9) Equipment and Supplies

9.1 Spectrophotometer operating at 540 nm, a light path of 2.5 cm or longer, and equipped with one-centimeter cells.

9.2 Analytical balance, Sartorius EDS150, or equivalent.

9.3 Auto pipettes, 40-200 ul, 200-1000 ul, and 1-5 ml with appropriate tips and accurate to ± 1%.

9.4 Evergreen 50 ml centrifuge tubes, accurate to ± 1%.

9.5 Class A volumetric flasks: 25 ml, and 1-L.

9.6 1-Liter beaker.

9.7 100-mL and 25-mL polypropylene or Pyrex graduated cylinders.

9.8 125-mL plastic bottles.

9.9 11-cm Whatman 42 filter paper.

10) Standards and Reagents

10.1 Deionized Water (DI) meeting the performance standard of ASTM Type II water for conductance (produce a conductivity of less than 1.0 µmhos/cm @ 25°C).

10.2 Dried Potassium Dichromate, $K_2Cr_2O_7$ (analytical reagent grade): Dry at 105 ° C for two hours, and cool to room temperature in a desiccator, in sufficient quantity to prepare stock solutions.

10.3 Chrome VI Calibration Stock Standard, 100 mg/L: Using the analytical balance, dissolve 282.8 mg of dried potassium dichromate, $K_2Cr_2O_7$ (analytical reagent grade), in reagent water and dilute to 1 liter in a Class A volumetric flask. Reagent must be prepared annually or if degradation is noted. Expiration date of this solution must not exceed that of the parent. (1.0mL = 0.10 mg Cr+6)

10.3.1 Alternatively can be purchased as a certified 1000 ug/mL Chrome VI standard from High Purity (catalog # 100012-7).

10.4 Chrome VI Intermediate Calibration Standard, 1.0 mg/L: Dilute 1.0 ml of the Calibration Stock Standard (Section 10.3) to 100 ml in a Class A volumetric flask. Reagent must be prepared annually, or if degradation is noted. Upon preparation, the expiration date must not exceed that of the parent solution.

10.4.1 Calibration Curve Standards: Using the 1.0 mg/L Cr+6 standard (Section 10.4), the following table documents calibration curve standard preparation. Reagents must be prepared annually, or if degradation is noted. The expiration date must not exceed that of the parent solution.

Calibration Standard Level, mg/L	ML of Standard, 1.0 mg/L Cr+6	Final Volume, mL
0	0	25 mL
0.005	0.125 mL	25 mL
0.010	0.250 mL	25 mL
0.050	1.25 mL	25 mL
0.100	2.50 ml	25 mL
0.500	12.5 ml	25 mL

**: Additional levels may be included.

10.5 Chrome VI Calibration Verification (ICV) Stock Standard, 100 mg/L as Cr+6: Purchase a second source certified stock CrVI standard or prepare from a second source of dry $K_2Cr_2O_7$. Utilize the same procedures as specified in Section 10.3 for preparation.

10.5.1 Alternatively can be purchased as a certified 1000 ug/mL Chrome VI standard from High Purity (catalog # 100012-7).

10.6 Chrome VI Intermediate Calibration Verification Standard, 1.0 mg/L: Dilute 1.0ml of the Calibration Verification Stock Cr VI Standard (Section 10.5) to 100 m1 in a Class A volumetric flask. Prepare annually, or if degradation is noted. The expiration date must not exceed that of the parent solution.

10.6.1 Add 6.25 mL of 1.0 mg/L ICV Standard (Section 10.6) to a 50 mL graduated tube. Bring to a volume of 25 mL with DI for a concentration of 0.25 mg/L.

10.7 Sulfuric acid - Reagent grade or higher.

10.8 Sulfuric acid, 10% (v/v): Dilute 10 mL of reagent grade sulfuric acid, H_2SO_4, to 100 mL with reagent water.

10.9 Diphenylcarbazide Reagent: ChromaVer-3 packets (25 ml size) - available from Hach.

10.9.1 If Hach packets are unavailable, the following may be prepared.

10.9.1.1 Dissolve 2.5000g of 1,5 Diphenylcarbazide in 500ml of acetone.
10.9.1.2 Store in an amber bottle.
10.9.1.3 Discard if solution becomes discolored or within 1 year of preparation, whichever is sooner.

11) Method Calibration

11.1 Initial Calibration

11.1.1 At a minimum, three calibration solutions and a blank (as specified in Section 9.4.1) must be utilized for calibration.
11.1.2 Initial calibration must be performed every six months or whenever calibration verification fails, whichever occurs first.
11.1.3 Initial calibration curves must be verified with an independent calibration verification (ICV) solution.

11.2 ICV @ 0.25 mg/L: Prepare the initial calibration verification standard as documented in section 9.6.1.

11.3 CCV: Calibration verification must be documented using one point at or above the mid-point of the calibration curve. Prepare the appropriate solution as documented in Section 9.6.1. If curve integrity is suspect, another calibration point should be added at the lowest calibration point (MQL). Prepare the appropriate solution as documented in Section 9.4.1.

11.4 Store hard copy curves in a three ring binder, date and initial all curves. Subsequent analyses must reference the applicable initial calibration curve.

11.5 Perform and document all required support equipment calibration checks (balances, pipettes, etc.).

12) Sample Preparation/Analysis

12.1 For hexavalent chromium determination in solids, prepare sample digestates according to SOP HN-WC-023 prior to analytical determination.

12.2 Turn on the spectrophotometer and set the wavelength to 540 nm. Allow sufficient time for the instrument to warm up (at least 30 minutes).

12.3 Sample/Standard Color development and measurement:

12.3.1 Transfer 25 mL of the sample or standard to be tested to a 50-mL Evergreen centrifuge tube.
12.3.2 Add 2 drops (10 drops for alkaline digestates) of concentrated sulfuric acid to each vial. Verify the pH to be $\leq$ 2.0.
12.3.3 Add one (1) packet of ChromaVer-3 to each vial, cap, and shake. (Vent intermittently to relieve pressure.)
12.3.4 Allow sample mixture to react for 5-10 minutes.
12.3.5 Transfer an appropriate portion of the solution to a 1-cm absorption cell and measure its absorbance at 540 nm.
12.3.6 Use DI water as a reference.

12.3.6.1 An aliquot of the sample containing all reagents except diphenylcarbazide may be prepared and used to correct the sample for turbidity and/or acute discoloration.

12.3.7 From the absorbance (corrected if necessary), determine the mg/L of chromium present by reference to the calibration curve.

12.4 Laboratory Control Samples (LCS) @ 0.2 mg/L

12.4.1 Add 5.0 ml of the Intermediate Initial Calibration Verification (Section 10.6) to an Evergreen centrifuge tube and bring to a final volume of 25 ml.
12.4.2 Process as documented in Section 12.3.2 through 12.3.5.
12.4.3 Note: If the calibration range has been extended, the concentration of the LCS should be adjusted to fall at or near the mid-point of the calibration curve.
12.4.4 Recovery of the LCS must meet accuracy performance criteria as outlined in the applicable LIMS test code.
12.4.5 If LCS recovery falls outside the acceptance criteria, all associated samples must be re-processed.

12.5 Matrix Spike Samples (MS/MSD)

12.5.1 Add 5.0 ml of the Intermediate Initial Calibration Solution (Section 10.4) to an Evergreen centrifuge tube and bring to a final volume of 25 ml with sample.
12.5.2 Process as documented in Section 12.3.2 through 12.3.5.
12.5.3 Recovery of the MS/MSD should meet accuracy and precision performance

criteria as outlined in the applicable LIMS test code.

12.5.4 If MS/MSD recoveries are outside acceptance criteria, the anomaly may be due to matrix interference(s). LCS results, as well as other associated QC, must be evaluated in order to determine if the anomaly is systemic or matrix related. If associated QC parameters indicate a probable matrix affect, sample results may be reported but must be qualified.

12.5.5 If MS/MSD recoveries are outside acceptance criteria and matrix interference is not apparent (i.e., systemic error), all associated samples must be re-processed. If re-analysis cannot be completed, all associated results must be qualified and narrated accordingly.

12.6 If the sample absorbance exceeds the absorbance reading of the highest concentration standard, a dilution must be performed. Extrapolate the volume of sample needed to fall at the mid-point of the calibration curve and reprocess the sample starting at Section 12.3.

13) Troubleshooting

13.1 N/A

14) Data Acquisition

14.1 All data must be recorded in the hexavalent chromium logbook.

14.2 Use the spectrophotometer documentation for instructions on generating a calibration curve, reading unknown samples, and storing the data file.

14.3 Typical Analytical Sequence:

14.3.1 Initial Calibration curve and a blank
14.3.2 Initial Calibration Verification standard

Note: If using a previously established calibration curve, verification will be based upon the mid-level standard of the calibration curve (referenced as a CCV) and a CCB.

14.3.3 Laboratory Method Blank
14.3.4 Laboratory Control Sample
14.3.5 Matrix spike
14.3.6 Matrix spike duplicate
14.3.7 Commercial samples (5)
14.3.8 Continuing Calibration Verification Standard
14.3.9 Continuing Calibration Blank

Note: Continuing calibration verification must be completed after every ten samples including QC.

15) Calculation, and Data Reduction Requirements

15.1 Chrome VI in water is read directly from the curve generated in 11.1. If a dilution was made the results must be multiplied by the dilution factor.

$$Chrome\,VI\ (mg/L) = \frac{(response,\ mg/L)(final\ volume,\ mL)}{(initial\ volume,\ mL)}\ X\ (dilution\ factor)$$

15.2 Chrome VI in soils is calculated by the following equation:

$$Chrome\,VI\ (mg/kg) = \frac{(response,\ mg/L)(final\ volume,\ L)}{(sample\ weight,\ kg)}$$

15.2.1 Note: This result is a wet weight result. If dry weight results are needed, percent solids must be determined. (See the Total Solids SOP HN-WC-011.) Multiply this result by 100 and divide by % solids. Results entered into LIMS will be automatically corrected for percent moisture if the "PMOIST" test code has been activated.

15.3 QC Calculations: LIMS calculates the percent recovery for various QC samples (MS, MSD, and LCS) according to the following equations:

15.3.1 % Recovery, %R (for MS and MSD Samples)

$$\%R = \frac{(SSR - SR)}{SA} \times 100$$

Where:

SSR = Spiked Sample Result (mg/L or mg/kg).
SR = Sample Result (unspiked).
SA = Spike Amount Added (mg/L or mg/kg).

15.3.2 % Recovery, %R (for standards and LCS, CRDL)

$$\%\ R = \frac{(SSR)}{SA} \times 100$$

Where:

SSR = Spiked Sample Result (mg/L or mg/kg).
SA = Spike Amount Added (mg/L or mg/kg).

15.3.3 % RPD (for precision or replication evaluation)

$$\%RPD = \frac{|SR_1 - SR_2|}{\frac{1}{2}(SR_1 + SR_2)} \times 100$$

Where:
SR_1 = Sample result for replicate 1.
SR_2 = Sample result for replicate 2.

16) Quality Control, Data Assessment and Corrective Action

16.1 Initial Calibration:

16.1.1 Initial calibrations must be performed bi-annually at a minimum, or earlier if calibration verification fails.

16.1.2 The lowest level of calibration must be at or below the method-reporting limit. The highest level of calibration defines the maximum reportable concentration.

16.1.3 The correlation coefficient must be equal to or greater than 0.995.

16.1.4 With the exception of the low & high calibration point, all data points must be used to establish acceptance criteria. The low and/or high data point may be dropped if instrument linearity is exceeded. However, the requirements documented in Section 16.1.2 must be fulfilled.

16.1.5 In the event of initial calibration failure, check instrument conditions, calibration solutions, and reprocess the curve. If additional problems are encountered, immediately notify the Department Supervisor and/or QA Manager.

16.1.6 All samples associated with a failed initial calibration must be re-processed. If samples cannot be re-processed due to insufficient sample volume, the original results must be flagged "Unusable".

16.2 Initial Calibration Verification (ICV):

16.2.1 Verify each new curve with a second source standard

16.2.2 The calculated value of the ICV must meet accuracy performance criteria of 90-110% of the true value.

16.2.3 In the event of ICV failure, check instrument conditions, calibration solutions, ICV solution, and reprocess. If additional problems are encountered, immediately notify the Department Supervisor and QA Manager.

16.2.4 All samples associated with a failed ICV must be re-processed. If samples cannot be re-processed due to insufficient sample volume, the original results must be flagged "Unusable".

16.3 Calibration Verification (CCV):

16.3.1 Verify the curve prior to running samples, every ten samples thereafter and at the end of the run with the same source as the initial calibration standard.

16.3.2 Calibration verification must be documented using two points on the calibration curve. One point must be at the lowest calibration point (MQL) and the other point must be at or above the mid-point of the calibration curve.

16.3.3 The calculated value must meet accuracy performance criteria of 90-110% of the true value.

16.3.4 The CCV may fail high if the bracketed samples are non-detect.

16.3.5 In the event of CCV failure, check instrument conditions, calibration solutions, CCV solution, and reprocess all samples since the last passing CCV. If additional problems are encountered, immediately notify the Department Supervisor and QA Manager.

16.3.6 All samples associated with a failed CCV must be re-processed. If samples cannot be re-processed due to insufficient sample volume, the original results must be flagged "Unusable".

16.4 Continuing Calibration Blanks (ICB and CCB)

16.4.1 Verify that the system is free of contamination after each new curve (ICB) and prior to running samples, every ten samples thereafter (CCB) and at the end of

the run (CCB).

16.4.2 Criteria: The blank results should be less than two times the method detection limit, or no more than 5% of sample concentration, or 5% of regulatory limits, whichever is greater. If above the limit, it is an indication of instrument drift and the baseline must be reset and the samples since the previous acceptable blank must be re-analyzed.

16.5 Method Blank

16.5.1 A method blank must be processed with each analytical batch or every 20 samples, whichever occurs first.

16.5.2 The method blank must be:

16.5.2.1 <1/2 the PQL, or
16.5.2.2 <5% of the sample concentration, or
16.5.2.3 <5% pf the regulatory limit.

16.5.3 All samples associated with a failed method blank must be reprocessed. If samples cannot be reprocessed, all associated analytical results must be flagged and narrated as to possible bias.

16.6 Laboratory Control Samples (LCS)

16.6.1 The LCS must be spiked at or below the mid-point of the calibration curve and be processed through the entire analytical procedure. Each batch of 20 samples must include a LCS.

16.6.2 LCS results must meet accuracy performance criteria as outlined in the applicable LIMS test code.

16.6.3 If the LCS falls outside the acceptance range, perform corrective action to solve the source of the error, re-prepare and re-analyze the sample batch. If the LCS fails high and the samples are non-detect, the data may be reported but it must be narrated.

16.7 Matrix Spike Samples (MS/MSD)

16.7.1 A MS/MSD pair must be processed with each analytical batch or every 20 samples, whichever occurs first.

16.7.2 Must meet accuracy and performance criteria as outlined in the applicable LIMS test code.

16.7.3 MS/MSD Failure;

16.7.3.1 Samples associated with a failed MS/MSD must be reviewed for possible systemic error.

16.7.3.2 If MS/MSD criteria are not achieved, no systemic error is determined, and the LCS criteria fall within acceptance criteria, the analytical results may be reported. Reported results should be narrated as to possible matrix bias.

16.7.3.3 If MS/MSD criteria are not achieved, systemic error is suspected and/or LCS criteria are not achieved, all associated samples must be reprocessed. If samples cannot be reprocessed, all associated samples must be flagged and narrated as to possible bias.

16.8 Duplicate Sample

16.8.1 Duplicates will be analyzed on a frequency of one duplicate for each 20 samples analyzed. If fewer than 20 samples are in a batch, one duplicate will be analyzed.

16.8.2 Acceptance limits for the water matrix and soil matrix are 20 % RPD.

16.8.3 A Matrix Spike Duplicate (MSD) may be substituted for the duplicate analysis unless specified otherwise by project requirements.

16.8.4 If duplicate results are outside the acceptance limits for relative percent deviation, first determine the cause. If it is a system error, correct the problem and reprocess all associated samples. If no system error is detected, the LCS must fall within the acceptance criteria in order for the data to be accepted. The sample results must be flagged for matrix interference.

17) Data Records Management

17.1 Preparation of solid samples must be recorded in LIMS.

17.2 Make all corrections to the analytical logbook with single line through the error, date, and initial. Make NO obliterations when manually recording data.

17.3 Archive hardcopy computer printouts (if applicable) according to daily run batches and file by date run.

17.4 All records must be maintained for a period of 7 years.

18) Quality Assurance and Quality Control

18.1 Logbooks must be reviewed by the department supervisor monthly.

18.2 Logbooks must be reviewed by the QA staff quarterly.

19) Contingencies for Handling Out of Control Data

19.1 When method required QC failures occur, the source of the QC failure must be determined, corrected and sample re-analysis carried out when possible.

19.2 When affected sample analysis cannot be repeated due to limitations (i.e. sample availability, or if reanalysis can only be performed after expiration of a sample hold time), the reporting of data associated with failed QC data must be appropriately flagged and narrated as necessary. Narration must define the effect that the error has upon the data quality (e.g. "E" flag data indicate the result to be only an estimate).

19.3 Analysts must document sufficient comments in LIMS for failed QC in order that project management can narrate/ensure data qualifiers (flags) are properly assigned to the reported data.

19.4 QC failures must be documented in the applicable batch data checklist. If systemic failures are indicated, a non-conformance report must be provided to the Department Supervisor and QA Manager for subsequent investigation.

20) Method Performance

20.1 Method Detection Limits

20.1.1 Frequency: An annual method detection limit study must be performed according to the SOP HN-QS-006.

20.2 Initial Demonstration of Performance Frequency:

20.2.1 Each analyst must demonstrate his or her ability to perform this analysis.
20.2.2 Criteria: The acceptance range for the initial demonstration of capability is 80-120% recovery.

21) Summary of Changes

Table 21.1 Summary of Changes

Revision Number	Effective Date	Document Editor	Description of Changes
R07	7/1/12	CES	Formatting

22) References and Related Documents

22.1 U.S. Environmental Protection Agency, OWSER, "Method 7196A, Hexavalent Chrome", Test Methods for Evaluating Solid Waste Physical/Chemical Methods, Update III, June 13, 1997.

22.2 Standard Methods for the Examination of Water and Wastewater, 19th Edition

22.3 ALS Environmental Quality Assurance Manual, Revision 6.0 (or most current)

ALS Environmental

DOCUMENT TITLE:	*NITRITE BY COLORIMETRY*
REFERENCED METHOD:	*SM 4500NO2-B / EPA 354.1*
SOP ID:	*HN-WC-012*
REV. NUMBER:	*R04*
EFFECTIVE DATE:	*08/15/2012*

NITRITE BY COLORIMETRY

SM 4500NO2-B / EPA 354.1

SOPID:	HN-WC-012	Rev. Number:	R04	Effective Date:	08/15/2012

Approved By: _____ Date: 8-2-12
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Laboratory Director – Jeff Glaser

Archival Date:	_____	Doc Control ID#:	_____	Editor:	_____

ANNUAL REVIEW

SIGNATURES BELOW INDICATE NO PROCEDURAL CHANGES HAVE BEEN MADE TO THE SOP SINCE THE APPROVAL DATE ABOVE. THIS SOP IS VALID FOR TWELVE ADDITIONAL MONTHS FROM DATE OF THE LAST SIGNATURE UNLESS INACTIVATED OR REPLACED BY SUBSEQUENT REVISIONS.

Signature	Title	Date
Signature	Title	Date
Signature	Title	Date

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NITRITE BY COLORIMETRY

1) Scope and Applicability

1.1 This Standard Operating Procedure (SOP) is applicable to the determination of nitrite concentration in aqueous matrices and in domestic/industrial wastes. This SOP may be used for the reporting of nitrite by EPA Method 354.1 and Standard Methods 4500-NO_2-B.

2) Summary of Procedure

2.1 Under acidic conditions, nitrite reacts with sulfanilamide to form a diazonium compound that combines with N-(1-naphthyl) ethylenediamine dihydrochloride to form a reddish-purple color. The final product may be measured spectrophotometrically at 540 nm.

2.2 The reporting range for nitrite utilizing this SOP is 0.01-0.40 mg/L NO_2-N.

3) Definitions

3.1 DI - ASTM Type II laboratory distilled water

3.2 LIMS – Laboratory Information Management System

3.3 Matrix: The component or substrate (e.g. surface water, groundwater, soil) containing the analyte of interest.

3.4 Method Blank (MB): An analyte-free matrix to which all reagents are added in the same volumes or proportions as used in sample processing and carried through the complete sample preparation and analytical procedure.

3.5 Laboratory Control Sample (LCS): A clean, analyte-free matrix spiked with compound(s) representative of the target analyte(s) and carried throughout the complete preparation/analytical procedure.

3.6 Sample: Any field aliquot, however identified, submitted for analysis.

3.7 Analytical Batch: A group of 20 or fewer field samples of the same matrix processed during the same 8 hour working shift.

3.8 Performance Evaluation Sample (PE): A certified solution of a method analytes whose concentration is unknown to the analyst.

4) Health and Safety Warnings

4.1 Lab Safety

4.1.1 Due to various hazards in the laboratory, safety glasses, disposable gloves, and laboratory coats or aprons must be worn when working with unknown samples. In addition, heavy-duty gloves and a face shield are recommended when dealing with toxic, caustic, and/or flammable chemicals.

4.1.2 The toxicity or carcinogenicity of each reagent used has not been precisely defined. However, each chemical used must be treated as a potential health hazard and exposure reduced to the lowest possible level. The laboratory maintains a current awareness file of OSHA regulations regarding the safe

handling of the chemicals specified in this method. A reference file of data handling sheets (MSDS) is available to all personnel involved in these analyses.

4.2 Waste Disposal

4.2.1 Procedures for sample disposal are documented in SOP HN-SAF-001, *Waste Disposal Procedures.*

4.2.2 Samples must be disposed according to Federal, State, and local regulations.

4.3 Pollution Prevention

4.3.1 The quantities of chemicals purchased, when possible, must be based on the expected usage during its shelf life.

4.3.2 Standards and reagents must be prepared in volumes consistent with laboratory use to minimize the volume of expired standards or reagents to be disposed.

5) Cautions

5.1 Be knowledgeable of the MSDS information for each chemical that is used in the procedure.

6) Interferences

6.1 The presence of strong oxidants or reductants will affect nitrite concentrations.

6.2 High alkalinity will produce negative bias in results due to a shift in pH. If sample pH is $\geq$ 10, the pH must be adjusted to approximately 6 prior to analysis.

7) Personnel Qualifications and Responsibilities

7.1 General Responsibilities - This method is restricted to use by or under the supervision of analysts experienced in the method.

7.2 Analyst - It is the responsibility of the analyst(s) to:

7.2.1 Produce contractually compliant data that meets all quality requirements using this procedure and the Data Reduction, Review and Validation SOP (HN-QS-009).

7.2.2 Complete the required demonstration of proficiency before performing this procedure without supervision.

7.2.3 Create and populate a data entry batch in LIMS for review by the Supervisor.

7.3 Section Supervisor - It is the responsibility of the section supervisor to:

7.3.1 Ensure that all analysts have the technical ability and have received adequate training required to perform this procedure.

7.3.2 Ensure analysts have completed the required demonstration of proficiency before performing this procedure without supervision.

7.3.3 Ensure the production of contractually compliant data that meets all quality requirements using this procedure and the Data Reduction, Review and Validation SOP.

7.4 Project Manager – It is the responsibility of the Project Manager to ensure that all contractual requirements for a client requiring this procedure are understood prior to initiating this procedure for a given set of samples.

8) Sample Collection, Handling, and Preservation

8.1 Sample containers: Plastic or glass, approximately 250 ml. These are purchased by the laboratory and meet EPA specifications for sample containers.

8.2 Preserve the samples at 4 ± 2 °C from the time of collection until analysis.

8.3 Samples must be analyzed within 48 hours of the date and time of collection.

9) Equipment and Supplies

9.1 Spectrophotometer for use @ 540 nm with 1 cm (or larger) cells

9.2 50 ml disposable digestion tubes

9.3 50 mL plastic graduated cylinder

9.4 Class A volumetric flasks (assorted volumes)

9.5 Finnpipette (or equivalent) autopipette(s)

9.6 Vacuum flasks

9.7 Buchner funnels

9.8 0.45µ glass microfiber filters

10) Standards and Reagents

10.1 Reagent water, Type II

10.2 Phosphoric acid, reagent grade or higher

10.3 Sulfanilamide, reagent grade or higher

10.4 N-(1-naphthyl) ethylenediamine dihydrochloride (NED), reagent grade or higher

10.5 Sodium nitrite, reagent grade or higher

10.6 Coloring Reagent:

10.6.1 Add 100 ml conc. phosphoric acid (Section 10.2) to approximately 700 ml DI water.
10.6.2 Add 10.0 g sulfanilamide (Section 10.3).
10.6.3 Add 1.0 g N-(1-naphthyl) ethylenediamine dihydrochloride (Section 10.4).
10.6.4 Stir until dissolved.
10.6.5 Bring to a final volume of 1L with DI water.
10.6.6 Transfer to a clean, amber appropriately labeled container. This solution is stable for one month if stored protected from light.

10.7 Nitrite Stock Solution @ 1.0 mg/ml NO_2-N: Purchased as a certified standard from High Purity Standards.

10.8 Nitrite Standard Solution @ 1.0 mg/L NO_2-N:

10.8.1 Add 1.0 ml of Nitrite Stock Solution (Section 10.7) to approximately 500 ml DI

water.

10.8.2 Bring to a final volume of 1L with DI water.

10.8.3 Transfer to a clean appropriately labeled container. This solution should be replaced annually or if degradation is noted.

10.8.4 The expiration date of this solution may not exceed that of its parent stock.

10.9 Nitrite Check Standard Solution @ 1mg/mL (obtain from Ricca or an alternate second source)

10.10 Nitrite Check Solution @ 1mg/L NO2-N:

10.10.1 Using the second source standard @ 1mg/mL, add 1.0 ml to approximately 50 ml of DI water in a Class A volumetric flask.

10.10.2 Bring to a final volume of 1.0 L.

10.10.3 Transfer to an appropriately labeled container.

10.10.4 This standard must be replaced every 12 months or if degradation is noted. The expiration date of the standard may not exceed that of its parent stock.

10.10.5 If a second source standard cannot be obtained, the primary supplier may be used. However, the material must be from a different lot number.

10.11 Nitrite LCS, MS/MSD Spike Solution @ 10 mg/L NO2-N:

10.11.1 Add 10.0 ml of Nitrite Stock Solution (Section 10.7) to approximately 500 ml DI water.

10.11.2 Bring to a final volume of 1L with DI water.

10.11.3 Transfer to a clean appropriately labeled container. This solution should be replaced annually or if degradation is noted.

10.11.4 The expiration date of this solution may not exceed that of its parent stock.

11) Method Calibration

11.1 Calibration Standards

11.1.1 Using the 1.0 mg/L nitrite standard solution (10.8), pipet the following volumes into a 50 ml tube or volumetric flask and bring to a final volume of 50 ml.

Standard Stock Solution (ml)	Concentration (mg/L)
0.0	0.0
0.5	0.01
2.5	0.05
5.0	0.10
20	0.40

11.2 Process each standard as detailed in the sample analysis section.

11.3 Record each respective standard absorbance and calculate the slope/intercept.

11.4 Calculate the correlation coefficient. This value must be $\geq$ 0.995 prior to proceeding.

11.5 Verify the calibration curve by processing a second source standard (Section 10.10) at or below the mid-point of the curve. The calculated concentration must fall within $\pm$ 10% of the expected value.

11.5.1 If the calibration curve fails to yield an acceptable correlation coefficient or if the second source standard fails to achieve acceptance criteria, determine the cause of the problem and repeat the calibration sequence.

12) Sample Preparation/Analysis

12.1 If the sample exhibits high particulate matter, process through a 0.45-micron filter prior to analysis. If sample pH is $\geq$ 10, adjust sample to a pH of ~ 6 with dilute HCl.

12.2 Add 50 ml of sample to graduated tube or volumetric flask.

12.3 Add 2 ml of coloring reagent (Section 10.6).

12.4 Cap, mix, and let sit for a minimum of 15 minutes.

12.5 Read the absorbance of the samples at 540 nm. Calculate sample nitrite concentration from the regression curve established in Section 11.5.

12.6 If the absorbance/concentration of the sample exceeds that of the highest calibration standard, dilute the sample accordingly and reprocess.

12.7 Fortified Samples (LCS/MS/MSD)

12.7.1 Add 1.0 ml of the 10 mg/L nitrite check solution (Section 10.11) to a 50 ml graduated digestion vial.

12.7.2 Bring to a final volume of 50 ml with DI water (LCS) or designated field sample (MS/MSD).

13) Troubleshooting

13.1 N/A

14) Data Acquisition

14.1 All data must be recorded in the Nitrite logbook.

14.2 Data is then manually entered into LIMS.

15) Calculation, and Data Reduction Requirements

15.1 Use the standard curve to plot Concentration (mg/L) vs. Absorbance.

15.2 Obtain concentration value of sample directly from the standard curve.

16) Quality Control, Data Assessment and Corrective Action

16.1 Method Detection Limits

16.1.1 An annual method detection limit study must be performed according to the appropriate SOP (HN-QS-006).

16.2 Initial Demonstration of Performance Frequency

16.2.1 Each analyst must demonstrate his/her ability to perform this analysis.

16.3 Method Blank

16.3.1 A method blank must be processed with each analytical batch or every 20

samples, whichever occurs first.

16.3.2 The method blank must be:

16.3.2.1 < 1/2 the PQL, or
16.3.2.2 < 5% the sample concentration, or
16.3.2.3 < 5% the regulatory limit

16.3.3 All samples associated with a failed method blank must be reprocessed. If the samples cannot be reprocessed, all associated analytical results must be flagged and narrated as to possible bias.

16.4 Matrix Spike/Matrix Spike Duplicate (MS/MSD)

16.4.1 A MS/MSD pair must be processed with each analytical batch or every 20 samples, whichever occurs first.
16.4.2 Must meet accuracy and precision performance criteria as outlined in the applicable LIMS test code.
16.4.3 The MSD may serve as a sample duplicate unless required otherwise by project specifications.

16.5 Laboratory Control (LCS)

16.5.1 A LCS must be processed with each analytical batch or every 20 samples, whichever occurs first.
16.5.2 Must meet accuracy performance criteria as outlined in the applicable LIMS test code.
16.5.3 Failure to achieve acceptance criteria in the LCS requires reanalysis of all associated samples in the analytical batch.

16.6 Continuing Calibration Verification (CCV)

16.6.1 Analyze a CCV after the calibration curve, after every 10 samples and at the end of the run.
16.6.2 If utilizing a previously established calibration curve, the beginning and ending CCV should include a low and high calibration point to verify slope integrity. The LCS may be used for the high calibration point.
16.6.3 The analyzed concentration of the CCV must be within ± 10% of the true value as outlined in the LIMS test code.

16.6.3.1 Failure to achieve acceptance criteria in the CCV requires reanalysis of all samples associated with the failed CCV.

16.6.4 Preparation

16.6.4.1 Pipet 2.5 ml and 15 ml of the 1.0 mg/L nitrite standard solution (Section 10.8) into separate 50 ml graduated tubes/flasks and bring to a final volume of 50 ml. (True value = 0.05 and 0.30 mg/L respectively.)

16.7 Continuing Calibration Blank (CCB)

16.7.1 Analyze a CCB after the calibration curve, prior to analysis, after every 10 samples, and at the end of the run.
16.7.2 The MB may be utilized as the beginning CCB. However, the more stringent

criteria (see Section 16.7.3) must be applied during evaluation.

16.7.3 The analyzed concentration of the CCB should be less than the detection limit and must be < ½ the MRL.

16.7.3.1 All samples associated with a contaminated method blank must be reanalyzed.

16.7.3.2 If the sample cannot be reanalyzed due to insufficient sample volume, all associated sample results must be flagged appropriately.

17) Data Records Management

17.1 All data must be recorded in the Nitrite logbook.

17.2 Each batch must contain the analyst, sample identity, concentration and comments.

17.3 Logbooks must be maintained for a period of no less than 7 years.

17.4 A peer analyst must review all data prior to entering into LIMS. The reviewer must initial each batch following review.

18) Quality Assurance and Quality Control

18.1 Logbooks must be reviewed monthly by the department supervisor.

18.2 Logbooks must be reviewed quarterly by the QA Staff.

18.3 The QA Staff must conduct periodic audits to evaluate compliance with this SOP.

19) Contingencies for Handling Out of Control Data

19.1 When method QC failures occur, the source of the QC failure must be determined, corrected, and all associated samples reanalyzed.

19.2 When affected samples cannot be reanalyzed due to volume and/or holding time limitations, all sample data associated with failed QC must be flagged and narrated accordingly.

19.3 The analyst must provide sufficient information and/or comments within LIMS or the data checklist such that the project manager can ensure the assignment of proper qualifiers and narration.

19.4 Deviations from this procedure or the quality control criteria outlined within must be documented via the data checklist and (if procedural or systemic) via the NC/CA database and submitted to QA for further evaluation.

20) Method Performance

20.1 Method Detection Limits

20.1.1 An annual method detection limit study must be performed according to the appropriate SOP (HN-QS-006).

20.2 The ongoing performance of this procedure is monitored through the semi-annual testing of a PE sample.

21) Summary of Changes

Table 21.1 Summary of Changes

Revision Number	Effective Date	Document Editor	Description of Changes
R03	7/1/12	CES	Formatting
R04	8/15/12	CES	Revised sec 10.8, 10.9, and 10.10 for spike concentration; added section 10.11; revised sec. 12.7 and 16.6.4.1 for preparation

22) References and Related Documents

22.1 U.S. Environmental Protection Agency, Methods for Chemical Analysis of Waters and Wastes, EPA/600/4-79-020, Method 354.1.

22.2 Standard Methods for the Examination of Water and Wastewater, 19th Edition, Method 4500-NO_2 B.

22.3 ALS Environmental Quality Assurance Manual Revision 6.0 (or most current)

ATTACHMENT 1-7

LABORATORY ACCURACY AND PRECISION
OBJECTIVES – ALS LABORATORIES

(

Table 7-1

ALS - Kelso Laboratories (Formerly CAS)
Laboratory Accuracy and Precision Objectives
for PCBs in Groundwater and Soil
Multi-Area QAPP
Weyerhaeuser Company
Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site

								LCS[1]		MS/MSD[1]			Surrogate Recovery[1]	
SOP ID	Method	Matrix	Analyte	Type	MDL[1]	RL	Units	LCL	UCL	LCL	UCL	%RPD	LCL	UCL
C-13	608	Water	Aroclor 1016	A	0.043	0.05	µg/L	50	114	50	114	30	--	--
C-13	608	Water	Aroclor 1221	A	0.058	0.1	µg/L	15	178	15	178	30	--	--
C-13	608	Water	Aroclor 1232	A	0.049	0.1	µg/L	10	215	10	215	30	--	--
C-13	608	Water	Aroclor 1242	A	0.018	0.1	µg/L	39	150	39	150	30	--	--
C-13	608	Water	Aroclor 1248	A	0.035	0.1	µg/L	38	158	38	158	30	--	--
C-13	608	Water	Aroclor 1254	A	0.029	0.1	µg/L	29	131	29	131	30	--	--
C-13	608	Water	Aroclor 1260	A	0.053	0.1	µg/L	8	127	8	127	30	--	--
C-13	608	Water	Decachlorobiphenyl	S	NA	NA	µg/L	--	--	--	--	--	10	134
C-13	608	Water	Tetrachloro-m-xylene	S	NA	NA	µg/L	--	--	--	--	--	15	114
C-13	8082A	Water	Aroclor 1016	A	0.049	0.2	µg/L	50	103	25	144	30	--	--
C-13	8082A	Water	Aroclor 1221	A	0.049	0.4	µg/L	--	--	--	--	--	--	--
C-13	8082A	Water	Aroclor 1232	A	0.049	0.2	µg/L	--	--	--	--	--	--	--
C-13	8082A	Water	Aroclor 1242	A	0.049	0.2	µg/L	--	--	--	--	--	--	--
C-13	8082A	Water	Aroclor 1248	A	0.049	0.2	µg/L	--	--	--	--	--	--	--
C-13	8082A	Water	Aroclor 1254	A	0.049	0.2	µg/L	--	--	--	--	--	--	--
C-13	8082A	Water	Aroclor 1260	A	0.049	0.2	µg/L	56	100	40	127	30	--	--
C-13	8082A	Water	Decachlorobiphenyl	S	NA	NA	µg/L	--	--	--	--	--	42	119
C-13	8082A	Water	Tetrachloro-m-xylene	S	NA	NA	µg/L	--	--	--	--	--	43	109
C-13	8082A LL	Soil	Aroclor 1016	A	2.1	10	µg/Kg	37	121	27	128	40	--	--
C-13	8082A LL	Soil	Aroclor 1221	A	2.1	20	µg/Kg	--	--	--	--	--	--	--
C-13	8082A LL	Soil	Aroclor 1232	A	2.1	10	µg/Kg	--	--	--	--	--	--	--
C-13	8082A LL	Soil	Aroclor 1242	A	2.1	10	µg/Kg	--	--	--	--	--	--	--
C-13	8082A LL	Soil	Aroclor 1248	A	2.1	10	µg/Kg	--	--	--	--	--	--	--
C-13	8082A LL	Soil	Aroclor 1254	A	2.1	10	µg/Kg	--	--	--	--	--	--	--
C-13	8082A LL	Soil	Aroclor 1260	A	2.1	10	µg/Kg	42	123	29	131	40	--	--
C-13	8082A LL	Soil	Decachlorobiphenyl	S	NA	NA	µg/Kg	--	--	--	--	--	50	123
C-13	8082A LL	Soil	Tetrachloro-m-xylene	S	NA	NA	µg/Kg	--	--	--	--	--	30	125

Notes:
[1] The laboratory MDLs and control limits provided are revised periodically by the laboratory. The MDLs and control limits used to evaluate data will be the current limits at the time of analysis as provided in laboratory data reports.

MDL - Method Detection Limit
RL - Report Limit
NA - Not Applicable
LCS - Laboratory Control Sample
MS/MSD - Matrix Spike/Matrix Spike Duplicate
RPD - Relative Percent Difference
LCL - Lower Control Limit (percent recovery)
UCL - Upper Control Limit (percent recovery)
A - Analyte
S - Surrogate

Table 7-2

ALS - Kelso Laboratories (Formerly CAS)
Laboratory Accuracy and Precision Objectives
for Metals and Inorganics in Groundwater and Soil
Multi-Area QAPP
Weyerhaeuser Company
Allied Paper, Inc,/Portage Creek/Kalamazoo River Superfund Site

								LCS[1]		MS/MSD[1]			Surrogate Recovery[1]	
SOP ID	Method	Matrix	Analyte	Type	MDL[1]	RL	Units	LCL	UCL	LCL	UCL	%RPD	LCL	UCL
C-18	200.8	Water	Aluminum	A	0.3	2	µg/L	85	115	70	130	20	--	--
C-18	200.8	Water	Antimony	A	0.02	0.05	µg/L	85	115	70	130	20	--	--
C-18	200.8	Water	Arsenic	A	0.1	0.5	µg/L	85	115	70	130	20	--	--
C-18	200.8	Water	Barium	A	0.02	0.05	µg/L	85	115	70	130	20	--	--
C-18	200.8	Water	Beryllium	A	0.006	0.02	µg/L	85	115	70	130	20	--	--
C-18	200.8	Water	Cadmium	A	0.005	0.02	µg/L	85	115	70	130	20	--	--
C-18	200.8	Water	Chromium	A	0.04	0.2	µg/L	85	115	70	130	20	--	--
C-18	200.8	Water	Cobalt	A	0.006	0.02	µg/L	85	115	70	130	20	--	--
C-18	200.8	Water	Copper	A	0.02	0.1	µg/L	85	115	70	130	20	--	--
C-31	200.7	Water	Iron	A	3	20	µg/L	92	111	75	125	20	--	--
C-18	200.8	Water	Lead	A	0.005	0.02	µg/L	85	115	70	130	20	--	--
C-31	200.7	Water	Magnesium	A	60	20	µg/L	85	115	70	130	20	--	--
C-18	200.8	Water	Manganese	A	0.006	0.05	µg/L	85	115	70	130	20	--	--
C-33	7470A	Water	Mercury	A	0.02	0.2	µg/L	83	117	75	125	20	--	--
C-34	245.1	Water	Mercury	A	0.02	0.2	µg/L	85	115	70	131	20	--	--
C-4	1631E	Water	Mercury	A	0.06	1	µg/L	77	123	71	125	24	--	--
C-7	1630	Water	Methyl Mercury	A	0.03	0.1	µg/L	67	133	65	135	35	--	--
C-18	200.8	Water	Nickel	A	0.03	0.2	µg/L	85	115	70	130	20	--	--
C-18	200.8	Water	Selenium	A	0.3	1	µg/L	85	115	70	130	20	--	--
C-18	200.8	Water	Silver	A	0.004	0.02	µg/L	85	115	70	130	20	--	--
C-31	200.7	Water	Sodium	A	70	200	µg/L	85	115	70	130	20	--	--
C-18	200.8	Water	Thallium	A	0.005	0.02	µg/L	85	115	70	130	20	--	--
C-18	200.8	Water	Vanadium	A	0.03	0.2	µg/L	85	115	70	130	20	--	--
C-18	200.8	Water	Zinc	A	0.2	0.5	µg/L	85	115	70	130	20	--	--
C-19	SM4500 CN G	Water	Cyanide, Amenable	A	0.002	0.01	µg/L	53	147	10	180	20	--	--

Table 7-2

ALS - Kelso Laboratories (Formerly CAS)
Laboratory Accuracy and Precision Objectives
for Metals and Inorganics in Groundwater and Soil
Multi-Area QAPP
Weyerhaeuser Company
Allied Paper, Inc,/Portage Creek/Kalamazoo River Superfund Site

								LCS[1]		MS/MSD[1]			Surrogate Recovery[1]	
SOP ID	Method	Matrix	Analyte	Type	MDL[1]	RL	Units	LCL	UCL	LCL	UCL	%RPD	LCL	UCL
C-18	6020A	Soil	Aluminum	A	400	2000	µg/Kg	41	158	75	125	20	--	--
C-18	6020A	Soil	Antimony	A	20	50	µg/Kg	50	150	75	125	20	--	--
C-18	6020A	Soil	Arsenic	A	60	500	µg/Kg	78	122	75	125	20	--	--
C-18	6020A	Soil	Barium	A	5	50	µg/Kg	81	119	75	125	20	--	--
C-18	6020A	Soil	Beryllium	A	3	20	µg/Kg	83	117	75	125	20	--	--
C-18	6020A	Soil	Cadmium	A	4	20	µg/Kg	81	119	75	125	20	--	--
C-18	6020A	Soil	Chromium	A	30	200	µg/Kg	80	119	75	125	20	--	--
C-18	6020A	Soil	Cobalt	A	3	20	µg/Kg	82	118	75	125	20	--	--
C-18	6020A	Soil	Copper	A	80	100	µg/Kg	83	116	75	125	20	--	--
C-31	6010C	Soil	Iron	A	700	4000	µg/Kg	50	149	75	125	20	--	--
C-18	6020A	Soil	Lead	A	9	50	µg/Kg	79	121	75	125	20	--	--
C-31	6010C	Soil	Magnesium	A	80	4000	µg/Kg	73	127	75	125	20	--	--
C-18	6020A	Soil	Manganese	A	30	50	µg/Kg	81	119	75	125	20	--	--
C-32	7471B	Soil	Mercury	A	2	20	µg/Kg	71	128	75	125	20	--	--
C-18	6020A	Soil	Nickel	A	30	200	µg/Kg	81	118	75	125	20	--	--
C-18	6020A	Soil	Selenium	A	200	1000	µg/Kg	80	120	75	125	20	--	--
C-18	6020A	Soil	Silver	A	8	20	µg/Kg	66	134	75	125	20	--	--
C-31	6010C	Soil	Sodium	A	4000	40000	µg/Kg	74	126	75	125	20	--	--
C-18	6020A	Soil	Thallium	A	3	20	µg/Kg	79	120	75	125	20	--	--
C-18	6020A	Soil	Vanadium	A	20	200	µg/Kg	79	121	75	125	20	--	--
C-18	6020A	Soil	Zinc	A	200	500	µg/Kg	73	121	75	125	20	--	--
C-19	9013/9012B	Soil	Cyanide, Total and Amenable	A	60	200	µg/Kg	62	128	10	171	20	--	--
C-9	350.1 Mod	Soil	Ammonia as Nitrogen	A	40	500	µg/Kg	90	110	55	135	32	--	--
C-8	300.0 Mod	Soil	Nitrate as Nitrogen	A	120	1000	µg/Kg	85	115	90	110	20	--	--
C-8	300.0 Mod	Soil	Nitrite as Nitrogen	A	60	1000	µg/Kg	85	115	90	110	20	--	--
C-10	365.3 Mod	Soil	Phosphorus, Total	A	20	100	µg/Kg	82	127	10	174	20	--	--

Notes:
[1] The laboratory MDLs and control limits provided are revised periodically by the laboratory. The MDLs and control limits used to evaluate data will be the current limits at the time of analysis as provided in laboratory data reports.

MDL - Method Detection Limit
RL - Report Limit
RPD - Relative Percent Difference
LCS - Laboratory Control Sample
MS/MSD - Matrix Spike/Matrix Spike Duplicate
LCL - Lower Control Limit (percent recovery)
UCL - Upper Control Limit (percent recovery)
A - Analyte
S - Surrogate

Table 7-3

ALS - Kelso Laboratories (Formerly CAS)
Laboratory Accuracy and Precision Objectives
for VOCs in Groundwater and Soil
Multi-Area QAPP
Weyerhaeuser Company
Allied Paper, Inc,/Portage Creek/Kalamazoo River Superfund Site

								LCS[1]		MS/MSD[1]			Surrogate Recovery[1]	
SOP ID	Method	Matrix	Analyte	Type	MDL[1]	RL	Units	LCL	UCL	LCL	UCL	%RPD	LCL	UCL
C-5, C-6	8260C	Water	1,1,1-Trichloroethane	A	0.075	0.5	µg/L	59	136	57	151	30	--	--
C-5, C-6	8260C	Water	1,1,2,2-Tetrachloroethane	A	0.16	0.5	µg/L	70	127	72	129	30	--	--
C-5, C-6	8260C	Water	1,1,2-Trichloroethane	A	0.14	0.5	µg/L	74	118	74	124	30	--	--
C-5, C-6	8260C	Water	1,1-Dichloroethane	A	0.077	0.5	µg/L	66	129	69	141	30	--	--
C-5, C-6	8260C	Water	1,1-Dichloroethene	A	0.08	0.5	µg/L	66	129	59	171	30	--	--
C-5, C-6	8260C	Water	1,2,4-Trichlorobenzene	A	0.096	2	µg/L	58	126	57	133	30	--	--
C-5, C-6	8260C	Water	1,2-Dibromoethane	A	0.1	2	µg/L	74	118	73	122	30	--	--
C-5, C-6	8260C	Water	1,2-Dichlorobenzene	A	0.12	0.5	µg/L	72	115	72	119	30	--	--
C-5, C-6	8260C	Water	1,2-Dichloroethane	A	0.08	0.5	µg/L	56	142	56	141	30	--	--
C-5, C-6	8260C	Water	1,2-Dichloropropane	A	0.095	0.5	µg/L	67	126	63	131	30	--	--
C-5, C-6	8260C	Water	1,3-Dichlorobenzene	A	0.1	0.5	µg/L	70	116	70	121	30	--	--
C-5, C-6	8260C	Water	1,4-Dichlorobenzene	A	0.12	0.5	µg/L	73	115	72	121	30	--	--
C-5, C-6	8260C	Water	2-Butanone	A	1.9	20	µg/L	71	149	65	147	30	--	--
C-5, C-6	8260C	Water	2-Hexanone	A	2.7	20	µg/L	59	131	53	132	30	--	--
C-5, C-6	8260C	Water	4-Methyl-2-pentanone	A	2.6	20	µg/L	64	134	64	139	30	--	--
C-5, C-6	8260C	Water	Acetone	A	3.3	20	µg/L	68	135	68	134	30	--	--
C-5, C-6	8260C	Water	Benzene	A	0.062	0.5	µg/L	69	124	63	144	30	--	--
C-5, C-6	8260C	Water	Bromodichloromethane	A	0.091	0.5	µg/L	63	129	61	134	30	--	--
C-5, C-6	8260C	Water	Bromoform	A	0.16	0.5	µg/L	52	144	54	140	30	--	--
C-5, C-6	8260C	Water	Bromomethane	A	0.1	0.5	µg/L	35	113	36	127	30	--	--
C-5, C-6	8260C	Water	Carbon Disulfide	A	0.069	0.5	µg/L	46	144	52	156	30	--	--
C-5, C-6	8260C	Water	Carbon Tetrachloride	A	0.096	0.5	µg/L	55	140	53	161	30	--	--
C-5, C-6	8260C	Water	Chlorobenzene	A	0.11	0.5	µg/L	72	116	69	126	30	--	--
C-5, C-6	8260C	Water	Chloroethane	A	0.16	0.5	µg/L	58	134	56	147	30	--	--
C-5, C-6	8260C	Water	Chloroform	A	0.072	0.5	µg/L	70	129	64	133	30	--	--
C-5, C-6	8260C	Water	Chloromethane	A	0.068	0.5	µg/L	34	130	49	127	30	--	--
C-5, C-6	8260C	Water	cis-1,2-Dichloroethene	A	0.067	0.5	µg/L	71	118	61	139	30	--	--
C-5, C-6	8260C	Water	cis-1,3-Dichloropropene	A	0.18	0.5	µg/L	62	132	66	134	30	--	--
C-5, C-6	8260C	Water	Dibromochloromethane	A	0.14	0.5	µg/L	67	126	68	125	30	--	--
C-5, C-6	8260C	Water	1,2-Dibromo-3-chloropropane	A	0.2	2	µg/L	55	132	59	133	30	--	--
C-5, C-6	8260C	Water	Dichlorodifluoromethane	A	0.13	0.5	µg/L	32	124	29	133	30	--	--
C-5, C-6	8260C	Water	Ethylbenzene	A	0.05	0.5	µg/L	67	121	66	136	30	--	--
C-5, C-6	8260C	Water	Isopropylbenzene	A	0.051	2	µg/L	67	129	58	144	30	--	--
C-5, C-6	8260C	Water	Methylene Chloride	A	0.1	2	µg/L	71	122	70	133	30	--	--
C-5, C-6	8260C	Water	Methyl tert-Butyl Ether*	A	0.11	0.5	µg/L	54	126	54	126	30	--	--

Table 7-3

ALS - Kelso Laboratories (Formerly CAS)
Laboratory Accuracy and Precision Objectives
for VOCs in Groundwater and Soil
Multi-Area QAPP
Weyerhaeuser Company
Allied Paper, Inc,/Portage Creek/Kalamazoo River Superfund Site

								LCS[1]		MS/MSD[1]			Surrogate Recovery[1]	
SOP ID	Method	Matrix	Analyte	Type	MDL[1]	RL	Units	LCL	UCL	LCL	UCL	%RPD	LCL	UCL
C-5, C-6	8260C	Water	Styrene	A	0.089	0.5	µg/L	74	121	66	131	30	--	--
C-5, C-6	8260C	Water	Tetrachloroethene	A	0.099	0.5	µg/L	62	126	61	131	30	--	--
C-5, C-6	8260C	Water	Toluene	A	0.054	0.5	µg/L	69	124	71	136	30	--	--
C-5, C-6	8260C	Water	trans-1,2-Dichloroethene	A	0.072	0.5	µg/L	67	125	65	143	30	--	--
C-5, C-6	8260C	Water	trans-1,3-Dichloropropene	A	0.068	0.5	µg/L	59	125	56	127	30	--	--
C-5, C-6	8260C	Water	Trichloroethene	A	0.1	0.5	µg/L	67	128	53	139	30	--	--
C-5, C-6	8260C	Water	Trichlorofluoromethane	A	0.12	0.5	µg/L	52	141	45	124	30	--	--
C-5, C-6	8260C	Water	Vinyl Chloride	A	0.075	0.5	µg/L	55	123	49	136	30	--	--
C-5, C-6	8260C	Water	m,p-Xylenes	A	0.11	0.5	µg/L	69	121	67	135	30	--	--
C-5, C-6	8260C	Water	o-Xylene	A	0.074	0.5	µg/L	71	119	67	127	30	--	--
C-5, C-6	8260C	Water	4-Bromofluorobenzene	S	NA	NA	µg/L	--	--	--	--	--	68	117
C-5, C-6	8260C	Water	Dibromofluoromethane	S	NA	NA	µg/L	--	--	--	--	--	73	122
C-5, C-6	8260C	Water	Toluene-D8	S	NA	NA	µg/L	--	--	--	--	--	78	129
C-5, C-6	8260C	Soil-mid	1,1,1-Trichloroethane	A	7.5	50	µg/Kg	61	136	61	118	40	--	--
C-5, C-6	8260C	Soil-mid	1,1,2,2-Tetrachloroethane	A	16	50	µg/Kg	63	127	57	133	40	--	--
C-5, C-6	8260C	Soil-mid	1,1,2-Trichloroethane	A	14	50	µg/Kg	73	118	74	113	40	--	--
C-5, C-6	8260C	Soil-mid	1,1-Dichloroethane	A	7.7	50	µg/Kg	70	124	18	114	40	--	--
C-5, C-6	8260C	Soil-mid	1,1-Dichloroethene	A	8	50	µg/Kg	67	141	61	132	40	--	--
C-5, C-6	8260C	Soil-mid	1,2,4-Trichlorobenzene	A	9.6	200	µg/Kg	55	134	50	146	40	--	--
C-5, C-6	8260C	Soil-mid	1,2-Dibromoethane	A	10	200	µg/Kg	70	122	71	114	40	--	--
C-5, C-6	8260C	Soil-mid	1,2-Dichlorobenzene	A	12	50	µg/Kg	75	114	75	109	40	--	--
C-5, C-6	8260C	Soil-mid	1,2-Dichloroethane	A	8	50	µg/Kg	70	126	68	117	40	--	--
C-5, C-6	8260C	Soil-mid	1,2-Dichloropropane	A	9.5	50	µg/Kg	73	121	78	114	40	--	--
C-5, C-6	8260C	Soil-mid	1,3-Dichlorobenzene	A	10	50	µg/Kg	69	117	74	110	40	--	--
C-5, C-6	8260C	Soil-mid	1,4-Dichlorobenzene	A	12	50	µg/Kg	69	114	74	110	40	--	--
C-5, C-6	8260C	Soil-mid	2-Butanone	A	190	2000	µg/Kg	65	139	77	140	40	--	--
C-5, C-6	8260C	Soil-mid	2-Hexanone	A	270	2000	µg/Kg	54	123	58	118	40	--	--
C-5, C-6	8260C	Soil-mid	4-Methyl-2-pentanone	A	260	2000	µg/Kg	73	126	71	108	40	--	--
C-5, C-6	8260C	Soil-mid	Acetone	A	330	2000	µg/Kg	47	142	70	135	40	--	--
C-5, C-6	8260C	Soil-mid	Benzene	A	6.2	50	µg/Kg	70	134	66	123	40	--	--
C-5, C-6	8260C	Soil-mid	Bromodichloromethane	A	9.1	50	µg/Kg	76	128	63	129	40	--	--
C-5, C-6	8260C	Soil-mid	Bromoform	A	16	50	µg/Kg	54	141	43	149	40	--	--
C-5, C-6	8260C	Soil-mid	Bromomethane	A	10	50	µg/Kg	29	171	14	139	40	--	--
C-5, C-6	8260C	Soil-mid	Carbon Disulfide	A	6.9	50	µg/Kg	48	140	48	130	40	--	--

Table 7-3

ALS - Kelso Laboratories (Formerly CAS)
Laboratory Accuracy and Precision Objectives
for VOCs in Groundwater and Soil
Multi-Area QAPP
Weyerhaeuser Company
Allied Paper, Inc,/Portage Creek/Kalamazoo River Superfund Site

								LCS[1]		MS/MSD[1]			Surrogate Recovery[1]	
SOP ID	Method	Matrix	Analyte	Type	MDL[1]	RL	Units	LCL	UCL	LCL	UCL	%RPD	LCL	UCL
C-5, C-6	8260C	Soil-mid	Carbon Tetrachloride	A	9.6	50	µg/Kg	56	125	56	125	40	--	--
C-5, C-6	8260C	Soil-mid	Chlorobenzene	A	11	50	µg/Kg	72	115	70	115	40	--	--
C-5, C-6	8260C	Soil-mid	Chloroethane	A	16	50	µg/Kg	53	134	36	126	40	--	--
C-5, C-6	8260C	Soil-mid	Chloroform	A	7.2	50	µg/Kg	73	125	72	125	40	--	--
C-5, C-6	8260C	Soil-mid	Chloromethane	A	6.8	50	µg/Kg	50	121	43	126	40	--	--
C-5, C-6	8260C	Soil-mid	cis-1,2-Dichloroethene	A	6.7	50	µg/Kg	77	124	78	119	40	--	--
C-5, C-6	8260C	Soil-mid	cis-1,3-Dichloropropene	A	18	50	µg/Kg	57	132	51	133	40	--	--
C-5, C-6	8260C	Soil-mid	Dibromochloromethane	A	14	50	µg/Kg	64	126	53	132	40	--	--
C-5, C-6	8260C	Soil-mid	1,2-Dibromo-3-chloropropane	A	20	200	µg/Kg	46	132	40	150	40	--	--
C-5, C-6	8260C	Soil-mid	Dichlorodifluoromethane	A	5.3	50	µg/Kg	21	143	20	132	40	--	--
C-5, C-6	8260C	Soil-mid	Ethylbenzene	A	5	50	µg/Kg	72	121	68	121	40	--	--
C-5, C-6	8260C	Soil-mid	Isopropylbenzene	A	5.1	200	µg/Kg	68	121	65	138	40	--	--
C-5, C-6	8260C	Soil-mid	Methylene Chloride	A	10	200	µg/Kg	69	121	68	126	40	--	--
C-5, C-6	8260C	Soil-mid	Methyl tert-Butyl Ether*	A	11	50	µg/Kg	64	126	66	117	40	--	--
C-5, C-6	8260C	Soil-mid	Styrene	A	8.9	50	µg/Kg	77	122	64	141	40	--	--
C-5, C-6	8260C	Soil-mid	Tetrachloroethene	A	9.9	50	µg/Kg	65	126	64	124	40	--	--
C-5, C-6	8260C	Soil-mid	Toluene	A	5.4	50	µg/Kg	74	118	67	123	40	--	--
C-5, C-6	8260C	Soil-mid	trans-1,2-Dichloroethene	A	7.2	50	µg/Kg	76	128	69	115	40	--	--
C-5, C-6	8260C	Soil-mid	trans-1,3-Dichloropropene	A	6.8	50	µg/Kg	55	129	55	112	40	--	--
C-5, C-6	8260C	Soil-mid	Trichloroethene	A	10	50	µg/Kg	69	126	62	119	40	--	--
C-5, C-6	8260C	Soil-mid	Trichlorofluoromethane	A	12	50	µg/Kg	42	119	45	117	40	--	--
C-5, C-6	8260C	Soil-mid	Vinyl Chloride	A	7.5	50	µg/Kg	53	125	49	127	40	--	--
C-5, C-6	8260C	Soil-mid	m,p-Xylenes	A	9.1	50	µg/Kg	74	124	66	122	40	--	--
C-5, C-6	8260C	Soil-mid	o-Xylene	A	7.4	50	µg/Kg	73	123	73	120	40	--	--
C-5, C-6	8260C	Soil-mid	4-Bromofluorobenzene	S	NA	NA	µg/Kg	--	--	--	--	--	58	136
C-5, C-6	8260C	Soil-mid	Dibromofluoromethane	S	NA	NA	µg/Kg	--	--	--	--	--	55	132
C-5, C-6	8260C	Soil-mid	Toluene-D8	S	NA	NA	µg/Kg	--	--	--	--	--	81	131

Notes:
[1] The laboratory MDLs and control limits provided are revised periodically by the laboratory. The MDLs and control limits used to evaluate data will be the current limits at the time of analysis as provided in laboratory data reports.

MDL - Method Detection Limit
RL - Report Limit
NA - Not Applicable
LCS - Laboratory Control Sample
MS/MSD - Matrix Spike/Matrix Spike Duplicate
RPD - Relative Percent Difference
LCL - Lower Control Limit (percent recovery)
UCL - Upper Control Limit (percent recovery)
A - Analyte
S - Surrogate

Table 7-4

ALS - Kelso Laboratories (Formerly CAS)
Laboratory Accuracy and Precision Objectives
for SVOCs in Groundwater and Soil
Multi-Area QAPP
Weyerhaeuser Company
Allied Paper, Inc,/Portage Creek/Kalamazoo River Superfund Site

								LCS[1]		MS/MSD[1]			Surrogate Recovery[1]	
SOP ID	Method	Matrix	Analyte	Type	MDL[1]	RL	Units	LCL	UCL	LCL	UCL	%RPD	LCL	UCL
C-20	8270D/3520C	Water	2,4,5-Trichlorophenol	A	0.38	10	µg/L	62	117	50	109	30	--	--
C-20	8270D/3520C	Water	2,4,6-Trichlorophenol	A	0.2	10	µg/L	63	117	59	104	30	--	--
C-20	8270D/3520C	Water	2,4-Dichlorophenol	A	0.3	10	µg/L	59	107	55	101	30	--	--
C-20	8270D/3520C	Water	2,4-Dimethylphenol	A	0.26	10	µg/L	32	100	13	122	30	--	--
C-20	8270D/3520C	Water	2,4-Dinitrotoluene	A	0.27	10	µg/L	61	126	54	119	30	--	--
C-20	8270D/3520C	Water	2-Chlorophenol	A	0.31	10	µg/L	59	101	43	103	30	--	--
C-20	8270D/3520C	Water	2-Methylnaphthalene	A	0.24	10	µg/L	57	106	49	99	30	--	--
C-20	8270D/3520C	Water	2-Methylphenol	A	0.33	10	µg/L	51	108	36	117	30	--	--
C-20	8270D/3520C	Water	2-Nitrophenol	A	0.37	10	µg/L	58	108	41	117	30	--	--
C-20	8270D/3520C	Water	3,3'-Dichlorobenzidine	A	0.27	25	µg/L	43	116	12	120	30	--	--
C-20	8270D/3520C	Water	2-Methyl-4,6-dinitrophenol	A	2.1	25	µg/L	51	127	52	118	30	--	--
C-20	8270D/3520C	Water	4-Chloro-3-methylphenol	A	0.49	10	µg/L	65	111	32	124	30	--	--
C-20	8270D/3520C	Water	4-Methylphenol	A	0.48	10	µg/L	47	118	47	118	30	--	--
C-20	8270D/3520C	Water	Acenaphthene	A	0.28	10	µg/L	61	110	37	119	30	--	--
C-20	8270D/3520C	Water	Acenaphthylene	A	0.24	10	µg/L	58	109	26	123	30	--	--
C-20	8270D/3520C	Water	Anthracene	A	0.61	10	µg/L	62	116	32	124	30	--	--
C-20	8270D/3520C	Water	Benz(a)anthracene	A	0.59	10	µg/L	69	113	31	132	30	--	--
C-20	8270D/3520C	Water	Benzo(a)pyrene	A	0.65	10	µg/L	57	124	24	131	30	--	--
C-20	8270D/3520C	Water	Benzo(b)fluoranthene	A	0.58	10	µg/L	66	117	30	136	30	--	--
C-20	8270D/3520C	Water	Benzo(g,h,i)perylene	A	0.81	10	µg/L	68	116	29	136	30	--	--
C-20	8270D/3520C	Water	Benzo(k)fluoranthene	A	0.83	10	µg/L	63	119	29	135	30	--	--
C-20	8270D/3520C	Water	Bis(2-chloroethyl) Ether	A	0.33	10	µg/L	56	104	36	112	30	--	--
C-20	8270D/3520C	Water	Bis(2-ethylhexyl) Phthalate	A	1.9	10	µg/L	64	122	10	197	30	--	--
C-20	8270D/3520C	Water	Butyl Benzyl Phthalate	A	0.47	10	µg/L	64	121	23	142	30	--	--
C-20	8270D/3520C	Water	Carbazole	A	0.36	10	µg/L	63	122	63	122	30	--	--
C-20	8270D/3520C	Water	Chrysene	A	0.79	10	µg/L	68	114	31	129	30	--	--
C-20	8270D/3520C	Water	Dibenz(a,h)anthracene	A	0.75	10	µg/L	65	121	66	109	30	--	--
C-20	8270D/3520C	Water	Dibenzofuran	A	0.33	10	µg/L	62	112	39	119	30	--	--
C-20	8270D/3520C	Water	Diethyl Phthalate	A	0.29	10	µg/L	55	119	44	132	30	--	--
C-20	8270D/3520C	Water	Dimethyl Phthalate	A	0.25	10	µg/L	64	119	57	115	30	--	--
C-20	8270D/3520C	Water	Di-n-butyl Phthalate	A	0.65	10	µg/L	65	126	31	142	30	--	--
C-20	8270D/3520C	Water	Di-n-octyl Phthalate	A	0.63	10	µg/L	60	131	32	142	30	--	--
C-20	8270D/3520C	Water	Fluoranthene	A	0.65	10	µg/L	52	128	31	136	30	--	--

Table 7-4

ALS - Kelso Laboratories (Formerly CAS)
Laboratory Accuracy and Precision Objectives
for SVOCs in Groundwater and Soil
Multi-Area QAPP
Weyerhaeuser Company
Allied Paper, Inc,/Portage Creek/Kalamazoo River Superfund Site

								LCS[1]		MS/MSD[1]			Surrogate Recovery[1]	
SOP ID	Method	Matrix	Analyte	Type	MDL[1]	RL	Units	LCL	UCL	LCL	UCL	%RPD	LCL	UCL
C-20	8270D/3520C	Water	Fluorene	A	0.32	10	µg/L	59	112	37	121	30	--	--
C-20	8270D/3520C	Water	Hexachlorobenzene	A	0.63	10	µg/L	63	117	26	134	30	--	--
C-20	8270D/3520C	Water	Hexachlorobutadiene	A	0.29	10	µg/L	47	106	25	108	30	--	--
C-20	8270D/3520C	Water	Hexachlorocyclopentadiene	A	1.2	10	µg/L	10	60	10	73	30	--	--
C-20	8270D/3520C	Water	Hexachloroethane	A	0.29	10	µg/L	50	100	37	93	30	--	--
C-20	8270D/3520C	Water	Indeno(1,2,3-cd)pyrene	A	0.68	10	µg/L	68	116	28	137	30	--	--
C-20	8270D/3520C	Water	Isophorone	A	0.25	10	µg/L	57	106	51	104	30	--	--
C-20	8270D/3520C	Water	Naphthalene	A	0.37	10	µg/L	60	98	44	100	30	--	--
C-20	8270D/3520C	Water	Nitrobenzene	A	0.57	10	µg/L	56	108	36	128	30	--	--
C-20	8270D/3520C	Water	N-Nitrosodi-n-propylamine	A	0.5	10	µg/L	56	112	46	112	30	--	--
C-20	8270D/3520C	Water	N-Nitrosodiphenylamine	A	0.48	10	µg/L	58	121	10	136	30	--	--
C-20	8270D/3520C	Water	Pentachlorophenol	A	2.4	25	µg/L	51	123	43	132	30	--	--
C-20	8270D/3520C	Water	Phenanthrene	A	0.48	10	µg/L	64	111	36	128	30	--	--
C-20	8270D/3520C	Water	Phenol	A	0.32	10	µg/L	52	104	10	147	30	--	--
C-20	8270D/3520C	Water	Pyrene	A	0.73	10	µg/L	53	124	19	138	30	--	--
C-20	8270D/3520C	Water	2,4,6-Tribromophenol	S	NA	NA	µg/L	--	--	--	--	--	46	127
C-20	8270D/3520C	Water	2-Fluorobiphenyl	S	NA	NA	µg/L	--	--	--	--	--	48	114
C-20	8270D/3520C	Water	2-Fluorophenol	S	NA	NA	µg/L	--	--	--	--	--	39	103
C-20	8270D/3520C	Water	Nitrobenzene-d5	S	NA	NA	µg/L	--	--	--	--	--	46	115
C-20	8270D/3520C	Water	Phenol-d6	S	NA	NA	µg/L	--	--	--	--	--	38	107
C-20	8270D/3520C	Water	Terphenyl-d14	S	NA	NA	µg/L	--	--	--	--	--	32	149
C-20	8270D/3541	Soil	2,4,5-Trichlorophenol	A	18	330	µg/Kg	46	103	27	115	40	--	--
C-20	8270D/3541	Soil	2,4,6-Trichlorophenol	A	14	330	µg/Kg	46	101	39	106	40	--	--
C-20	8270D/3541	Soil	2,4-Dichlorophenol	A	16	330	µg/Kg	43	94	29	106	40	--	--
C-20	8270D/3541	Soil	2,4-Dimethylphenol	A	15	330	µg/Kg	29	93	10	117	40	--	--
C-20	8270D/3541	Soil	2,4-Dinitrotoluene	A	15	330	µg/Kg	48	119	36	127	40	--	--
C-20	8270D/3541	Soil	2-Chlorophenol	A	9.9	330	µg/Kg	43	93	27	96	40	--	--
C-20	8270D/3541	Soil	2-Methylnaphthalene	A	11	330	µg/Kg	44	95	30	105	40	--	--
C-20	8270D/3541	Soil	2-Methylphenol	A	17	330	µg/Kg	44	96	14	103	40	--	--
C-20	8270D/3541	Soil	2-Nitrophenol	A	14	330	µg/Kg	44	95	31	102	40	--	--
C-20	8270D/3541	Soil	3,3'-Dichlorobenzidine	A	27	330	µg/Kg	50	112	10	120	40	--	--
C-20	8270D/3541	Soil	2-Methyl-4,6-dinitrophenol	A	140	2000	µg/Kg	41	119	10	138	40	--	--

Table 7-4

ALS - Kelso Laboratories (Formerly CAS)
Laboratory Accuracy and Precision Objectives
for SVOCs in Groundwater and Soil
Multi-Area QAPP
Weyerhaeuser Company
Allied Paper, Inc,/Portage Creek/Kalamazoo River Superfund Site

								LCS[1]		MS/MSD[1]			Surrogate Recovery[1]	
SOP ID	Method	Matrix	Analyte	Type	MDL[1]	RL	Units	LCL	UCL	LCL	UCL	%RPD	LCL	UCL
C-20	8270D/3541	Soil	4-Chloro-3-methylphenol	A	17	330	µg/Kg	44	101	34	100	40	--	--
C-20	8270D/3541	Soil	4-Methylphenol	A	17	330	µg/Kg	38	94	26	97	40	--	--
C-20	8270D/3541	Soil	Acenaphthene	A	13	330	µg/Kg	49	97	30	113	40	--	--
C-20	8270D/3541	Soil	Acenaphthylene	A	16	330	µg/Kg	48	105	46	108	40	--	--
C-20	8270D/3541	Soil	Anthracene	A	14	330	µg/Kg	53	106	48	111	40	--	--
C-20	8270D/3541	Soil	Benz(a)anthracene	A	12	330	µg/Kg	54	109	47	114	40	--	--
C-20	8270D/3541	Soil	Benzo(a)pyrene	A	20	330	µg/Kg	51	114	31	122	40	--	--
C-20	8270D/3541	Soil	Benzo(b)fluoranthene	A	17	330	µg/Kg	53	110	33	124	40	--	--
C-20	8270D/3541	Soil	Benzo(g,h,i)perylene	A	20	330	µg/Kg	50	110	26	126	40	--	--
C-20	8270D/3541	Soil	Benzo(k)fluoranthene	A	19	330	µg/Kg	52	112	36	117	40	--	--
C-20	8270D/3541	Soil	Bis(2-chloroethyl) Ether	A	12	330	µg/Kg	42	97	29	103	40	--	--
C-20	8270D/3541	Soil	Bis(2-ethylhexyl) Phthalate	A	19	330	µg/Kg	51	115	35	126	40	--	--
C-20	8270D/3541	Soil	Butyl Benzyl Phthalate	A	16	330	µg/Kg	53	114	36	129	40	--	--
C-20	8270D/3541	Soil	Carbazole	A	11	330	µg/Kg	52	113	29	127	40	--	--
C-20	8270D/3541	Soil	Chrysene	A	12	330	µg/Kg	53	109	33	121	40	--	--
C-20	8270D/3541	Soil	Dibenz(a,h)anthracene	A	27	330	µg/Kg	53	114	30	127	40	--	--
C-20	8270D/3541	Soil	Dibenzofuran	A	12	330	µg/Kg	47	101	35	112	40	--	--
C-20	8270D/3541	Soil	Diethyl Phthalate	A	14	330	µg/Kg	45	121	23	131	40	--	--
C-20	8270D/3541	Soil	Dimethyl Phthalate	A	16	330	µg/Kg	48	113	28	124	40	--	--
C-20	8270D/3541	Soil	Di-n-butyl Phthalate	A	12	330	µg/Kg	52	117	28	144	30	--	--
C-20	8270D/3541	Soil	Di-n-octyl Phthalate	A	24	330	µg/Kg	51	121	36	136	40	--	--
C-20	8270D/3541	Soil	Fluoranthene	A	11	330	µg/Kg	47	117	34	142	40	--	--
C-20	8270D/3541	Soil	Fluorene	A	13	330	µg/Kg	46	103	31	116	40	--	--
C-20	8270D/3541	Soil	Hexachlorobenzene	A	15	330	µg/Kg	50	109	37	119	40	--	--
C-20	8270D/3541	Soil	Hexachlorobutadiene	A	14	330	µg/Kg	42	99	27	107	40	--	--
C-20	8270D/3541	Soil	Hexachlorocyclopentadiene	A	12	330	µg/Kg	10	68	10	79	40	--	--
C-20	8270D/3541	Soil	Hexachloroethane	A	22	330	µg/Kg	40	96	25	102	40	--	--
C-20	8270D/3541	Soil	Indeno(1,2,3-cd)pyrene	A	39	330	µg/Kg	53	112	29	132	40	--	--
C-20	8270D/3541	Soil	Isophorone	A	14	330	µg/Kg	42	93	33	103	40	--	--
C-20	8270D/3541	Soil	Naphthalene	A	14	330	µg/Kg	44	92	31	103	40	--	--
C-20	8270D/3541	Soil	Nitrobenzene	A	26	330	µg/Kg	46	99	34	99	40	--	--
C-20	8270D/3541	Soil	N-Nitrosodi-n-propylamine	A	19	330	µg/Kg	46	103	32	107	40	--	--
C-20	8270D/3541	Soil	N-Nitrosodiphenylamine	A	18	330	µg/Kg	44	113	35	112	40	--	--

Table 7-4

ALS - Kelso Laboratories (Formerly CAS)
Laboratory Accuracy and Precision Objectives
for SVOCs in Groundwater and Soil
Multi-Area QAPP
Weyerhaeuser Company
Allied Paper, Inc,/Portage Creek/Kalamazoo River Superfund Site

								LCS[1]		MS/MSD[1]			Surrogate Recovery[1]	
SOP ID	**Method**	**Matrix**	**Analyte**	**Type**	**MDL[1]**	**RL**	**Units**	**LCL**	**UCL**	**LCL**	**UCL**	**%RPD**	**LCL**	**UCL**
C-20	8270D/3541	Soil	Pentachlorophenol	A	130	2000	µg/Kg	44	109	10	135	40	--	--
C-20	8270D/3541	Soil	Phenanthrene	A	10	330	µg/Kg	52	108	35	119	40	--	--
C-20	8270D/3541	Soil	Phenol	A	19	330	µg/Kg	40	87	18	106	40	--	--
C-20	8270D/3541	Soil	Pyrene	A	14	330	µg/Kg	53	124	26	130	40	--	--
C-20	8270D/3541	Soil	2,4,6-Tribromophenol	S	NA	NA	µg/Kg	--	--	--	--	--	20	123
C-20	8270D/3541	Soil	2-Fluorobiphenyl	S	NA	NA	µg/Kg	--	--	--	--	--	32	104
C-20	8270D/3541	Soil	2-Fluorophenol	S	NA	NA	µg/Kg	--	--	--	--	--	20	83
C-20	8270D/3541	Soil	Nitrobenzene-d5	S	NA	NA	µg/Kg	--	--	--	--	--	29	116
C-20	8270D/3541	Soil	Phenol-d6	S	NA	NA	µg/Kg	--	--	--	--	--	26	106
C-20	8270D/3541	Soil	Terphenyl-d14	S	NA	NA	µg/Kg	--	--	--	--	--	37	133

Notes:
[1] The laboratory MDLs and control limits provided are revised periodically by the laboratory. The MDLs and control limits used to evaluate data will be the current limits at the time of analysis as provided in laboratory data reports.

MDL - Method Detection Limit
RL - Report Limit
NA - Not Applicable
LCS - Laboratory Control Sample
MS/MSD - Matrix Spike/Matrix Spike Duplicate
RPD - Relative Percent Difference
LCL - Lower Control Limit (percent recovery)
UCL - Upper Control Limit (percent recovery)
A - Analyte
S - Surrogate

Table 7-5

ALS - Kelso Laboratories (Formerly CAS)
Laboratory Accuracy and Precision Objectives
for TPH in Groundwater and Soil
Multi-Area QAPP
Weyerhaeuser Company
Allied Paper, Inc,/Portage Creek/Kalamazoo River Superfund Site

								LCS[1]		MS/MSD[1]			Surrogate Recovery[1]	
SOP ID	**Method**	**Matrix**	**Analyte**	**Type**	**MDL[1]**	**RL**	**Units**	**LCL**	**UCL**	**LCL**	**UCL**	**%RPD**	**LCL**	**UCL**
C-23	8015C	Water	Diesel Range Organics	A	19	100	µg/L	61	149	46	140	30	--	--
C-23	8015C	Water	Residual Range Organics	A	19	100	µg/L	67	127	49	132	30	--	--
C-23	8015C	Water	o-Terphenyl	S	NA	NA	µg/L	--	--	--	--	--	55	133
C-23	8015C	Soil	Diesel Range Organics	A	1.6	25	mg/kg	42	134	23	144	40	--	--
C-23	8015C	Soil	Residual Range Organics	A	2.9	25	mg/kg	48	141	29	167	40	--	--
C-23	8015C	Soil	o-Terphenyl	S	NA	NA	mg/kg	--	--	--	--	--	51	126
C-22	8015C	Water	Gasoline Range Organics	A	13	50	µg/L	85	121	71	131	30	--	--
C-22	8015C	Water	4-Bromofluorobenzene	S	NA	NA	%	--	--	--	--	--	80	107
C-22	8015C	Soil	Gasoline Range Organics	A	1.3	5	mg/kg	76	123	68	120	40	--	--
C-22	8015C	Soil	4-Bromofluorobenzene	S	NA	NA	%	--	--	--	--	--	83	119

Notes:
[1] The laboratory MDLs and control limits provided are revised periodically by the laboratory. The MDLs and control limits used to evaluate data will be the current limits at the time of analysis as provided in laboratory data reports.

MDL - Method Detection Limit
RL - Report Limit
NA - Not Applicable
LCS - Laboratory Control Sample
MS/MSD - Matrix Spike/Matrix Spike Duplicate
RPD - Relative Percent Difference
LCL - Lower Control Limit (percent recovery)
UCL - Upper Control Limit (percent recovery)
A - Analyte
S - Surrogate

Table 7-6

ALS - Holland Laboratories
Laboratory Accuracy and Precision Objectives
for PCBs in Groundwater and Soil
Multi-Area QAPP
Weyerhaeuser Company
Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site

								LCS[1]		MS/MSD[1]			Surrogate Recovery[1]	
SOP ID	Method	Matrix	Analyte	Type	MDL[1]	RL	Units	LCL	UCL	LCL	UCL	%RPD	LCL	UCL
A-14	E608	Water	Aroclor 1016	A	0.06	0.2	µg/L	50	130	40	140	50	--	--
A-14	E608	Water	Aroclor 1221	A	0.06	0.2	µg/L	--	--	--	--	--	--	--
A-14	E608	Water	Aroclor 1232	A	0.06	0.2	µg/L	--	--	--	--	--	--	--
A-14	E608	Water	Aroclor 1242	A	0.06	0.2	µg/L	--	--	--	--	--	--	--
A-14	E608	Water	Aroclor 1248	A	0.06	0.2	µg/L	--	--	--	--	--	--	--
A-14	E608	Water	Aroclor 1254	A	0.06	0.2	µg/L	--	--	--	--	--	--	--
A-14	E608	Water	Aroclor 1260	A	0.06	0.2	µg/L	50	130	40	140	50	--	--
A-14	E608	Water	Aroclor 1262	A	0.03	0.2	µg/L	--	--	--	--	--	--	--
A-14	E608	Water	Aroclor 1268	A	0.03	0.2	µg/L	--	--	--	--	--	--	--
A-14	E608	Water	Decachlorobiphenyl	S	NA	NA	µg/L	--	--	--	--	--	40	110
A-10,14	SW8082	Water	Aroclor 1016	A	0.13	0.2	µg/L	50	130	40	140	50	--	--
A-10,14	SW8082	Water	Aroclor 1221	A	0.13	0.2	µg/L	--	--	--	--	--	--	--
A-10,14	SW8082	Water	Aroclor 1232	A	0.13	0.2	µg/L	--	--	--	--	--	--	--
A-10,14	SW8082	Water	Aroclor 1242	A	0.13	0.2	µg/L	--	--	--	--	--	--	--
A-10,14	SW8082	Water	Aroclor 1248	A	0.13	0.2	µg/L	--	--	--	--	--	--	--
A-10,14	SW8082	Water	Aroclor 1254	A	0.025	0.2	µg/L	--	--	--	--	--	--	--
A-10,14	SW8082	Water	Aroclor 1260	A	0.025	0.2	µg/L	50	130	40	140	50	--	--
A-10,14	SW8082	Water	Decachlorobiphenyl	S	NA	NA	µg/L	--	--	--	--	--	40	110
A-10,14	SW8082	Water	Tetrachloro-m-xylene	S	NA	NA	µg/L	--	--	--	--	--	40	110
A-14	SW8082	Soil	Aroclor 1016	A	35.59	40	µg/Kg	50	130	40	140	50	--	--
A-14	SW8082	Soil	Aroclor 1221	A	35.59	40	µg/Kg	--	--	--	--	--	--	--
A-14	SW8082	Soil	Aroclor 1232	A	35.59	40	µg/Kg	--	--	--	--	--	--	--
A-14	SW8082	Soil	Aroclor 1242	A	35.59	40	µg/Kg	--	--	--	--	--	--	--
A-14	SW8082	Soil	Aroclor 1248	A	35.59	40	µg/Kg	--	--	--	--	--	--	--
A-14	SW8082	Soil	Aroclor 1254	A	11.16	40	µg/Kg	--	--	--	--	--	--	--
A-14	SW8082	Soil	Aroclor 1260	A	11.16	40	µg/Kg	50	130	40	140	50	--	--
A-14	SW8082	Soil	Decachlorobiphenyl	S	NA	NA	µg/Kg	--	--	--	--	--	40	140
A-14	SW8082	Soil	Tetrachloro-m-xylene	S	NA	NA	µg/Kg	--	--	--	--	--	45	124

Notes:
[1] The laboratory MDLs and control limits provided are revised periodically by the laboratory. The MDLs and control limits used to evaluate data will be the current limits at the time of analysis as provided in laboratory data reports.

MDL - Method Detection Limit
RL - Report Limit
NA - Not Applicable
LCS - Laboratory Control Sample
MS/MSD - Matrix Spike/Matrix Spike Duplicate
RPD - Relative Percent Difference
LCL - Lower Control Limit (percent recovery)
UCL - Upper Control Limit (percent recovery)
A - Analyte
S - Surrogate

Table 7-7

ALS - Holland Laboratories
Laboratory Accuracy and Precision Objectives
for Metals and Inorganics in Groundwater and Soil
Multi-Area QAPP
Weyerhaeuser Company
Allied Paper, Inc,/Portage Creek/Kalamazoo River Superfund Site

								LCS[1]		MS/MSD[1]			Surrogate Recovery[1]	
SOP ID	Method	Matrix	Analyte	Type	MDL[1]	RL	Units	LCL	UCL	LCL	UCL	%RPD	LCL	UCL
A-20,21	SW6020A	Water	Aluminum	A	0.782	10	µg/L	80	120	75	125	20	--	--
A-20,21	SW6020A	Water	Antimony	A	0.036	5	µg/L	80	120	75	125	20	--	--
A-20,21	SW6020A	Water	Arsenic	A	0.584	5	µg/L	80	120	75	125	20	--	--
A-20,21	SW6020A	Water	Barium	A	0.063	5	µg/L	80	120	75	125	20	--	--
A-20,21	SW6020A	Water	Beryllium	A	0.082	2	µg/L	80	120	75	125	20	--	--
A-20,21	SW6020A	Water	Cadmium	A	0.045	2	µg/L	80	120	75	125	20	--	--
A-20,21	SW6020A	Water	Calcium	A	7.456	500	µg/L	80	120	75	125	20	--	--
A-20,21	SW6020A	Water	Chromium, Total	A	0.27	5	µg/L	80	120	75	125	20	--	--
A-36	Calculation	Water	Chromium, Trivalent	A	NA	5	µg/L	--	--	--	--	--	--	--
A-36	SW7196A	Water	Chromium, Hexavalent	A	5	5	µg/L	80	120	75	125	30	--	--
A-20,21	SW6020A	Water	Cobalt	A	0.041	5	µg/L	80	120	75	125	20	--	--
A-20,21	SW6020A	Water	Copper	A	0.528	5	µg/L	80	120	75	125	20	--	--
A-20,21	SW6020A	Water	Hardness (Calculation)	A	40	2000	µg/L	80	120	75	125	20	--	--
A-20,21	SW6020A	Water	Iron	A	5.331	80	µg/L	80	120	75	125	20	--	--
A-20,21	SW6020A	Water	Lead	A	0.051	5	µg/L	80	120	75	125	20	--	--
A-20,21	SW6020A	Water	Magnesium	A	5.452	200	µg/L	80	120	75	125	20	--	--
A-20,21	SW6020A	Water	Manganese	A	0.054	5	µg/L	80	120	75	125	20	--	--
A-24	E1631E	Water	Low Level Mercury	A	0.07	0.5	ng/L	77	123	71	125	24	--	--
A-23	SW7470	Water	Mercury	A	0.1	0.2	µg/L	80	120	75	125	20	--	--
A-20,21	SW6020A	Water	Nickel	A	0.253	5	µg/L	80	120	75	125	20	--	--
A-20,21	SW6020A	Water	Potassium	A	10	200	µg/L	80	120	75	125	20	--	--
A-20,21	SW6020A	Water	Selenium	A	0.643	5	µg/L	80	120	75	125	20	--	--
A-20,21	SW6020A	Water	Silver	A	0.042	5	µg/L	80	120	75	125	20	--	--
A-20,21	SW6020A	Water	Sodium	A	10	200	µg/L	80	120	75	125	20	--	--
A-20,21	SW6020A	Water	Thallium	A	0.062	5	µg/L	80	120	75	125	20	--	--
A-20,21	SW6020A	Water	Vanadium	A	0.163	5	µg/L	80	120	75	125	20	--	--
A-20,21	SW6020A	Water	Zinc	A	0.479	10	µg/L	80	120	75	125	20	--	--
A-30	SW9012A	Water	Cyanide, Amenable	A	1	5	µg/L	83	120	70	130	30	--	--

Table 7-7

ALS - Holland Laboratories
Laboratory Accuracy and Precision Objectives
for Metals and Inorganics in Groundwater and Soil
Multi-Area QAPP
Weyerhaeuser Company
Allied Paper, Inc,/Portage Creek/Kalamazoo River Superfund Site

								LCS[1]		MS/MSD[1]			Surrogate Recovery[1]	
SOP ID	Method	Matrix	Analyte	Type	MDL[1]	RL	Units	LCL	UCL	LCL	UCL	%RPD	LCL	UCL
A-19,21	SW6020A	Soil	Aluminum	A	60	500	µg/Kg	80	120	75	125	25	--	--
A-19,21	SW6020A	Soil	Antimony	A	1	250	µg/Kg	80	120	75	125	25	--	--
A-19,21	SW6020A	Soil	Arsenic	A	30	250	µg/Kg	80	120	75	125	25	--	--
A-19,21	SW6020A	Soil	Barium	A	7	250	µg/Kg	80	120	75	125	25	--	--
A-19,21	SW6020A	Soil	Beryllium	A	2	100	µg/Kg	80	120	75	125	25	--	--
A-19,21	SW6020A	Soil	Cadmium	A	1	100	µg/Kg	80	120	75	125	25	--	--
A-19,21	SW6020A	Soil	Chromium	A	40	250	µg/Kg	80	120	75	125	25	--	--
A-19,21	SW6020A	Soil	Cobalt	A	1	250	µg/Kg	80	120	75	125	25	--	--
A-19,21	SW6020A	Soil	Copper	A	40	250	µg/Kg	80	120	75	125	25	--	--
A-19,21	SW6020A	Soil	Iron	A	830	4000	µg/Kg	80	120	75	125	25	--	--
A-19,21	SW6020A	Soil	Lead	A	1	250	µg/Kg	80	120	75	125	25	--	--
A-19,21	SW6020A	Soil	Magnesium	A	270	10000	µg/Kg	80	120	75	125	25	--	--
A-19,21	SW6020A	Soil	Manganese	A	20	250	µg/Kg	80	120	75	125	25	--	--
A-22	SW7471	Soil	Mercury	A	1	20	µg/Kg	80	120	75	125	35	--	--
A-19,21	SW6020A	Soil	Nickel	A	20	250	µg/Kg	80	120	75	125	25	--	--
A-19,21	SW6020A	Soil	Selenium	A	30	250	µg/Kg	80	120	75	125	25	--	--
A-19,21	SW6020A	Soil	Silver	A	1	250	µg/Kg	80	120	75	125	25	--	--
A-19,21	SW6020A	Soil	Sodium	A	870	10000	µg/Kg	80	120	75	125	25	--	--
A-19,21	SW6020A	Soil	Thallium	A	6	250	µg/Kg	80	120	75	125	25	--	--
A-19,21	SW6020A	Soil	Vanadium	A	10	250	µg/Kg	80	120	75	125	25	--	--
A-19,21	SW6020A	Soil	Zinc	A	20	500	µg/Kg	80	120	75	125	25	--	--
A-30	SW9012A	Soil	Cyanide, Total	A	20	500	µg/Kg	85	119	70	130	30	--	--
A-28	A4500-NH3 G-97	Soil	Ammonia as Nitrogen	A	10740	15000	µg NH3-N/Kg	70	130	70	130	30	--	--
A-37	A4500-NO2 B	Soil	Nitrogen, Nitrite	A	9	700	µg/Kg	80	120	75	125	20	--	--
A-27	E353.2	Soil	Nitrogen, Nitrate	A	130	1000	µg/Kg	80	120	75	125	35	--	--
A-25	E365.1 R2.0	Soil	Phosphorus, Total	A	60	1000	µg/Kg	90	110	90	110	20	--	--

Notes:
[1] The laboratory MDLs and control limits provided are revised periodically by the laboratory. The MDLs and control limits used to evaluate data will be the current limits at the time of analysis as provided in laboratory data reports.

MDL - Method Detection Limit
RL - Report Limit
NA - Not Applicable
LCS - Laboratory Control Sample
MS/MSD - Matrix Spike/Matrix Spike Duplicate
RPD - Relative Percent Difference
LCL - Lower Control Limit (percent recovery)
UCL - Upper Control Limit (percent recovery)
A - Analyte
S - Surrogate

Table 7-8

ALS - Holland Laboratories
Laboratory Accuracy and Precision Objectives
for SVOCs in Groundwater and Soil
Multi-Area QAPP
Weyerhaeuser Company
Allied Paper, Inc,/Portage Creek/Kalamazoo River Superfund Site

								LCS[1]		MS/MSD[1]			Surrogate Recovery[1]	
SOP ID	Method	Matrix	Analyte	Type	MDL[1]	RL	Units	LCL	UCL	LCL	UCL	%RPD	LCL	UCL
A-10,11	SW8270	Water	2,4,5-Trichlorophenol	A	0.11	5	µg/L	50	110	50	110	30	--	--
A-10,11	SW8270	Water	2,4,6-Trichlorophenol	A	0.1	5	µg/L	50	115	50	115	30	--	--
A-10,11	SW8270	Water	2,4-Dichlorophenol	A	0.21	10	µg/L	50	105	50	105	30	--	--
A-10,11	SW8270	Water	2,4-Dimethylphenol	A	0.24	5	µg/L	30	110	30	110	30	--	--
A-10,11	SW8270	Water	2,4-Dinitrotoluene	A	0.78	5	µg/L	50	120	50	120	30	--	--
A-10,11	SW8270	Water	2-Chlorophenol	A	0.72	5	µg/L	35	105	35	105	30	--	--
A-10,11	SW8270	Water	2-Methylnaphthalene	A	0.12	5	µg/L	45	105	45	105	30	--	--
A-10,11	SW8270	Water	2-Methylphenol	A	0.6	5	µg/L	40	110	40	110	30	--	--
A-10,11	SW8270	Water	2-Nitrophenol	A	0.18	5	µg/L	40	115	40	115	30	--	--
A-10,11	SW8270	Water	3,3´-Dichlorobenzidine	A	0.53	5	µg/L	**	**	**	**	**	--	--
A-10,11	SW8270	Water	4,6-Dinitro-2-methylphenol	A	0.34	20	µg/L	40	130	40	130	30	--	--
A-10,11	SW8270	Water	4-Chloro-3-methylphenol	A	0.64	5	µg/L	45	110	45	110	30	--	--
A-10,11	SW8270	Water	4-Methylphenol	A	0.55	5	µg/L	30	110	30	110	30	--	--
A-10,11	SW8270	Water	Acenaphthene	A	0.11	5	µg/L	45	110	45	110	30	--	--
A-10,11	SW8270	Water	Acenaphthylene	A	0.12	5	µg/L	50	105	50	105	30	--	--
A-10,11	SW8270	Water	Anthracene	A	0.72	5	µg/L	55	110	55	110	30	--	--
A-10,11	SW8270	Water	Benzo(a)anthracene	A	0.57	5	µg/L	55	110	55	110	30	--	--
A-10,11	SW8270	Water	Benzo(a)pyrene	A	0.1	5	µg/L	55	110	55	110	30	--	--
A-10,11	SW8270	Water	Benzo(b)fluoranthene	A	0.73	5	µg/L	45	120	45	120	30	--	--
A-10,11	SW8270	Water	Benzo(g,h,i)perylene	A	0.7	5	µg/L	40	125	40	125	30	--	--
A-10,11	SW8270	Water	Benzo(k)fluoranthene	A	0.17	5	µg/L	45	125	45	125	30	--	--
A-10,11	SW8270	Water	Bis(2-chloroethyl)ether	A	0.11	5	µg/L	35	110	35	110	30	--	--
A-10,11	SW8270	Water	Bis(2-ethylhexyl)phthalate	A	0.11	5	µg/L	40	125	40	125	30	--	--
A-10,11	SW8270	Water	Butyl benzyl phthalate	A	0.1	5	µg/L	45	115	45	115	30	--	--
A-10,11	SW8270	Water	Carbazole	A	0.83	10	µg/L	50	150	50	150	30	--	--
A-10,11	SW8270	Water	Chrysene	A	0.71	5	µg/L	55	110	55	110	30	--	--
A-10,11	SW8270	Water	Dibenzo(a,h)anthracene	A	0.67	5	µg/L	40	125	40	125	30	--	--
A-10,11	SW8270	Water	Dibenzofuran	A	0.11	5	µg/L	55	105	55	105	30	--	--
A-10,11	SW8270	Water	Diethyl phthalate	A	0.68	20	µg/L	40	120	40	120	30	--	--
A-10,11	SW8270	Water	Dimethyl phthalate	A	0.13	20	µg/L	25	125	25	125	30	--	--
A-10,11	SW8270	Water	Di-n-butyl phthalate	A	0.71	5	µg/L	55	115	55	115	30	--	--
A-10,11	SW8270	Water	Di-n-octyl phthalate	A	0.12	5	µg/L	35	135	35	135	30	--	--
A-10,11	SW8270	Water	Fluoranthene	A	0.77	5	µg/L	55	115	55	115	30	--	--

Table 7-8

ALS - Holland Laboratories
Laboratory Accuracy and Precision Objectives
for SVOCs in Groundwater and Soil
Multi-Area QAPP
Weyerhaeuser Company
Allied Paper, Inc,/Portage Creek/Kalamazoo River Superfund Site

								LCS[1]		MS/MSD[1]			Surrogate Recovery[1]	
SOP ID	Method	Matrix	Analyte	Type	MDL[1]	RL	Units	LCL	UCL	LCL	UCL	%RPD	LCL	UCL
A-10,11	SW8270	Water	Fluorene	A	0.1	5	µg/L	50	110	50	110	30	--	--
A-10,11	SW8270	Water	Hexachlorobenzene	A	0.1	5	µg/L	50	110	50	110	30	--	--
A-10,11	SW8270	Water	Hexachlorobutadiene	A	0.12	5	µg/L	25	105	25	105	30	--	--
A-10,11	SW8270	Water	Hexachlorocyclopentadiene	A	0.18	20	µg/L	25	105	25	105	30	--	--
A-10,11	SW8270	Water	Hexachloroethane	A	0.12	5	µg/L	30	95	30	95	30	--	--
A-10,11	SW8270	Water	Indeno(1,2,3-cd)pyrene	A	0.69	5	µg/L	45	125	45	125	30	--	--
A-10,11	SW8270	Water	Isophorone	A	0.11	5	µg/L	50	110	50	110	30	--	--
A-10,11	SW8270	Water	Naphthalene	A	0.12	5	µg/L	40	100	40	100	30	--	--
A-10,11	SW8270	Water	Nitrobenzene	A	0.1	5	µg/L	45	110	45	110	30	--	--
A-10,11	SW8270	Water	N-Nitrosodi-n-propylamine	A	0.13	5	µg/L	35	130	35	130	30	--	--
A-10,11	SW8270	Water	N-Nitrosodiphenylamine	A	0.81	5	µg/L	50	110	50	110	30	--	--
A-10,11	SW8270	Water	Pentachlorophenol	A	0.11	20	µg/L	40	115	40	115	30	--	--
A-10,11	SW8270	Water	Phenanthrene	A	0.86	5	µg/L	50	115	50	115	30	--	--
A-10,11	SW8270	Water	Phenol	A	0.09	5	µg/L	12	43	12	43	30	--	--
A-10,11	SW8270	Water	Pyrene	A	0.65	5	µg/L	50	130	50	130	30	--	--
A-10,11	SW8270	Water	2,4,6-Tribromophenol	S	NA	NA	µg/L	--	--	--	--	--	38	115
A-10,11	SW8270	Water	2-Fluorobiphenyl	S	NA	NA	µg/L	--	--	--	--	--	32	100
A-10,11	SW8270	Water	2-Fluorophenol	S	NA	NA	µg/L	--	--	--	--	--	22	59
A-10,11	SW8270	Water	4-Terphenyl-d14	S	NA	NA	µg/L	--	--	--	--	--	23	112
A-10,11	SW8270	Water	Nitrobenzene-d5	S	NA	NA	µg/L	--	--	--	--	--	31	93
A-10,11	SW8270	Water	Phenol-d6	S	NA	NA	µg/L	--	--	--	--	--	13	36
A-16,11	SW8270	Soil	2,4,5-Trichlorophenol	A	7.97	160	µg/Kg	50	110	50	110	30	--	--
A-16,11	SW8270	Soil	2,4,6-Trichlorophenol	A	7.96	160	µg/Kg	45	110	45	110	30	--	--
A-16,11	SW8270	Soil	2,4-Dichlorophenol	A	9.71	160	µg/Kg	45	110	45	110	30	--	--
A-16,11	SW8270	Soil	2,4-Dimethylphenol	A	40.75	330	µg/Kg	30	105	30	105	30	--	--
A-16,11	SW8270	Soil	2,4-Dinitrotoluene	A	8.93	160	µg/Kg	50	115	50	115	30	--	--
A-16,11	SW8270	Soil	2-Chlorophenol	A	8.95	160	µg/Kg	45	105	45	105	30	--	--
A-16,11	SW8270	Soil	2-Methylnaphthalene	A	9.82	80	µg/Kg	45	105	45	105	30	--	--
A-16,11	SW8270	Soil	2-Methylphenol	A	9.62	160	µg/Kg	40	105	40	105	30	--	--
A-16,11	SW8270	Soil	2-Nitrophenol	A	8.7	160	µg/Kg	40	110	40	110	30	--	--
A-16,11	SW8270	Soil	3,3´-Dichlorobenzidine	A	9.33	660	µg/Kg	**	**	**	**	**	--	--
A-16,11	SW8270	Soil	4,6-Dinitro-2-methylphenol	A	48.1	330	µg/Kg	**	**	**	**	**	--	--

Table 7-8

ALS - Holland Laboratories
Laboratory Accuracy and Precision Objectives
for SVOCs in Groundwater and Soil
Multi-Area QAPP
Weyerhaeuser Company
Allied Paper, Inc,/Portage Creek/Kalamazoo River Superfund Site

								LCS[1]		MS/MSD[1]			Surrogate Recovery[1]	
SOP ID	Method	Matrix	Analyte	Type	MDL[1]	RL	Units	LCL	UCL	LCL	UCL	%RPD	LCL	UCL
A-16,11	SW8270	Soil	4-Chloro-3-methylphenol	A	9.03	160	µg/Kg	45	115	45	115	30	--	--
A-16,11	SW8270	Soil	4-Methylphenol	A	9.81	160	µg/Kg	40	105	40	105	30	--	--
A-16,11	SW8270	Soil	Acenaphthene	A	9.12	30	µg/Kg	45	110	45	110	30	--	--
A-16,11	SW8270	Soil	Acenaphthylene	A	9.46	30	µg/Kg	45	105	45	105	30	--	--
A-16,11	SW8270	Soil	Anthracene	A	10.17	30	µg/Kg	55	105	55	105	30	--	--
A-16,11	SW8270	Soil	Benzo(a)anthracene	A	12.17	30	µg/Kg	50	110	50	110	30	--	--
A-16,11	SW8270	Soil	Benzo(a)pyrene	A	15.44	30	µg/Kg	50	110	50	110	30	--	--
A-16,11	SW8270	Soil	Benzo(b)fluoranthene	A	16.11	30	µg/Kg	45	115	45	115	30	--	--
A-16,11	SW8270	Soil	Benzo(g,h,i)perylene	A	23.54	30	µg/Kg	40	125	40	125	30	--	--
A-16,11	SW8270	Soil	Benzo(k)fluoranthene	A	13.6	30	µg/Kg	45	115	45	115	30	--	--
A-16,11	SW8270	Soil	Bis(2-chloroethyl)ether	A	8.33	160	µg/Kg	40	105	40	105	30	--	--
A-16,11	SW8270	Soil	Bis(2-ethylhexyl)phthalate	A	9.9	330	µg/Kg	45	125	45	125	30	--	--
A-16,11	SW8270	Soil	Butyl benzyl phthalate	A	13.83	160	µg/Kg	50	125	50	125	30	--	--
A-16,11	SW8270	Soil	Carbazole	A	11.4	160	µg/Kg	50	150	50	150	30	--	--
A-16,11	SW8270	Soil	Chrysene	A	11.31	30	µg/Kg	55	110	55	110	30	--	--
A-16,11	SW8270	Soil	Dibenzo(a,h)anthracene	A	17.06	30	µg/Kg	40	125	40	125	30	--	--
A-16,11	SW8270	Soil	Dibenzofuran	A	9.13	160	µg/Kg	50	105	50	105	30	--	--
A-16,11	SW8270	Soil	Diethyl phthalate	A	8.3	330	µg/Kg	50	115	50	115	30	--	--
A-16,11	SW8270	Soil	Dimethyl phthalate	A	8.33	330	µg/Kg	50	110	50	110	30	--	--
A-16,11	SW8270	Soil	Di-n-butyl phthalate	A	10.04	330	µg/Kg	55	110	55	110	30	--	--
A-16,11	SW8270	Soil	Di-n-octyl phthalate	A	12.31	160	µg/Kg	40	130	40	130	30	--	--
A-16,11	SW8270	Soil	Fluoranthene	A	11.89	30	µg/Kg	55	115	55	115	30	--	--
A-16,11	SW8270	Soil	Fluorene	A	8.74	30	µg/Kg	50	110	50	110	30	--	--
A-16,11	SW8270	Soil	Hexachlorobenzene	A	9.09	160	µg/Kg	45	120	45	120	30	--	--
A-16,11	SW8270	Soil	Hexachlorobutadiene	A	8.44	160	µg/Kg	40	115	40	115	30	--	--
A-16,11	SW8270	Soil	Hexachlorocyclopentadiene	A	34.89	330	µg/Kg	40	115	40	115	30	--	--
A-16,11	SW8270	Soil	Hexachloroethane	A	8.74	160	µg/Kg	35	110	35	110	30	--	--
A-16,11	SW8270	Soil	Indeno(1,2,3-cd)pyrene	A	18.93	30	µg/Kg	40	120	40	120	30	--	--
A-16,11	SW8270	Soil	Isophorone	A	8.67	160	µg/Kg	45	110	45	110	30	--	--
A-16,11	SW8270	Soil	Naphthalene	A	8.53	30	µg/Kg	40	105	40	105	30	--	--
A-16,11	SW8270	Soil	Nitrobenzene	A	8.65	160	µg/Kg	40	115	40	115	30	--	--
A-16,11	SW8270	Soil	N-Nitrosodi-n-propylamine	A	8.74	160	µg/Kg	40	115	40	115	30	--	--
A-16,11	SW8270	Soil	N-Nitrosodiphenylamine	A	59.33	160	µg/Kg	50	115	50	115	30	--	--

Table 7-8

ALS - Holland Laboratories
Laboratory Accuracy and Precision Objectives
for SVOCs in Groundwater and Soil
Multi-Area QAPP
Weyerhaeuser Company
Allied Paper, Inc,/Portage Creek/Kalamazoo River Superfund Site

								LCS[1]		MS/MSD[1]			Surrogate Recovery[1]	
SOP ID	Method	Matrix	Analyte	Type	MDL[1]	RL	Units	LCL	UCL	LCL	UCL	%RPD	LCL	UCL
A-16,11	SW8270	Soil	Pentachlorophenol	A	14.75	330	µg/Kg	25	120	25	120	30	--	--
A-16,11	SW8270	Soil	Phenanthrene	A	30	30	µg/Kg	50	110	50	110	30	--	--
A-16,11	SW8270	Soil	Phenol	A	8.46	160	µg/Kg	40	100	40	100	30	--	--
A-16,11	SW8270	Soil	Pyrene	A	12.47	30	µg/Kg	45	125	45	125	30	--	--
A-16,11	SW8270	Soil	2,4,6-Tribromophenol	S	NA	NA	µg/Kg	--	--	--	--	--	34	140
A-16,11	SW8270	Soil	2-Fluorobiphenyl	S	NA	NA	µg/Kg	--	--	--	--	--	12	100
A-16,11	SW8270	Soil	2-Fluorophenol	S	NA	NA	µg/Kg	--	--	--	--	--	33	117
A-16,11	SW8270	Soil	4-Terphenyl-d14	S	NA	NA	µg/Kg	--	--	--	--	--	25	137
A-16,11	SW8270	Soil	Nitrobenzene-d5	S	NA	NA	µg/Kg	--	--	--	--	--	37	107
A-16,11	SW8270	Soil	Phenol-d6	S	NA	NA	µg/Kg	--	--	--	--	--	40	106

Notes:
[1] The laboratory MDLs and control limits provided are revised periodically by the laboratory. The MDLs and control limits used to evaluate data will be the current limits at the time of analysis as provided in laboratory data reports.

MDL - Method Detection Limit
RL - Report Limit
NA - Not Applicable
LCS - Laboratory Control Sample
MS/MSD - Matrix Spike/Matrix Spike Duplicate
RPD - Relative Percent Difference
LCL - Lower Control Limit (percent recovery)
UCL - Upper Control Limit (percent recovery)
** - Compound not in spike mixture
A - Analyte
S - Surrogate

Table 7-9

ALS - Holland Laboratories
Laboratory Accuracy and Precision Objectives
for VOCs in Groundwater and Soil
Multi-Area QAPP
Weyerhaeuser Company
Allied Paper, Inc,/Portage Creek/Kalamazoo River Superfund Site

								LCS[1]		MS/MSD[1]			Surrogate Recovery[1]	
SOP ID	Method	Matrix	Analyte	Type	MDL[1]	RL	Units	LCL	UCL	LCL	UCL	%RPD	LCL	UCL
A-8	SW8260C	Water	1,1,1-Trichloroethane	A	0.13	1	µg/L	65	130	65	130	30	--	--
A-8	SW8260C	Water	1,1,2,2-Tetrachloroethane	A	0.13	1	µg/L	65	130	65	130	30	--	--
A-8	SW8260C	Water	1,1,2-Trichloroethane	A	0.08	1	µg/L	75	125	75	125	30	--	--
A-8	SW8260C	Water	1,1-Dichloroethane	A	0.11	1	µg/L	70	135	70	135	30	--	--
A-8	SW8260C	Water	1,1-Dichloroethene	A	0.11	1	µg/L	70	130	70	130	30	--	--
A-8	SW8260C	Water	1,2,4-Trichlorobenzene	A	0.16	1	µg/L	65	135	65	135	30	--	--
A-8	SW8260C	Water	1,2-Dibromoethane	A	0.16	1	µg/L	80	120	80	120	30	--	--
A-8	SW8260C	Water	1,2-Dichlorobenzene	A	0.13	1	µg/L	70	120	70	120	30	--	--
A-8	SW8260C	Water	1,2-Dichloroethane	A	0.15	1	µg/L	70	130	70	130	30	--	--
A-8	SW8260C	Water	1,2-Dichloropropane	A	0.13	2	µg/L	75	125	75	125	30	--	--
A-8	SW8260C	Water	1,3-Dichlorobenzene	A	0.16	2	µg/L	75	125	75	125	30	--	--
A-8	SW8260C	Water	1,4-Dichlorobenzene	A	0.14	2	µg/L	75	125	75	125	30	--	--
A-8	SW8260C	Water	2-Butanone	A	0.22	5	µg/L	30	150	30	150	30	--	--
A-8	SW8260C	Water	2-Hexanone	A	0.11	5	µg/L	55	130	55	130	30	--	--
A-8	SW8260C	Water	4-Methyl-2-pentanone	A	0.09	5	µg/L	60	135	60	135	30	--	--
A-8	SW8260C	Water	Acetone	A	0.32	20	µg/L	40	140	40	140	30	--	--
A-8	SW8260C	Water	Benzene	A	0.18	1	µg/L	80	120	80	120	30	--	--
A-8	SW8260C	Water	Bromodichloromethane	A	0.12	1	µg/L	75	120	75	120	30	--	--
A-8	SW8260C	Water	Bromoform	A	0.14	1	µg/L	70	130	70	130	30	--	--
A-8	SW8260C	Water	Bromomethane	A	0.21	1	µg/L	30	145	30	145	30	--	--
A-8	SW8260C	Water	Carbon disulfide	A	0.17	2.5	µg/L	35	165	35	165	30	--	--
A-8	SW8260C	Water	Carbon tetrachloride	A	0.12	1	µg/L	65	140	65	140	30	--	--
A-8	SW8260C	Water	Chlorobenzene	A	0.12	1	µg/L	80	120	80	120	30	--	--
A-8	SW8260C	Water	Chloroethane	A	0.45	1	µg/L	60	135	60	135	30	--	--
A-8	SW8260C	Water	Chloroform	A	0.15	1	µg/L	65	135	65	135	30	--	--
A-8	SW8260C	Water	Chloromethane	A	0.16	1	µg/L	70	125	70	125	30	--	--
A-8	SW8260C	Water	cis-1,2-Dichloroethene	A	0.11	1	µg/L	70	125	70	125	30	--	--
A-8	SW8260C	Water	cis-1,3-Dichloropropene	A	0.08	1	µg/L	70	130	70	130	30	--	--
A-8	SW8260C	Water	Dibromochloromethane	A	0.13	1	µg/L	60	135	60	135	30	--	--
A-8	SW8260C	Water	1,2-Dibromo-3-chloropropane	A	0.31	1	µg/L	50	130	50	130	30	--	--
A-8	SW8260C	Water	Dibromomethane	A	0.17	1	µg/L	75	125	75	125	30	--	--
A-8	SW8260C	Water	Dichlorodifluoromethane	A	0.19	1	µg/L	30	155	30	155	30	--	--
A-8	SW8260C	Water	Ethylbenzene	A	0.13	1	µg/L	75	125	75	125	30	--	--
A-8	SW8260C	Water	Isopropylbenzene	A	0.13	1	µg/L	75	125	75	125	30	--	--

Table 7-9

ALS - Holland Laboratories
Laboratory Accuracy and Precision Objectives
for VOCs in Groundwater and Soil
Multi-Area QAPP
Weyerhaeuser Company
Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site

								LCS[1]		MS/MSD[1]			Surrogate Recovery[1]	
SOP ID	Method	Matrix	Analyte	Type	MDL[1]	RL	Units	LCL	UCL	LCL	UCL	%RPD	LCL	UCL
A-8	SW8260C	Water	Methyl tert-butyl ether	A	0.07	5	µg/L	65	125	65	125	30	--	--
A-8	SW8260C	Water	Methylene chloride	A	0.18	5	µg/L	55	140	55	140	30	--	--
A-8	SW8260C	Water	Styrene	A	0.1	1	µg/L	65	135	65	135	30	--	--
A-8	SW8260C	Water	Tetrachloroethene	A	0.15	2	µg/L	45	150	45	150	30	--	--
A-8	SW8260C	Water	Toluene	A	0.12	1	µg/L	75	120	75	120	30	--	--
A-8	SW8260C	Water	trans-1,2-Dichloroethene	A	0.12	1	µg/L	60	140	60	140	30	--	--
A-8	SW8260C	Water	trans-1,3-Dichloropropene	A	0.14	1	µg/L	55	140	55	140	30	--	--
A-8	SW8260C	Water	Trichloroethene	A	0.13	1	µg/L	70	125	70	125	30	--	--
A-8	SW8260C	Water	Trichlorofluoromethane	A	0.18	1	µg/L	60	145	60	145	30	--	--
A-8	SW8260C	Water	Vinyl chloride	A	0.17	1	µg/L	50	145	50	145	30	--	--
A-8	SW8260C	Water	m,p-Xylene	A	0.2	2	µg/L	75	130	75	130	30	--	--
A-8	SW8260C	Water	o-Xylene	A	0.08	1	µg/L	80	120	80	120	30	--	--
A-8	SW8260C	Water	1,2-Dichloroethane-d4	S	NA	NA	µg/L	--	--	--	--	--	70	120
A-8	SW8260C	Water	4-Bromofluorobenzene	S	NA	NA	µg/L	--	--	--	--	--	75	120
A-8	SW8260C	Water	Dibromofluoromethane	S	NA	NA	µg/L	--	--	--	--	--	85	115
A-8	SW8260C	Water	Toluene-d8	S	NA	NA	µg/L	--	--	--	--	--	85	120
A-7,9	SW8260B	Soil	1,1,1-Trichloroethane	A	11.42	30	µg/Kg	70	135	70	135	30	--	--
A-7,9	SW8260B	Soil	1,1,2,2-Tetrachloroethane	A	13.2	30	µg/Kg	55	130	55	130	30	--	--
A-7,9	SW8260B	Soil	1,1,2-Trichloroethane	A	10.61	30	µg/Kg	60	125	60	125	30	--	--
A-7,9	SW8260B	Soil	1,1-Dichloroethane	A	10.98	30	µg/Kg	75	125	75	125	30	--	--
A-7,9	SW8260B	Soil	1,1-Dichloroethene	A	12.6	30	µg/Kg	65	135	65	135	30	--	--
A-7,9	SW8260B	Soil	1,2,4-Trichlorobenzene	A	15.51	30	µg/Kg	65	130	65	130	30	--	--
A-7,9	SW8260B	Soil	1,2-Dibromoethane	A	11.83	30	µg/Kg	70	125	70	125	30	--	--
A-7,9	SW8260B	Soil	1,2-Dichlorobenzene	A	12	30	µg/Kg	75	120	75	120	30	--	--
A-7,9	SW8260B	Soil	1,2-Dichloroethane	A	14.23	30	µg/Kg	70	135	70	135	30	--	--
A-7,9	SW8260B	Soil	1,2-Dichloropropane	A	9.94	30	µg/Kg	70	120	70	120	30	--	--
A-7,9	SW8260B	Soil	1,3-Dichlorobenzene	A	12.02	30	µg/Kg	70	125	70	125	30	--	--
A-7,9	SW8260B	Soil	1,4-Dichlorobenzene	A	11.44	30	µg/Kg	70	125	70	125	30	--	--
A-7,9	SW8260B	Soil	2-Butanone	A	74.22	200	µg/Kg	30	160	30	160	30	--	--
A-7,9	SW8260B	Soil	2-Hexanone	A	7.36	30	µg/Kg	45	145	45	145	30	--	--
A-7,9	SW8260B	Soil	4-Methyl-2-pentanone	A	10.14	30	µg/Kg	45	145	45	145	30	--	--
A-7,9	SW8260B	Soil	Acetone	A	63.52	100	µg/Kg	20	160	20	160	30	--	--
A-7,9	SW8260B	Soil	Benzene	A	12.04	30	µg/Kg	75	125	75	125	30	--	--

Table 7-9

ALS - Holland Laboratories
Laboratory Accuracy and Precision Objectives
for VOCs in Groundwater and Soil
Multi-Area QAPP
Weyerhaeuser Company
Allied Paper, Inc,/Portage Creek/Kalamazoo River Superfund Site

								LCS[1]		MS/MSD[1]			Surrogate Recovery[1]	
SOP ID	Method	Matrix	Analyte	Type	MDL[1]	RL	Units	LCL	UCL	LCL	UCL	%RPD	LCL	UCL
A-7,9	SW8260B	Soil	Bromodichloromethane	A	6.73	30	µg/Kg	70	130	70	130	30	--	--
A-7,9	SW8260B	Soil	Bromoform	A	5.91	30	µg/Kg	55	135	55	135	30	--	--
A-7,9	SW8260B	Soil	Bromomethane	A	11.49	75	µg/Kg	30	160	30	160	30	--	--
A-7,9	SW8260B	Soil	Carbon disulfide	A	14.86	30	µg/Kg	45	160	45	160	30	--	--
A-7,9	SW8260B	Soil	Carbon tetrachloride	A	8.53	30	µg/Kg	65	135	65	135	30	--	--
A-7,9	SW8260B	Soil	Chlorobenzene	A	12.22	30	µg/Kg	75	125	75	125	30	--	--
A-7,9	SW8260B	Soil	Chloroethane	A	63.68	100	µg/Kg	40	155	40	155	30	--	--
A-7,9	SW8260B	Soil	Chloroform	A	12.36	30	µg/Kg	70	125	70	125	30	--	--
A-7,9	SW8260B	Soil	cis-1,2-Dichloroethylene	A	12.17	30	µg/Kg	65	125	65	125	30	--	--
A-7,9	SW8260B	Soil	cis-1,3-Dichloropropene	A	10.26	30	µg/Kg	70	125	70	125	30	--	--
A-7,9	SW8260B	Soil	Dibromochloromethane	A	5.55	30	µg/Kg	65	135	65	135	30	--	--
A-7,9	SW8260B	Soil	1,2-Dibromo-3-chloropropane	A	14.61	30	µg/Kg	40	135	40	135	30	--	--
A-7,9	SW8260B	Soil	Dichlorodifluoromethane	A	13.55	30	µg/Kg	35	135	35	135	30	--	--
A-7,9	SW8260B	Soil	Ethylbenzene	A	11.14	30	µg/Kg	75	125	75	125	30	--	--
A-7,9	SW8260B	Soil	Isopropylbenzene	A	12.92	30	µg/Kg	75	130	75	130	30	--	--
A-7,9	SW8260B	Soil	Methyl tert-butyl ether	A	12.7	30	µg/Kg	75	125	75	125	30	--	--
A-7,9	SW8260B	Soil	Methylene chloride	A	11.76	30	µg/Kg	55	145	55	145	30	--	--
A-7,9	SW8260B	Soil	Styrene	A	11.18	30	µg/Kg	75	125	75	125	30	--	--
A-7,9	SW8260B	Soil	Tetrachloroethene	A	13.36	30	µg/Kg	64	140	64	140	30	--	--
A-7,9	SW8260B	Soil	Toluene	A	11.26	30	µg/Kg	70	125	70	125	30	--	--
A-7,9	SW8260B	Soil	trans-1,2-Dichloroethene	A	9.24	30	µg/Kg	65	135	65	135	30	--	--
A-7,9	SW8260B	Soil	trans-1,3-Dichloropropene	A	10.04	30	µg/Kg	65	125	65	125	30	--	--
A-7,9	SW8260B	Soil	Trichloroethene	A	14.01	30	µg/Kg	75	125	75	125	30	--	--
A-7,9	SW8260B	Soil	Trichlorofluoromethane	A	8.26	30	µg/Kg	25	185	25	185	30	--	--
A-7,9	SW8260B	Soil	Vinyl chloride	A	13.54	30	µg/Kg	60	125	60	125	30	--	--
A-7,9	SW8260B	Soil	m,p-Xylene	A	22.72	60	µg/Kg	80	125	80	125	30	--	--
A-7,9	SW8260B	Soil	o-Xylene	A	12.73	30	µg/Kg	75	125	75	125	30	--	--
A-7,9	SW8260B	Soil	1,2-Dichloroethane-d4	S	NA	NA	µg/Kg	--	--	--	--	--	70	130
A-7,9	SW8260B	Soil	4-Bromofluorobenzene	S	NA	NA	µg/Kg	--	--	--	--	--	70	130
A-7,9	SW8260B	Soil	Dibromofluoromethane	S	NA	NA	µg/Kg	--	--	--	--	--	70	130
A-7,9	SW8260B	Soil	Toluene-d8	S	NA	NA	µg/Kg	--	--	--	--	--	70	130

Table 7-9

ALS - Holland Laboratories
Laboratory Accuracy and Precision Objectives
for VOCs in Groundwater and Soil
Multi-Area QAPP
Weyerhaeuser Company
Allied Paper, Inc,/Portage Creek/Kalamazoo River Superfund Site

								LCS[1]		MS/MSD[1]			Surrogate Recovery[1]	
SOP ID	**Method**	**Matrix**	**Analyte**	**Type**	**MDL[1]**	**RL**	**Units**	**LCL**	**UCL**	**LCL**	**UCL**	**%RPD**	**LCL**	**UCL**

Notes:
[1] The laboratory MDLs and control limits provided are revised periodically by the laboratory. The MDLs and control limits used to evaluate data will be the current limits at the time of analysis as provided in laboratory data reports.

MDL - Method Detection Limit
RL - Report Limit
NA - Not Applicable
LCS - Laboratory Control Sample
MS/MSD - Matrix Spike/Matrix Spike Duplicate
RPD - Relative Percent Difference
LCL - Lower Control Limit (percent recovery)
UCL - Upper Control Limit (percent recovery)
A - Analyte
S - Surrogate

Table 7-10

ALS - Houston Laboratories
Laboratory Accuracy and Precision Objectives
for PCDD/PCDF in Groundwater and Soil
Multi-Area QAPP
Weyerhaeuser Company
Allied Paper, Inc,/Portage Creek/Kalamazoo River Superfund Site

								LCS[1]		MS/MSD[1]			Surrogate Recovery[1]	
SOP ID	Method	Matrix	Analyte	Type	MDL[1]	RL	Units	LCL	UCL	LCL	UCL	%RPD	LCL	UCL
A-34,35	8290A	Soil	2,3,7,8-TCDD	A	0.0562	0.5	ng/Kg	67	158	67	158	20	--	--
A-34,35	8290A	Soil	1,2,3,7,8-PeCDD	A	0.0312	2.5	ng/Kg	70	142	70	142	20	--	--
A-34,35	8290A	Soil	1,2,3,4,7,8-HxCDD	A	0.0322	2.5	ng/Kg	70	164	70	164	20	--	--
A-34,35	8290A	Soil	1,2,3,6,7,8-HxCDD	A	0.0304	2.5	ng/Kg	76	134	76	134	20	--	--
A-34,35	8290A	Soil	1,2,3,7,8,9-HxCDD	A	0.0291	2.5	ng/Kg	64	162	64	162	20	--	--
A-34,35	8290A	Soil	1,2,3,4,6,7,8-HpCDD	A	0.0208	2.5	ng/Kg	70	140	70	140	20	--	--
A-34,35	8290A	Soil	OCDD	A	0.0381	5	ng/Kg	78	144	78	144	20	--	--
A-34,35	8290A	Soil	2,3,7,8-TCDF	A	0.0415	0.5	ng/Kg	75	158	75	158	20	--	--
A-34,35	8290A	Soil	1,2,3,7,8-PeCDF	A	0.0324	2.5	ng/Kg	80	134	80	134	20	--	--
A-34,35	8290A	Soil	2,3,4,7,8-PeCDF	A	0.0351	2.5	ng/Kg	68	160	68	160	20	--	--
A-34,35	8290A	Soil	1,2,3,4,7,8-HxCDF	A	0.0195	2.5	ng/Kg	72	134	72	134	20	--	--
A-34,35	8290A	Soil	1,2,3,6,7,8-HxCDF	A	0.0188	2.5	ng/Kg	84	130	84	130	20	--	--
A-34,35	8290A	Soil	1,2,3,7,8,9-HxCDF	A	0.0248	2.5	ng/Kg	78	130	78	130	20	--	--
A-34,35	8290A	Soil	2,3,4,6,7,8-HxCDF	A	0.0204	2.5	ng/Kg	70	156	70	156	20	--	--
A-34,35	8290A	Soil	1,2,3,4,6,7,8-HpCDF	A	0.0278	2.5	ng/Kg	82	122	82	122	20	--	--
A-34,35	8290A	Soil	1,2,3,4,7,8,9-HpCDF	A	0.0373	2.5	ng/Kg	78	138	78	138	20	--	--
A-34,35	8290A	Soil	OCDF	A	0.0661	5	ng/Kg	63	170	63	170	20	--	--
A-33,35	8290A	Soil	C13-1,2,3,7,8-PeCDF	S	NA	NA	ng/Kg	--	--	--	--	--	40	135
A-33,35	8290A	Soil	C13-1,2,3,7,8-PeCDD	S	NA	NA	ng/Kg	--	--	--	--	--	40	135
A-33,35	8290A	Soil	C13-1,2,3,6,7,8-HxCDD	S	NA	NA	ng/Kg	--	--	--	--	--	40	135
A-33,35	8290A	Soil	C13-1,2,3,4,6,7,8-HpCDD	S	NA	NA	ng/Kg	--	--	--	--	--	40	135
A-33,35	8290A	Soil	C13-1,2,3,4,6,7,8-HpCDF	S	NA	NA	ng/Kg	--	--	--	--	--	40	135
A-33,35	8290A	Soil	C13-1,2,3,4,6,7,8,9-OCDD	S	NA	NA	ng/Kg	--	--	--	--	--	40	135
A-33,35	8290A	Soil	C13-1,2,3,4,7,8-HxCDF	S	NA	NA	ng/Kg	--	--	--	--	--	40	135
A-33,35	8290A	Soil	C13-2,3,7,8-TCDF	S	NA	NA	ng/Kg	--	--	--	--	--	40	135
A-33,35	8290A	Soil	C13-2,3,7,8-TCDD	S	NA	NA	ng/Kg	--	--	--	--	--	40	135
A-33,35	8290A	Soil	37C14-2,3,7,8-TCDD	S	NA	NA	ng/Kg	--	--	--	--	--	40	135

Table 7-10

ALS - Houston Laboratories
Laboratory Accuracy and Precision Objectives
for PCDD/PCDF in Groundwater and Soil
Multi-Area QAPP
Weyerhaeuser Company
Allied Paper, Inc,/Portage Creek/Kalamazoo River Superfund Site

								LCS[1]		MS/MSD[1]			Surrogate Recovery[1]	
SOP ID	Method	Matrix	Analyte	Type	MDL[1]	RL	Units	LCL	UCL	LCL	UCL	%RPD	LCL	UCL
A-33,35	8290A	Water	2,3,7,8-TCDD	A	0.813	5	pg/L	67	158	67	158	20	--	--
A-33,35	8290A	Water	1,2,3,7,8-PeCDD	A	0.328	25	pg/L	70	142	70	142	20	--	--
A-33,35	8290A	Water	1,2,3,4,7,8-HxCDD	A	0.585	25	pg/L	70	164	70	164	20	--	--
A-33,35	8290A	Water	1,2,3,6,7,8-HxCDD	A	0.543	25	pg/L	76	134	76	134	20	--	--
A-33,35	8290A	Water	1,2,3,7,8,9-HxCDD	A	0.523	25	pg/L	64	162	64	162	20	--	--
A-33,35	8290A	Water	1,2,3,4,6,7,8-HpCDD	A	1.240	25	pg/L	70	140	70	140	20	--	--
A-33,35	8290A	Water	OCDD	A	1.340	50	pg/L	78	144	78	144	20	--	--
A-33,35	8290A	Water	2,3,7,8-TCDF	A	0.591	5	pg/L	75	158	75	158	20	--	--
A-33,35	8290A	Water	1,2,3,7,8-PeCDF	A	0.427	25	pg/L	80	134	80	134	20	--	--
A-33,35	8290A	Water	2,3,4,7,8-PeCDF	A	0.474	25	pg/L	68	160	68	160	20	--	--
A-33,35	8290A	Water	1,2,3,4,7,8-HxCDF	A	0.319	25	pg/L	72	134	72	134	20	--	--
A-33,35	8290A	Water	1,2,3,6,7,8-HxCDF	A	0.305	25	pg/L	84	130	84	130	20	--	--
A-33,35	8290A	Water	1,2,3,7,8,9-HxCDF	A	0.435	25	pg/L	78	130	78	130	20	--	--
A-33,35	8290A	Water	2,3,4,6,7,8-HxCDF	A	0.313	25	pg/L	70	156	70	156	20	--	--
A-33,35	8290A	Water	1,2,3,4,6,7,8-HpCDF	A	0.703	25	pg/L	82	122	82	122	20	--	--
A-33,35	8290A	Water	1,2,3,4,7,8,9-HpCDF	A	0.956	25	pg/L	78	138	78	138	20	--	--
A-33,35	8290A	Water	OCDF	A	0.883	50	pg/L	63	170	63	170	20	--	--
A-33,35	8290A	Water	C13-1,2,3,7,8-PeCDF	S	NA	NA	pg/L	--	--	--	--	--	40	135
A-33,35	8290A	Water	C13-1,2,3,7,8-PeCDD	S	NA	NA	pg/L	--	--	--	--	--	40	135
A-33,35	8290A	Water	C13-1,2,3,6,7,8-HxCDD	S	NA	NA	pg/L	--	--	--	--	--	40	135
A-33,35	8290A	Water	C13-1,2,3,4,6,7,8-HpCDD	S	NA	NA	pg/L	--	--	--	--	--	40	135
A-33,35	8290A	Water	C13-1,2,3,4,6,7,8-HpCDF	S	NA	NA	pg/L	--	--	--	--	--	40	135
A-33,35	8290A	Water	C13-1,2,3,4,6,7,8,9-OCDD	S	NA	NA	pg/L	--	--	--	--	--	40	135
A-33,35	8290A	Water	C13-1,2,3,4,7,8-HxCDF	S	NA	NA	pg/L	--	--	--	--	--	40	135
A-33,35	8290A	Water	C13-2,3,7,8-TCDF	S	NA	NA	pg/L	--	--	--	--	--	40	135
A-33,35	8290A	Water	C13-2,3,7,8-TCDD	S	NA	NA	pg/L	--	--	--	--	--	40	135
A-33,35	8290A	Water	37C14-2,3,7,8-TCDD	S	NA	NA	pg/L	--	--	--	--	--	40	135

Notes:
[1] The laboratory MDLs and control limits provided are revised periodically by the laboratory. The MDLs and control limits used to evaluate data will be the current limits at the time of analysis as provided in laboratory data reports.

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RL - Report Limit
NA - Not Applicable
LCS - Laboratory Control Sample
MS/MSD - Matrix Spike/Matrix Spike Duplicate
RPD - Relative Percent Difference
LCL - Lower Control Limit (percent recovery)
UCL - Upper Control Limit (percent recovery)
A - Analyte
S - Surrogate